Final Report (C5521)

Monitoring of Plymouth Sound and Estuaries SAC 2011

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Issue date: March 2012

Cefas Document Control

Title:

Submitted to:	Natural England
Date submitted:	March 2012
Project Manager:	Dr. Sue Ware
Report compiled by:	Dr. Sue Ware
Quality control by:	Matthew Curtis
Approved by & date:	Dr Siân Limpenny 20/3/2012
Version:	V3

Version Control History			
Author	**Date**	**Comment**	**Version**
S. Ware and B. Meadows	March 2012	Draft submitted for internal QA	V1
S. Ware and B. Meadows	March 2012	Revised following internal QA	V2
S. Ware and B. Meadows	June 2012	Revised following NE Review	V3

Plymouth Sound and Estuaries Survey 2011

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March 2012

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Executive Summary

This report describes the results from an interdisciplinary field survey aimed at assessing the status of Annex I habitat features in the Plymouth Sound and Estuaries Special Area of Conservation (SAC). The habitat features of interest are (i) estuarine bedrock, boulder and cobble communities and (ii) subtidal mixed cobble and gravel communities. Surveys were carried out in the River Tamar and Plymouth Sound during 7th-9th October 2011 to monitor the status of the features within the SAC in accordance with Regulation 35 of the Habitats Regulations.

Previous survey work indicated that the estuarine habitat sub-features of interest (namely bedrock, boulder and cobble) were present for approximately 1km upstream and downstream of the Tamar Bridge. This work indicated that these features supported a number of red algae and sponge species in shallow areas whereas mixed substrata were present and characterised by sponges, ascidians and anemones in the deeper channel. The results of the 2011 survey validated the presence and extent of the 'mixed substrata' sub-features in the deeper channel areas in the vicinity of the Tamar Bridge and provided a characterisation of the associated algal and faunal communities. Bedrock, boulder and cobble communities had previously been identified along the River margins in areas which were inaccessible during the 2012 survey due to the presence of yacht moorings. Therefore, it was not possible to provide an assessment of the status of these attributes as part of the 2012 survey. Similarly, it was not possible to confirm the presence of the attribute A3.362/IR.LIR.IFaVS.CcasEle which has previously been observed in the upper reaches of the River Tamar due to inaccessibility of these areas to the survey vessel.

The sub-features of interest (namely subtidal cobble and gravel) in the Plymouth Sound had previously been identified to occur in the vicinity of Duke Rock and in the area to the south-east of the breakwater. Attributes of interest, associated with this sub-feature, are described as red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles. The current survey confirmed the presence and extent of this sub-feature (and its associated attributes) and also provided a characterisation of its associated algal and faunal communities.

Recommendations are provided on possible alternatives for future monitoring of the area given the limitations of the survey techniques within each habitat type. In particular, it is recommended that acoustic surveys are carried out, prior to groundtruthing, to provide a more scientifically robust assessment of the habitat features and sub-features in the SAC.

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1 Background and Introduction

Specific habitats associated with estuaries and large shallow inlets and bays have been listed in Annex I of the European Habitats Directive as deserving special protection for conservation. The Plymouth Sound (and its associated estuaries) is situated on the south coast of Devon and is comprised of a complex of marine inlets (or rias) which have been identified to be of considerable biological and historical importance. The variety of habitats (and their associated communities) within the SAC reflect the transitional salinity gradient from areas of low salinity in the upper estuary to the fully marine waters within the Plymouth Sound.

Eight major biogeographical zones (underpinned by variations in salinity and wave exposure regime) have been identified for the River Tamar and Plymouth Sound. These are described by Moore *et al*. (1999) as:

Zone 1: Open Coast (south of breakwater)

Extends northwards from Renney Rocks to Staddon Point (on the eastern side of the sound) and includes Penlee Point on the western side. This zone is relatively exposed to the prevailing south-westerly winds. Therefore, associated communities are reflective of this relatively high energy environment. Sub-tidal regions within this zone comprise a number of slate bedrock outcrops which support rich faunal communities along with dense stands of kelp and other algal species. Areas surrounding the reefs are characterised by a mosaic of coarse shale and sand and muddy sands. These areas have previously been identified as supporting one of the attributes of interest for this current round of monitoring (namely the ephemeral red algal biotope SS.SMp.KSwSS.LsacR.CbPb).

Zone 2: Sheltered Bay (central sound, north of breakwater, including Cawsand Bay)

Comprises the central region of the Plymouth Sound with habitats (and associated faunal communities) reflective of the relatively sheltered environment which occasionally experiences slightly increased turbidity (and slightly decreased salinity) resulting from river outflows. Subtidal sediments in the lee of the breakwater largely comprise muddy sands whilst areas of tide-swept mixed cobbles and boulders (to the south-east of Duke Rock) have been identified as supporting the ephemeral red algal biotope of interest, described as forming open glades between the bedrock outcrops.

Zone 3: Outer Estuary (northern Sound)

Incorporates the area between Drake's Island and the mouths of the River Tamar and Plym. Waters within this zone frequently exhibit high turbidity levels and low surface salinity. Infralittoral areas comprise steep sloping limestone rock surfaces which continue down into the sublittoral areas. As the water depth increases the limestone rock slopes give way to flat low-lying limestone rock exposures interspersed by extensive patches muddy or clean shell gravel.

Zone 4: Lower Estuary

This zone extends up the Tamar River from Devil's Point to the southern extent of the entrance to the River Lynher. Salinity within this zone is reduced (typically between 20-30‰) with the infralittoral habitats present identified to support a number of fucoid and filamentous algae. Sublittoral rock, within this zone, are characterised by sponge and barnacle dominated biotopes

Zone 5: Central Estuary

This zone extends from the intersection of the River Lynher with the River tamar and extends upstream to Cargreen. Habitats along the shoreline are dominated by fucoid algae and a number of barnacle species with sublittoral rock habitats in this region being characterised by the sponge *Halichondria panacea* and the barnacle *Balanus crenatus*.

Zone 6: Upper Estuary

This zone extends from Cargreen to South Hooe and typically experiences very low salinity levels in the region of 5‰. The mud habitats along the shoreline and in the deeper channel comprise relatively impoverished infaunal communities characterised by a number of polychaete and amhipod species namely *Corophium* spp.

Zone 7: Riverine-Estuary Transition

Comprises the area between South Hooe and Halton Quay. Fully freshwater conditions frequently occur within these areas and the appearance of the reed *Phragmites* sp. in the northern extent of this zone reflects the transition to fully riverine conditions.

Zone 8: Riverine

The riverine zone encompasses the area north of Halton Quay. A number of fauna typical of estuarine conditions occur including the brown shrimp *Crangon crangon*, the polychaete *Nereis diversicolor* and the shore crab *Cancer maenus*.

The present investigation is intended to provide further monitoring information on the presence and condition of specific sub-features (and their associated attributes) as required for the relevant monitoring reporting cycle. In this context, the habitat features of interest are (i) estuarine bedrock, boulder and cobble communities and (ii) subtidal mixed cobble and gravel communities.

1.1 Links to action plan

The Plan of Action (PoA) document listed a number of work packages to ensure the attainment of the projects objectives; these included:

- Develop a cost effective sampling design to enable a measure of each sub-feature attribute to be obtained. The design will take into account the existing baseline data that is available to allow a robust comparison to be made to assess for change.

- To undertake the necessary survey work within the sites according to the chosen sampling design as well as subsequent analysis and interpretation of data obtained to meet the aims outlined above.

- To assess for any signs of human derived damage or disturbance

- To report on any deficiencies of individual data collection methods or techniques.

- To provide fully detailed Standard Operating Protocols (SOPs) for the work undertaken to ensure that these can be repeated in the future

- To provide all data in the relevant Mapping European Seabed Habitats (MESH) Data Exchange Format. Data added to Marine Recorder.

1.2 Location Map

The extent of the 2011 survey areas within the Plymouth Sound and Estuaries SAC are indicated by the red boundaries shown below in Figure 1. The survey area boundaries were informed by the findings of previous studies which indicated the sub-features of interest (namely ‘Estuarine Bedrock, Boulder and Cobble Communities’ and ‘Subtidal Mixed Cobble and Gravel Communities’) were present within these areas of search (Moore *et al*., 1999a,b and Moore and Gilliland, 2000).

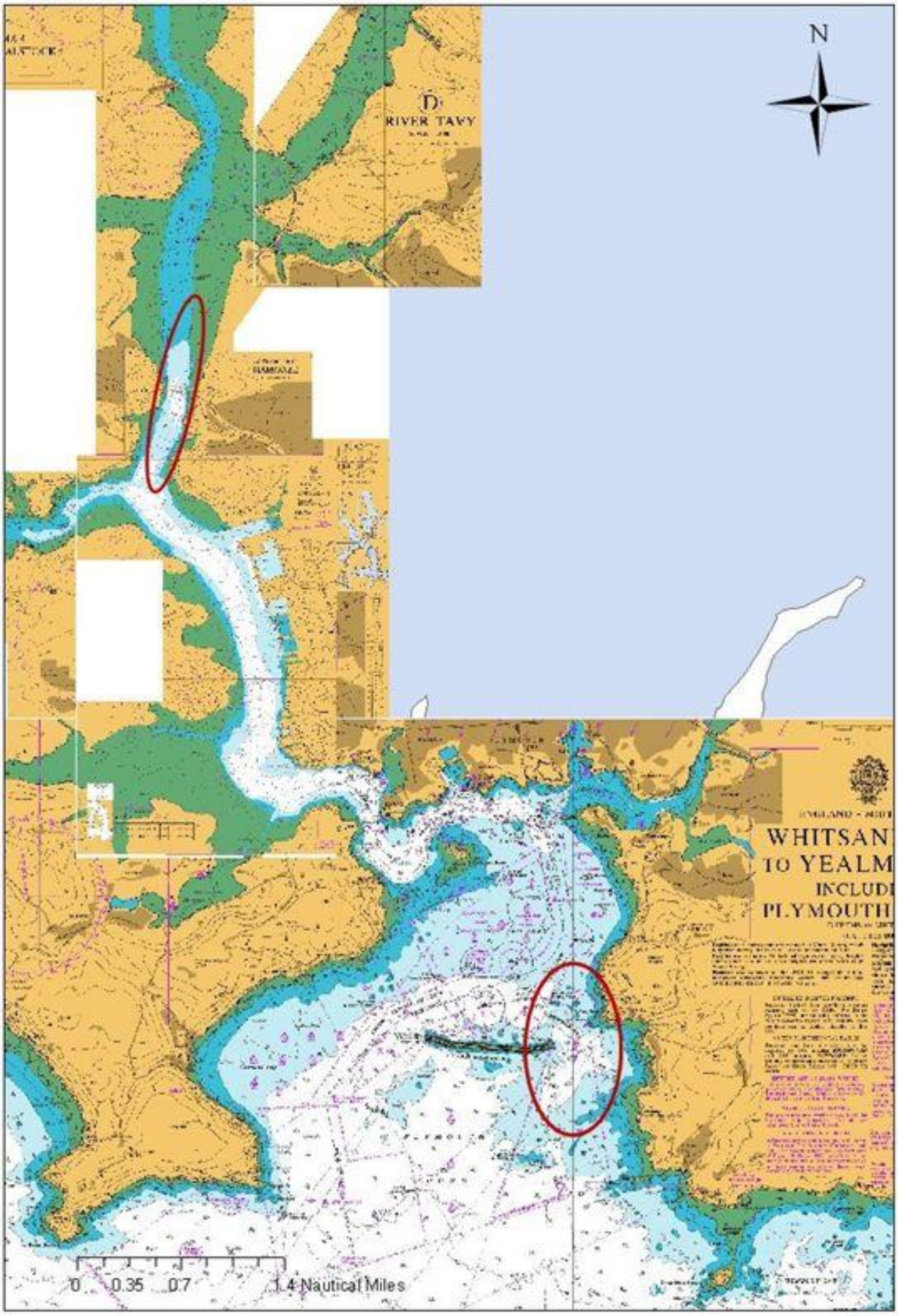


Figure 1. Plymouth Sound and Estuaries 2011 survey areas (indicated by red boudaries).

1.3 Geological and Biological Context

The sub-features of interest (and their associated attributes) within the Plymouth Sound and Estuaries SAC for this survey are described below in Table 1.

Table 1. Description of attributes that require assessment in 2011 for the Plymouth Sound and Estuaries SAC according to the Regulation 35 (formerly Regulation 33) package for the site.

Feature	Sub-Feature	Attribute	Measure and Target
Estuaries	Estuarine Bedrock, Boulder and Cobble Communities	Extent and distribution of characteristic biotopes: **A3.362/IR.LIR.IFaVS.CcasEle** (previously SIR.Cor.Ele) **A3.225/IR.MIR.KT.FilRVS** (previously LsacRS.FiR)	Extent and distribution of characteristic biotopes should not deviate significantly from an established baseline subject to natural change. *Measured during summer, once during reporting cycle.*
Large Shallow Inlet and Bay	Subtidal Mixed Cobble and Gravel Communities	Species composition of characteristic biotope: **A5.5211/SS.SMp.KSwSS.LsacR.CbPb** (previously EphR)	Species composition and abundance of characteristic biotope should not deviate significantly from an established baseline subject to natural change. *Measured during summer, once during reporting cycle.*

Previous survey work indicated that estuarine bedrock and cobble was present for approximately 1km upstream and downstream of the Tamar Bridge (Moore *et al*., 1999). These substrata were previously described by Moore et al, 1999 as supporting red algae, sponges (including *Halichondria* sp.) and barnacles (A3.225/IR.MIR.KT.FilRVS – previously LsacRS.FiR) with mixed substrata in the deeper river channel supporting sponges, ascidians and anemones (A5.42/SS.SMx.SMxVS).

Subtidal cobble and gravel were previously identified to occur in the vicinity of Duke Rock and to the area south-east of the breakwater. These areas had previously being described as supporting the algal species biotope A5.5211/SS.SMp.KSwSS.LsacR.CbPb (previously EphR).

2 Survey Design and Methods

2.1 Survey Project Team

The Plymouth Sound and Estuaries SAC survey was carried out during 7th-9th October 2011. The Devon and Severn Inshore Fisheries and Conservation Authority (D&S IFCA) Fishery Patrol Vessel 'Drumbeat of Devon' was used as a platform for the purpose of the survey (Figure 2). Biological expertise was provided by Dr. Sue Ware (Cefas) and technical expertise was provided by Bill Meadows (Cefas) for the duration of the fieldwork.

Figure 2. Devon and Severn IFCA Fisheries Patrol Vessel 'Drumbeat of Devon'.

2.2 Planning: including site/station selection

2.2.1 Aims and Objectives

The aims of the survey carried out within the Plymouth Sound and Estuaries SAC were to assess the extent of the sub-features of interest and to characterise their associated biological communities in accordance with Regulation 35 (formerly Regulation 33) (JNCC, 2004). Particular attributes of interest were those which had previously been identified as being associated with the given sub-features, namely A3.225/IR.MIR.KT.FilRVS on the estuarine bedrock, boulder and cobble habitats and A5.5211/SS.SMp.KSwSS.LsacR.CbPb on mixed cobbles and gravel substrata. However, in addition to the attributes detailed above there are also requirements under Common Standards Monitoring (CSM) to characterise the biotope composition of each sub-feature and describe their distribution and spatial pattern.

The survey was designed to provide a robust characterisation of the 'data poor' sub-features against which future monitoring data may be compared. Furthermore, where possible, the 2011 survey data was collected to allow comparisons with existing data to inform an assessment of potential change in the extent and/or condition of the sub-features of interest.

2.2.2 Search Strategy and Methods

The adopted survey strategy comprised an array of new video and still imaging sampling stations (where previous characterisation data were sparse or non-existent) along with a number of existing sampling stations which had been visited during previous video or diver surveys (particularly in the vicinity of Duke Rock) (Figure 3).

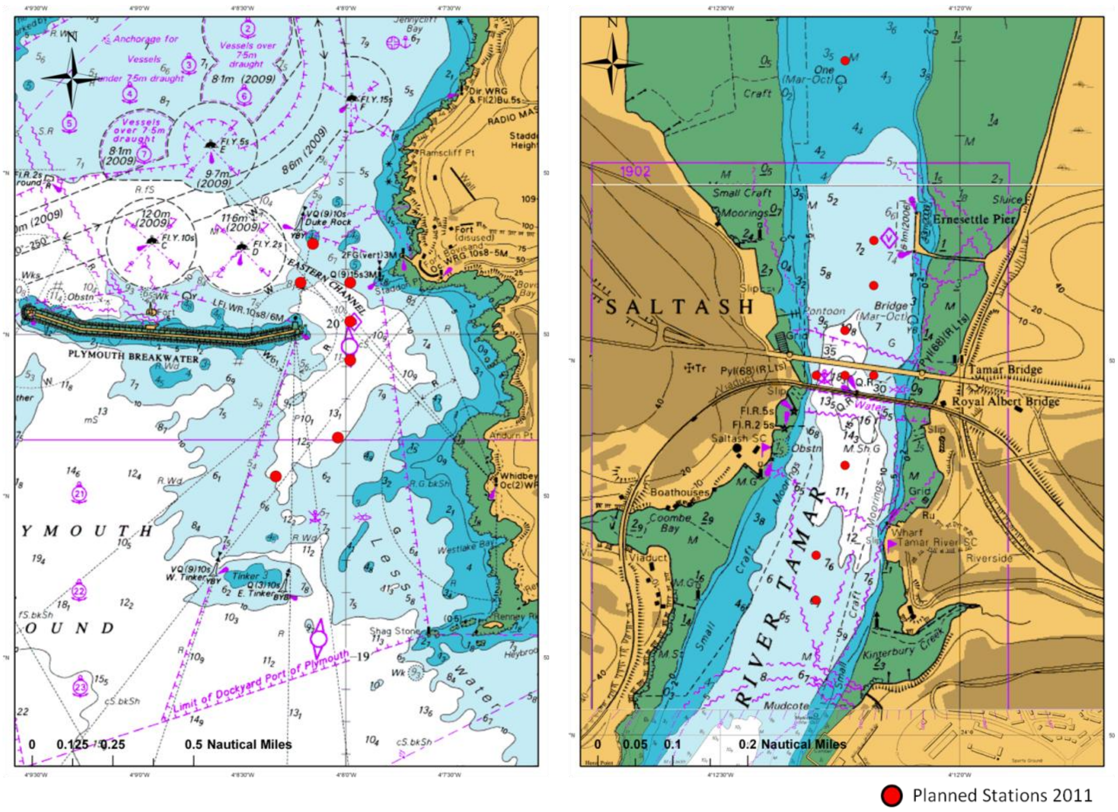


Figure 3. Planned station positions for the 2011 survey in Plymouth Sound (left) and the River Tamar (right).

2.3 Sampling Methods

The survey employed a Kongsberg OE14-208 camera (video and stills) system, deployed using a mini-sledge configured as a drop camera frame (Figure 4).

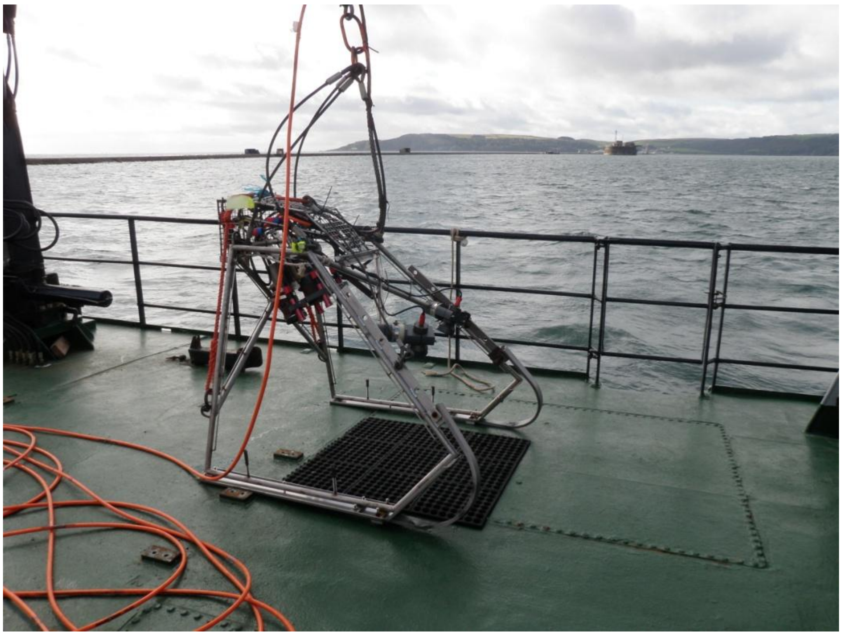


Figure 4. Drop camera frame with video and stills cameras and lighting configured according to MESH ROG.

The drop video camera and stills system was set up in a way to follow Common Standards Monitoring, and in particular the MESH guidelines 'Recommended Operating Guidelines (ROG) for underwater video and photographic imaging techniques[1]'. The camera was placed in a drop down frame along with two Cefas high intensity LED striplights. A Cefas quad laser rangefinder was aimed along the boresight of the camera to give reference dimensions on the seabed as the frame varied in altitude. Video was recorded on a Sony GV-HD700 in DV tape format. The video and stills were annotated with time and position using a GPS referenced video overlay from a Furuno GPS37 satellite receiver (differential corrections were obtained using the IALA differential service). The drop frame height was controlled via a winch operator in sight of the video feed.

On arrival at each site, the ship drifted through the station position in the most suitable direction as dictated by the tidal currents and wind conditions. The drop camera system was deployed from the port side crane and lowered into position just off the seabed. Once the camera was in position, the ship moved along the transect at a speed of 0.3-0.5 knots. A real-time video link was fed to a) a monitor positioned in the dry laboratory (where scientists observed the footage in order to provide a summary of habitat types and dominant fauna present) and b) a monitor on deck viewable by the

[1] Reference URL: http://www.searchmesh.net/PDF/GMHM3_Video_ROG.pdf

winch operator (to allow the camera to be lifted and lowered depending on the bathymetry). Video footage was acquired for the full length of each transect and still images were taken at 1 minute intervals (plus additional 'ad hoc' points to capture particular features or fauna of interest).

Logsheets were populated for each station with the time, position and water depth at the start and end of each transect along with a brief summary of the main habitat types and species present. Video footage was simultaneously recorded on to two Digital Video Tapes (DVT) and a media catalogue was populated to show which tape or disk contained the video footage acquired at each station. Still images were downloaded from the camera system at regular intervals and were stored and backed up on two separate portable hard drives.

2.4 Sample Processing/Analysis Methodologies

Each video tow was analysed by viewing several times, first to detect and record any changes in biotope across the entire transect, and second, to describe the physical features and quantify the epifaunal species characterising each biotope. Physical features recorded included the proportion of different substrate types, inclination, texture, stability and evidence of siltation. Epifauna were quantified according to the MNCR SACFOR abundance scale (S = Superabundant, A = Abundant, C = Common, F= Frequent, O = Occasional, R = Rare). A minimum of three photographic stills were analysed from each of the different biotopes identified in the video transect. Epifauna were also recorded using the SACFOR scale. All information extracted from the video and stills samples was recorded on the MNCR Habitat recording forms.

2.5 Video and stills data Analysis

Multivariate analyses (using Primer v6) were applied to the SACFOR data derived from video and stills to explore spatial characteristics of the faunal assemblages identified. A Bray-Curtis similarity measure was applied to the species abundance data (using a linear numerical scale applied to the SACFOR scores). A Similarity Profile (SIMPROF) routine was then carried out to explore the faunal community patterns within the data and to look at how these relate to the spatial distribution of the assigned European Nature Information System (EUNIS) classifications. All information extracted from the video and stills samples was recorded on the MNCR Habitat recording forms before being entered into the Marine Recorder database.

2.6 Data QA/QC

Video and photographic stills were processed and results checked following the recommendations of the National Marine Biological Analytical Quality Control Scheme and those described in Ware & Kenny, (2011).

3 Results

3.1 Species abundance data, ID of key species, rarities etc

Data extracted from video and still photography are at best semi-quantitative, therefore there are limitations to what can be achieved through statistical data analyses. Detailed inspection of the video and stills photographs revealed a total of 50 mostly epifuana taxa (video and still data combined). The relative distribution of epifauna taxa across the two survey areas is illustrated in Figure 5 below.

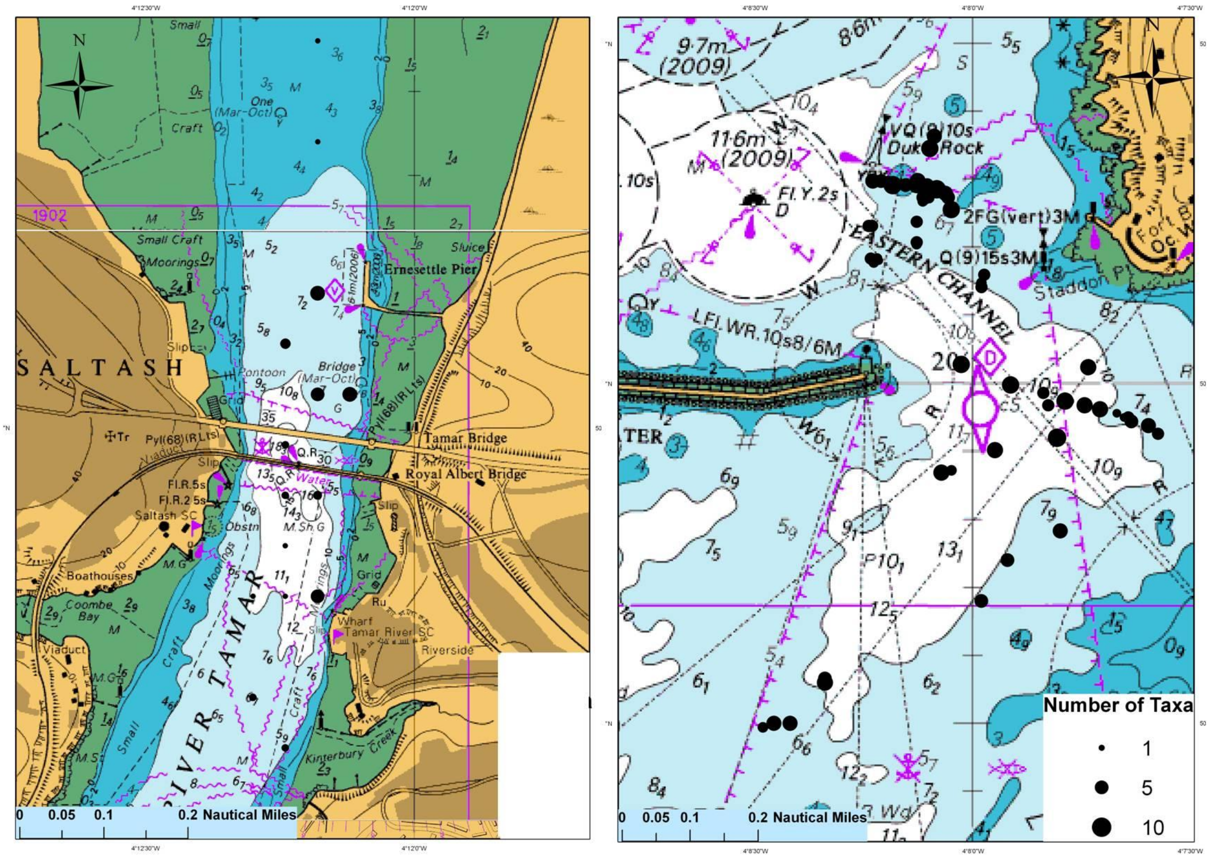


Figure 5. Relative distribution of the number of epifaunal taxa identified from video footage and still images at each sampling station.

Whilst absolute values should be treated with caution, differences in the relative distribution of epifaunal taxa across the two survey areas are evident. In the River Tamar highest numbers of taxa were observed in the areas in close proximity to the Tamar and Royal Albert Bridges (where the habitats comprised relatively denser areas of boulder and cobble). Fewer numbers of epifaunal taxa were observed to be associated with the more sedimentary mixed habitats present upstream and downstream of the bridges. The areas along the margins of the River Tamar where the infralittoral rock associated communities (namely A3.225/IR.MIR.KT.FilRVS – previously LsacRS.FiR) had previously been identified were inaccessible to the 2012 survey vessel due to the presence of a number of yacht moorings. Therefore, it was not possible to confirm the presence and extent of this biotope during the 2012 monitoring survey. Similarly, presence and extent of the attribute A3.362/IR.LIR.IFaVS.CcasEle-previously SIR.Cor.Ele previously identified to be present in the upper reaches of the River Tamar could not be confirmed during the 2012 survey due to inaccessibility of these shallow waters for the survey vessel.

In the Plymouth Sound survey area relatively high numbers of epifaunal taxa were observed in associated with Duke Rock. Moderately high numbers of taxa were observed in the video footage and stills obtained for the surrounding sediments and in the cobble and gravelly areas to the south-west of the breakwater.

3.2 Biotope Classifications

3.2.1 River Tamar

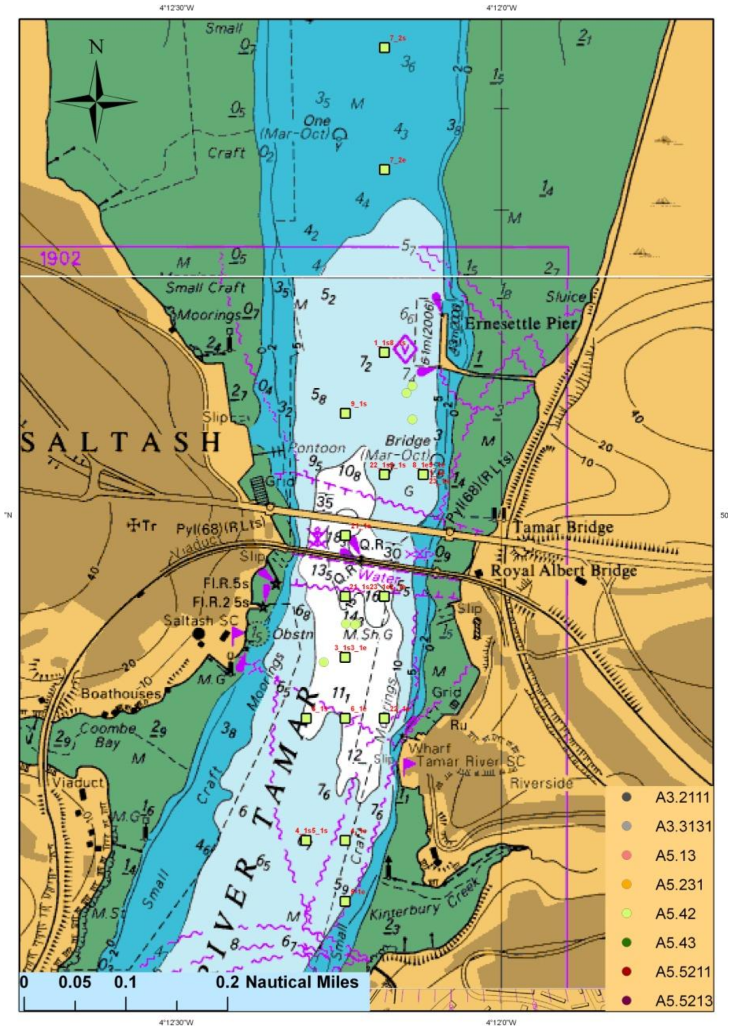


Figure 6. Tamar Bridge: Video start and end positions (depicted by square symbols) and still image positions (depicted by circle symbols) with points coloured according to their assigned EUNIS classification.

All stations in the vicinity of the Tamar Bridge, situated in the deeper mid channel areas, were assigned to the habitat classification 'sublittoral mixed sediment' (A5.42/ SS.SMx.SMxVS). High levels of turbidity within this survey area resulted in poor visibility (which, in turn, resulted in poor quality of video footage and still images). However, the substrates within these areas were identified to be largely comprised of muddy sand with patches of dead *Crepidula fornicata* shell, pebbles and cobbles and occasional small boulders (Table 4).

It was not possible to survey the shallow areas, along the river margins, due to the numerous yacht trot moorings rendering these areas inaccessible. However, a diver survey carried out during August 2011 (24/08/11) provided useful complementary information on faunal communities within these less accessible regions of the survey areas.

3.2.2 Plymouth Sound

A number of biotopes were identified to be present across the Plymouth Sound survey area (Table 2, Figure 7 and Figure 8).

Table 2. Biotopes identified to be present at the stations surveyed in the Plymouth Sound. Attributes targeted for assessment during the 2011 monitoring are shown in bold.

Biotope	EUNIS	MNCR
L. saccharina and *L. digitata* on sheltered sublittoral fringe rock	A3.3131	IR.LIR.K.Lsac.Ldig
L. digitata on moderately exposed sublittoral fringe bedrock	A3.2111	IR.MIR.KR.Ldig.Ldig
Infralittoral mixed sediment	A5.43	SS.SMx.IMx
Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles	**A5.5211**	**SS.SMp.KSwSS.LsacR.CbPb**
Infralittoral coarse sediment	A5.13	SS.SCS.ICS
Infralittoral mobile clean sand with sparse fauna	A5.231	SS.SSa.IFiSa
L. saccharina and filamentous red algae on infralittoral sand	A5.5213	SS.SMp.ISwSS.LsacR.Sa

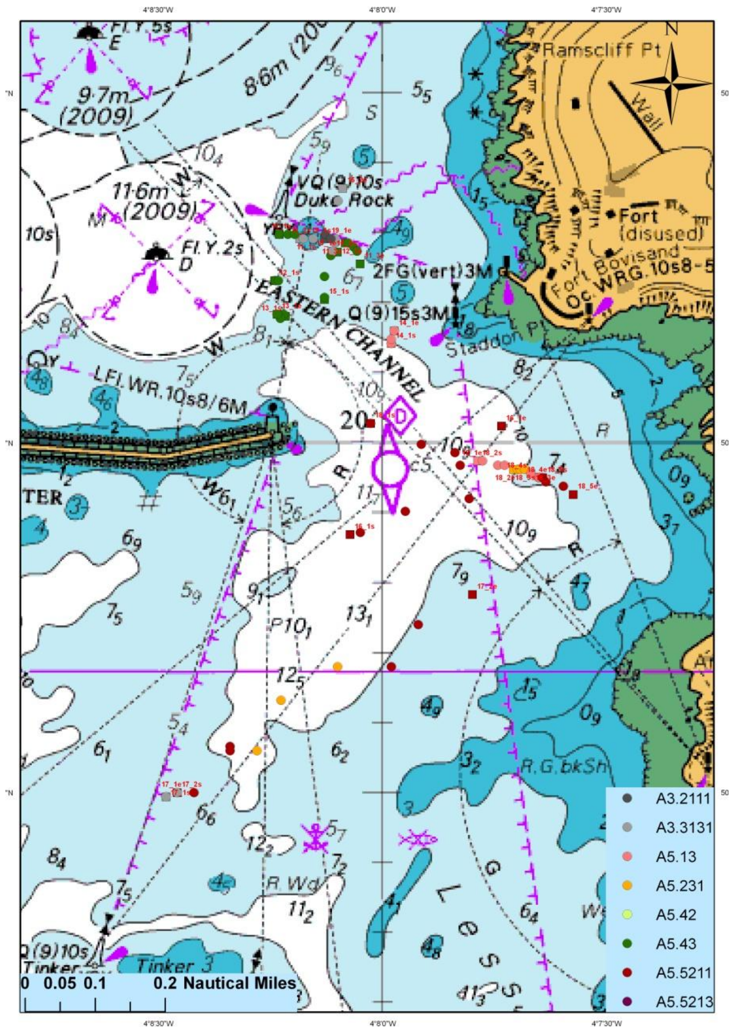


Figure 7. Plymouth Sound: Video start and end positions (depicted by square symbols) and still image positions (depicted by circle symbols) with points coloured according to their assigned EUNIS classification.

A number of biotopes were identified from the video and still images within the Plymouth Sound survey area. Duke Rock was characterised by sheltered and moderately exposed sublittoral fringe bedrock with dense beds of *Laminaria digitata* and *Laminaria saccharina* (A3.3131/IR.LIR.K.Lsac.Ldig and A3.2111/ IR.MIR.KR.Ldig.Ldig). The areas surrounding Duke Rock were identified to be largely characterised by infralittoral mixed sediments (A5.43/SS.SMx.IMx).

The survey area within the deeper waters to the east and south-east of the breakwater were predominantly characterised by the attribute of interest, namely red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles (A5.5211/SS.SMp.KSwSS.LsacR.CbPb) interspersed with infralittoral coarse sediments and sand (A5.13/SS.SCS.ICS and A5.23/ SS.SSa.IFiSa). An additional station (station 20) was surveyed in an area to the west of the breakwater (off Picklecombe Point where previous sublittoral recording (Moore et al., 1999) had identified the presence of one of the attributes of interest A5.5211/SS.SMp.KSwSS.LsacR.CbPb. The stations surveyed during the 2011 survey identified the two biotopes A5.5213/SS.SMp.ISwSS.LsacR.Sa and A3.2111/IR.MIR.KR.Ldig.Ldig to be characteristic of this area (Figure 8).

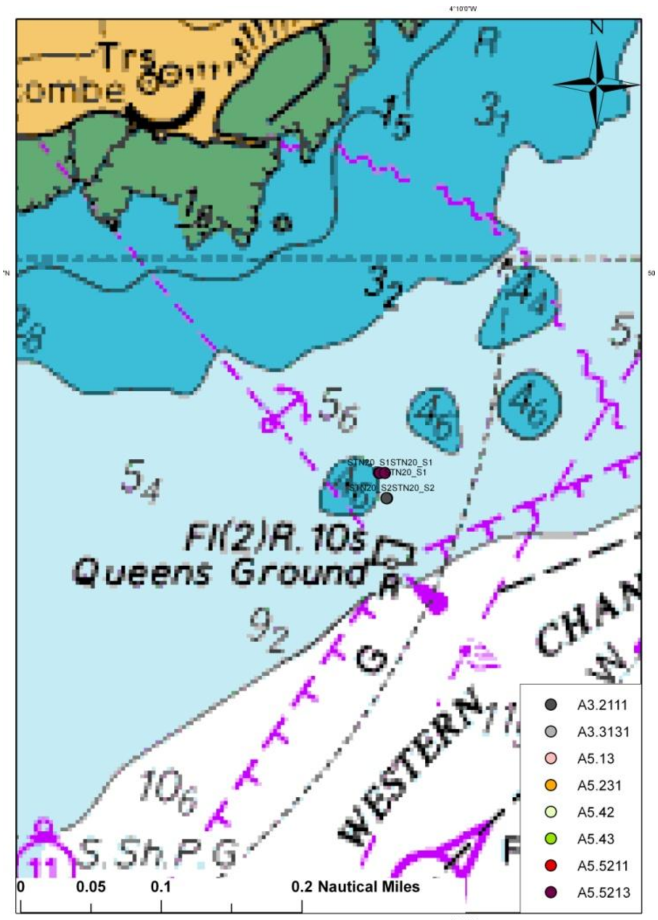


Figure 8. Additional station off Picklecombe Point: Video start and end positions (depicted by square symbols) and still image positions (depicted by circle symbols) with points coloured according to their assigned EUNIS classification.

3.3 *Faunal Community Characteristics*

Patterns in epifaunal community characteristics across the survey areas were explored using multivariate statistical techniques. Cluster analyses identified that the video and still images collected could be delineated across 10 distinct groupings or clusters based on their characterising species (Figure 9 and Table 3).

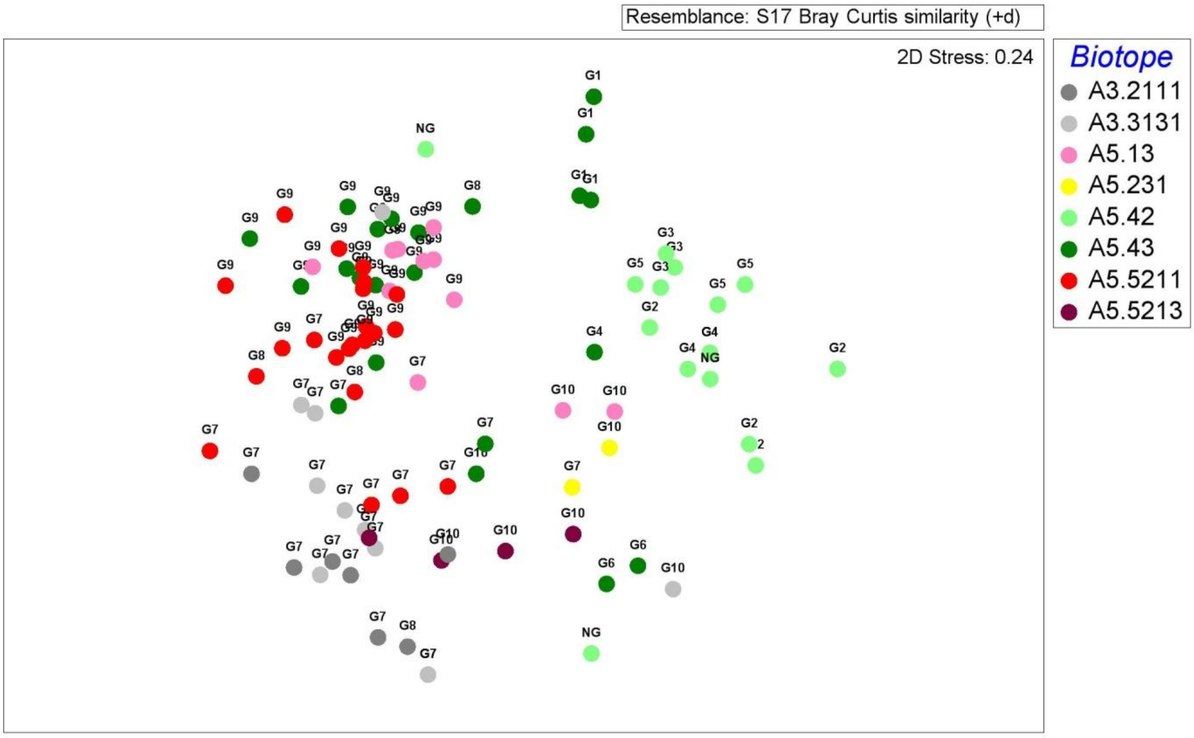


Figure 9. Graphical results from multivariate analysis of epifaunal data (SACFOR) extracted from video footage and still photographs. MDS plot illustrating the relative similarity between sampling sites, each represented according to the group number (G1-G10) assigned by a SIMPROF routine; each number denotes a statistically different assemblage. Symbols denote the assigned EUNIS biotope classification for given samples.

Table 3. Average similarity contribution of each taxon to the distinct assemblage in which it s found. Distinct assemblages identified by a SIMPROF routine on SACFOR data extracted from video and stills. Colours reflect relative similarity (Red=High, Green=Low).

	G1	G2	G3	G4	G5	G6	G7	G8	G9	G10
Ophiura ophiura	51								0.13	
Pomatoceros sp.							0.66	9.48	38.6	
Asterias rubens					45.1					
U. sponge_encrusting			43.3				0.14		0.56	
Marthasterias glacialis						31.6	6		0.35	
U. hydroid			13.3				0.35	24		
Urticina felina		37.1								
U. red algae_foliose	12.8						6.91		7.56	4.65
U. brown algae_foliose						21.1				
Laminaria digitata							12.7	6.72		1.22
U. brown algae_filamentous							0.12	6.72		13.2
Nemertesia antennina				16.7						
Laminaria saccharina							3.21		2.72	7.93
Serpulidae			13.3							
U. red algae_encrusting							0.49	3.76	3.67	
Cerianthus lloydii	6.06									
U. red algae_filamentous							5.35		0.57	
Dilsea carnosa							1.61	2.38	0.15	
Scyliorhinus canicula		3.7								
Obelia sp.							1.9			
U. bryozoan_encrusting		1.85								
U. sponge_cushion		1.85								
Pecten maximus									0.03	0.69
Anemonia viridis							0.1			
Ulva lactuca							0.03		0.04	
Kallymenia reniformis							0.05			
Sagartia sp.									0.04	
Bivalvia									0.03	
Total number of taxa	**5**	**8**	**3**	**3**	**3**	**7**	**20**	**8**	**27**	**13**
Total taxa contributing to similarity	**3**	**4**	**3**	**1**	**1**	**2**	**15**	**6**	**13**	**5**
Average Similarity	**69.8**	**44.5**	**70**	**16.7**	**45.1**	**52.6**	**39.6**	**53**	**54.5**	**27.7**

3.3.1 River Tamar

Stations within the River Tamar (assigned to the biotope A5.42: 'sublittoral mixed sediment in variable salinity') fell into the SIMPROF groups 2, 3, 4 and 5. SIMPER analyses indicated that encrusting and cushion sponges and hydroids (including *Nemertesia antennina*) along with the common starfish *Asterias rubens* primarily contributed to the average similarity within these groups. A number of fish species were also observed during the survey in the River Tamar and these included Pollack *Pollachius pollachius*, dogfish *Scyliorhinus canicula* and the thornback ray *Raja clavata*.

Diver observations (carried out in August 2011 by Dr. Keith Hiscock) assisted in validating the identification of certain species from the video and stills (and also expanded the species list) for the shallow sublittoral areas immediately below the Tamar Bridge. Sponges observed to be present included *Halicliona oculata* and *Scypha ciliatum*. A number of anemones (*Actinothoe sphyrodeta*, *Sagartia troglodytes*, *Urticina felina*) and both solitary and colonial ascidians (*Styela clava*, *Clavelina lepadiformis*, *Tridemnum* sp) were also observed. Mobile fauna identified to be present included the crabs *Carcinus maenus*, *Liocarcinus depurator* and *Maja squinado* along with starfish *Asterias rubens* and *Marthasterias glacialis*. A similar array of fish species to those observed during the video survey were identified during the dive including the thornback ray *Raja clavata* and the dragonet *Callionymus lyra.*

3.3.2 Plymouth Sound

Stations assigned to the sublittoral fringe rock biotopes (A3.3131/IR.LIR.K.Lsac.Ldig and A3.2111/IR.MIR.KR.Ldig.Ldig) largely fell into SIMPROF group 7 and were characterised by the kelp species (*L. digitata* and *L.saccharina*) along with species of foliose red algae (including *Dilsea carnosa* and *Kallymenia reniformis*) and the foliose green algae *Ulva lactuca*.

The remaining stations were largely assigned to a number of biotopes associated with infralittoral coarse and mixed sediments. Those assigned to infralittoral coarse, mixed and sand sediments (A5.13/ SS.SCS.ICS, A5.43/SS.SMx.IMx and A5.231/ SS.SSa.IFiSa.IMoSa respectively) largely comprised SIMPROF groups 1, 8 and 9. SIMPER analyses indicated that these groups were characterised by the presence of hydroid turf (including *Nemertesia* spp.), filamentous and foliose red alage (including *Dilsea carnosa*) along with a number of mobile fauna including the echinoderms *Ophiura ophiura* and *Marthasterias glacialis* and the scallop *Pecten maximus.*

SIMPROF groups 9 and 10 largely comprised stations which had been classified as '*Laminaria saccharina* and filamentous red algae on infralittoral sand' (A5.5213/ SS.SMp.KSwSS.LsacR.Sa) and 'Red seaweeds and kelps on tide swept mobile infralittoral cobbles and pebbles' (A5.5211/ SS.SMp.KSwSS.LsacR.CbPb). SIMPER analyses indicated that a number of filamentous and foliose red algal species (including *Dilsea carnosa*) and kelp species (*L. digitata and L. saccharina*) primarily contributed to similarity within these groups along with the echinoderm species *Ophiura ophiura* and *Marthasterias glacialis*.

3.4 *Example stills for biotopes identified*

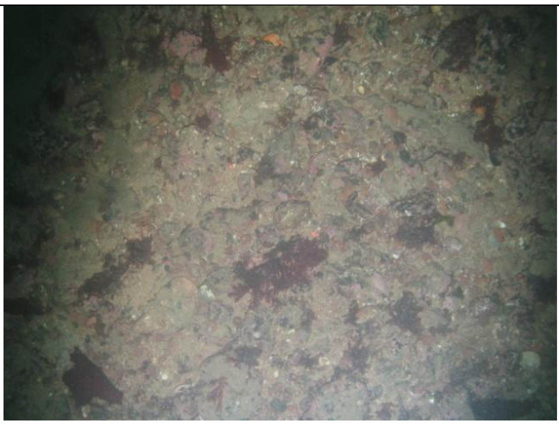
3.4.1 River Tamar

Table 4. Example stills for biotopes identified in the River Tamar survey area (images courtesy of Dr. Keith Hiscock).

Biotope	Eunis Code	
Sublittoral mixed sediments in variable salinity (SS.SMx.SMxVS)	**A5.42**	  

3.4.2 Plymouth Sound

Table 5. Example stills for biotopes identified in the Plymouth Sound survey area.

Biotope	Eunis Code	
Laminaria digitata **on moderately exposed sublittoral fringe bedrock** (IR.MIR.KR.Ldig.Ldig)	**A3.2111**	
Laminaria saccharina **and** ***Laminaria digitata*** **on sheltered sublittoral fringe rock** (IR.LIR.K.Lsac.Ldig)	**A3.3131**	
Infralittoral coarse sediment (SS.SCS.ICS)	**A5.13**	

Biotope	Eunis Code	
Infralittoral mobile clean sand with sparse fauna (SS.SSa.IFiSa.IMoSa)	**A5.231**	
Infralittoral mixed sediment (SS.SMx.IMx)	**A5.43**	
***Laminaria saccharina* and filamentous red algae on infralittoral sand** (SS.SMp.KSwSS.LsacR.Sa)	**A5.5213**	
Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles (SS.SMp.KSwSS.LsacR.CbPb)	**A5.5211**	

3.5 Human Activities

3.5.1 River Tamar

This survey was not specifically designed to establish the presence or effects arising from anthropogenic activities. However, during the survey the presence of a number of yacht trot moorings in the vicinity of the River Tamar was noted (Figure 10). Such moorings can cause the physical loss of habitat (due to presence of mooring blocks etc.) and have been hypothesised to result in physical damage to habitats (due to abrasion arising as a result of mooring ropes and scouring around the mooring blocks) (OSPAR ICG-CE, 2011).

Figure 10. Yacht moorings within the River Tamar survey area.

3.5.2 Plymouth Sound

Again, this survey was not designed to establish the effects of human activities. Nevertheless, it was evident during the survey that there are a number of human activities carried out in the Plymouth Sound including fishing using static gear (strings of pots) and vessel traffic and moorings/anchorages. During the course of the survey in the Plymouth Sound the drop camera system became caught on static fishing gear on a number of occasions (stations 12, 15, 20) suggestive of a relatively high intensity of this activity within the survey area.

4 Discussion

4.1 Summary of Habitats Recorded

The findings of the 2011 monitoring survey confirmed the location and extents of a number of the sub-features of interest (and their attributes) according to their described spatial distribution based on previous surveys carried out in 1999 and 2000 (Moore, 2000, Moore *et al*, 1999a, b). However, inaccessibility of a number of the previously surveyed areas in the River Tamar (namely the river margins in the vicinity of the Tamar Bridge and the upper reaches of the river) resulted in a number of the previously described attributes (namely IR.LIR.IFaVS.CcasEle-previously SIR.Cor.Ele and IR.MIR.KT.FiiRVS-previously LsacRS.FiR not being detected or assessed during the 2012 survey. This should not be interpreted as a change in status of these given attributes as the reason they were not identified and assessed during the 2012 monitoring survey was due to inaccessibility to the areas where they had previously been described (and not a result of their absence or decreased extent).

4.1.1 River Tamar

The areas surveyed within the River Tamar were identified to comprise sublittoral mixed sediments in variable salinity (A5.42). A number of flora and fauna were identified to be present in association with these mixed habitat types and included a number of encrusting and cushion sponges (*Halicliona oculata* and *Scypha ciliatum*), hydroids (*Nemertesia* spp. and *Hydrallmania falcata*) and a variety of anemones including *Urticina felina* and *Actinothoe sphyrodeta* (Figure 11, bottom left) along with both solitary and colonial and ascidians. Mobile fauna present included the crabs *Maja squinado* and the hermit crab *Pagurus bernhardus* along with the common and spiny starfish *Asterias rubens* and *Marthasterias glacialis* (Figure 11, top right). A number of fish species were also observed during the video and dive survey in the River Tamar and these included Pollack *Pollachius pollachius*, dogfish *Scyliorhinus canicula*, thornback ray *Raja clavata* along with bib (*Trisopterus luscus*) (Figure 11, top left) and Goldsinney wrasse (*Ctenolabrus rupestris*).

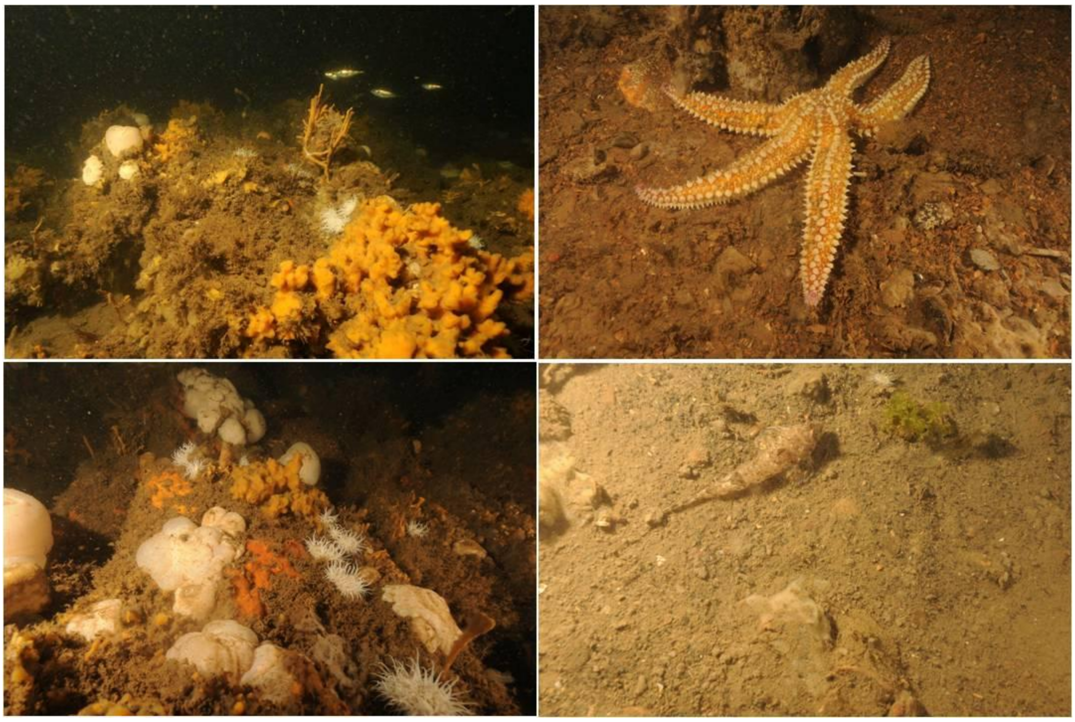


Figure 11. Images of characteristic fauna in the River Tamar survey area courtesy of Dr. Keith Hiscock during a 2011 diving survey.

4.1.2 Plymouth Sound

Duke Rock, located to the north-east of the breakwater, was identified to be characterised by the sublittoral fringe rock biotopes '*Laminaria saccharina* and *Laminaria digitata* on sheltered sublittoral fringe rock' (A3.3131) and '*Laminaria digitata* on moderately exposed sublittoral fringe bedrock' (A3.2111). In addition to the kelp species, a number of foliose red algae (*Dilsea carnosa* and *Kallymenia reniformis*) and green algae (*Ulva lactuca*) were associated with this biotope.

Stations on the periphery of Duke Rock consisted of infralittoral coarse and mixed sediments and were characterised by a number of filamentous and foliose red algae, hydroid species (including *Nemertesia antennina*) the echinoderms *Ophiura ophiura* and *Marthasterais glacialis* and the scallop *Pecten maximus*.

The region to the east and south-east of the breakwater had previously been reported to represent the sub-feature of interest (namely subtidal mixed cobble and gravel sediments) (Moore *et al*., 1999) and the presence of this was confirmed during the 2011 survey. These areas were identified to consist of tide swept mobile infralittoral cobbles and pebbles with associated red seaweeds and kelps (A5.5211). The algal and faunal communities associated with these sediments comprised filamentous and foliose red algal species (including *Dilsea carnosa*) and kelp species (*L. digitata and L. saccharina*) along with the echinoderm species *Ophiura ophiura* and *Marthasterias glacialis*.

4.2 Identification of appropriate indicators to assess state of features

Monitoring of sub-features for which an SAC has been designated (along with their associated attributes) in support of Regulation 35 (formerly Regulation 33) requires an assessment of the extent and distribution of given features (and sub-features) and also the status (or condition) of their associated characteristic faunal communities (JNCC, 2004). Temporal reporting cycles vary according to the given feature or attribute. Therefore, monitoring in this context constitutes a robust evaluation of the presence and extent of those broadscale habitat features (and sub-features contained within them) along with a robust characterisation (over an appropriate temporal cycle) of their associated biotopes.

Whilst it is considered that such an evaluation was achieved by the 2011 survey, it is suggested that future monitoring effort would benefit from the application of acoustic techniques (bathymetric and backscatter) in advance of the groundtruthing survey (video or diver). This would act to increase confidence that the full extent of the physical habitat features of interest (in this instance, estuarine bedrock, boulder and cobble communities and subtidal mixed cobble and gravel communities) has been identified. Where the presence, distribution and extent of the physical habitat feature has been robustly defined a more directed (and statistically informed) characterisation (and assessment of condition) of its associated attributes can be achieved through application of the required density of sampling.

Therefore, it is suggested that the appropriate methods and indicators for monitoring the features (and sub-features) of interest in this area comprise a combination of acoustic techniques along with groundtruthing surveys (employing an appropriate survey platform to afford access to those regions of ineterst) to allow spatial patterns in the status of the associated attributes (e.g., faunal community characteristics and their condition) to be evaluated. Such evaluations could be repeated at intervals to provide a more robust temporal assessment of the features of interest. Robust characterisation of the attributes and evaluation of their condition traditionally employs a suite of measures (or indicators) to explore their species composition (including measures of diversity and evenness) along with assessments of their functional status.

4.3 Survey and Data Limitations

4.3.1 River Tamar Survey Limitations

A number of limitations were identified during the course of the survey in the River Tamar. Firstly, a number of the areas of interest (namely the river margins predicted to comprise bedrock and boulder habitats) were inaccessible to the survey vessel due to the presence of a number of yacht trot moorings. Furthermore, despite timing the survey effort within the River Tamar to coincide with predicted times for optimal visibility (slack water), high turbidity levels resulted in poor quality video (and few useable still images) from this region.

4.3.2 Plymouth Sound

The presence and location of static fishing gear (strings of crab pots) dictated the choice of survey direction when proceeding along planned transect lines. This, however, did not result in any inaccessibility to the areas planned for survey.

4.3.3 Data Limitations

A number of limitations in the survey data collected were identified in terms of robustly assessing the necessary features of interest (and their associated attributes). Firstly, as discussed above in section 4.2, assessment of the presence, extent and distribution of the physical features of interest would be improved greatly by the application of acoustic techniques to direct the subsequent groundtruthing and characterisation effort. Only where the true spatial distribution and extent of the physical habitat feature of interest is known can an adequate density of groundtruth sampling be planned and achieved to adequately describe the characteristics (and variability) of the attributes of interest (community composition) across the full area.

Secondly, a number of limitations arise when employing video and still imaging (or diver observation) techniques either in isolation (or in combination). Whilst application of the SACFOR scale, to video transects or still images, is appropriate to inform spatial patterns in the distribution of biotopes and/or community characteristics of a given habitat, it can still only be considered to be qualitative (or semi-quantitative) data at best. Additional difficulties arise when attempting to use such data for the purposes of setting statistically robust measures of current (or changing) condition or status of the attributes of interest. These include inherent subjectivity (in terms of sediment descriptions and faunal identifications) which can be ameliorated to some extent by consistency in the post-processing and application of appropriate QA processes. Furthermore, the effective acquisition of quantitative data (to which statistically robust analyses can be applied) is challenging when attempting to extract such data from images where field of view is variable (e.g., drop camera and diver surveys). Again, this can be ameliorated to some extent by the presence of a scaling devise (e.g., laser ranger finders) to assist in standardising the field of view (or effort) to minimise the effects of variable effort on those indicators affected (namely measures underpinned by species abundance or richness measures). Finally, where attempts are made to design and carry out surveys (using such techniques) to effectively assess the current (or baseline) status (along with subsequent changes), existing quantitative data sets are required to allow variability across the features of interest to be defined. This provides the data required to inform the density of sampling needed to provide the desired power of detection of change (in the given indicator of interest) over the time period of interest. This is particularly important for those attributes which exhibit high levels of variability over relatively short time scales (e.g., ephemeral algal biotopes).

4.4 Anthropogenic Impacts

A number of human activities were observed within the survey areas during the period of the survey. However, the ability to confidently attribute any observations of current status (or subsequent changes in status) in the habitat features, and their associated faunal communities, to the potential effects of such human induced pressures is not possible with the current survey design. The ability to delineate natural fluctuations in the indicators utilised to infer condition of given attributes (traditionally measures of species composition, indicators of diversity and/or functional measures) is underpinned by a comprehensive understanding of the natural spatial and temporal variability exhibited by the given receptor or attribute of interest (e.g., species, community) and the metric employed to assess its status. Such assessments are reliant on a combination of directed research or operational monitoring (to robustly attribute observed negative state changes or impacts to given human pressures present). Additionally, sufficiently long time series data for comparable attributes (in comparable environmental regimes) are required to effectively delineate observed human induced changes from natural ‘background’ fluctuations.

5 Conclusions

5.1 Overall Conclusions in relation to survey aims and objectives

Objective 1: Develop a cost effective sampling design to enable a measure of each sub-feature attribute to be obtained.

A sampling strategy was devised and executed that, within limitations imposed by budget, time and environmental conditions, delivered data of sufficient quality to make an informed physical and biological assessment of the attributes of interest.

Objective 2: To make an assessment of change for each attribute against a baseline where it exists. Where it does not, produce a baseline against which future measures can be assessed.

The biotopes identified, in association with the physical sub-features of interest, validated the presence and extent predicted and described from previous surveys (where possible). Survey stations in the deeper, central channel of the River Tamar, in the vicinity of the Tamar Bridge, were characterised by mixed sediments, including areas of boulder and cobble. Associated communities comprised a similar assemblage of faunal species as described in 1999 (Moore *et al*., 1999), namely 'cushion sponges, hydroids and ascidians on very tide-swept sheltered circalittoral rock'- ECR.BS.CuSH. Attributes of interest in the shallower river margins in the vicinity of the Tamar Bridge and in the upper reaches of the river could not be assessed during the 2012 survey due to inaccessibility for the survey vessel.

The predicted (and described) extent of the ephemeral red algal biotope in the Plymouth Sound survey area was identified to be similar to that observed during the 1999 and 2000 diver and ROV surveys.

Objective 3: To assess for any signs of human derived damage or disturbance

Whilst a number of human activities were observed within the survey areas during the period of the survey the ability to confidently attribute any observations of current status (or subsequent changes in status) in the habitat features, and their associated faunal communities, to the potential effects of such human induced pressures is not possible with the current survey design. The ability to delineate natural fluctuations in the indicators utilised to infer condition of given attributes (traditionally measures of species composition, indicators of diversity and/or functional measures) is underpinned by a comprehensive understanding of the natural spatial and temporal variability exhibited by the given receptor or attribute of interest (e.g., species, community) and the metric employed to assess its status. Such assessments are reliant on a combination of directed research or operational monitoring (to robustly attribute observed negative state changes or impacts to given human pressures present). Additionally, sufficiently long time series data for comparable attributes (in comparable environmental regimes) are required to effectively delineate observed human induced changes from natural 'background' fluctuations.

Objective 4: To report on any deficiencies of individual data collection methods or techniques
In light of the outcomes of the 2011 survey a number of recommendations have emerged which will help inform and refine future monitoring effort for these sub-features and their associated attributes within the Plymouth Sound and Estuaries SAC. Recommendations are provided on possible alternatives for future monitoring of the area given the limitations of the survey techniques within each habitat type. In particular, it is recommended that acoustic surveys are carried out, prior to groundtruthing, to provide a more scientifically robust assessment of the habitat features and sub-features in the SAC.

5.2 Future Monitoring Scheme

Recommendations for future monitoring surveys are given below:

- Assess the spatial extent and distribution of the physical features of interest through application of acoustic techniques (appropriate to the detection of the physical feature) prior to carrying out the groundtruthing surveys. For example, multibeam bathymetric surveys are recommended to allow the delineation of topographic features such as upstanding bedrock and/or backscatter data from sonar or multibeam echsounders for mixed sedimentary habitats.

- Apply groundtruthing techniques (appropriate to the feature of interest) at an adequate sampling density to effectively characterise the attributes associated with the features. This should be informed by acoustic data, and any previously obtained groundtruthing data, to provide information on their known spatial and temporal variability.

- The choice of appropriate groundtruthing techniques, to allow the collection of suitably robust and quantitative data, will vary depending on a number of factors. It is recommended that such considerations include, accessibility of the areas of interest (diver surveys may be preferable to video surveys where areas are inaccessible by larger survey vessels). Diver surveys may be also be preferable where there is a requirement to identify certain taxa to species level (a number of the algal species and sponges encountered during the survey can not be identified using imaging techniques alone). Finally, it should be noted that all survey techniques employed have associated limitations. For example, increased accessibility to areas of interest using diver surveys will be offset by increased subjectivity of the resultant (largely qualitative) data set along with limited ability to standardise survey effort. This is also true, albeit to a lesser extent, when applying video survey techniques though the limitations in subsequent analyses (and the interpretation of results) of a largely qualitative resultant data set should equally be considered.

6 Acknowledgements

We would like to thank the crew of the survey vessel 'FPV Drumbeat of Devon' and the environmental officers of the Devon and Severn IFCA for their expertise and assistance in making the survey a success. Additionally, we would like to thank Matthew Curtis for his contribution to video and still image processing and QA and would also like to thank Dr. Keith Hiscock for provision of observations and species identifications from his recent dive survey in the River Tamar and kind permission to use a number of his images in the report.

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8 Annexes

8.1 Survey Metadata

Cruise Code	Stn No.	Gear	Date	SOL	EOL	Lat	Long	Depth (m)
DB1_11	1	DC	07/10/2011	13:59	14:09	50.411000	-4.203850	8
DB1_11	1	DC	07/10/2011	13:59	14:09	50.409900	-4.202283	8
DB1_11	2	DC	07/10/2011	14:14	14:23	50.409283	-4.203867	10
DB1_11	2	DC	07/10/2011	14:14	14:23	50.407767	-4.203383	10
DB1_11	3	DC	07/10/2011	14:32	14:40	50.406667	-4.204200	19.5
DB1_11	3	DC	07/10/2011	14:32	14:40	50.406250	-4.204067	19.5
DB1_11	4	DC	07/10/2011	14:47	14:49	50.403967	-4.205017	19
DB1_11	4	DC	07/10/2011	14:47	14:49	50.403817	-4.204650	19
DB1_11	5	DC	07/10/2011	15:08	15:20	50.403383	-4.205783	11.5
DB1_11	5	DC	07/10/2011	15:08	15:20	50.402233	-4.204900	11.3
DB1_11	6	DC	07/10/2011	15:52	15:54	50.405917	-4.204550	15.5
DB1_11	6	DC	07/10/2011	15:52	15:54	50.405917	-4.204550	15.5
DB1_11	7a	DC	07/10/2011	16:12	16:20	50.415950	-4.203383	9.5
DB1_11	7a	DC	07/10/2011	16:12	16:20	50.414000	-4.203667	9.5
DB1_11	7b	DC	07/10/2011	16:21	16:45	50.416933	-4.203617	9.5
DB1_11	7b	DC	07/10/2011	16:21	16:45	50.414083	-4.203667	9.5
DB1_11	8	DC	07/10/2011	16:54	17:05	50.411167	-4.203517	11.5
DB1_11	8	DC	07/10/2011	16:54	17:05	50.409750	-4.202167	12
DB1_11	9	DC	07/10/2011	17:12	17:21	50.410033	-4.204250	11.5
DB1_11	9	DC	07/10/2011	17:12	17:21	50.408500	-4.204550	17.8
DB1_11	10	DC	08/10/2011	09:53	10:14	50.338200	-4.137067	12
DB1_11	10	DC	08/10/2011	09:53	10:14	50.337750	-4.134150	12
DB1_11	11	DC	08/10/2011	10:21	10:47	50.338117	-4.137733	13.5
DB1_11	11	DC	08/10/2011	10:21	10:47	50.337933	-4.133867	13.5
DB1_11	12	DC	08/10/2011	10:54	11:05	50.337200	-4.137333	13.5
DB1_11	12	DC	08/10/2011	10:54	11:05	50.337883	-4.135050	13.5
DB1_11	13	DC	08/10/2011	11:12	11:18	50.336350	-4.136933	13.5
DB1_11	13	DC	08/10/2011	11:12	11:18	50.336433	-4.137300	13.5
DB1_11	14	DC	08/10/2011	11:25	11:36	50.335633	-4.133017	13.7
DB1_11	14	DC	08/10/2011	11:25	11:36	50.336033	-4.133700	13.7
DB1_11	15	DC	08/10/2011	11:40	11:52	50.336750	-4.135483	13
DB1_11	15	DC	08/10/2011	11:40	11:52	50.339433	-4.134833	13
DB1_11	16	DC	08/10/2011	12:14	12:32	50.331150	-4.134533	13.5
DB1_11	16	DC	08/10/2011	12:14	12:32	50.333733	-4.128900	15
DB1_11	17	DC	08/10/2011	12:44	13:22	50.324867	-4.141750	12.8
DB1_11	17	DC	08/10/2011	12:44	13:22	50.329717	-4.129983	12.8
DB1_11	18	DC	08/10/2011	14:54	15:15	50.334267	-4.134900	17
DB1_11	18	DC	08/10/2011	14:54	15:15	50.332100	-4.126233	15
DB1_11	19a	DC	08/10/2011	15:43	15:46	50.338183	-4.135250	10
DB1_11	19a	DC	08/10/2011	15:43	15:46	50.338083	-4.135117	10
DB1_11	19b	DC	08/10/2011	15:50	15:53	50.338083	-4.135117	10
DB1_11	19b	DC	08/10/2011	15:50	15:53	50.338083	-4.135117	10
DB1_11	20a	DC	08/10/2011	16:21	16:38	50.340467	-4.169400	10
DB1_11	20a	DC	08/10/2011	16:21	16:38	50.339117	-4.167650	10
DB1_11	20b	DC	08/10/2011	16:41	16:48	50.338667	-4.167333	10
DB1_11	20b	DC	08/10/2011	16:41	16:48	50.338333	-4.166550	10
DB1_11	21	DC	09/10/2011	09:45	10:01	50.407250	-4.204433	15
DB1_11	21	DC	09/10/2011	09:45	10:01	50.408183	-4.204817	15
DB1_11	22	DC	09/10/2011	10:07	10:38	50.409633	-4.203917	10.5

8.2 Media catalogue

Cruise Code	Label	Stations
DB1_11	DVT 1	1, 2, 3, 4, 5, 6
DB1_11	DVT 2	7, 8, 9
DB1_11	DVT 3	10, 11, 12
DB1_11	DVT 4	13, 14, 15, 16
DB1_11	DVT 5	17, 18, 19, 20
DB1_11	DVT 6	21, 22, 23
DB1_11	DVT 7	23

8.3 Video Data Summary

Date	EventName	Video SampleRef	Method	StartTime (hh:mm:ss)	EndTime (hh:mm:ss)	Duration (hh:mm:ss)	Projection	Start (Lat)	Start (Long)	End (Lat)	End(Long)	Biotope (EUNIS)	Classification (Exact copy of MNCR descriptor)	BiotopeKey (MNCRcode)
07/10/2011	STN 1	STN1_S1	DC	13:59:44	14:09:13	00:09:29	WGS84	50.4110	-4.2030	50.4090	-4.2020	A5.42	Sublittoral mixed sediment in variable salinity	SS.SMx.SMxVS
07/10/2011	STN 2	STN2_S1	DC	14:14:56	14:22:41	00:07:45	WGS84	50.4090	-4.2030	50.4070	-4.2030	A5.42	Sublittoral mixed sediment in variable salinity	SS.SMx.SMxVS
07/10/2011	STN 3	STN3_S1	DC	14:33:01	14:39:21	00:06:20	WGS84	50.4060	-4.2040	50.4060	-4.2040	A5.42	Sublittoral mixed sediment in variable salinity	SS.SMx.SMxVS
07/10/2011	STN 4	STN4_S1	DC	14:48:43	14:49:05	00:00:22	WGS84	50.4030	-4.2050	50.4030	-4.2040	A5.42	Sublittoral mixed sediment in variable salinity	SS.SMx.SMxVS
07/10/2011	STN 5	STN5_S1	DC	15:08:51	15:20:00	00:11:09	WGS84	50.4030	-4.2050	50.4020	-4.2040	A5.42	Sublittoral mixed sediment in variable salinity	SS.SMx.SMxVS
07/10/2011	STN 6	STN6_S1	DC	15:52:21	15:54:00	00:01:39	WGS84	50.4050	-4.2050	50..405	-4.2040	A5.42	Sublittoral mixed sediment in variable salinity	SS.SMx.SMxVS
07/10/2011	STN 7	STN7_S1	DC	16:12:27	16:21:09	00:01:23	WGS84	50.4150	-4.2130	50.4140	-4.2030	A5.42	Sublittoral mixed sediment in variable salinity	SS.SMx.SMxVS
07/10/2011	STN 7	STN7_S2	DC	16:21:09	16:45:27	00:24:18	WGS84	50.4160	-4.2030	50.4140	-4.2030	A5.42	Sublittoral mixed sediment in variable salinity	SS.SMx.SMxVS
07/10/2011	STN 8	STN8_S1	DC	16:54:59	17:04:37	00:09:36	WGS84	50.4110	-4.2030	50.4090	-4.2020	A5.42	Sublittoral mixed sediment in variable salinity	SS.SMx.SMxVS
07/10/2011	STN 9	STN9_S1	DC	17:12:30	17:21:16	00:08:46	WGS84	50.4100	-4.2040	50.4090	-4.2020	A5.42	Sublittoral mixed sediment in variable salinity	SS.SMx.SMxVS
08/10/2011	STN10	STN10_S1	DC	No vid			WGS84	50.3382	-4.1371	50.3378	-4.1342	A5.43	Infralittoral mixed sediment	SS.SMx.IMx
08/10/2011	STN11	STN11_S1	DC	10:24:00	10:30:00	00:06:00	WGS84	50.3383	-4.1372	50.3382	-4.1364	A5.43	Infralittoral mixed sediment	SS.SMx.IMx
08/10/2011	STN11	STN11_S2	DC	10:30:00	10:41:30	00:11:30	WGS84	50.3382	-4.1364	50.3381	-4.1347	A3.3131	Laminaria saccharina and Laminaria digitata on sheltered sublittoral fringe rock	IR.LIR.K.Lsac.Ldig
08/10/2011	STN11	STN11_S3	DC	10:41:30	10:46:30	00:05:30	WGS84	50.3381	-4.1347	50.3376	-4.1342	A5.43	Infralittoral mixed sediment	SS.SMx.IMx
08/10/2011	STN12	STN12_S1	DC	10:54:47	10:58:00	00:02:13	WGS84	50.3372	-4.1373	50.3379	-4.1350	A5.43	Infralittoral mixed sediment	SS.SMx.IMx
08/10/2011	STN13	STN13_S1	DC	11:12:25	11:16:30	00:04:05	WGS84	50.3364	-4.1369	50.3364	-4.1372	A5.43	Infralittoral mixed sediment	SS.SMx.IMx
08/10/2011	STN14	STN14_S1	DC	11:26:00	11:33:00	00:07:00	WGS84	50.3364	-4.1330	50.3360	-4.1337	A5.13	Infralittoral coarse sediment	SS.SCS.ICS
08/10/2011	STN15	STN15_S1	DC	11:41:00	11:47:30	00:06:30	WGS84	50.3368	-4.1355	50.3379	-4.1352	A5.43	Infralittoral mixed sediment	SS.SMx.IMx
08/10/2011	STN15	STN15_S2	DC	11:47:30	11:50:00	00:02:30	WGS84	50.3379	-4.1352	50.3394	-4.1348	A3.3131	Laminaria saccharina and Laminaria digitata on sheltered sublittoral fringe rock	IR.LIR.K.Lsac.Ldig
08/10/2011	STN16	STN16_S1	DC	12:14:00	12:32:00	00:00:00	WGS84	50.3312	-4.1345	50.3337	-4.1289	A5.5211	Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles	SS.SMp.KSwSS.LsacR.CbPb
08/10/2011	STN17	STN17_S1	DC	12:45:00	12:47:45	00:02:45	WGS84	50.3249	-4.1414	50.3250	-4.1410	A3.3131	Laminaria saccharina and Laminaria digitata on sheltered sublittoral fringe rock	IR.LIR.K.Lsac.Ldig
08/10/2011	STN17	STN17_S2	DC	12:47:45	13:08:30	00:20:45	WGS84	50.3250	-4.4096	50.3260	-4.1390	A5.5211	Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles	SS.SMp.KSwSS.LsacR.CbPb
08/10/2011	STN17	STN17_S3	DC	13:08:30	13:14:00	00:05:30	WGS84	50.3260	-4.1390	50.3280	-4.1330	A5.231	Infralittoral mobile clean sand with sparse fauna	SS.SSa.IFiSa.IMoSa
08/10/2011	STN17	STN17_S4	DC	13:14:00	13:20:00	00:06:00	WGS84	50.3280	-4.1330	50.3290	-4.1300	A5.5211	Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles	SS.SMp.KSwSS.LsacR.CbPb
08/10/2011	STN18	STN18_S1	DC	14:56:00	15:06:20	00:10:10	WGS84	50.3343	-4.1298	50.3329	-4.1298	A5.5211	Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles	SS.SMp.KSwSS.LsacR.CbPb
08/10/2011	STN18	STN18_S2	DC	15:06:20	15:10:00	00:03:40	WGS84	50.3329	-4.1298	50.3327	-4.1285	A5.13	Infralittoral coarse sediment	SS.SCS.ICS
08/10/2011	STN18	STN18_S3	DC	15:10:00	15:11:20	00:01:20	WGS84	50.3327	-4.1285	50.3326	-4.1278	A5.231	Infralittoral mobile clean sand with sparse fauna	SS.SSa.IFiSa.IMoSa
08/10/2011	STN18	STN18_S4	DC	15:11:20	15:12:40	00:01:20	WGS84	50.3326	-4.1278	50.3325	-4.1274	A5.13	Infralittoral coarse sediment	SS.SCS.ICS
08/10/2011	STN18	STN18_S5	DC	15:12:40	15:15:15	00:02:35	WGS84	50.3325	-4.1274	50.3321	-4.1262	A5.5211	Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles	SS.SMp.KSwSS.LsacR.CbPb
08/10/2011	STN19	STN19_S1	DC	15:44:00	15:45:30	00:01:30	WGS84	50.3382	-4.1355	50.3382	-4.1354	A3.2111	Laminaria digitata on moderately exposed sublittoral fringe bedrock	IR.MIR.KR.Ldig.Ldig
08/10/2011	STN20	STN20_S1	DC	16:34:00	16:35:30	00:01:30	WGS84	50.3393	-4.1682	50.3392	-4.1681	A5.5213	Laminaria saccharina and filamentous red algae on infralittoral sand	SS.SMp.KSwSS.LsacR.Sa
08/10/2011	STN20	STN20_S2	DC	16:35:30	16:36:30	00:01:00	WGS84	50.3390	-4.1681	50.3390	-4.1681	A3.2111	Laminaria digitata on moderately exposed sublittoral fringe bedrock	IR.MIR.KR.Ldig.Ldig
08/10/2011	STN20	STN20_S3	DC	16:36:30	16:37:30	00:01:00	WGS84	50.3390	-4.1681	50.3391	-4.1677	A5.231	Infralittoral mobile clean sand with sparse fauna	SS.SSa.IFiSa.IMoSa
09/10/2011	STN 21	STN21_1	DC	09:54:54	10:00:48	00:05:54	WGS84	50.4070	-4.2040	50.4080	-4.2040	A5.42	Sublittoral mixed sediment in variable salinity	SS.SMx.SMxVS
09/10/2011	STN 22	STN22_1	DC	10:07:54	10:37:38	00:05:54	WGS84	50.4090	-4.2030	50.4050	-4.2030	A5.42	Sublittoral mixed sediment in variable salinity	SS.SMx.SMxVS
09/10/2011	STN 23	STN23_1	DC	10:56:50	11:16:18	00:19:28	WGS84	50.4090	-4.2020	50.4070	-4.2030	A5.42	Sublittoral mixed sediment in variable salinity	SS.SMx.SMxVS

8.4 Still Data Summary

Date	EventName	Still Sample Ref	Method	Fix Time (hh:mm:ss)	Projection	Lat	Long	Biotope (EUNIS)	Classification (Exact copy of MNCR descriptor)	BiotopeKey (MNCRcode)
07/10/2011	STN1_S1	STN1_0016	DC	14:05:00	WGS84	50.4105	-4.2023	A5.42	Sublittoral mixed sediment in variable salinity	SS.SMx.SMxVS
07/10/2011	STN1_S1	STN1_0018	DC	14:07:00	WGS84	50.4103	-4.2024	A5.42	Sublittoral mixed sediment in variable salinity	SS.SMx.SMxVS
07/10/2011	STN1_S1	STN1_23	DC	14:09:00	WGS84	50.4099	-4.2023	A5.42	Sublittoral mixed sediment in variable salinity	SS.SMx.SMxVS
07/10/2011	STN3_1	STN3_27	DC	14:34:00	WGS84	50.4066	-4.2037	A5.42	Sublittoral mixed sediment in variable salinity	SS.SMx.SMxVS
07/10/2011	STN3_1	STN3_28	DC	14:34:00	WGS84	50.4065	-4.2038	A5.42	Sublittoral mixed sediment in variable salinity	SS.SMx.SMxVS
07/10/2011	STN3_1	STN3_29	DC	14:36:00	WGS84	50.4066	-4.2040	A5.42	Sublittoral mixed sediment in variable salinity	SS.SMx.SMxVS
07/10/2011	STN6_1	STN6_45	DC	15:52:00	WGS84	50.4059	-4.2046	A5.42	Sublittoral mixed sediment in variable salinity	SS.SMx.SMxVS
08/10/2011	STN11_S1	STN 11_S1_0048	DC	10:24:00	WGS84	50.3383	-4.1372	A5.43	Infralittoral mixed sediment	SS.SMx.IMx
08/10/2011	STN11_S1	STN 11_S1_0056	DC	10:26:00	WGS84	50.3383	-4.1368	A5.43	Infralittoral mixed sediment	SS.SMx.IMx
08/10/2011	STN11_S1	STN 11_S1_0063	DC	10:28:00	WGS84	50.3383	-4.1366	A5.43	Infralittoral mixed sediment	SS.SMx.IMx
08/10/2011	STN11_S2	STN 11_S2_0072	DC	10:31:00	WGS84	50.3382	-4.1363	A3.3131	Laminaria saccharina and Laminaria digitata on sheltered sublittoral fringe rock	IR.LIR.K.Lsac.Ldig
08/10/2011	STN11_S2	STN 11_S2_0081	DC	10:33:00	WGS84	50.3382	-4.1359	A3.3131	Laminaria saccharina and Laminaria digitata on sheltered sublittoral fringe rock	IR.LIR.K.Lsac.Ldig
08/10/2011	STN11_S2	STN 11_S2_0100	DC	10:39:00	WGS84	50.3391	-4.1350	A3.3131	Laminaria saccharina and Laminaria digitata on sheltered sublittoral fringe rock	IR.LIR.K.Lsac.Ldig
08/10/2011	STN11_S3	STN 11_S3_0110	DC	10:42:00	WGS84	50.3381	-4.1346	A5.43	Infralittoral mixed sediment	SS.SMx.IMx
08/10/2011	STN11_S3	STN 11_S3_0117	DC	10:44:00	WGS84	50.3380	-4.1344	A5.43	Infralittoral mixed sediment	SS.SMx.IMx
08/10/2011	STN11_S3	STN 11_S3_0123	DC	10:45:00	WGS84	50.3379	-4.1343	A5.43	Infralittoral mixed sediment	SS.SMx.IMx
08/10/2011	STN12_S1	STN12_S1_0127	DC	10:55:00	WGS84	50.3372	-4.1373	A5.43	Infralittoral mixed sediment	SS.SMx.IMx
08/10/2011	STN12_S1	STN12_S1_0128	DC	10:55:00	WGS84	50.3372	-4.1373	A5.43	Infralittoral mixed sediment	SS.SMx.IMx
08/10/2011	STN12_S1	STN12_S1_0130	DC	10:55:00	WGS84	50.3372	-4.1372	A5.43	Infralittoral mixed sediment	SS.SMx.IMx
08/11/2011	STN13_S1	STN13_S1_0134	DC	11:13:00	WGS84	50.3364	-4.1370	A5.43	Infralittoral mixed sediment	SS.SMx.IMx
08/11/2011	STN13_S1	STN13_S1_0137	DC	11:14:00	WGS84	50.3363	-4.1371	A5.43	Infralittoral mixed sediment	SS.SMx.IMx
08/11/2011	STN13_S1	STN13_S1_0140	DC	11:16:00	WGS84	50.3364	-4.1372	A5.43	Infralittoral mixed sediment	SS.SMx.IMx
08/10/2011	STN14_S1	STN14_S1_0143	DC	11:26:00	WGS84	50.3357	-4.1330	A5.13	Infralittoral coarse sediment	SS.SCS.ICS
08/10/2011	STN14_S1	STN14_S1_0146	DC	11:27:00	WGS84	50.3358	-4.1330	A5.13	Infralittoral coarse sediment	SS.SCS.ICS
08/10/2011	STN14_S1	STN14_S1_0150	DC	11:28:00	WGS84	50.3360	-4.1329	A5.13	Infralittoral coarse sediment	SS.SCS.ICS
08/10/2011	STN15_S1	STN15_S1_0153	DC	11:41:00	WGS84	50.3368	-4.1355	A5.43	Infralittoral mixed sediment	SS.SMx.IMx
08/10/2011	STN15_S1	STN15_S1_0161	DC	11:44:00	WGS84	50.3373	-4.1355	A5.43	Infralittoral mixed sediment	SS.SMx.IMx
08/10/2011	STN15_S1	STN15_S1_0168	DC	11:46:00	WGS84	50.3378	-4.1352	A5.43	Infralittoral mixed sediment	SS.SMx.IMx
08/10/2011	STN15_S2	STN15_S2_0173	DC	11:47:00	WGS84	50.3379	-4.1352	A3.3131	Laminaria saccharina and Laminaria digitata on sheltered sublittoral fringe rock	IR.LIR.K.Lsac.Ldig
08/10/2011	STN15_S2	STN15_S2_0176	DC	11:48:00	WGS84	50.3381	-4.1351	A3.3131	Laminaria saccharina and Laminaria digitata on sheltered sublittoral fringe rock	IR.LIR.K.Lsac.Ldig
08/10/2011	STN15_S2	STN15_S2_0177	DC	11:49:00	WGS84	50.3382	-4.1351	A3.3131	Laminaria saccharina and Laminaria digitata on sheltered sublittoral fringe rock	IR.LIR.K.Lsac.Ldig
08/10/2011	STN16_S1	STN16_S1_0187	DC	12:15:00	WGS84	50.3312	-4.1342	A5.5211	Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles	SS.SMp.KSwSS.LsacR.CbPb
08/10/2011	STN16_S1	STN16_S1_0202	DC	12:20:00	WGS84	50.3317	-4.1325	A5.5211	Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles	SS.SMp.KSwSS.LsacR.CbPb
08/10/2011	STN16_S1	STN16_S1_0223	DC	12:26:00	WGS84	50.3328	-4.1304	A5.5211	Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles	SS.SMp.KSwSS.LsacR.CbPb
08/10/2011	STN17_S1	STN17_S1_0246	DC	12:46:00	WGS84	50.3249	-4.1414	A3.3131	Laminaria saccharina and Laminaria digitata on sheltered sublittoral fringe rock	IR.LIR.K.Lsac.Ldig
08/10/2011	STN17_S1	STN17_S1_0249	DC	12:46:00	WGS84	50.3250	-4.1410	A3.3131	Laminaria saccharina and Laminaria digitata on sheltered sublittoral fringe rock	IR.LIR.K.Lsac.Ldig
08/10/2011	STN17_S2	STN17_S2_0251	DC	12:48:00	WGS84	50.3250	-4.1403	A5.5211	Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles	SS.SMp.KSwSS.LsacR.CbPb
08/10/2011	STN17_S2	STN17_S2_0262	DC	13:06:00	WGS84	50.3260	-4.1390	A5.5211	Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles	SS.SMp.KSwSS.LsacR.CbPb
08/10/2011	STN17_S2	STN17_S2_0268	DC	13:07:00	WGS84	50.3260	-4.1390	A5.5211	Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles	SS.SMp.KSwSS.LsacR.CbPb
08/10/2011	STN17_S3	STN17_S3_0271	DC	13:09:00	WGS84	50.3260	-4.1390	A5.231	Infralittoral mobile clean sand with sparse fauna	SS.SSa.IFiSa.IMoSa
08/10/2011	STN17_S3	STN17_S3_0275	DC	13:10:00	WGS84	50.3270	-4.1370	A5.231	Infralittoral mobile clean sand with sparse fauna	SS.SSa.IFiSa.IMoSa
08/10/2011	STN17_S3	STN17_S3_0277	DC	13:12:00	WGS84	50.3280	-4.1350	A5.231	Infralittoral mobile clean sand with sparse fauna	SS.SSa.IFiSa.IMoSa
08/10/2011	STN17_S4	STN17_S4_0284	DC	13:14:00	WGS84	50.3280	-4.1330	A5.5211	Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles	SS.SMp.KSwSS.LsacR.CbPb
08/10/2011	STN17_S4	STN17_S4_0295	DC	13:17:00	WGS84	50.3290	-4.1320	A5.5211	Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles	SS.SMp.KSwSS.LsacR.CbPb
08/10/2011	STN17_S4	STN17_S4_0306	DC	13:20:00	WGS84	50.3301	-4.1300	A5.5211	Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles	SS.SMp.KSwSS.LsacR.CbPb
08/10/2011	STN18_S1	STN18_S1_0005	DC	14:57:00	WGS84	50.3338	-4.1338	A5.5211	Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles	SS.SMp.KSwSS.LsacR.CbPb
08/10/2011	STN18_S1	STN18_S1_0020	DC	15:02:00	WGS84	50.3333	-4.1319	A5.5211	Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles	SS.SMp.KSwSS.LsacR.CbPb
08/10/2011	STN18_S1	STN18_S1_0027	DC	15:04:00	WGS84	50.3331	-4.1306	A5.5211	Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles	SS.SMp.KSwSS.LsacR.CbPb
08/10/2011	STN18_S2	STN18_S2_0035	DC	15:07:00	WGS84	50.3329	-4.1296	A5.13	Infralittoral coarse sediment	SS.SCS.ICS
08/10/2011	STN18_S2	STN18_S2_0039	DC	15:08:00	WGS84	50.3328	-4.1290	A5.13	Infralittoral coarse sediment	SS.SCS.ICS
08/10/2011	STN18_S2	STN18_S2_0041	DC	15:09:00	WGS84	50.3328	-4.1288	A5.13	Infralittoral coarse sediment	SS.SCS.ICS
08/10/2011	STN18_S3	STN18_S3_0046	DC	15:10:00	WGS84	50.3327	-4.1283	A5.231	Infralittoral mobile clean sand with sparse fauna	SS.SSa.IFiSa.IMoSa
08/10/2011	STN18_S3	STN18_S3_0047	DC	15:10:00	WGS84	50.3327	-4.1282	A5.231	Infralittoral mobile clean sand with sparse fauna	SS.SSa.IFiSa.IMoSa
08/10/2011	STN18_S3	STN18_S3_0048	DC	15:10:00	WGS84	50.3327	-4.1280	A5.231	Infralittoral mobile clean sand with sparse fauna	SS.SSa.IFiSa.IMoSa
08/10/2011	STN18_S4	STN18_S4_0050	DC	15:11:00	WGS84	50.3326	-4.1278	A5.13	Infralittoral coarse sediment	SS.SCS.ICS
08/10/2011	STN18_S4	STN18_S4_0053	DC	15:12:00	WGS84	50.3325	-4.1275	A5.13	Infralittoral coarse sediment	SS.SCS.ICS
08/10/2011	STN18_S4	STN18_S4_0054	DC	15:12:00	WGS84	50.3325	-4.1275	A5.13	Infralittoral coarse sediment	SS.SCS.ICS
08/10/2011	STN18_S5	STN18_S5_0055	DC	15:12:00	WGS84	50.3325	-4.1274	A5.5211	Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles	SS.SMp.KSwSS.LsacR.CbPb
08/10/2011	STN18_S5	STN18_S5_0057	DC	15:13:00	WGS84	50.3324	-4.1273	A5.5211	Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles	SS.SMp.KSwSS.LsacR.CbPb
08/10/2011	STN18_S5	STN18_S5_0063	DC	15:14:00	WGS84	50.3323	-4.1266	A5.5211	Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles	SS.SMp.KSwSS.LsacR.CbPb
08/10/2011	STN19_S1	STN19_S1_0066	DC	15:14:00	WGS84	50.3382	-4.1355	A3.2111	Laminaria digitata on moderately exposed sublittoral fringe bedrock	IR.MIR.KR.Ldig.Ldig
08/10/2011	STN19_S1	STN19_S1_0067	DC	15:44:00	WGS84	50.3383	-4.1354	A3.2111	Laminaria digitata on moderately exposed sublittoral fringe bedrock	IR.MIR.KR.Ldig.Ldig
08/10/2011	STN19_S1	STN19_S1_0070	DC	14:44:00	WGS84	50.3820	-4.1352	A3.2111	Laminaria digitata on moderately exposed sublittoral fringe bedrock	IR.MIR.KR.Ldig.Ldig
08/10/2011	STN20_S1	STN20_S1_0095	DC	16:34:00	WGS84	50.3393	-4.1682	A5.5213	Laminaria saccharina and filamentous red algae on infralittoral sand	SS.SMp.KSwSS.LsacR.Sa
08/10/2011	STN20_S1	STN20_S1_0096	DC	16:34:00	WGS84	50.3393	-4.1682	A5.5213	Laminaria saccharina and filamentous red algae on infralittoral sand	SS.SMp.KSwSS.LsacR.Sa
08/10/2011	STN20_S1	STN20_S1_0097	DC	16:34:00	WGS84	50.3393	-4.1681	A5.5213	Laminaria saccharina and filamentous red algae on infralittoral sand	SS.SMp.KSwSS.LsacR.Sa
08/10/2011	STN20_S2	STN20_S2_0098	DC	16:35:00	WGS84	50.3390	-4.1681	A3.2111	Laminaria digitata on moderately exposed sublittoral fringe bedrock	IR.MIR.KR.Ldig.Ldig
08/10/2011	STN20_S2	STN20_S2_0099	DC	16:35:00	WGS84	50.3390	-4.1681	A3.2111	Laminaria digitata on moderately exposed sublittoral fringe bedrock	IR.MIR.KR.Ldig.Ldig

About us

Cefas is a multi-disciplinary scientific research and consultancy centre providing a comprehensive range of services in fisheries management, environmental monitoring and assessment, and aquaculture to a large number of clients worldwide.

We have more than 500 staff based in 2 laboratories, our own ocean-going research vessel, and over 100 years of fisheries experience.

We have a long and successful track record in delivering high-quality services to clients in a confidential and impartial manner.
(www.cefas.defra.gov.uk)

Cefas Technology Limited (CTL) is a wholly owned subsidiary of Cefas specialising in the application of Cefas technology to specific customer needs in a cost-effective and focussed manner.

CTL systems and services are developed by teams that are experienced in fisheries, environmental management and aquaculture, and in working closely with clients to ensure that their needs are fully met.
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- oil, water, chemical, pharmaceutical, agro-chemical, aggregate and marine industries
- non-governmental and environmental organisations
- regulators and enforcement agencies
- local authorities and other public bodies

We also work successfully in partnership with other organisations, operate in international consortia and have several joint ventures commercialising our intellectual property

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Further information

Natural England evidence can be downloaded from our **Access to Evidence Catalogue**. For more information about Natural England and our work see **Gov.UK**. For any queries contact the Natural England Enquiry Service on 0300 060 3900 or e-mail **enquiries@naturalengland.org.uk** .

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Report number RP2885
ISBN 978-1-78354-276-5

First Edition 17 December 2015