JOINT NATURE CONSERVATION COMMITTEE

THE MARINE HABITAT CLASSIFICATION FOR BRITAIN AND IRELAND VERSION 04.05

INTRODUCTION

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Summary

This publication presents a fully revised version of the national classification of benthic marine habitats (seashore and seabed habitats and their associated communities of species) for Britain and Ireland. It was originally developed by JNCC's Marine Nature Conservation Review (MNCR) as part of the EC Life Nature-funded BioMar project (Connor *et al.* 1997 a, b).

The classification provides a tool to aid the management and conservation of marine habitats. It has been developed through the analysis of empirical data sets, the review of other classifications and scientific literature, and in collaboration with a wide range of marine scientists and conservation managers. It is fully compatible with and contributes to the European EUNIS habitat classification system (http://mrw.wallonie.be/dgrne/sibw/EUNIS/home.html).

An outline of the rationale, uses, overall structure and development methods is given in this introductory document. The classification website (www.jncc.gov.uk/MarineHabitatClassification) contains a full listing of newly defined and revised classification types, a detailed description of each type, distribution maps and, where possible, colour photographs. Separate documents are available to download on the website, containing biotope descriptions for each of the sections of the classification.

The classification is presented in hierarchical format, and through a series of habitat matrices. It comprises:

		Number of types defined
Level 1	Environment (marine)	1
Level 2	Broad habitat types	5
Level 3	Habitat complexes	24
Level 4	Biotope complexes	75
Levels 5 & 6	Biotopes and sub-biotopes	370

IMPORTANT

This classification supersedes versions 97.06 and 03.02.

Users of the classification must ensure they state which version has been used in any reports, data interpretation or field survey.

Acknowledgements

The development and success of the classification has only been possible through the considerable input and tremendous enthusiasm of a wide variety of people. Expertise from scientific and conservation management perspectives, with international through to local standpoints, and with views on both general philosophies and practical considerations have been essential to ensure the classification has developed as a robust scientific but practical tool for marine nature conservation and environmental management. We are very grateful to all those involved, for both the many positive comments which have encouraged us and the criticisms which have helped to sharpen the end product.

The following have particularly contributed to the present version:

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Introduction

This publication presents a classification of marine habitats for the shores and seabed around Britain and Ireland. It has been substantially revised and updated from the previous version which was developed by JNCC's Marine Nature Conservation Review (MNCR) as part of the EC Life Nature-funded BioMar programme (Connor *et al.* 1997a, b). This new version reflects the continuing needs of end-users for improved information about each habitat, which is presented in a variety of interactive ways in this web-based version. As a result of re-analysis of field data, including new data from recent surveys in candidate Special Areas of Conservation (cSACs), a number of new habitat types have been described. The classification has been restructured, both to reflect improved understanding of the inter-relationship of habitat types and to align itself more closely with the European EUNIS habitat classification system (http://mrw.wallonie.be/dgrne/sibw/EUNIS/home.html).

Rationale and need for a habitat classification

Purpose and scope

Seabed habitats and the communities of species that occupy them are an essential component of the marine ecosystem and our overall understanding of ecosystem function must relate seabed habitats to hydrography, nutrient cycling, plankton changes and the distribution of wide-ranging species (i.e. fish stocks, marine mammals, birds). A greater understanding of the distribution, extent and status or quality of marine habitats is required to facilitate the protection of threatened and rare habitats and, more generally, the assessment of the state of the marine environment. Such information is also needed to improve spatial and strategic planning of human activities, in particular to promote the wiser use of habitats where there are competing demands (e.g. fishing, sand and gravel extraction, wind energy generation, nature conservation). As such, information on marine habitats needs to play a major role in the ecosystem-based approach to management of the marine environment that is now widely advocated at national and international levels (Defra 2002; North Sea Conference 2002).

This habitat classification has, consequently, been developed as a tool to aid the management and conservation of marine habitats. It provides an ecologically-based classification of seashore and seabed features, aimed primarily at classifying benthic communities of invertebrates and seaweeds in a way which is meaningful both to detailed scientific application and to the much broader requirements for management of the marine environment. The classification is relevant to the habitat requirements of more mobile species, such as fish and marine mammals, but these are not its primary focus. Whilst the corresponding European EUNIS classification also includes water column (plankton) habitats, this aspect has not yet been developed here.

The classification aims to provide comprehensive coverage, by including habitats for artificial, polluted or barren areas as well as more natural habitats, which encompass:

1. **Marine, estuarine and brackish-water (lagoon) habitats -** It also includes reference to saltmarsh habitats described in the National Vegetation Classification (NVC) (Rodwell 2000; Doody, Johnston & Smith 1993) as these are regularly covered by the sea, and NVC types which occur in brackish lagoons (Rodwell 1995).
2. **Rock and sediment habitats.**
3. **Upper shore to coastal waters** - From the supralittoral or splash zone and strand-line on the shore out to the 200 nm limit. The habitats beyond the near-shore subtidal zone (about the 3 mile/5 km limit) and below about 50 m depth are less well described here, due to more limited availability of data; more types will be defined as data become available.
4. **Plant and animal communities, including epibiota and infauna -** Types are defined using both their fauna and flora. Most benthic marine habitats include sedentary animals and small mobile animals which are an integral part of the community, whilst in many habitats, especially in deeper water, there are no plants (seaweeds or marine angiosperms) to characterise the habitats. Sediment types are defined both by their epibiota (surface-dwelling animals and plants) and their infauna (animals living in the sediment).
5. **Britain and Ireland** - It covers habitats throughout Britain and Ireland and, through a widely-accepted broad framework, is readily expandable to include offshore continental shelf habitats and other areas in the north-east Atlantic, Mediterranean and Baltic Seas. This is being achieved through the EUNIS classification.

Requirements of a habitat classification system

To underpin management and conservation of the marine environment, a habitat classification system should:

- be scientifically sound, adopting a logical structure in which the types are clearly defined on ecological grounds, avoiding overlap in their definition and duplication of types in different

parts of the system, and ensuring that ecologically-similar types are placed near to each other and at an appropriate level (within a hierarchical classification);

- provide a common and easily understood language for the description of marine habitats;
- be comprehensive, accounting for all the marine habitats within its geographic scope;
- be practical in format and clear in its presentation;
- include sufficient detail to be of practical use for conservation managers and field surveyors but be sufficiently broad (through hierarchical structuring) to enable summary habitat information to be presented at national and international levels or its use by non-specialists;
- be sufficiently flexible to enable modification resulting from the addition of new information, but stable enough to support ongoing uses. Changes should be clearly documented to enable reference back to previous versions (where possible, newly defined types need to be related back to types in earlier versions of the classification).

The following considerations were taken into account in establishing the classification:

- its intended application by a variety of users and at various scales (environmental managers, marine scientists and field surveyors working at local, national and international levels);
- the variety of intended applications;
- the variation in the scale of physical and biological features (recognising that marine ecosystems operate at a wide variety of scales, e.g. whole estuaries, individual mussel beds);
- the different levels of detail in available data;
- the different skill levels of future users and their different methods of survey.

Applications

A number of applications for the habitat classification system have been identified:

- to provide a practical system for the consistent description of habitat types;
- to map habitats to assess their geographical distribution;
- to map habitats to assess their extent;
- to provide categories for the assessment of the state of marine biological communities;
- to assess changes in habitat distribution and extent over time, to provide information on quality status, and rate of change in habitat distribution;
- to assess the relative importance of particular habitats (i.e. which habitats are rare or of national or regional importance) and the implications of this for prioritising management and conservation action. Such assessment can lead to the listing of habitats for conservation action (e.g. Red lists);
- to enable the nature conservation value of habitats at specific sites to be assessed, such as in the identification of marine protected areas (MPAs);
- to enable an assessment of the extent of protection afforded to habitats by existing or proposed MPAs and the degree to which this provides sufficient protection;
- to enable the range and intensity of human activities that occur in particular habitats, and the degree to which such habitats are affected by those activities, to be systematically assessed;
- to facilitate presentation of habitat information at a scale and level of detail that enables appropriate management action to be taken. Such presentation should be flexible to address a variety of biodiversity and management issues;

- habitat mapping information needs to be used in conjunction with other spatial information in Geographical Information Systems (GIS), particularly activities, management and conservation areas, and other environmental data sets.

Nature of the marine environment

The habitat scale in characterising the marine environment

The marine environment can be described or characterised at a number of different scales, ranging from ocean-level processes through to those that occur at species and genetic level (Connor *et al.* 2002). The scales of relevance here are marine landscapes, habitats and species; their inter-relationship can be expressed as follows:

- **Species** provide the globally accepted original classification of biological diversity, with well-established rules of taxonomy to distinguish between different types. Their classification is arranged in a hierarchy of genera, families, orders, classes and phyla.
- **Habitats** comprise suites of species (communities or assemblages) that consistently occur together, but which are derived from different parts of the taxonomic hierarchy (e.g. kelps, molluscs and fish in a kelp forest habitat). Their classification can also be structured in a hierarchy (biotopes, biotope complexes, broad habitats), reflecting degrees of similarity.
- **Marine Landscapes** comprise suites of habitats that consistently occur together, but which are often derived from different parts of the habitat classification hierarchy (e.g. saltmarsh, intertidal mudflats, rocky shores and subtidal mussel beds in an estuary).

The approach to classification or characterisation at each scale differs, each adopting differing factors to suit the requirements at that scale. Whilst the classification (taxonomy) of species, and to a lesser degree habitats, is now well established the seascapes concept and their characterisation is a more recent approach to characterisation of the marine environment (Laffoley *et al.* 2000, Day & Roff 2000). The marine landscape concept was applied to the seabed and water column of the Irish Sea as part of the Irish Sea Pilot project (www.jncc.gov.uk/IrishSeaPilot).

Environmental influences at the habitat scale

Each species tends to live within a certain environment; that is, it has a preference for a combination of environmental factors (a niche), such as the substratum, temperature, salinity and hydrodynamic conditions that it is able to live within. The tolerance to different environmental conditions varies between species; it can be rather broad for some very common species but much more tightly defined for others. The niche occupied by a species may vary both temporally and spatially and is influenced not only by its physiological requirements and tolerance to change but also by the interactions between species, i.e. competition and predator-prey relationships.

In any particular place on the shore or seabed, a suite of species will occur, each adapted to the particular environmental conditions of that place, such as the conditions of an intertidal mudflat. Where such a suite of species occurs in other locations under similar environmental conditions, it can be defined as a **community** (or association or assemblage) of species which is occurring within a particular **habitat** type. The collective term **biotope** is now in common usage to encompass both of these biotic and abiotic elements.

Shore and seabed habitats are colonised primarily by seaweeds (on the shore and in shallow water) and by marine invertebrates from a wide range of phyla. Lichens (in the splash zone), higher plants (especially in saltmarshes) and fish contribute to a lesser degree. In contrast to terrestrial habitats, it is commonplace for marine habitats to be characterised, i.e. dominated, by animals rather than plants, and for the substratum to provide the main structure to the habitat (rather than plants such as in a forest).

Only a proportion of habitats have obvious dominant species (e.g. kelp forests, mussel beds, maerl beds). Many, particularly in deeper water, support a mosaic of species, none of which is particularly dominant, which may exhibit a degree of patchiness over the seashore or seabed and, in some cases, vary markedly with time. In these respects the species offer a much less robust mechanism for structuring a classification system than does the physical habitat in which they occur.

In the marine environment, there is a strong relationship between the abiotic nature of the habitat and the biological composition of the community it supports. Most communities appear to occur within a recognisable suite of environmental factors, although some occur within a more tightly-defined set of factors (habitat). One of the most important factors influencing species composition is the type of substratum present, which can be broadly divided into rock and sediment (the latter is closely linked to the hydrodynamic regime) whilst in estuaries salinity is an important factor. Community structure is additionally modified by biological factors such as recruitment, predation, grazing and inter-species competition. Species may modify habitats by their boring, accretion and bioturbation. The most important habitat attributes which appear to influence community composition are described in Table 1. In addition to habitat factors, biological and anthropogenic influences affect community composition. Some aspects of anthropogenic influence are outlined in Table 2.

Terminology: the terms biotope, habitat and community

A **biotope** is defined as the combination of an abiotic habitat and its associated community of species. It can be defined at a variety of scales (with related corresponding degrees of similarity) and should be a regularly occurring association to justify its inclusion within a classification system.

A **habitat** is taken to encompass the substratum (rock, sediment or biogenic reefs such as mussels), its topography and the particular conditions of wave exposure, salinity, tidal currents and other water quality characteristics (e.g. turbidity and oxygenation) which contribute to the overall nature of a place on the shore or seabed.

The term **community** is used here to mean an association of species which has particular species, at certain densities, in common.

Although communities are influenced by biological interactions (e.g. predation, recruitment processes) and by interference from certain human activities, their overall character is very strongly determined by the nature of the surrounding abiotic conditions. This consistent relationship between the biotic and abiotic elements is fundamental to the structure of the classification system. Types can be defined at a variety of scales, enabling the development of a hierarchical classification of types. The degree of similarity varies depending upon the scale considered, with more broadly defined types (e.g. sheltered rocky shores) having a lower level of similarity compared with more finely defined types (e.g. a lower shore sheltered rocky biotope).

Whilst the term habitat, as used here, is its more accepted scientific meaning, the term is more widely used, for instance in the EC Habitats Directive, to also include the community of species living in the habitat; the common use of the term is, therefore, synonymous with the term biotope.

Table 1 Environmental factors which influence community structure

Factor	*Rocky habitats*	*Sediment habitats*
Substratum	Varies from bedrock, through boulders to stony plains, often mixed with sediment. The degree of stability of the rock is important, with algae and animals increasingly able to colonise smaller stones in more sheltered stable conditions.	Ranges from shingle (mobile cobbles and pebbles), through gravel and sand to very soft mud and muddy gravels. The type of sediment, mainly determined by the dynamics of water movement at the site, is highly important in structuring community composition, although salinity may become more critical in upper estuarine conditions.
Zonation: emersion / immersion on the shore (desiccation); depth in the subtidal (illumination) ***(see Figure 1 and Table5 for further details)***	A major factor, related to the length of time the rock is exposed by the tide, which leads to very marked horizontal bands of zonation on most rocky coasts. Supralittoral and littoral fringe zones on the extreme upper shore are lichen dominated. The main eulittoral zone is characterised by barnacles, mussels or fucoid algae, the infralittoral by kelps and the circalittoral by animals.	Much less obvious than on rocky coasts, but with a zone of drying on the upper shore and a more water-logged/saturated zone on the lower shore. With increasingly finer sediments the saturated zone extends further up the shore. Very sheltered areas often support saltmarsh vegetation at extreme high water level. Shallow subtidal sediments reflect a high degree of wave disturbance and high temperature/salinity fluctuations, with increasingly more stable conditions with depth.
Exposure to wave action	Marked differences result due to different wave exposures. Exposed shores are usually animal (mussel and barnacle) dominated, whilst sheltered shores are fucoid algal dominated. Such differences can occur over only 10's of metres at certain sites, such as opposite sides of a headland. In the subtidal a similar pattern is exhibited, but is increasingly more masked by tidal-current influence with depth.	Principally expressed by the resultant grade of sediment, with coarse sands on exposed coasts and fine muds on sheltered coasts. Areas subject to periodic (seasonal) wave action may exhibit sub-climactic communities.
Strength of tidal currents	Strong offshore currents affect many coasts and have a particularly marked influence on circalittoral communities, with lessening effects in shallow water and on the shore (where the influence of wave action predominates). However constricted sections of some inlets, particularly the narrows in sealochs, can have very strong currents which affect both the shallow subtidal and the lower shore zones, significantly increasing species richness.	Contributes, with wave action, to determining sediment grade and consequent community type. In estuaries and sealochs this can lead to coarser sediments than would normally be expected in wave-sheltered areas. The lower shore of some inlets by the main channel can have tide-swept sands and gravels with distinctive species-rich communities.

Salinity	The majority of rocky coasts are subject to full salinity, but within marine inlets are subject to increasing freshwater influence. Variable salinities (in estuaries) lead to species-poor examples of open coast communities whilst the very limited areas of rock in permanently reduced salinities (in lagoons) may support quite distinct communities. Localised freshwater influence often results in the growth of ephemeral green algae on the shore.	Variable and reduced-salinity conditions are typical of sediment shores within inlets, especially estuaries, and play an important role, alongside sediment type, in determining community type. Salinity eventually becomes the more important structuring factor in the upper reaches of estuaries and in lagoons.
Temperature (relates to biogeography)	National differences in water temperature give more species-rich communities in the south and west and more species-poor communities in the north and east.	
Topography	Topography has a marked influence on the variety of communities which may occur. Variations in topography (resulting from a particular rock type) which lead to vertical faces, overhangs, gullies, caves and rockpools all increase habitat and micro-habitat diversity compared with uniform areas of rock.	Variations in the slope of the beach can indicate differing degrees of saturation, whilst drainage channels may be subject to increased freshwater influence or currents. In the subtidal, variation in slope has little influence on community type, although the presence of dunes can affect small-scale community structure. Larger features such as sandbanks usually indicate coarser sediments compared with surrounding sediment plains.
Geology	The rock type is significant in two respects, affecting overall topography (see above) and the surface texture for colonisation. Soft limestones and chalks have a pitted surface which can affect species composition, whilst these types, plus peats and clays, are soft enough to be bored by piddocks and other species.	Not applicable.
Oxygenation	Not generally applicable, as most rocky habitats are subject to full oxygenation. Severe deoxygenation can lead to reduction in species and the presence of bacterial growths.	More sheltered fine sediments tend to become anoxic below the surface, giving a distinct black layer. Severe deoxygenation significantly reduces species richness.
Wave surge	On exposed coasts gullies subject to wave surge have distinct animal-dominated communities. Wave surge on vertical rock tends to give communities typical of more exposed sites (e.g. *Alaria esculenta* occurring on moderately exposed vertical rock).	Influences sediment grade and result in highly-mobile species-poor habitats.

Scour, turbidity and siltation	Sand scour and sediment in suspension can encourage growth of ephemeral algae and sometimes mussels (*Mytilus* spp.) and tube-worms (*Sabellaria* spp.). Siltation in sheltered areas often restricts the growth of algae.	A high degree of scour and turbidity may result in species-poor communities.
Shading	Shaded faces on the shore encourage the growth of species intolerant of desiccation.	Not applicable.
Organic carbon	Not applicable.	Significant in many sediment communities. Organic enrichment can alter community structure and lead to increased numbers of opportunist species e.g. capitellid worms.
Hydrographic regime (residual currents); water quality	The overall hydrographic regime and water quality characteristics of an area play an important role in determining community composition. Key aspects of these factors are discussed above. In addition to these, residual current flow is also very important, as it may affect larval distribution and water quality aspects such as nutrient levels as well as water temperature, salinity and turbidity.	

Table 2 Summary of anthropogenic influences on community structure

Physical disturbance	Physical disturbance by trampling can impact significantly on rocky shore communities. Disturbance of rock communities in the subtidal is generally less marked. Activities such as fisheries for crabs and lobsters tend to result in only limited changes in the balance of species composition within biotopes but may rarely result in significant shifts in community composition. Where dredging (e.g. for scallops) occurs close to rocky habitats, delicate species can be damaged.	Disturbance of sediment types is widespread, particularly through benthic fisheries activities and aggregate extraction; such disturbance can have significant effects on community composition and may, in some cases, result in completely altered biotopes compared with fully natural conditions. Areas subject to prolonged sedimentary disturbance may exhibit highly variable, sub-climactic communities.
Pollution	Severe pollution may reduce species richness (pollution effects are not well studied).	Pollution may reduce species richness, encourage higher densities of opportunist species, e.g. capitellid polychaetes, or alter community structure.

Classification development - approach and methods used

Review of classification systems and literature

Before embarking on the development of the MNCR BioMar classification (Connor *et al*. 1997a, b), a review of existing classification systems was undertaken (Hiscock & Connor 1991). From these, proposals for a classification structure (Connor *et al*. 1995 a, b) were developed that drew upon the best features of the existing systems, whilst avoiding their weaker aspects. There was subsequent wide consultation on the proposed classification structure, including through two European workshops held during the EC-funded BioMar project (Hiscock *ed*. 1995; Connor *ed.* 1997). These workshops helped ensure broad acceptance of the proposed structure and its wide applicability across European seas.

In addition to a review of classification schemes, an extensive review of the literature describing marine habitats was also undertaken. This helped formulate the initial lists of types which might form the basis of the classification. For this the scientific literature was of considerable help for sediment habitats (a traditional area for marine studies) but relatively poor for rocky habitats (which, in the subtidal, attracted attention only relatively recently through use of SCUBA diving techniques). These initial lists of types were then refined on the basis of new dedicated field surveys, data analyses and field trials.

Consultation and testing

Phases of external consultation and testing of the classification system have been essential to ensure the classification is as robust and usable as possible.

The advice of external consultees has been important in two key areas:

- Marine scientists have contributed expertise in their understanding of the marine environment and its communities, both from a generic perspective and with specific knowledge of communities at particular sites around the country. Of particular importance has been advice on the relationships of environmental factors to community structure and the spatial and temporal dynamics of the marine environment.
- Environmental and conservation managers and end-users have helped define their end needs for the classification system. This has been reflected both in terms of the overall structure of the classification, such as the orientation of biotope complexes to mapping and sensitivity needs, the type of information given in the description of each classification type, and the demands of field application.

Field surveys and other data acquisition

The MNCR undertook a programme of field surveys throughout Britain between 1987 and 1998, collecting data suitable to develop the classification. In addition, data were acquired from the published literature and through collaboration with a wide variety of academic, government and other organisations. Comparable data were collected in Ireland through the BioMar project between 1992 and 1996. The data comprise information on the nature of each site (such as substratum, wave exposure and height or depth surveyed), the type of sampling undertaken, the site's location and the species present (together with an indication of their abundance) within discrete habitats at the site. In total, data for over 16,000 sites comprising more than 36,000 habitat records from around Britain and Ireland have been collated and entered onto the MNCR database. The programme, survey methods and database are described in Hiscock *ed.* (1996). The database includes a module which holds definitions of each classification type, linked to a national dictionary of marine species and to the field survey data. The field survey data have been made widely accessible via the web-based MERMAID application (www.jncc.gov.uk/mermaid) and via the National Biodiversity Network (www.searchnbn.org) from an MS Access-based ‘relational’ database.

Data analysis

For the 1997 classification, data analyses using the TWINSPAN and DECORANA clustering and ordination techniques were employed to help define the types. The analytical processes adopted are described in Mills (1994).

The 1997 version was revised and refined to develop the present version. Extensive re-analyses of the data were carried out using the analytical techniques available in PRIMER (Clarke & Warwick, 2001). The data were initially divided into the five broad habitat types shown in the primary habitat matrix in Table 3 (Littoral Rock, Littoral Sediment, Infralittoral Rock, Circalittoral Rock and Sublittoral Sediment). Due to the large size of the datasets within each broad habitat, some further *a priori* divisions of the data within broad habitats were necessary before analysis was possible. Additional analyses were carried out on data from "borderline" habitats to ensure these *a priori* splits did not force artificial divisions into the classification where this was not supported by differences in the survey data. Analysis within each broad habitat was led by a specialist for that habitat type. The following is a description of the analyses carried out within each broad habitat:

Littoral rock

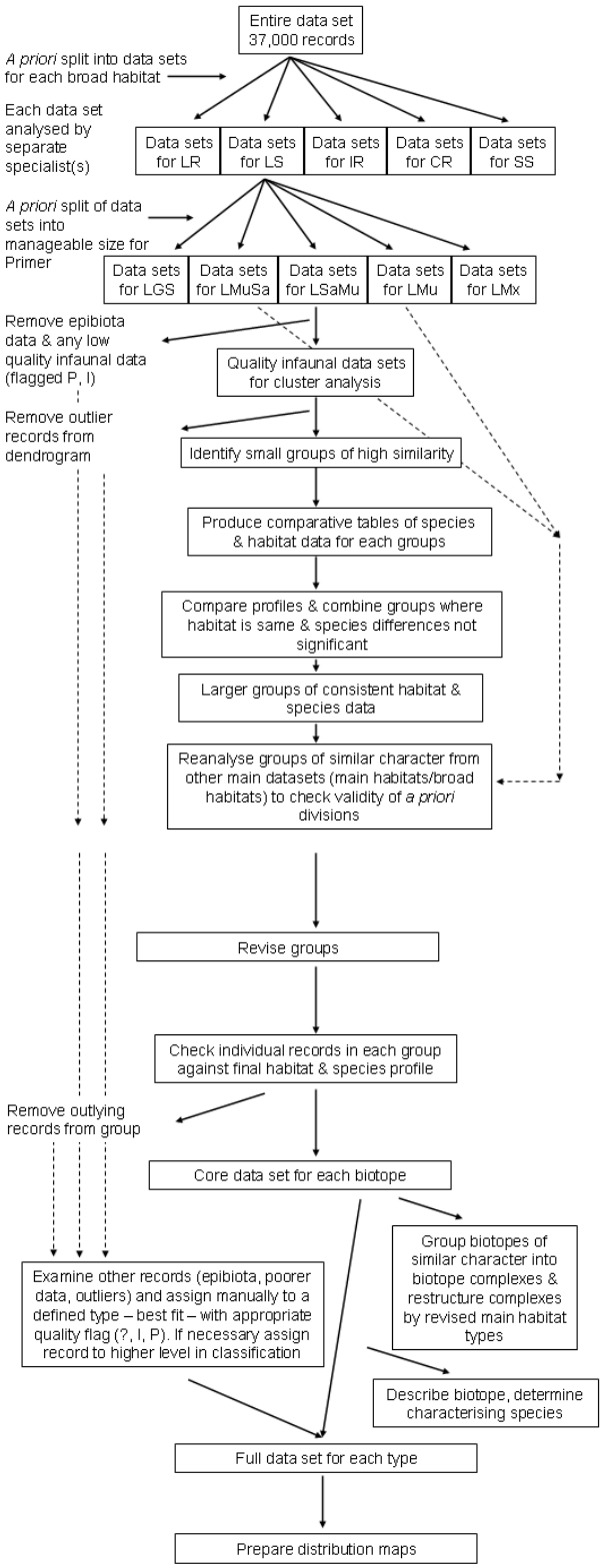
As the biotopes defined in version 97.06 (Connor *et al.*, 1997 a, b) were generally considered satisfactory, analysis focused on clarifying the boundaries between closely related types and confirming the validity of certain less-well defined types. This included attention to the inter-relationship of fucoid-dominated types regarding the bedrock/boulder/mixed substrata and fully marine/variable salinity transitions and examination of the various red algal-dominated types. Additionally new data from intertidal caves enabled substantial development of the classification here. On the basis of these analyses, some restructuring at biotope complex level was necessary.

Littoral sediment

Due to the size of the Littoral Sediment dataset (>4000 records), some *a priori* division was necessary to provide datasets that could be managed within PRIMER (Clarke & Warwick, 2001). Data were divided based on the sediment type categories at habitat complex level in the 97.06 classification (Connor *et al.*, 1997a, b): gravels and sands, muddy sands, sandy muds, muds and mixed sediments. Semi-quantitative epifaunal data were considered to be of less value than quantitative infaunal data for the purposes of the analysis and were thus excluded. Epifaunal data were however used to define types where a significant proportion of species would be sampled in epibiota sampling techniques, and/or where few infaunal samples were available, e.g. for mussel beds.

Cluster analysis was carried out based on species matrices listing individual counts per m^2 in each sample, using the PRIMER software package (Clarke & Warwick, 2001). The data were divided into small clusters of biologically similar records, based on the resulting dendrograms. Comparative tables were produced to compare the species data and physical data between each of the small clusters. Where there were no notable differences between the physical and biological characteristics of the small clusters, they were amalgamated into larger groups which would form the preliminary basis for biotopes and sub-biotopes. Where similar biological and physical profiles appeared from clusters derived from different datasets, those data were joined and re-analysed. In particular, there was some overlap between the 'gravels and sands' and the 'muddy sands', and between the 'muddy sands' and 'mud' datasets. This re-analysis was carried out to ensure that the *a priori* divisions of the data did not artificially force divisions of otherwise coherent clusters. The resulting preliminary biotope and sub-biotope groups of records were then checked to ensure cohesion of both the environmental and species data. Individual records which differed significantly from the average profile for the group (in terms of biology or physical habitat characteristics) were removed, resulting in a group of records which formed the basis of the biotope descriptions (core biotope records). The physical and biological profiles from the core biotope records were then used to group biotopes of similar character into biotope complexes, and these in turn were assigned to habitat complexes and broad habitats. Note that, in addition to the habitat complexes defined on sediment character, two additional categories were created based on epifaunal characteristics (littoral sediments dominated by macrophytes, and littoral biogenic reefs).

Figure 2. Overview of the data analysis process carried out during classification development (focussing on Littoral Sediments)



Infralittoral rock

As the biotopes defined in version 97.06 were generally considered satisfactory, analysis focused on clarifying the boundaries between closely related types and confirming the validity of certain less-well defined types. This included particular attention to the tide-swept kelp types and the inter-relationship of highly grazed and poorly grazed kelp habitats. On the basis of these analyses, some restructuring at biotope complex level was necessary. Attention was also paid to the vertical rock section of the infralittoral rock classification, and examining how these additional biotopes could be fitted into the existing biotope complexes, reflecting the subtle differences in their biological character.

Circalittoral rock

Due to the complexities of this part of the classification, especially the more subtle differences between types on the open coast, a full re-analysis of the data were undertaken. The large size of the circalittoral rock dataset meant that some *a priori* division was necessary to provide datasets that could be managed within PRIMER (Clarke & Warwick, 2001). Data were divided on the basis of three previously determined energy levels; high, moderate and low energy. Cluster analysis was carried out using epifaunal species matrices exported from the AREV database, using the PRIMER software package (Clarke & Warwick, 2001). The data were divided into small clusters of biologically similar records, based on the resulting dendrograms. Comparative tables were produced to compare the species data and physical data between each of the small clusters. Where there were no notable differences between the physical and biological characteristics of the small clusters, they were amalgamated into larger groups which would form the preliminary basis for biotopes and sub-biotopes. Where similar biological and physical profiles appeared from clusters derived from different datasets, those data were joined and re-analysed. This re-analysis was carried out to ensure that the *a priori* divisions of the data did not artificially force divisions of otherwise coherent clusters. The resulting preliminary biotope and sub-biotope groups of records were then checked to ensure cohesion of both the environmental and species data. Individual records which differed significantly from the average profile for the group (in terms of biology or physical habitat characteristics) were removed, resulting in a group of records which formed the basis of the biotope descriptions (core biotope records). The physical and biological profiles from the core biotope records were then used to group biotopes of similar character into biotope complexes, and these in turn were assigned to habitat complexes and broad habitats. As in the infralittoral rock section, further analysis was also carried out on the vertical rock section of the circalittoral rock classification.

Sublittoral sediment

A full re-analysis of the existing data on the MNCR database in addition to data supplied by the sublittoral specialist was carried out (approximately 10,000 records in total). This followed a similar approach to that described for littoral sediment and as outlined in Figure 2. Data were split according to sediment type, data type (infaunal or epibiota) and sampling technique (where appropriate). Poor quality data was also removed prior to analysis for later manual assessment. Cluster analysis was undertaken using either PRIMER (as described for the littoral sediments) or TWINSPAN (following the guidelines in Mills, 1994). Clusters of biologically similar records were produced and assessed using comparative tables. Clusters with poor species definition or highly variable physical characteristics were further sub-divided until more homogenous groups were derived. Where similar biological and physical profiles appeared from clusters derived from different main habitat datasets those data were combined and re-analysed using the same clustering methods as described above in order ensure that the *a priori* divisions of the data did not bias the results of the analysis.

Where similar biological and physical profiles were found in clusters from datasets of differing sampling method or those with different types of data (e.g. epibiota or infauna) the groups were re-analysed where possible at a lower level of resolution (either presence-absence or on the MNCR SACFOR scale) using PRIMER or TWINSPAN such that the differences in data type were reduced. As for the littoral sediments the resulting groups were then checked for cohesion with regard the physical and biological data, and individual records assigned to the groups were checked against the profiles of the groups as a whole and re-assigned if necessary.

The physical and biological profiles from the core records for each type were then used to group types of similar character into the broader biotope complexes and these in turn were assigned to one of the six main habitats for sublittoral sediment, derived from the EUNIS classification. The relationship between the sublittoral sediment biotopes is shown for separate depth bands in a series of habitat matrices, available to download as images from the classification website.

Structure of the classification

A framework for the classification (EUNIS levels 2 and 3)

Whilst the classification has been developed for nature conservation purposes and hence needed to be biologically driven, the dynamic nature of certain populations of species, and sometimes whole communities, meant it was essential to identify the habitat within which the community (of potentially varying composition) occurs to ensure types defined would be robust over time. Full use is also made of the habitat attributes to provide a structure to the classification which is both logical and easy to use. In this way much more significant use of habitat characteristics is made than for many terrestrial classifications, where vegetation alone is often the prime determinant of the classification's structure. The classification is presented in such a way as to allow access via either the habitat attributes through a series of habitat matrices or the biological community in a hierarchical classification of biotopes and higher types.

Each of the environmental gradients outlined in Table 1 can be considered to form an axis within a multi-dimensional matrix. Each community develops according to a suite of environmental conditions (and biological influences) which lie within such a multi-dimensional matrix, reflecting varying biological character according to its position along each particular gradient. Although the degree of importance of each habitat attribute varies for differing communities, the first two, namely substratum and the vertical gradient or zonation, appear to play a highly significant role in all communities. They are also the most easily and reliably recorded attributes in the field and are readily mapped. These factors combine to make the attributes of substratum and zonation the most appropriate for structuring the upper end of the classification.

The primary habitat matrix of substrata versus zonation (Table 3) illustrates the framework adopted for the classification. It represents EUNIS levels 2 and 3 in the hierarchical classification and has been developed to reflect the most significant changes in biology at a scale appropriate to an internationally applicable classification. Table 4 outlines the rationale behind the divisions adopted for these two levels in the classification.

Table 3 Framework for the habitat classification - the primary matrix (EUNIS levels 2 and 3). Letters in [ ] refer to codes. * indicates where various codes are inserted at a lower level in the hierarchy.

	SUBSTRATUM	ROCK				SEDIMENT					
		High energy rock	**Moderate energy rock**	**Low energy rock**	**Features on rock**	**Coarse sediment**	**Sand**	**Mud**	**Mixed sediment**	**Macrophyte-dominated sediment**	**Biogenic reefs**
		[H*R]	**[M*R]**	**[L*R]**	**[F*R]**	**[CS]**	**[Sa]**	**[Mu]**	**[Mx]**	**[Mp]**	**[BR]**
	ZONE	(wave exposed or very tide-swept)	(moderately wave-exposed or tide-swept)	(wave sheltered and weak tidal currents)	(rockpools, caves)	Mobile cobble & pebble, gravel, coarse sand	Clean sands & non-cohesive muddy sands	Cohesive sandy muds & muds	Heterogeneous mixtures of gravel, sand & mud		
LITTORAL	**LITTORAL [L]** (splash zone, strandline & intertidal)	High energy littoral rock [HLR]	Moderate energy littoral rock [MLR]	Low energy littoral rock [LLR]	Features on littoral rock [FLR]	Littoral coarse sediment [LCS]	Littoral sand [LSa]	Littoral mud [LMu]	Littoral mixed sediment [LMx]	Littoral macrophyte-dominated sediment [LMp]	Littoral biogenic reefs [LBR]
SUBLITTORAL [S]	**INFRA-LITTORAL [I]** (shallow subtidal)	High energy infralittoral rock [HIR]	Moderate energy infralittoral rock [MIR]	Low energy infralittoral rock [LIR]	Features on infralittoral rock [FIR]	Sublittoral coarse sediment [SCS]	Sublittoral sand [SSa]	Sublittoral mud [SMu]	Sublittoral mixed sediment [SMx]	Sublittoral macrophyte-dominated sediment [SMp]	Sublittoral biogenic reefs [SBR]
	CIRCA-LITTORAL [C] (nearshore deeper and offshore subtidal)	High energy circalittoral rock [HCR]	Moderate energy circalittoral rock [MCR]	Low energy circalittoral rock [LCR]	Features on circalittoral rock [FCR]						

Table 4 Rationale behind the main divisions adopted in the primary habitat matrix (EUNIS levels 2 and 3)

Rock, Sediment	A primary distinction is made between communities which develop on hard substrata (epibiota) and those which can develop in soft sediments (infauna). Sediments can support distinctive epibiota as well as infauna. The term rock is used in a broad sense to indicate hard substrata such as bedrock, boulders, stable cobbles, artificial substrata and biogenic substrata. Sediments also include pebbles and cobbles which are essentially mobile (shingle) or may have a small proportion of stones and shells on the surface, supporting epibiota. Where biogenic substrata develop on substantially sediment substrata, they are included in the sediment section of the classification.
Littoral, Sublittoral (Infralittoral, Circalittoral)	These represent the major divisions in a vertical gradient from the terrestrial environment to the edge of the continental shelf (about 200 m depth). The main factors which control the zonation are immersion, thermal stability, light, wave action and salinity. They interact in a complex manner to produce a general zonation pattern, applicable to both rock and sediment habitats throughout Europe and beyond. Table 5 illustrates the inter-relationship of the factors for each zone, and Figure 1 provides a typical schematic profile of this zonation pattern.
High energy rock, Moderate energy rock, Low energy rock	These are defined on an energy gradient, reflecting exposure to wave action or tidal currents, or a combination of both (note, this energy gradient was reflected in the 1997 classification, but expressed as 'exposure'; the resulting confusion with wave exposure has now been removed). This energy gradient is broadly paralleled in sediment habitats, where coarse clean sediments occur in high energy conditions and fine muds occur in low energy conditions. Although the effects of wave action and tidal currents can be significantly different, there are many instances where the increase in tidal current strength in wave-sheltered habitats gives rise to communities similar to those found on more wave-exposed coasts but in reduced tidal currents. For example, increased currents in the infralittoral zone change the kelp *Laminaria saccharina* communities of very wave-sheltered sites to *Laminaria hyperborea* communities similar to those on open, more wave-exposed coasts. Very strong tidal currents in the circalittoral appear to override the effect of wave action to a large extent, giving rise to a suite of associated communities of barnacles, cushion sponges and the hydroid *Tubularia indivisa* which are less obviously affected by wave action. These communities are similar in character to those of surge gullies which are subject to extreme wave action.

Coarse sediments, Sands, Muds, Mixed sediments, Macrophyte communities on sediments, Biogenic Reefs

The particular sediment grade, typically derived from the hydrodynamic conditions of the site, strongly influences community structure. The four main divisions adopted here reflect major changes in species character, particularly related to the amount of silt or clay in the sediment. In addition, some sediments support communities of macrophytes (angiosperms and seaweeds) which attach to small stones and shells on the sediment surface, whilst on others biogenic reefs develop in which a particular species aggregates to form a stable surface upon which other species can live. With both macrophyte and biogenic reef communities the underlying sediment may support infaunal communities according to the particular sediment type; however the prominent character of the epibiota communities has led to a preference to group such biotopes under these separate major categories.

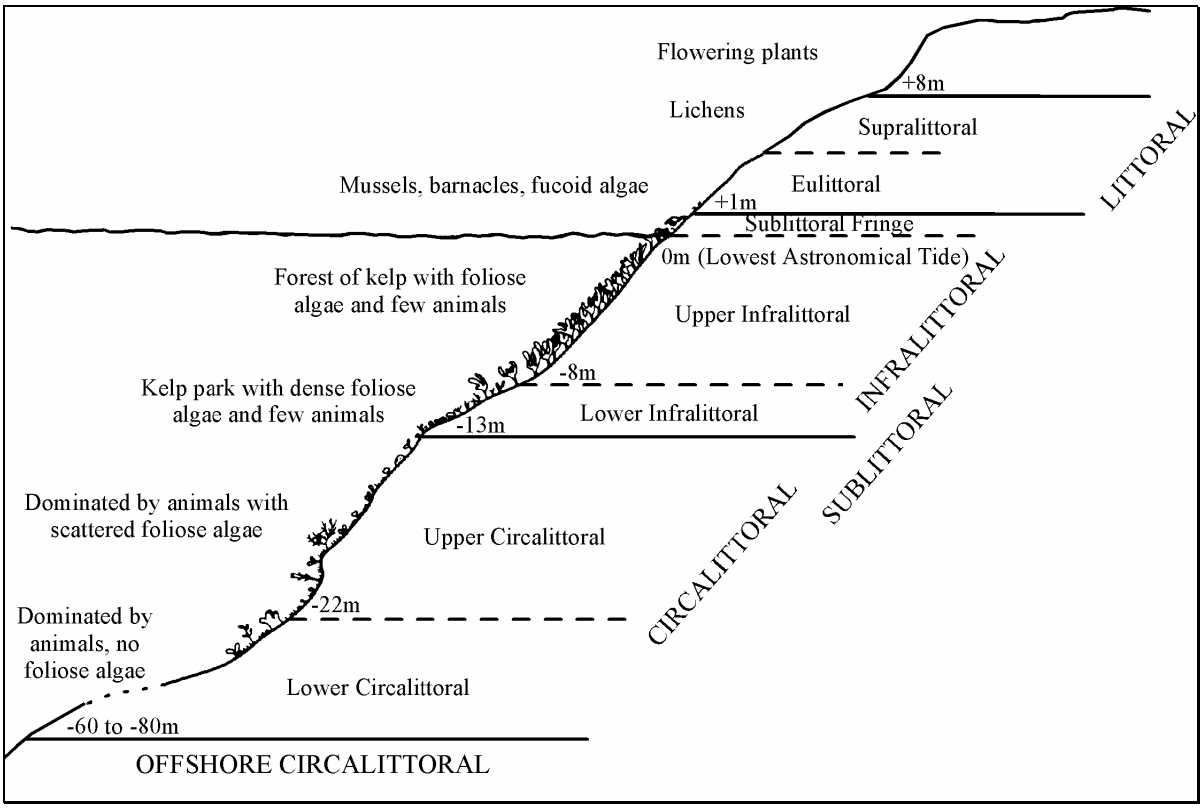


Figure 1 Profile of a rocky shore and seabed showing the biological zones (modified from Hiscock *ed.* 1996); heights and depths given are typical values for south-west Britain. In sediment habitats a similar vertical zonation for the main zones is found.

Table 5 Marine biological zones and the factors determining them

Zone	*Typical upper boundaries around Britain and Ireland*	*Immersion*	*Thermal stability*	*Light*	*Salinity*	*Wave action*
Adlittoral		Spray only	Highly variable	Photic	Saline influence	None
Supralittoral	+10 to +6 m	Spray and splash	Highly variable	Photic	Euryhaline	Highly variable
Eulittoral	+7 to +4 m MHWS	Regular immersion and emersion	Highly variable	Photic	Euryhaline	Highly variable
Infralittoral	+1 to 0 m MLWS	Immersed (intermittent spring tide emersion of sublittoral fringe)	Variable - eurythermal	Euphotic	Euryhaline	Variable
Circalittoral	-5 to -20 m	Immersed	Moderately variable - mesothermal	Mesophotic (sparse algae, algal crusts)	Mesohaline / Stenohaline	Moderately variable
Circalittoral offshore	-40 to -80 m	Immersed	Stable - stenothermal	Aphotic	Stenohaline	Stable
Bathyal	-200 m	Immersed	Very stable - stenothermal	Aphotic	Stenohaline	Stable

Development of a hierarchical classification

It was considered essential to develop a hierarchical classification structure in which broader, higher types in the classification could be more finely divided to support more detailed use. The development of the hierarchy comes from both a top-down and a bottom-up approach:

Top-down classification

Taking the marine environment as a whole, it can be sub-divided into a series of broad habitat categories, based largely on their physical character as described here. At the very broadest level, differentiation can be made between rock and sediment habitats, and between those on the shore (intertidal) and those in the subtidal or deep ocean. These high-level divisions can be further subdivided on the basis of different types of sediment (e.g. gravel, mud), different degrees of wave exposure on rocky coasts (exposed, sheltered) and varying depth bands below the low water mark (e.g. shallow water where light penetrates, deeper water with little light). Such broad-scale differences in habitat character are readily understood by non-specialists and provide classification types that are easily mapped; however, they also have ecological relevance as they reflect major changes in habitat character upon which species depend (see above).

The top-level types depicted in the primary habitat matrix (Table 3) show levels 2 and 3 in the hierarchical classification. It is important to note that these top-level categories were developed after consideration of how best to classify biological data at the lower end of the classification.

Bottom-up classification

Field survey, whether on the shore or in the subtidal, reveals that different places support different communities of species. The precise combination of species and their relative abundance varies from place to place and is dependent both on environmental characteristics and upon interactions between

species. Visits to different sites that have similar environmental characteristics, such as sediment type and depth, show certain levels of similarity in their species composition. Multivariate analysis of the data from field surveys (e.g. grabs, diver observations) groups these data into clusters that have similar character – this forms the basis of defining the types at the lower end of the classification (levels 5 and 6). These can themselves be grouped into higher types with similar character (level 4), thus forming the basis for the bottom-up approach to development of the classification based on real field sample data.

The two approaches have been merged together into a single hierarchy, thus catering for broad-scale application in management and mapping and fine-scale application for detailed survey, monitoring and scientific study. The levels can be differentiated in relation to their degree of biological distinctiveness, to the ability to discriminate types by various methods of remote and *in situ* sampling, to the ease of recognition by workers with differing skill levels and to the end use of the classification for conservation management at various scales.

Six levels in the hierarchy have thus been developed, equating directly to the levels in the EUNIS classification:

Level 1 Environment (marine) – A single category is defined within EUNIS to distinguish the marine environment from terrestrial and freshwater habitats.

Level 2 Broad habitats - These are extremely broad divisions of national and international application for which EC Habitats Directive Annex I habitats (e.g. reefs, mudflats and sandflats not covered by seawater at low tide) are the approximate equivalent.

Level 3 Main habitats - These serve to provide very broad divisions of national and international application which reflect major differences in biological character. They are equivalent to the intertidal Sites of Special Scientific Interest (SSSI) selection units (for designation of shores in the UK) (Joint Nature Conservation Committee 1996) and can be used as national mapping units.

Level 4 Biotope complexes - These are groups of biotopes with similar overall physical and biological character. Where biotopes consistently occur together and are relatively restricted in their extent, such as rocky shores and very near-shore subtidal rocky habitats, they provide better units for mapping than the component biotopes, better units for management and for assessing sensitivity than the individual biotopes. They are relatively easy to identify, either by non-specialists or by coarser methods of survey (such as video or rapid shore surveys), thereby offering opportunities for data collection by a wide range of people and without recourse to specialist species identification skills.

Level 5 Biotopes - These are typically distinguished by their different dominant species or suites of conspicuous species. On rocky substrata, most should be readily recognised by workers with a basic knowledge of marine species, although quantitative sampling will be necessary in many of the sediment types. The vast majority of available biological sample data are attributable to this level (or the sub-biotope level), which is equivalent to the communities defined in terrestrial classifications such as the UK National Vegetation Classification (e.g. Rodwell *ed.* 1995). Intertidal and subtidal sediment biotopes may cover very extensive areas of shore or seabed.

Level 6 ***Sub-biotopes*** - These are typically defined on the basis of less obvious differences in species composition (e.g. less conspicuous species), minor geographical and temporal variations, more subtle variations in the habitat or disturbed and polluted variations of a natural biotope. They will often require greater expertise or survey effort to identify.

The primary habitat matrix (Table 3) provides an overview of levels 2 and 3 in the classification. Biotope matrices for each broad habitat, showing the relationship of biotopes and sub-biotopes to key environmental factors, can be downloaded as images from the classification website. For each broad habitat, a hierarchy structure diagram showing the relationship between units at the higher and lower hierarchical levels has been created in Excel™, and all the types in the classification are listed in hierarchical order in an additional Excel™ spreadsheet, all available to download from the classification website

Distinguishing and defining types

To ensure consistency across the classification in how types are defined, a working definition as to what constitutes a biotope, enabling its distinction from closely-related types, has been developed. The following criteria are applied:

1. The entity can be distinguished on the basis of a consistent difference in species composition based on:

    - different dominant species, some of which (e.g. mussels and kelps) may be structurally important; and
    - the co-occurrence of several species characteristic of the particular habitat conditions (even though some of these may occur more widely in other combinations).

    A combination of both the presence and abundance of the most 'obvious' species in a community is used. Sub-biotopes are often defined using less conspicuous species.

2. It occurs in a recognisably different habitat (but acknowledging that distinct communities may develop in the same habitat through change with time). Sub-biotopes are often defined on the basis of more subtle habitat differences. Some highly subtle differences may be critical in determining community structure (e.g. water circulation/exchange patterns in sealoch basins, oxygenation levels in the water column/sediment, sediment structure other than grain size composition). The separate divisions of habitat factors used in field recording are not necessarily be reflected in the end division of types.

3. It is a recognisable entity in the field, i.e. it is not an artefact of data analysis.

4. The assemblage of species recurs under similar habitat conditions in (at least several) widely-separate geographical locations. Associations of species confined to a small geographical area are considered unlikely to represent a recurrent community (unless the habitat is considered unique), but should rather be treated as a variation of a more widely occurring type.

5. As a working guide the biotope extends over an area at least 5 m x 5 m, but can also cover many square kilometres, such as for extensive offshore sediment plains. For minor habitats, such as rockpools and overhangs on the shore, this 'minimum size' can be split into several discrete patches at a site. Small features, such as crevices in rock or the biota on kelp stipes, are described as features of the main biotope rather than biotopes in their own right. Some entities, by virtue of their extent around the coast, may warrant description despite showing only minor differences in species composition; such types are often treated as sub-biotopes.

6. It is a single entity in the field, although there may be some spatial variation or patchiness from one square metre to the next. Therefore each area of shore or seabed should correlate to only one biotope defined in classification (a 1:1 relationship of field units to classification units). Whenever possible, the surface species characteristics of sediment habitats (their epibiota) are described in association with the sediment infauna as a single entity, rather than treated as separate communities. Note however that the nature of available data has severely restricted the clear association of these two aspects in the classification as they are typically derived from differing survey techniques. Thus in the present classification there remain units defined primarily on the basis of their epibiota or their infauna but which, given further research, will be shown to be the same biotope. Epibiota-derived biotopes may also ‘overlay’ a number of infaunal biotopes, which are differentiated by more subtle environmental differences, and thus need to be referred to a higher unit in the classification.

The following considerations are also taken into account in deciding whether to establish a biotope:

- There is a need to recognise that it is commonplace to have no distinct boundary between two different 'types', but a gradual transition, such that distinction of types is somewhat arbitrary at particular reference points or nodes along a continuum. Additionally, some communities may be largely transitional (in a temporal sense) in nature and whilst recognisable in the field represent a stage between two or more ‘stable’ biotopes. In some areas, e.g. due to periodic

disturbance, a community may be held in a transitional or sub-climactic state for prolonged periods and certain habitats may be so variable that the position of a biotope along a gradient cannot be accurately defined. These factors are of critical importance when assessing typicality of a site to a particular type or its quality or conservation importance.

- Where different associations are shown to occur within the same habitat, they may be spatial or temporal mosaics caused by factors such as grazing, disturbance or chance recruitment. These should be linked together in the classification as, for conservation purposes, it is important to manage or protect the habitat in which several communities may occur over time.
- To produce a practicable working classification it has been necessary at times to be general rather than specific in splitting different types, so that an excessively and unnecessarily complex classification is not developed (bearing in mind the end units that are necessary for practical use).
- Separation of communities can be related to conservation value - does the type add variety (of habitat or species) to a particular stretch of coast. This relates to natural habitats and excludes artificial, polluted or disturbed habitats which should not be considered of high conservation value although they may support distinct communities.

How to use the classification

Habitat matrices

The primary habitat matrix (Table 3) provides a general framework for the classification and shows the level 2 and 3 types. In addition, more detailed matrices have been created for each of the broad habitats, showing the distribution of individual biotopes and sub-biotopes (levels 5 and 6) in relation to key habitat factors. The format of these matrices has changed significantly from previous versions of the classification to better depict the relationship of biotopes to habitat factors. For the rocky habitats, biotopes are shown in relation to energy levels, whereas for sediment habitats, biotopes are shown in relation to sediment type using a modified Folk triangle approach (Folk 1954).

The matrices aim to provide a rapid indication of the range of biotopes that could occur under particular habitat conditions, e.g. moderate energy infralittoral rock or intertidal sandflats. They can be used to indicate which closely related biotopes should be considered before determining to which type a sample record should be assigned.

Presentation of the biotopes and sub-biotopes within these matrices has a number of benefits:

- It helps to display the relationship of a biotope to other closely related types and to clarify the main habitat parameters which contribute to its structure. These relationships are less clear in a more conventional listing of types (e.g. the hierarchical listing).
- It enables the identification of dissimilar communities within apparently similar physical environments. Here, although there may be subtle physical factors which drive such differences in biological composition, other factors such as seasonal change, chance recruitment, grazing pressures or pollution effects may account for the differences and allow such communities to be linked within the classification.
- It also facilitates the undertaking of new ecological survey in a more structured manner, by enabling the full range of habitats in an area to be identified and sampled.

The matrices for littoral rock, littoral sediment, infralittoral rock, circalittoral rock and sublittoral sediment are available to download as images from the classification website.

Hierarchy structure diagrams

Hierarchy structure diagrams have been created for each of the broad habitats, providing an overview of all the lower level units within each broad habitat type. These diagrams are available to download as Excel™ spreadsheets from the classification website. They have also been included at the end of the pdf documents containing the biotope descriptions available to download for each section of the classification.

Hierarchical list of types

A full hierarchical list of types is available to download as an Excel™ spreadsheet from the classification website. The types are presented in hierarchical order, to help bring together those types which are most similar to each other in character.

Layout of descriptions for each type

Descriptions for each unit in the classification, from broad habitats to sub-biotopes, are laid out as follows:

Code

A unique letter code, reflecting the level of the described type within the classification hierarchy.

Title

The title gives the key biological and physical features of the type, with emphasis on the features which help to distinguish it from closely related types of the same level in the hierarchy. The habitat

part of the title usually includes the zone, substratum and another key habitat factor. To avoid becoming overly clumsy the titles do **not** cover all habitat characteristics or characterising species, and common names are not given (although they are given in the text description).

NOTE: It is very important to refer to the full description and to the habitat matrices to determine the full nature of the type and not to rely on the title alone.

Habitat characteristics

The typical habitat characteristics of the type for salinity, wave exposure, tidal currents, substratum, zone, height or depth band and, where appropriate, other factors critical to that particular type. The range given for each factor tends to be broader for higher types and more tightly defined for lower types. When assigning samples to types, it should be noted that in some cases the type may occur outside the range given (see profiles given in the comparative tables which show that a small proportion of records may occur outside the typical range for the type), though care should be taken to ensure that another type has not been described to cover the example being considered. All heights and depths are corrected to chart datum.

Previous code

Codes used in versions 6.95, 96.7, and 97.06 (Connor *et al*. 1995 a, 1996, 1997 a, b) are given where different to the current code. Where communities from previous versions have been combined or split, previous codes are shown as far as possible. Some communities in the revised classification are newly defined and may not relate directly to types in the previous classification. Lookup tables which help to translate 2004 to 1997 codes (and vice versa) are available to download in the form of an Excel™ spreadsheet from the classification website.

Description

An account of the general nature of the habitat and community characteristics, and its micro-habitat features (e.g. crevices, under-boulders, kelp stipes) if present.

Situation

Describes the general situation on the shore or in the sublittoral, in relation to other types (i.e. along gradients of substratum, zonation, wave exposure, tidal currents, salinity etc.).

Temporal variation

This section outlines the known natural temporal dynamics of the type described, such as seasonal changes in community structure or physical environment. In general, much more information is needed for this section. In some cases separate types may have been defined because there is a lack of knowledge that the communities are temporal variations within a single habitat type.

Similar types

Attention is drawn to similar types which should be considered before assigning a field record to a particular biotope. The main similarities and principal distinguishing features are described for each similar biotope.

Characterising species

A list of those species which contribute most to the overall similarity between core records assigned to the type, i.e. characterise the type, with associated information on their frequency of occurrence, their individual contribution to the similarity within the core data set of records, and the typical abundance at which they occur.

For each type, characterising species have been determined using the SIMPER routine in PRIMER (Clarke & Warwick, 2001). For a given set of records (in this case, core records of each type), SIMPER indicates and ranks the individual contribution of each species to the overall similarity within the data set. Both the frequency of occurrence of each species within the dataset and their abundance (using the SACFOR abundance scale (p.46) for epifaunal data and numeric counts for infaunal data)

are taken into account during this process. Species that contribute more than 1% to the overall similarity of the records within the data set are defined as 'characterising species', and listed in a characterising species table. Those that contribute less that 1% are not listed. Species which qualify according to the SIMPER routine, but are Present or Rare on the MNCR SACFOR scale and present in fewer than 20% of the records, are occasionally excluded from the characterising species table.

Care has been taken to mention each of the characterising species in the descriptions for each type. Sometimes additional species are mentioned that are particularly indicative (faithful) of that type or characteristic of a biogeographic region, but which have not qualified as 'characterising species' according to the SIMPER routine.

The **% contribution to similarity** column of the table shows the contribution of each characterising species to the similarity within the type, i.e. the higher the contribution, the higher the importance of the species. The number of species in the table reflects the species diversity within each type. In types with a high species richness, a large number of species each contribute with a relatively low amount to the similarity within the group. If a type has low diversity, then a small number of species contribute with relatively large amounts to the overall similarity and hence fewer species are listed in the table. In a few cases, a long species list indicates low overall similarity of records within the type.

The **% frequency of occurrence** column of the table shows the occurrence of a species within a certain biotope. The symbols represent percentage occurrence in the samples as follows:

●●●●●	Occurs in 81-100% of the records for the type
●●●●	Occurs in 61-80% of the records for the type
●●●	Occurs in 41-60% of the records for the type
●●	Occurs in 21-40% of the records for the type

The **typical abundance** column of the table shows the mean SACFOR abundance for each characterising species within the samples where it is present. Quantitative infaunal counts have been converted to the SACFOR scale for compatibility of data presentation. For types where the core records are exclusively quantitative infaunal records (e.g. most of the littoral sediment types), an additional column is included in the characterising species table, showing mean counts per m^2 for each species within the core data set.

Comparative tables

Comparative tables of physical (habitat) and biological (species) data have been generated in the form of Excel™ spreadsheets to enable a comparative overview over similar biotopes or other classification units. The spreadsheets are available to download on the classification website.

Comparative tables of habitat data

The habitat (physical) comparative tables are generated from the MNCR database, using only the core data sets for each type (see data analysis section). Each column represents a separate type.

The left column of the table lists each of the habitat factors and their categories, as per the field data. For each type, the percentage of records containing data for each category is shown both in figures and as a bar. For example a table may indicate that 85% of the records for a type were recorded as full salinity and the remaining 15% as variable salinity.

The percentage given reflects only the available data for that factor. Consequently, where the data for a factor are lacking, particularly if that is a high proportion of full data set for that data, the resulting percentage distribution across the categories may not fully reflect the character of that type.

Where more than one category can be recorded in the field data, e.g. zone and depth band, the figures within a habitat factor may exceed 100%.

Comparative tables of species data

The species comparative tables are generated from the MNCR database, using only the core data sets for each type (see data analysis section, p.17 ff). Each column represents a separate type.

The left column of the table lists, in taxonomic order, the species which occur in at least one of the types shown in that table. To ensure clarity, the tables are compiled with a minimum percentage cut-off of 20%: that is, only species present in more than 20% of the records for a particular type are displayed. The percentage of records for each type containing each species is shown both in figures and as a bar.

For types where the core records are semi-quantitative samples (e.g. epifaunal samples on rocky shores), a letter alongside these bars indicates the median SACFOR abundance of that species from the records that it occurred in. For example, C 50 next to *Patella vulgata* indicates that *P. vulgata* occurred in 50% of the records for that particular type and that it had a median abundance of "common" where it occurred.

For types where the core records consist of quantitative samples (e.g. infaunal core samples on intertidal sediments), the comparative tables display the mean number of individuals per m^2.

Species nomenclature

All species names are given according to Howson & Picton (1997), excepting for angiosperms, which follow Stace (1991), and lichens, which follow Purvis *et al.* (1992). Guiry & Dhonncha (2002) provides a later checklist for algae and additional useful information; the present publication and database does not yet follow this revised checklist.

Understanding the codes

A letter coding system has been adopted in preference to a fully numerical coding system or an alpha-numeric system (as used in the NVC and EUNIS systems). This has a number of advantages. It enables the construction of intuitive codes which can readily be related to their respective types without recourse to the full type title. Furthermore, it enables changes to the order in which the types are presented without the need to change a numerically sequenced code. This was particularly useful in the early development phase of the classification, but has continued to be of use during subsequent revisions of the classification.

Construction of codes follows a few simple rules, which achieve consistency throughout the classification whilst aiming to keep the resultant codes relatively short and intuitive. Familiarity with the rules for code construction and with the types themselves, by those working regularly with the classification, results in rapid use of codes as a short-hand means of referring to the types defined.

Codes are defined for each level in the classification. Within a level, they comprise one or several elements. They are based on the following rules:

1. Broad habitat and main habitat codes are based on habitat factors or gross biological features (e.g. macrophytes and biogenic reefs).
2. Biotope complex, biotope and sub-biotope codes are based wherever possible upon the most characteristic taxa (which preferably also dominate spatially/numerically) (preferably no more than two per biotope complex, biotope or sub-biotope).
3. Where the biological composition is too complex to derive a simple code, features of the habitat are used (e.g. VS for variable salinity).
4. Codes for habitat factors, higher taxa and descriptive community features (e.g. park, crustose) are derived from a standard lexicon (Table 6). A full list of codes used is contained in the hierarchical list which can be downloaded from the classification website.
5. Codes for names of genera are derived using the first three letters of a genus or higher taxon name (e.g. Ala for ***Ala****ria*, Chr for **Chr**ysophyceae). Codes for species names are derived using the first letter of the genus and the first three letters of the specific name (e.g. Ldig for ***L****aminaria* ***dig****itata*).
6. Within the code each new element of the code starts with a capital letter.

7. As far as practical the code elements are unique, but some duplication is adopted in the interests of keeping codes short. The code for any given type (i.e. for the level defined, regardless of whether it is stringed with higher codes – see below) is always unique.

8. All the biotope/sub-biotope codes are unique, so users familiar with the classification can refer to individual biotopes using only the codes for these levels in the hierarchy.

9. The full codes are compiled using the code for each level in the hierarchy, separated from the next level by a full stop, starting with the broad habitat (level 2), followed by the main habitat, biotope complex and so on. For example LS.LSA.MoSa.AmSco.Eur:

2	broad habitat	littoral sediment	LS
3	main habitat	littoral sand	LSA
4	biotope complex	mobile sand	MoSa
5	Biotope	Amphipods and *Scolelepis* spp.	AmSco
6	Sub-biotope	*Eurydice* sub-biotope	Eur

NOTE: to avoid confusion, others using the classification should <u>not</u> erect similar codes for types not currently described in the national classification.

Table 6 Lexicon of codes (excluding those at genus and species level)

Code	Meaning	Type	Level	97.06 code	Comments
Aalb	*Abra alba*	Genus/species	4, 5, 6	Abr	
Aasp	*Ascidiella aspersa*	Genus/species	4, 5, 6	Aasp	
Abr	*Abra*	Genus/species	4, 5, 6		
Abra	*Amphiura brachiata*	Genus/species	4, 5, 6		
Achi	*Amphiura chiajei*	Genus/species	4, 5, 6	Achi	
Act	*Actinothoe*	Genus/species	4, 5, 6		
Adia	*Alcyonidium diaphanum*	Genus/species	4, 5, 6	Adia	
Adig	*Alcyonium digitatum*	Genus/species	4, 5, 6	Alc	
Afal	*Ampharete falcata*	Genus/species	4, 5, 6	Amp	
Afil	*Amphiura filiformis*	Genus/species	4, 5, 6	Afil	
Aglo	*Alcyonium glomeratum*	Genus/species	4, 5, 6		
Ahn	*Ahnfeltia*	Genus/species	4, 5, 6	Ahn	
Airr	*Astropecten irregularis*	Genus/species	4, 5, 6		
Al	Algae/algal	Taxon group	4, 5, 6	Al	
Ala	*Alaria*	Genus/species	4, 5, 6	Ala	
Am	Amphipods	Taxon group	4, 5, 6	A	
Amen	*Ascidia mentula*	Genus/species	4, 5, 6	Amen	
Amp	*Ampelisca*	Genus/species	4, 5, 6		
Amy	*Amythasides*	Genus/species	4, 5, 6		
An	Anemones	Taxon group	4, 5, 6	An	
Ang	Angiosperms	Taxon group	4, 5, 6	Ang	
Anit	*Abra nitida*	Genus/species	4, 5, 6		
Ant	*Antedon*	Genus/species	4, 5, 6	Ant	

Aope	*Aequipecten opercularis*	Genus/species	4, 5, 6		
Aph	*Aphelochaeta*	Genus/species	4, 5, 6	Aph	
Apri	*Abra prismatica*	Genus/species	4, 5, 6		
Aps	*Apseudes*	Genus/species	4, 5, 6		
Are	*Arenicola*	Genus/species	4, 5, 6	Are	
As	Ascidians	Taxon group	4, 5, 6	As	
Asc	*Ascophyllum*	Genus/species	4, 5, 6	Asc	
Ascmac	*Ascophyllum nodosum ecad mackaii*	Genus/species	4, 5, 6	Asc*mac	
Asqu	*Amphipholis squamata*	Genus/species	4, 5, 6		
Aten	*Angulus tenuis*	Genus/species	4, 5, 6		
Aud	*Audouinella*	Genus/species	4, 5, 6		
Axi	Axinellid sponges	Taxon group	4, 5, 6	Axi	
B	Barnacles	Taxon group	4, 5, 6	B	
B	Biogenic [reefs]	Community feature	2, 3		
Bal	*Balanus*	Genus/species	4, 5, 6	Bal	
Bar	Barren	Community feature	4, 5, 6	Bar	
Bat	*Bathyporeia*	Genus/species	4, 5, 6	Bat	
Beg	*Beggiatoa*	Genus/species	4, 5, 6	Beg	
Bif	*Bifurcaria*	Genus/species	4, 5, 6	Bif	
Blan	*Branchiostoma lanceolatum*	Genus/species	4, 5, 6	Bra	
Bli	*Blidingia*	Genus/species	4, 5, 6	Bli	
Blyr	*Brissopsis lyrifera*	Genus/species	4, 5, 6	Bri	
Bo	Boulders	Habitat factor	4, 5, 6	Bo	
Br	Brachiopods	Taxon group	4, 5, 6	Br	
Bri	Brittlestars	Taxon group	4, 5, 6	Bri	
Bug	*Bugula*	Genus/species	4,5,6	Bug	
By	Bryozoans	Taxon group	4, 5, 6	By	
C	Circalittoral	Habitat factor	2, 3	C	
C	Coarse [sediment]	Habitat factor	2, 3		
Cap	*Capitella*	Genus/species	4, 5, 6	Cap	
Cape	Cape-form (kelp)	Community feature	4, 5, 6		
Car	*Caryophillia*	Genus/species	4, 5, 6	Car	
Care	*Corophium arenarium*	Genus/species	4, 5, 6	Cor	
Cb	Cobble	Habitat factor	4, 5, 6		
CC	Crustose coralline algae	Taxon group	4, 5, 6	CC	
Ccas	*Cordylophora caspia*	Genus/species	4, 5, 6	Cor	
Ccor	*Clathrina coriacea*	Genus/species	4, 5, 6	Cla	
Cer	*Cerastoderma*	Genus/species	4, 5, 6	Cer	
Cha	*Chara*	Genus/species	4, 5, 6		
Cho	*Chorda*	Genus/species	4, 5, 6	Cho	
Chr	Chrysophyceae	Taxon group	4, 5, 6	Chr	

Cht	*Chthamalus*	Genus/species	4, 5, 6	Cht	
Cio	*Ciona*	Genus/species	4, 5, 6	Cio	
Cir	Cirratulid polychaetes	Taxon group	4, 5, 6		
Cla	*Cladophora rupestris*	Genus/species	4, 5, 6		
Cllo	*Cerianthus lloydii*	Genus/species	4, 5, 6		
Co	Colonial [ascidians]	Community feature	4, 5, 6		
Cod	*Codium*	Genus/species	4, 5, 6	Cod	
Coff	*Corallina officinalis*	Genus/species	4, 5, 6	Coff & Cor	
Con	*Conopeum*	Genus/species	4, 5, 6	Con	
Cor	Corallinaceae/coralline	Taxon group	4, 5, 6	Cor	
Cr	Crusts/crustose	Community feature	4, 5, 6	C	
Cre	*Crepidula*	Genus/species	4, 5, 6	Cre	
Cri	Crisiid bryozoans	Taxon group	4, 5, 6	Cri	
Crl	Coral (reefs e.g. *Lophelia*)	Taxon group	4, 5, 6		
CrSp	Crustose sponges	Taxon group	4, 5, 6	SC	
Cset	*Chaetozone setosa*	Genus/species	4, 5, 6		
Cu	Cushion [sponges]	Community feature	4, 5, 6	CuS	
Cum	Cumaceans	Taxon group	4, 5, 6		
Cup	Cup corals (Scleractinia)	Taxon group	4, 5, 6	Cup	
Cv	Caves	Habitat factor	4, 5, 6	Cv	
Cvar	*Chlamys varia*	Genus/species	4, 5, 6	Cvar	
Cvir	*Corynactis viridis*	Genus/species	4, 5, 6	Cor	
Cvol	*Corophium volutator*	Genus/species	4, 5, 6	Cor	
Cys	*Cystoseira*	Genus/species	4, 5, 6	Cys	
Den	*Dendrodoa*	Genus/species	4, 5, 6	Den	
Des	*Desmarestia*	Genus/species	4, 5, 6		
Dic	*Dictyopteris*	Genus/species	4, 5, 6	Dic	
Dp	Deep (circalittoral)	Habitat factor	4, 5, 6		
Dys	*Dysidia*	Genus/species	4, 5, 6		
Ec	Echinoderms	Taxon group	4, 5, 6		
Ecor	*Echinocardium cordatum*	Genus/species	4, 5, 6	Ecor	
Edef	*Eudorellopsis deformis*	Genus/species	4, 5, 6		
Edw	Edwardsia	Genus/species	4, 5, 6	Edw	
Ele	*Electra*	Genus/species	4, 5, 6	Ele	
Ens	*Ensis*	Genus/species	4, 5, 6	Ens	
Ent	*Enteromorpha*	Genus/species	4, 5, 6	Ent	
Eph	Ephemeral (seaweeds)	Community feature	4, 5, 6	Eph	
Epus	*Echinocyamus pusillus*	Genus/species	4, 5, 6		
Er	Erect [sponges]	Community feature	4, 5, 6	ErS	
Est	Estuarine	Habitat factor	4, 5, 6	Est	

Ete	*Eteone*	Genus/species	4, 5, 6		
Eud	*Eudendrium*	Genus/species	4, 5, 6	Eud	
Eun	*Eunicella*	Genus/species	4, 5, 6	Eun	
Eur	*Eurydice*	Genus/species	4, 5, 6	Eur	
F	Features (e.g. rockpools, caves)	Habitat factor	2, 3		
F	Fucoids	Taxon group	4, 5, 6	F	
F	Full [salinity] (=marine)	Habitat factor	4, 5, 6	FS	
Fa	Fauna/faunal	Taxon group	4, 5, 6	Fa	
Fab	*Fabricia*	Genus/species	4, 5, 6	Fab	
Fcer	*Fucus ceranoides*	Genus/species	4, 5, 6	Fcer	
Fdis	*Fucus distichus*	Genus/species	4, 5, 6	Fdis	
Ffab	*Fabulina fabulina*	Genus/species	4, 5, 6		
Fi	Fine [sand or mud]	Habitat factor	4, 5, 6		
Fil	Filamentous (seaweeds)	Community feature	4, 5, 6	Fi	
Flu	*Flustra*	Genus/species	4, 5, 6	Flu	
Fo	Foliose (seaweeds)	Community feature	4, 5, 6	Fo	
For	Foraminiferans	Taxon group	4, 5, 6	For	
Fou	Fouling	Community feature	4, 5, 6		
Fser	*Fucus serratus*	Genus/species	4, 5, 6	Fser	In MLR
Fserr	*Fucus serratus*	Genus/species	4, 5, 6	Fserr	In LLR
Fspi	*Fucus spiralis*	Genus/species	4, 5, 6	Fspi	
Ft	Forest (kelp)	Community feature	4, 5, 6	Ft	
Fun	*Funiculina*	Genus/species	4, 5, 6	Fun	
Fur	*Furcellaria*	Genus/species	4, 5, 6	Fur	
Fves	*Fucus vesiculosus*	Genus/species	4, 5, 6	Fves	
G	Green seaweeds (Chlorophyceae)	Taxon group	4, 5, 6	G	
G	Gully [surge gully]	Habitat factor	4, 5, 6	G	
Gam	*Gammarus*	Genus/species	4, 5, 6		
Glap	*Glycera lapidum*	Genus/species	4, 5, 6		
Gra	*Gracilaria*	Genus/species	4, 5, 6		
Gv	Gravel/gravelly	Habitat factor	4, 5, 6		
Gz	Grazed (seaweed communities)	Community feature	4, 5, 6	Gz	
H	High energy (very wave/tide exposed)	Habitat factor	2, 3	E	
H	Hydroids	Taxon group	4, 5, 6	H	
Hal	*Halidrys*	Genus/species	4, 5, 6	Hal	
Hap	Haptophyceae	Taxon group	4, 5, 6		
Har	*Hartlaubella*	Genus/species	4, 5, 6	Har	
Hbow	*Halichondria bowerbanki*	Genus/species	4, 5, 6	Hbow	

Hchr	*Halcampa chrysanthellum*	Genus/species	4, 5, 6	Hal	
Hed	*Hediste*	Genus/species	4, 5, 6	Hed	
Helo	*Hesionura elongata*	Genus/species	4, 5, 6		
Het	*Heteromastus*	Genus/species	4, 5, 6		
Hia	*Hiatella*	Genus/species	4, 5, 6	Hia	
Hil	*Hildenbrandia*	Genus/species	4, 5, 6		
Him	*Himanthalia*	Genus/species	4, 5, 6	Him	
Ho	Holothurians	Taxon group	4, 5, 6	Ho	
Hocu	*Haliclona oculata*	Genus/species	4, 5, 6	Hocu	
Hyd	*Hydrallmania*	Genus/species	4, 5, 6	Hyd	
I	Infralittoral	Habitat factor	2, 3	I	
K	Kelps	Taxon group	4, 5, 6	K	
L	Littoral	Habitat factor	2, 3	L	
L	Low [salinity]	Habitat factor	4, 5, 6		
L	Low energy (wave/tide sheltered)	Habitat factor	2, 3	S	
Lag	Lagoonal (low or reduced salinity)	Habitat factor	4, 5, 6	Lag	
Lan	*Lanice*	Genus/species	4, 5, 6	Lan & Lcon	
Lcor	*Lithothamnion corallioides*	Genus/species	4, 5, 6	Lcor	
Ldig	*Laminaria digitata*	Genus/species	4, 5, 6	Ldig	
Lev	*Levinsenia*	Genus/species	4, 5, 6		
Lfas	*Lithothamnion fasciculatum*	Genus/species	4, 5, 6	Lfas	
Lg	Large (solitary) [ascidians]	Community feature	4, 5, 6	SoAs	
Lgla	*Lithothamnion glaciale*	Genus/species	4, 5, 6	Lgla	
Lhof	*Limnodrilus hoffmeisteri*	Genus/species	4, 5, 6	Lim	
Lhyp	*Laminaria hyperborea*	Genus/species	4, 5, 6	Lhyp	
Lic	Lichens	Taxon group	4, 5, 6	L	
Lim	*Limaria*	Genus/species	4, 5, 6	Lim	
Lit	*Littorina*	Genus/species	4, 5, 6		
Lkor	*Lagis koreni*	Genus/species	4, 5, 6		
Loch	*Laminaria ochreleuca*	Genus/species	4, 5, 6	Loch	
Lop	*Lophelia*	Genus/species	4, 5, 6	Lop	
Lpyg	*Lichaena pygmaea*	Genus/species	4, 5, 6	Lic	
Lsac	*Laminaria saccharina*	Genus/species	4, 5, 6	Lsac	
Lum	*Lumbrinereis*	Genus/species	4, 5, 6		
M	Mid [estuarine]	Habitat factor	4, 5. 6		
M	Moderate energy (Moderately wave/tide exposed)	Habitat factor	2, 3	M	
Mac	*Macoma*	Genus/species	4, 5, 6	Mac	

Mag	*Magelona*	Genus/species	4, 5, 6	Mag	
Mal	Maldanid polychaetes	Taxon group	4, 5, 6		
Mas	*Mastocarpus*	Genus/species	4, 5, 6	Mas	
Max	*Maxmuelleria*	Genus/species	4, 5, 6		
Mdis	*Musculus discors*	Genus/species	4, 5, 6	Mus	
Med	*Mediomastus*	Genus/species	4, 5, 6		
Meg	Megafauna (burrowing)	Community feature	4, 5, 6	Meg	
Mel	*Mellina*	Genus/species	4, 5, 6		
Mo	Mobile	Habitat factor	4, 5, 6	Mob	
Mod	*Modiolus*	Genus/species	4, 5, 6	Mod	
Moe	*Moerella*	Genus/species	4, 5, 6		
Mol	*Molgula*	Genus/species	4, 5, 6	Mol	
Mp	Macrophytes (angiosperms or seaweeds)	Taxon group	2, 3		
Mrl	Maerl	Taxon group	4, 5, 6	Mrl	
Msen	*Metridium senile*	Genus/species	4, 5, 6	Met	
Msim	*Microphthalmus similis*	Genus/species	4, 5, 6		
Mu	Mud/muddy [sand]	Habitat factor	2, 3	MU	
Mus	Mussels	Taxon group	4, 5, 6	M	
MuSa	Muddy sand	Habitat factor	4, 5, 6	MS	
Mx	Mixed sediments (mixtures of gravel, sand & mud, often with shell, pebble & cobble)	Habitat factor	2, 3, 4, 5, 6	MX & Mx	
Myr	*Myrtea*	Genus/species	4, 5, 6		
Mys	*Mysella*	Genus/species	4, 5, 6		
Myt	*Mytilus*	Genus/species	4, 5, 6	Myt	
Ncir	*Nephtys cirrosa*	Genus/species	4, 5, 6	Ncir	
Nem	*Nemertesia*	Genus/species	4, 5, 6	Nem	
Neo	*Neocrania*	Genus/species	4, 5, 6	Neo	
Nhom	*Nephtys hombergii*	Genus/species	4, 5, 6	Nhom	
Nint	*Neomysis integer*	Genus/species	4, 5, 6	Neo	
Nmix	*Neopentadactyla mixta*	Genus/species	4, 5, 6	Neo	
Nten	*Nuculoma tenuis*	Genus/species	4, 5, 6		
Nuc	*Nucula*	Genus/species	4, 5, 6	Nuc	
O	Offshore circalittoral	Habitat factor	2, 3	CO	
Obor	*Ophelia borealis*	Genus/species	4, 5, 6		
Ocn	*Ocnus*	Genus/species	4, 5, 6	Ocn	
Odub	*Ophryotrocha dubia*	Genus/species	4, 5, 6		
Ofus	*Owenia fusiformis*	Genus/species	4, 5, 6		
Ol	Oligochaetes	Taxon group	4, 5, 6	Ol	
Oph	*Ophiura*	Genus/species	4, 5, 6	Oph	
Osm	*Osmundea*	Genus/species	4, 5, 6	Osm	
Ost	*Ostrea*	Genus/species	4, 5, 6	Ost	

Ov	Overhangs	Habitat factor	4, 5, 6	Ov	
Pal	*Palmaria*	Genus/species	4, 5, 6	Pal	
Par	*Paracentrotus*	Genus/species	4, 5, 6	Par	
Paur	*Polyclinum aurantium*	Genus/species	4, 5, 6	Paur	
Pb	Pebbles	Habitat factor	4, 5, 6		
Pcal	*Phymatolithon calcareum*	Genus/species	4, 5, 6	Phy	
Pcom	*Porella compressa*	Genus/species	4, 5, 6		
Pcri	*Phyllophora crispa*	Genus/species	4, 5, 6	Pcri	
Pec	*Pectenogammarus*	Genus/species	4, 5, 6	Pec	
Pel	*Pelvetia*	Genus/species	4, 5, 6	Pel	
Pen	*Pentapora*	Genus/species	4, 5, 6		
Pful	*Paraonis fulgens*	Genus/species	4, 5, 6		
Pha	*Phakellia*	Genus/species	4, 5, 6	Pha	
Phi	*Philine*	Genus/species	4, 5, 6	Phi	
Phy	*Phyllophora*	Genus/species	4, 5, 6	Phy	
Pid	Piddocks (bivalves)	Taxon group	4, 5, 6	Pid	
Pil	*Pilinia*	Genus/species	4, 5, 6		
Pjef	*Paramphinome jeffreysii*	Genus/species	4, 5, 6		
Pk	Park (kelp)	Community feature	4, 5, 6	Pk	
Pkef	*Protodorvillea kefersteini*	Genus/species	4, 5, 6		
Plon	*Photis longicaudata*	Genus/species	4, 5, 6		
Pmax	*Pecten maximus*	Genus/species	4, 5, 6		
Pnk	Plankton	Taxon group	2, 3		
Po	Polychaetes	Taxon group	4, 5, 6	P	
Pol	*Polydora*	Genus/species	4, 5, 6	Pol	
Pom	*Pomatoceros*	Genus/species	4, 5, 6	Pom	
Pon	*Pontocrates*	Genus/species	4, 5, 6	Pon	
Por	*Porphyra*	Genus/species	4, 5, 6	Por	
Pova	*Parvecardium ovale*	Genus/species	4, 5, 6	Par	
Ppel	*Phaxus pellucidus*	Genus/species	4, 5, 6		
Pra	*Prasiola*	Genus/species	4, 5, 6	Pra	
Pro	*Protanthea*	Genus/species	4, 5, 6	Pro	
Prot	*Polyides rotundus*	Genus/species	4, 5, 6	Pol	
Psa	*Psammechinus*	Genus/species	4, 5, 6	Psa	
Pse	*Pseudamussium*	Genus/species	4, 5, 6		
Puly	*Patella ulyssiponensis*	Genus/species	4, 5, 6		
R	Red seaweeds (Rhodophyceae)	Taxon group	4, 5, 6	R	
R	Reduced [salinity]	Habitat factor	4, 5, 6	RS	
R	Reef (biogenic)	Habitat factor	2, 3		
R	Rock (bedrock, boulders, stable cobbles & pebbles)	Habitat factor	2, 3	R	
Rho	*Rhodothamniella*	Genus/species	4, 5, 6	Rho	
Rkp	Rockpools	Habitat factor	4, 5, 6	Rkp	

Rup	*Ruppia*	Genus/species	4, 5, 6	Rup	
S	Salinity (Full, Variable, Reduced, Low)	Habitat factor	4, 5, 6	S	
S	Sediment	Habitat factor	2, 3	S	
S	Sublittoral	Habitat factor	2, 3, 4, 5, 6	S	
S	Surge [gully]	Habitat factor	4, 5, 6	SG	
Sa	Sands/sandy [mud]	Habitat factor	2, 3, 4, 5, 6	Snd & S	
Sab	*Sabellaria*	Genus/species	4, 5, 6	Sab	
Sac	*Saccorhiza*	Genus/species	4, 5, 6	Sac	
Sag	*Sagartia*	Genus/species	4, 5, 6		
Salv	*Sabellaria alveolata*	Genus/species	4, 5, 6	Salv	
SaMu	Sandy mud	Habitat factor	4, 5, 6	SMu	
Sar	*Sargassum*	Genus/species	4, 5, 6	Sar	
Sco	*Scolelepis*	Genus/species	4, 5, 6		
Scr	Scoured	Habitat factor	4, 5, 6	Scr	
Scr	*Scrobicularia plana*	Genus/species	4, 5, 6		
Scup	*Sertularella cupressina*	Genus/species	4, 5, 6	Scup	
Sec	*Securiflustra*	Genus/species	4, 5, 6	Sec	
Sed	Sediment	Habitat factor	4, 5, 6	Sed	
Sem	*Semibalanus*	Genus/species	4, 5, 6	Sem	
Ser	*Serpula*	Genus/species	4, 5, 6	Ser	
Sf	Soft [rock]	Habitat factor	4, 5, 6	SfR	
Sgr	Seagrass	Taxon group	4, 5, 6	Sgr	
Sh	Shingle	Habitat factor	4, 5, 6	Sh	
Sm	Saltmarsh	Taxon group	4, 5, 6	Sm	
Sm	Small (solitary) [ascidians]	Community feature	4, 5, 6		
Sp	Sponges	Taxon group	4, 5, 6	S	
Spav	*Sabella pavonina*	Genus/species	4, 5, 6		
Spn	Seapens	Taxon group	4, 5, 6	Sp	
Sspi	*Sabellaria spinulosa*	Genus/species	4, 5, 6	Sspi	
St	Strandline	Habitat factor	4, 5, 6		
Str	*Streblospio*	Genus/species	4, 5, 6		
Sty	*Styela*	Genus/species	4, 5, 6	Sty	
Sub	*Suberites*	Genus/species	4, 5, 6	Sub	
Sund	*Sagartiageton undatum*	Genus/species	4, 5, 6		
Sw	Seaweeds	Taxon group	4, 5, 6	Sw	
Swi	*Swiftia*	Genus/species	4, 5, 6	Swi	
T	Tide-swept	Habitat factor	4, 5, 6	T	
Tal	Talitrid amphipods	Taxon group	4, 5, 6	Tal	
Tb	Tube/tube-building	Community feature	4, 5, 6	Tube	
Tben	*Tubificoides benedii*	Genus/species	4, 5, 6	Tub	

Tf	Turf	Community feature	4, 5, 6	Tf	
Thy	*Thyasira*	Genus/species	4, 5, 6	Thy	
Tra	*Trailliella*	Genus/species	4, 5, 6	Tra	
Ttub	*Tubifex tubifex*	Genus/species	4, 5, 6	Ttub	
Tub	*Tubularia indivisa*	Genus/species	4, 5, 6	Tub	
Tubi	*Tubificoides*	Genus/species	4, 5, 6	Tub	
U	Upper [estuarine]	Habitat factor	4, 5. 6		
Ulo	*Ulothrix*	Genus/species	4, 5, 6	Ulo	
Uro	*Urospora*	Genus/species	4, 5, 6	Uro	
Urt	*Urticina*	Genus/species	4, 5, 6	Urt	
V	Variable [salinity]	Habitat factor	4, 5, 6	VS	
Ven	Venerid bivalves	Taxon group	4, 5, 6	Ven	
Ver	*Verrucaria*	Genus/species	4, 5, 6	Ver	
Vir	*Virgularia*	Genus/species	4, 5, 6	Vir	
Vmuc	*Verrucaria mucosa*	Genus/species	4, 5, 6		
Vsen	*Venerupis senegalensis*	Genus/species	4, 5, 6	Vsen	
Vt	Vertical	Habitat factor	4, 5, 6	V	
WC	Water column	Habitat factor	2, 3		
X	Mixed (rocky) substrata (boulders, stones & sediment mixtures)	Habitat factor	4, 5, 6	X	
XFa	Mixed fauna	Taxon group	4, 5, 6	XFa	
XFoR	Mixed foliose red seaweeds	Taxon group	4, 5, 6		
XK	Mixed kelps	Taxon group	4, 5, 6	XK	
YG	Yellow & grey lichens	Taxon group	4, 5, 6	YG	
Zmar	*Zostera marina*	Genus/species	4, 5, 6	Zmar	
Znol	*Zostera noltii*	Genus/species	4, 5, 6	Znol	
	Abietinaria abietina	Genus/species	4, 5, 6	Abi	
	Calcareous	Community feature	4, 5, 6	Ca	
	Catenella caespitosa	Genus/species	4, 5, 6	Cat	
	Ciocalypta penicillus	Genus/species	4, 5, 6	Cio	
	Corbula gibba	Genus/species	4, 5, 6	Cor	
	Crustose bryozoans	Taxon group	4, 5, 6	ByC	
	Echinus esculentus	Genus/species	4, 5, 6	Ech	
	Exposed	Habitat factor	2, 3	E	Replaced by H (high energy)
	Gammarus	Genus/species	4, 5, 6	Gam	
	Gravels and clean sands	Habitat factor	2, 3	GS	Replaced by CS (coarse sediments)
	Halichondria panicea	Genus/species	4, 5, 6	Hpan	
	Lithothamnion dentatum	Genus/species	4, 5, 6	Lden	
	Littorina littorea	Genus/species	4, 5, 6	Llit	

	Marine	Habitat factor	4, 5, 6	Mar	Replaced by FS (full salinity)
	Massive [sponges]	Community feature	4, 5, 6	MaS	
	Moderately exposed	Habitat factor	2, 3	M	Replaced by M (moderate energy)
	Mya arenaria	Genus/species	4, 5, 6	Mare	
	Mya truncata	Genus/species	4, 5, 6	Mtru	
	Ophiopholis aculeata	Genus/species	4, 5, 6	Oacu	
	Oysters	Taxon group	4, 5, 6	Oy	
	Parasmittina trispinosa	Genus/species	4, 5, 6	Par	
	Patella	Genus/species	4, 5, 6	Pat	
	Polycarpa	Genus/species	4, 5, 6	Pol	
	Polymastia boletiformis	Genus/species	4, 5, 6	Pbol	
	Pygospio elegans	Genus/species	4, 5, 6	Pyg	
	Sertularia argentea	Genus/species	4, 5, 6	Ser	
	Sheltered	Habitat factor	2, 3	S	Replaced by L (low energy)
	Spisula elliptica	Genus/species	4, 5, 6	Sell	
	Stolonica	Genus/species	4, 5, 6	Sto	
	Synaptid holothurians	Taxon group	4, 5, 6	Syn	
	Tubeworms	Taxon group	4, 5, 6	Tw	
	Zostera	Genus/species	4, 5, 6	Zos	

Field recording and data management

MNCR field recording techniques are described in Hiscock (1996), with Appendix 8 providing the guidance on how to complete MNCR field recording forms (the forms can be downloaded from the JNCC website, www. jncc.gov.uk).

Procedural Guidelines for a wide range of field sampling techniques are given in the Marine Monitoring Handbook (Davies *et al*. 2001, also available to download from the JNCC website).

The Marine Recorder database application has been specifically developed to accept marine biological data from a wide range of survey techniques, including the data held originally in the MNCR database. The application can be downloaded from the JNCC website, and includes a dictionary of the habitat classification types.

Terms used for field recording and habitat definition

The following definitions are taken from guidance notes for MNCR field recording (Appendix 8 in Hiscock *ed*. 1996). Some terms are modified for use in the classification.

Salinity - The categories are defined as follows (the points of separation approximate to critical tolerance limits for marine species):

Fully marine	30-40 ‰
Variable	18-40 ‰
Reduced	18-30 ‰
Low	<18 ‰

Wave exposure - These categories take account of the **aspect** of the coast (related to direction of prevailing or strong winds), the fetch (distance to nearest land), its **openness** (the degree of open water offshore) and its **profile** (the depth profile of water adjacent to the coast). Estimation of wave exposure requires inspection of charts and maps.

Extremely exposed	This category is for the few open coastlines which face into prevailing wind and receive oceanic swell without any offshore breaks (such as islands or shallows) for several thousand km and where deep water is close to the shore (50 m depth contour within about 300 m, e.g. Rockall).
Very exposed	These are open coasts which face into prevailing winds and receive oceanic swell without any offshore breaks (such as islands or shallows) for several hundred km but where deep water is not close (>300 m) to the shore. They can be adjacent to extremely exposed sites but face away from prevailing winds (here swell and wave action will refract towards these shores) or where, although facing away from prevailing winds, strong winds and swell often occur (for instance, the east coast of Fair Isle).
Exposed	At these sites, prevailing wind is onshore although there is a degree of shelter because of extensive shallow areas offshore, offshore obstructions, a restricted (<90º) window to open water. These sites will not generally be exposed to strong or regular swell. This can also include open coasts facing away from prevailing winds but where strong winds with a long fetch are frequent.
Moderately exposed	These sites generally include open coasts facing away from prevailing winds and without a long fetch but where strong winds can be frequent.

Sheltered	At these sites, there is a restricted fetch and/or open water window. Coasts can face prevailing winds but with a short fetch (say <20 km) or extensive shallow areas offshore or may face away from prevailing winds.
Very sheltered	These sites are unlikely to have a fetch greater than 20 km (the exception being through a narrow (<30º) open water window, they face away from prevailing winds or have obstructions, such as reefs, offshore.
Extremely sheltered	These sites are fully enclosed with fetch no greater than about 3 km.
Ultra sheltered	Sites with fetch of a few tens or at most 100s of metres.

In the habitat classification **exposed** (as in **exposed littoral rock**) encompasses the **extremely exposed**, **very exposed** and **exposed** categories, whilst **sheltered** (as in **sheltered littoral rock**) encompasses **sheltered** to **ultra sheltered** categories.

Tidal currents (or streams) (maximum at surface) - This is maximum tidal current strength which **affects** the actual area surveyed. **Note for shores and inshore areas this may differ considerably from the tidal currents present offshore.** In some narrows and sounds the top of the shore may only be covered at slack water, but the lower shore is subject to fast running water.

Very strong	>6 knots	(>3 m/sec.)
Strong	3-6 knots	(>1.5-3 m/sec.)
Moderately strong	1-3 knots	(0.5-1.5 m/sec.)
Weak	<1 knot	(<0.5 m/sec.)
Very weak	Negligible	

In the habitat classification tide-swept habitats typically have moderately strong or stronger tidal currents.

Zone - These definitions primarily relate to rocky habitats or those where algae grow (e.g. stable shallow sublittoral sediments). For use of the terms **infralittoral** and circalittoral in the classification, especially for sediments, refer also to Table 5.

Supralittoral	Colonised by yellow and grey lichens, above the *Littorina* populations but generally below flowering plants.
Upper littoral fringe	This is the splash zone above High Water of Spring Tides with a dense band of the black lichen by *Verrucaria maura*. *Littorina saxatilis* and *Littorina neritoides* often present. May include saltmarsh species on shale/pebbles in shelter.
Lower littoral fringe	The *Pelvetia* (in shelter) or *Porphyra* (exposed) belt. With patchy *Verrucaria maura, Verrucaria mucosa* and *Lichina pygmaea* present above the main barnacle population. May also include saltmarsh species on shale/pebbles in shelter.
Upper eulittoral	Barnacles and limpets present in quantity or with dense *Fucus spiralis* in sheltered locations.
Mid eulittoral	Barnacle-limpet dominated, sometimes mussels or dominated by *Fucus vesiculosus* and *Ascophyllum nodosum* in sheltered locations. *Mastocarpus stellatus* and *Palmaria palmata* patchy in lower part. Usually quite a wide belt.
Lower eulittoral	*Fucus serratus, Mastocarpus stellatus, Himanthalia elongata* or *Palmaria palmata* variously dominant; barnacles sparse.

Sublittoral fringe	Dominated by *Alaria esculenta* (very exposed), *Laminaria digitata* (exposed to sheltered) or *Laminaria saccharina* (very sheltered) with encrusting coralline algae; barnacles sparse.
Upper infralittoral	Dense forest of kelp.
Lower infralittoral	Sparse kelp park, dominated by foliose algae except where grazed. May lack kelp.
Upper circalittoral	Dominated by animals, lacking kelp but with sparse foliose algae except where grazed.
Lower circalittoral	Dominated by animals with no foliose algae but encrusting coralline algae.

Substratum

Bedrock	Includes very soft rock-types such as chalk, peat and clay.
Boulders	Very large (>1024 mm), large (512-1024 mm), small (256-512 mm)
Cobbles	64-256 mm
Pebbles	16-64 mm
Gravel	4-16 mm
Coarse sand	1-4 mm
Medium sand	0.25-1 mm
Fine sand	0.063 - 0.25 mm
Mud	<0.063 mm (the silt/clay fraction)

Each division of sediment type above represents two divisions on the Wentworth scale (Wentworth 1922).

In the habitat classification, bedrock, stable boulders, cobbles or pebbles and habitats of mixed boulder, cobble, pebble and sediment (**mixed substrata**) as well as artificial substrata (concrete, wood, metal) are collectively referred to as **rock**. Highly mobile cobbles and pebbles (shingle), together with gravel and coarse sand are collectively referred to as **coarse sediments**. **Mixed sediment** consists of heterogeneous mixtures of gravel, sand and mud and may often have shells and stones also.

MNCR SACFOR abundance scales

The MNCR cover/density scales adopted from 1990 provide a unified system for recording the abundance of marine benthic flora and fauna in biological surveys (Connor & Hiscock 1996). The scales are given below and should be used in conjunction with the following notes:

1. Whenever an attached species covers the substratum and percentage cover can be estimated, that scale should be used in preference to the density scale.
2. Use the *massive/turf* percentage cover scale for all species, excepting those given under *crust/meadow*.
3. Where two or more layers exist, for instance foliose algae overgrowing crustose algae, total percentage cover can be over 100% and abundance grades will reflect this.
4. Percentage cover of littoral species, particularly the fucoid algae, must be estimated when the tide is out.
5. Use quadrats as reference frames for counting, particularly when density is borderline between two of the scale.
6. Some extrapolation of the scales may be necessary to estimate abundance for restricted habitats such as rockpools.
7. The species (as listed over) take precedence over their actual size in deciding which scale to use.
8. When species (such as those associated with algae, hydroid and bryozoan turf or on rocks and shells) are incidentally collected (i.e. collected with other species that were specifically collected for identification) and no meaningful abundance can be assigned to them, they should be noted as present (P).

MNCR SACFOR abundance scales

S = Superabundant, A = Abundant, C = Common, F = Frequent, O = Occasional, R = Rare

GROWTH FORM			SIZE OF INDIVIDUALS / COLONIES					
% COVER	**CRUST / MEADOW**	**MASSIVE / TURF**	**<1 cm**	**1-3 cm**	**3-15 cm**	**>15 cm**	**DENSITY**	
>80%	S		S				>1 / 0.0001 m^2 (1x1 cm)	>10,000/ m^2
40-79%	A	S	A	S			1-9 / 0.001 m^2 (3.16x3.16 cm)	1000-9999 / m^2
20-39%	C	A	C	A	S		1-9 / 0.01 m^2 (10x10 cm)	100-999 / m^2
10-19%	F	C	F	C	A	S	1-9 / 0.1 m^2	10-99 / m^2
5-9%	O	F	O	F	C	A	1-9 / m^2	
1-5% or density	R	O	R	O	F	C	1-9 / 10 m^2 (3.16x3.16 m)	
<1% or density		R		R	O	F	1-9 / 100 m^2 (10x10 m)	
					R	O	1-9 / 1000 m^2 (31.6x31.6 m)	
						R	>1 / 10,000 m^2 (100x100 m)	<1 / 1000 m^2

PORIFERA	Crusts *Halichondria*	Massive spp. *Pachymatisma*		Small solitary *Grantia*	Large solitary *Stelligera*	
HYDROZOA		Turf species *Tubularia* *Abietinaria*		Small clumps *Sarsia* *Aglaophenia*	Solitary *Corymorpha* *Nemertesia*	
ANTHOZOA	*Corynactis*	*Alcyonium*		Small solitary *Epizoanthus* *Caryophyllia*	Med. Solitary *Virgularia* *Cerianthus* *Urticina*	Large solitary *Eunicella* *Funiculina* *Pachycerianthus*
ANNELIDA	*Sabellaria spinulosa*	*Sabellaria alveolata*	*Spirorbis*	Scale worms *Nephtys* *Pomatoceros*	*Chaetopterus* *Arenicola* *Sabella*	
CRUSTACEA	Barnacles Tubiculous amphipods		*Semibalanus* Amphipods	*B. balanus* *Anapagurus* *Pisidia*	*Pagurus* *Galathea* Small crabs	*Homarus* *Nephrops* *Hyas araneus*
MOLLUSCA	 *Mytilus* *Modiolus*		 Small gastropod *L. neritoides* Small bivalves *Nucula*	Chitons Med. gastropod *L. littorea* *Patella* Med. bivalves *Mytilus* *Pododesmus*	 Large gastropod *Buccinum* Lge bivalves *Mya, Pecten* *Arctica*	
BRACHIOPODA				*Neocrania*		
BRYOZOA	Crusts	*Pentapora* *Bugula Flustra*			*Alcyonidium* *Porella*	
ECHINO-DERMATA				 *Echinocyamus* *Ocnus*	*Antedon* Small starfish Brittlestars *Echinocardium* *Aslia, Thyone*	 Large starfish *Echinus* *Holothuria*
ASCIDIACEA	Colonial *Dendrodoa*			Small solitary *Dendrodoa*	Large solitary *Ascidia, Ciona*	*Diazona*
PISCES					Gobies Blennies	Dog fish Wrasse
PLANTS	Crusts, Maerl *Audouinella* Fucoids, Kelp *Desmarestia*	Foliose Filamentous			*Zostera*	Kelp *Halidrys* *Chorda* *Himanthalia*

Examples of groups or species for each category

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Littoral Sediment Section

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LS Littoral Sediments

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt), Reduced/low (0.5-30ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Shingle; gravel; sand; mud; mixed sediment
Zone:	
Height band:	Strandline, Upper shore, Mid shore, Lower shore

Biotope description

Littoral sediment includes habitats of shingle (mobile cobbles and pebbles), gravel, sand and mud or any combination of these which occur in the intertidal zone. Littoral sediment is defined further using descriptions of particle sizes - mainly gravel (16-4 mm), coarse sand (4-1 mm), medium sand (1-0.25 mm), fine sand (0.25-0.063 mm) and mud (less than 0.063 mm) and various admixtures of these (and coarser) grades - muddy sand, sandy mud and mixed sediment (cobbles, gravel, sand and mud together). Littoral sediments support communities tolerant to some degree of drainage at low tide and often subject to variation in air temperature and reduced salinity in estuarine situations. Very coarse sediments tend to support few macrofaunal species because these sediments tend to be mobile and subject to a high degree of drying when exposed at low tide. Finer sediments tend to be more stable and retain some water between high tides, and therefore support a greater diversity of species. Medium and fine sand shores usually support a range of oligochaetes, polychaetes, and burrowing crustaceans, and even more stable muddy sand shores also support a range of bivalves. Very fine and cohesive sediment (mud) tends to have a lower species diversity, because oxygen cannot penetrate far below the sediment surface. A black, anoxic layer of sediment develops under these circumstances, which may extend to the sediment surface and in which few species can survive. Some intertidal sediments are dominated by angiosperms, e.g. eelgrass (*Zostera noltii*) beds on the mid and upper shore of muddy sand flats, or saltmarshes which develop on the extreme upper shore of sheltered fine sediment flats.

Situation

Littoral sediments are found across the entire intertidal zone, including the strandline. Sediment biotopes can extend further landwards (dune systems, marshes) and further seawards (sublittoral sediments). Sediment shores are generally found along relatively more sheltered stretches of coast compared to rocky shores. Muddy shores or muddy sand shores occur mainly in very sheltered inlets and along estuaries, where wave exposure is low enough to allow fine sediments to settle. Sandy shores and coarser sediment (gravel, pebbles, cobbles) shores are found in areas subject to higher wave exposures.

Temporal variation

Littoral sediment environments can change markedly over seasonal cycles, with sediment being eroded during winter storms and accreted during calmer summer months. The particle size structure of the sediment may change from finer to coarser during winter months, as finer sediment gets resuspended in seasonal exposed conditions. This may affect the sediment infauna, with some species only present in summer when sediments are more stable. These changes are most likely to affect sandy shores on relatively open shores. Sheltered muddy shores are likely to be more stable throughout the year, but may have a seasonal cover of green seaweeds during the summer period, particularly in nutrient enriched areas or where there is freshwater input.

LS.LCS Littoral coarse sediments

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Shingle; gravel; coarse sand
Zone:	
Height band:	Upper shore, Mid shore, Lower shore

Biotope description

Littoral coarse sediments include shores of mobile pebbles, cobbles and gravel, sometimes with varying amounts of coarse sand. The sediment is highly mobile and subject to high degrees of drying between tides. As a result, few species are able to survive in this environment. Beaches of mobile cobbles and pebbles tend to be devoid of macroinfauna, while gravelly shores may support limited numbers of crustaceans such as *Pectenogammarus planicrurus*.

Situation

Littoral coarse sediments are found along relatively exposed open shores, where wave action prevents finer sediments from settling. Coarse sediments may also be present on the upper parts of shores where there are more stable, sandy biotopes on the lower and mid shore.

Temporal variation

The sediment particle size structure may vary seasonally, with relatively finer sediments able to settle during calmer conditions in summer. Where the sediment grain size is very large (at the interface between sediment and boulder shores), cobbles may be mobile during exposed winter conditions, but stable enough during summer months to support limited juvenile rocky shore epifauna (e.g. juvenile barnacles).

LS.LCS.Sh Shingle (pebble) and gravel shores

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Shingle; gravel; coarse sand
Zone:	
Height band:	Upper shore, Mid shore, Lower shore

Biotope description

Littoral shingle and gravel shores include shores of mobile pebbles and gravel, sometimes with varying amounts of coarse sand. The sediment is highly mobile and subject to high degrees of drying between tides. As a result, few species are able to survive in this environment. Beaches of mobile shingle tend to be devoid of macroinfauna, while gravelly shores may support limited numbers of crustaceans such as *Pectenogammarus planicrurus*.

Situation

Littoral gravels and shingles are found along relatively exposed open shores, where wave action prevents finer sediments from settling. Gravel and shingle may also be present on the upper parts of shores where there are more stable, sandy biotopes on the lower and mid shore.

Temporal variation

The sediment particle size structure may vary seasonally, with relatively finer sediments able to settle during calmer conditions in summer.

LS.LCS.Sh.BarSh Barren littoral shingle

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Pebbles; cobbles; gravel
Zone:	
Height band:	Upper shore, Mid shore, Lower shore

Previous code

LGS.Sh.BarSh	97.06
LMXD.BAR	6.95

Biotope description

Shingle or gravel shores, typically with sediment particle size ranging from 4 - 256 mm, sometimes with some coarse sand mixed in. This biotope is normally only found on exposed open coasts in fully marine conditions. Such shores tend to support virtually no macrofauna in their very mobile and freely draining substratum. The few individuals that may be found are those washed into the habitat by the ebbing tide, including the occasional amphipod or small polychaete.

Situation

BarSh often extends over the whole shore, sometimes extending into the subtidal zone. BarSh may occur on the upper shore above BarSa, and in moderately exposed conditions, above AmSco on the lower shore. Tal may occur on the same shore as BarSh, where driftlines of algae and other debris accumulate on the upper shore.

Temporal variation

There may be a temporary cover of the green seaweeds *Enteromorpha* spp. or *Ulva* spp. during periods of stability in the summer.

Similar biotopes

LS.LSa.MoSa.BarSa	A similarly barren sediment habitat, but where the sediment is predominantly sand.

LS.LCS.Sh.Pec *Pectenogammarus planicrurus* in mid shore well-sorted gravel or coarse sand

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	
Substratum:	Gravel; very coarse sand (no fine sand or mud)
Zone:	
Height band:	Upper shore, Mid shore
Other features:	The lee of obstacles such as rocky outcrops and groynes

Previous code

LGS.SH.Pec	97.06

Biotope description

Shores of well-sorted gravel with a predominant particle size of 4.0 mm but ranging between 3 and 6 mm support dense populations of the amphipod *Pectenogammarus planicrurus*. Material finer than 2 mm reduces the ability of the amphipod to survive. The amphipod is tolerant of variable salinity, although a preference for a specific salinity regime has not been determined. As this habitat is regularly under-surveyed, its distribution is unclear.

Situation

The biotope is often associated with the lee side of obstacles such as rock outcrops and groynes; this may be due to the deposition of algal debris, shelter from wave action or degree of sorting due to localised tidal flow around the obstacle (most likely a combination of the first and last influence).

Temporal variation

Not known.

Similar biotopes

LS.LSa.MoSa.BarSa	Shores with finer sediments (mobile coarse sands). The infauna is very poor, often the habitat is devoid of macrofauna.
LS.LSa.St.Tal	Occurs on the strandline on shores with a wider range of exposures and sediment types, confined to driftlines of seaweeds and other debris. The sandhopper *Talitrus saltator* dominates the fauna.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Pectenogammarus planicrurus	●●●●●	Frequent	100	7

LS.LSa Littoral sands and muddy sands

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered, Very sheltered
Tidal streams:	
Substratum:	Sand; muddy sand
Zone:	
Height band:	Strandline, Upper shore, Mid shore, Lower shore

Biotope description

Shores comprising clean sands (coarse, medium or fine-grained) and muddy sands with up to 25% silt and clay fraction. Shells and stones may occasionally be present on the surface. The sand may be duned or rippled as a result of wave action or tidal currents. Littoral sands exhibit varying degrees of drying at low tide depending on the steepness of the shore, the sediment grade and the height on the shore. The more mobile sand shores are relatively impoverished (LS.LSa.MoSa), with more species-rich communities of amphipods, polychaetes and, on the lower shore, bivalves developing with increasing stability in finer sand habitats (LS.LSa.FiSa). Muddy sands (LS.LSa.MuSa), the most stable within this habitat complex, contain the highest proportion of bivalves.

Situation

A strandline of talitrid amphipods (Tal) typically develops at the top of the shore where decaying seaweed accumulates. Fully marine sandy shores occur along stretches of open coast, whilst muddy sands are often present in more sheltered lower estuarine conditions and may be subject to some freshwater influence.

Temporal variation

Littoral sandy shore environments can change markedly over seasonal cycles, with sediment being eroded during winter storms and accreted during calmer summer months. The particle size structure of the sediment may change from finer to coarser during winter months, as finer sediment gets resuspended in seasonal exposed conditions. This may affect the sediment infauna, with some species only present in summer when sediments are more stable. More sheltered muddy sand shores are likely to be more stable throughout the year, but may have a seasonal cover of green seaweeds during the summer period, particularly in nutrient enriched areas or where there is freshwater input.

LS.LSa.St Strandline

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Very strong, Strong, Moderately strong
Substratum:	Shingle; sand
Zone:	
Height band:	Strandline, Upper shore, Mid shore

Biotope description

The strandline is the shifting line of decomposing seaweed and debris which is typically left behind on sediment (and some rocky shores) at the upper extreme of the intertidal at each high tide. These ephemeral bands of seaweed often shelter communities of sandhoppers. A fauna of dense juvenile mussels may be found in sheltered firths, attached to algae on shores of pebbles, gravel, sand, mud and shell debris with a strandline of fucoid algae.

Situation

Strandlines may occur in bands along the upper extreme of any sediment shore and some rocky shores.

Temporal variation

Strandlines tend to be mobile, as they consist of driftlines of decomposing seaweed and other debris, which will decompose, and be shifted by the tide. The amount of debris washed up on strandlines, and hence the extent of the strandline, may vary significantly depending on factors such as recent storms or high tides.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
OLIGOCHAETA	•••	Common	11	254
Enchytraeidae	•	Present	2	50
Talitridae	••	Present	26	
Talitrus saltator	•••••	Common	87	1180
Talitrus saltator	••••	Present	27	
Talorchestia deshayesii	•••	Present	26	

LS.LSa.St.Tal Talitrids on the upper shore and strand-line

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered, Very sheltered
Tidal streams:	
Substratum:	Shingle; sand
Zone:	
Height band:	Strandline, Upper shore, Mid shore

Previous code

LGS.S.Tal	97.06
LMXD.TAL	6.95

Biotope description

A community of sandhoppers (talitrid amphipods) may occur on any shore where driftlines of decomposing seaweed and other debris accumulate on the strandline. The biotope occurs most frequently on medium and fine sandy shores, but may also occur on a wide variety of sediment shores composed of muddy sediment, shingle and mixed substrata, or on rocky shores. The decaying seaweed provides cover and humidity for the sandhopper *Talitrus saltator*. In places on sand that regularly accumulate larger amounts of weed, *Talorchestia deshayesii* is often present. Oligochaetes, mainly enchytraeids, can occur where the stranded debris remains damp as a result of freshwater seepage across the shore or mass accumulation of weed in shaded situations. On shingle and gravel shores and behind saltmarshes the strandline talitrid species tend to be mainly *Orchestia* species. Abundances of the characterising species tend to be highly patchy. Two characterising species lists are presented below. They are derived from two sets of data, which were analysed separately. The first shows data from infaunal samples, the second shows data from epifaunal samples. The epifaunal lists contains no counts per square metre, as the data were collected on the SACFOR scale.

Situation

Tal may occur on the same shore as a range of sediment (especially sandy) biotopes, where driftlines of algae and other debris accumulate on the upper shore. These biotopes include BarSh, BarSa, Ol, AmSco, and Po. The biotope also occurs at the back of boulder, cobble and pebble shores, above mixed sediment and rocky biotopes.

Temporal variation

This biotope varies in its position between spring and neap tides, and as a result of changing weather. After storms, it may extend into the fore dunes, during spring tides it will occur high on the shore, and during neaps the greatest numbers of talitrids may be found at or just below MHWN level. The amount of debris washed up on strandlines, and hence the extent of this biotope, may also vary significantly depending on factors such as recent storms or high tides.

Similar biotopes

LS.LSa.MoSa.BarSa	Occurs in similar physical conditions, in medium to fine mobile sands. Tal may occur on driftlines on the upper shore above (on) BarSa.
LS.LSa.MoSa.AmSco.Eur	Occurs in slightly more sheltered conditions in medium to fine mobile sands. AmSco.Eur occurs lower down on the shore than Tal, and is not confined to driftlines. It has a higher diversity of species, particularly amphipods such as *Bathyporeia* spp.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
OLIGOCHAETA	●●●	Common	11	254
Enchytraeidae	●	Present	2	50
Talitridae	●●●●●	Present	26	
Talitrus saltator	●●●●	Common	87	1180
Talitrus saltator	●●●●	Present	27	
Talorchestia deshayesii	●●●	Present	26	

LS.LSA.St.MytFab *Mytilus edulis* and *Fabricia sabella* in littoral mixed sediment

Habitat (physical) description

Salinity:	Full (30-35ppt)	LMX.MytFab	97.06
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered		
Tidal streams:			
Substratum:	Mixed sediment, shell debris		
Zone:			

Biotope description

Pebbles, gravel, sand and shell debris with mud in sheltered Firths with a strandline of fucoid algae. The fauna is characterised by juvenile mussels *Mytilus edulis*, often in very high numbers. The nemertean worm *Lineus* spp. may be abundant and oligochaetes are common. Polychaetes such as *Pygospio elegans*, *Scoloplos armiger* and *Fabricia sabella* may be present in high densities. *Fabricia sabella* is typically found amongst algal holdfasts and between cobbles on rocky shores. The bivalves *Macoma balthica* and *Cerastoderma edule*, typical of muddy sediments, characterise the community. The validity of this biotope is uncertain, as it has only been recorded from the Dornoch Firth and the Moray Firth. Its position within the classification, as a strandline community, is also very uncertain, but there is not enough information available for a better description or classification at this stage.

Situation

Occurs on sheltered shores of the Dornoch Firth and Moray Firth.

Temporal variation

Not known.

Similar biotopes

LS.LMx.LMus.Myt	Occurs on mixed substrates, often under variable salinity, lower on the shore. Adult *M. edulis* form beds on the surface of the sediment. Few polychaetes are recorded for Myt, though that may result from a lack of infaunal sampling. A range of rocky shore species occur attached to scattered cobbles and boulders, including *Semibalanus balanoides*, *Elminius modestus*, *Littorina* spp., and *Fucus vesiculosus*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Lineus	●●●●	Abundant	2	75
Scoloplos armiger	●●●●	Super-abundant	6	72
Pygospio elegans	●●●●●	Abundant	13	100
Fabricia sabella	●●●●●	Common	6	89
OLIGOCHAETA	●●●●●	Common	12	83
Hydrobia ulvae	●●●●	Abundant	11	67
Mytilus edulis	●●●●●	Abundant	11	100
Cerastoderma edule	●●●	Abundant	2	50
Macoma balthica	●●●●●	Abundant	37	37

LS.LSa.MoSa Barren or amphipod dominated mobile sand shores

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Sand
Zone:	
Height band:	Upper shore, Mid shore, Lower shore

Biotope description

Shores consisting of clean mobile sands (coarse, medium and some fine-grained), with little very fine sand, and no mud present. Shells and stones may occasionally be present on the surface. The sand may be duned or rippled as a result of wave action or tidal currents. The sands are non-cohesive, with low water retention, and thus subject to drying out between tides, especially on the upper shore and where the shore profile is steep. Most of these shores support a limited range of species, ranging from barren, highly mobile sands to more stable clean sands supporting communities of isopods, amphipods and a limited range of polychaetes. Species which can characterise mobile sand communities include *Scolelepis squamata*, *Pontocrates arenarius*, *Bathyporeia pelagica*, *B. pilosa*, *Haustorius arenarius* and *Eurydice pulchra*.

Situation

Mobile sand shores are typically situated along open stretches of coastline, with a relatively high degree of wave exposure. Bands of gravel and shingle may be present on the upper shore of exposed beaches. Where the wave exposure is less, and the shore profile more shallow, mobile sand communities may also be present on the upper part of the shore, with more stable fine sand communities present lower down. A strandline of talitrid amphipods (Tal) typically develops at the top of the shore where decaying seaweed accumulates.

Temporal variation

Mobile sand shores may show significant seasonal changes, with sediment accretion during calm summer periods and beach erosion during more stormy winter months. There may be a change in sediment particle size structure, with finer sediment grains washed out during winter months, leaving behind coarser sediments.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Scolelepis squamata	••	Common	16	68
Pontocrates arenarius	••	Common	18	55
Bathyporeia pelagica	••	Common	6	54
Bathyporeia pilosa	••	Frequent	8	114
Haustorius arenarius	••	Frequent	6	23
Eurydice pulchra	•••	Frequent	32	67

LS.LSa.MoSa.BarSa Barren littoral coarse sand

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	
Substratum:	coarse to fine sand
Zone:	
Height band:	Upper shore, Mid shore, Lower shore

Previous code

LGS.S.BarSnd	97.06
LSND.BAR	6.95

Biotope description

Freely-draining sandy beaches, particularly on the upper and mid shore, which lack a macrofaunal community due to their continual mobility. Trial excavations are unlikely to reveal any macrofauna in these typically steep beaches on exposed coasts. Oligochaetes, probably mainly enchytraeids, and the isopod *Eurydice pulchra* may be found in extremely low abundances, but if present in any quantity should be classed as Ol or AmSco.Eur. Burrowing amphipods (*Bathyporeia* spp.) may be present on very rare occasions. Occasionally, other species may be left behind in low abundance by the ebbing tide.

Situation

BarSa may occur on the mid and/or lower shore below BarSh in exposed conditions. In moderately exposed conditions, and where BarSa occurs on the upper shore, a range of relatively more species-rich clean sand communities may occur on the mid and lower shore. These include AmSco, Ol, and Po, depending on the degree of wave exposure and sediment mobility. Tal may occur on the same shore as BarSa, where driftlines of algae and other debris accumulate on the upper shore.

Temporal variation

Not known.

Similar biotopes

LS.LCS.Sh.BarSh	Similar physical environment, differentiated solely on the basis of larger sediment particle size.
LS.LSa.MoSa.Ol	Occurs in similar sediment types but in slightly more sheltered conditions. Oligochaetes occur in relatively high densities.
LS.LSa.MoSa.AmSco.Sco	Occurs in slightly more sheltered conditions. The fauna is poor, characterised by the polychaetes *Scolelepis squamata* and *S. foliosa*.
LS.LSa.MoSa.AmSco.Pon	Occurs in more sheltered conditions, in sediments with a slightly higher proportion of fine sands. The infauna is more diverse, with the crustaceans *Bathyporeia* spp. and *Pontocrates arenarius* common.
LS.LSa.MoSa.AmSco.Eur	Occurs in more sheltered conditions, in sediments with a slightly higher proportion of fine sand. The infauna is more diverse, with the crustaceans *Bathyporeia* spp. and *Eurydice* spp. common.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
NEMERTEA	●●●	Present	52	17
OLIGOCHAETA	●●	Present	15	18
Eurydice pulchra	●●	Present	26	6

LS.LSa.MoSa.Ol Oligochaetes in littoral mobile sand

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Gravel; sand
Zone:	
Height band:	Upper shore, Mid shore, Lower shore

Previous code

LGS.Est.Ol	97.06
LGS.S.BarSnd (part)	97.06
LGS.S.AEur (part)	97.06

Biotope description

A species-poor community of oligochaetes occurring in estuarine conditions where sands and gravel are associated with the lower shore river channel in estuaries. The sediment is relatively coarse and mobile due to strong river flow and subject to variable salinity. The biotope also occurs in fully marine conditions on open shores with mobile, medium to fine, usually clean, sand. Oligochaetes, including enchytraeid oligochaetes, constitute the infaunal assemblage. This biotope has been split into two sub-biotopes, based on the physical environment (a full salinity and a variable salinity type).

Situation

Ol often occurs in variable salinity conditions, in channels of very fast flowing river mouths at the bottom of otherwise sheltered estuarine shores. In this situation, biotopes under the LS.LMu.MEst and LS.LMu.UEst biotope complexes may be present above the river channel. Ol also occurs on open, fully marine shores. Where it is situated on the mid shore, BarSh and/or BarSa may be present on the upper shore, and lower down on the shore, AmSco.Sco and AmSco.Pon may be found. Ol may also occur on the upper shore, with AmSco.Eur present on the mid shore, and Po.Pful or Po.Aten on the lower shore. Tal may be found on the upper shore where driftlines of wracks and debris accumulate.

Temporal variation

Wave exposure may be higher on some beaches during winter than during the summer months, leading to the disappearance of infaunal species in winter. Where this happens, the biotope may change to BarSa. If conditions become more sheltered, seasonally or permanently, the sediment may become colonised by a greater range of species and the area may change to AmSco.

Similar biotopes

LS.LMu.UEst.Tben	Occurs on upper estuarine muddy shores where there is no strong river flow, and hence the sediment is very soft. While the physical environment is very different, the infaunal community is similarly poor. It consists of oligochaetes, including *Tubificoides benedii* and *Heterochaeta costata*, as well as the polychaete *Capitella capitata*.
LS.LSa.MoSa.BarSa	Occurs in similar sediment types, under more exposed conditions, on open coasts. Infauna is virtually absent as a result of the high mobility of the sediment.
LS.LSa.MoSa.AmSco	Occurs on open fully marine shores with clean mobile sand. The infauna is more diverse, characterised by a range of crustaceans such as *Pontocrates arenarius*, *Bathyporeia* spp., *Haustorius arenarius*, and *Eurydice pulchra*, as well as the polychaetes *Scolelepis* spp.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
OLIGOCHAETA	••••	Abundant	88	2045
Enchytraeidae	••	Common	6	389

LS.LSa.MoSa.Ol.FS Oligochaetes in full salinity littoral mobile sand

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Moderately strong
Substratum:	Gravel, sand
Zone:	
Height band:	Upper shore, Mid shore, Lower shore

Previous code

LGS.S.BarSnd (part)	97.06
LGS.S.AEur (part)	97.06

Biotope description

A species-poor community of oligochaetes occurring in fully marine conditions on open shores with mobile, medium to fine, usually clean, sand. Oligochaetes, including enchytraeid oligochaetes, constitute the infaunal assemblage. On rare occasions individuals of polychaete or crustacean species may be encountered (e.g. *Nephtys* spp., *Eurydice pulchra*, *Bathyporeia* spp.), though these are not characterising for the biotope and if present in any significant abundance, the area should be classed as AmSco.

Situation

Where Ol.FS is situated on the mid shore, BarSh and/or BarSa may be present on the upper shore, and lower down on the shore, AmSco.Sco and AmSco.Pon may be found. Ol may also occur on the upper shore, with AmSco.Eur present on the mid shore, and Po.Pful or Po.Aten on the lower shore. Tal may be found on the upper shore where driftlines of decomposing seaweed and other debris accumulate.

Temporal variation

Wave exposure may be higher on some beaches during winter than during the summer months, leading to the disappearance of infaunal species in winter. Where this happens, the biotope may change to BarSa. If conditions become more sheltered, seasonally or permanently, the sediment may become colonised by a greater range of species and the area may change to AmSco.

Similar biotopes

LS.LMu.UEst.Tben	Occurs on upper estuarine muddy shores where there is no strong river flow, and hence the sediment is very soft. While the physical environment is very different, the infaunal community is similarly poor. It consists of oligochaetes, including *Tubificoides benedii* and *Heterochaeta costata*, as well as the polychaete *Capitella capitata*.
LS.LSa.MoSa.BarSa	Occurs in similar sediment types, under more exposed conditions, on open coasts. Infauna is virtually absent as a result of the high mobility of the sediment.
LS.LSa.MoSa.AmSco	Occurs on open fully marine shores with clean mobile sand. The infauna is more diverse, characterised by a range of crustaceans such as *Pontocrates arenarius*, *Bathyporeia* spp., *Haustorius arenarius*, and *E. pulchra*, as well as the polychaetes *Scolelepis* spp.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
OLIGOCHAETA	••••	Abundant	90	1941
Enchytraeidae	••	Common	7	49

LS.LSa.MoSa.Ol.VS Oligochaetes in variable salinity littoral mobile sand

Habitat (physical) description

Salinity:	Variable (18-35ppt)
Wave exposure:	Extremely sheltered
Tidal streams:	Weak
Substratum:	Pebble, gravel, sand
Zone:	
Height band:	Upper shore, Mid shore, Lower shore

Previous code

LGS.Est.Ol	97.06

Biotope description

A species-poor community of oligochaetes occurring in estuarine conditions where sands and gravel are associated with the lower shore river channel in estuaries. The sediment is relatively coarse and mobile due to strong river flow and subject to variable salinity. There is usually very little mud in the sediment. Oligochaetes, including enchytraeid oligochaetes, constitute the infaunal assemblage. Nemerteans may be present, and nematodes may be frequent.

Situation

Ol.VS occurs in channels of very fast flowing river mouths at the bottom of otherwise sheltered estuarine shores. In this situation, biotopes under the LS.LMu.MEst and LS.LMu.UEst biotope complexes may be present above the river channel. Tal may be found on the upper shore where driftlines of decomposing seaweed and other debris accumulate.

Temporal variation

Not known.

Similar biotopes

LS.LMu.UEst.Tben	Occurs on upper estuarine muddy shores where there is no strong river flow, and hence the sediment is very soft. While the physical environment is very different, the infaunal community is similarly poor. It consists of oligochaetes, including *Tubificoides benedii* and *Heterochaeta costata*, as well as the polychaete *Capitella capitata*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
NEMERTEA	••	Present	10	280
NEMATODA	••	Frequent	5	37
OLIGOCHAETA	••••	Abundant	70	2045
Enchytraeidae	••	Common	6	389

LS.LSa.MoSa.AmSco Amphipods and *Scolelepis* spp. in littoral medium-fine sand

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Sand
Zone:	
Height band:	Upper shore, Mid shore, Lower shore

Previous code

LGS.S.AP.Pon (part)	97.06
LGS.S.AP.P (part)	97.06
LGS.S.AEur (part)	97.06

Biotope description

Mobile clean sandy beaches on exposed and moderately exposed shores, with sediment grain sizes ranging from medium to fine, often with a fraction of coarser sediment. The sediment contains little or no organic matter, and usually no anoxic layer is present at all. It tends to be well-drained, retaining little water at low tide, though the sediment of the AmSco.Pon sub-biotope may remain damp throughout the tidal cycle. These beaches usually occur under fully marine conditions, though the AmSco.Eur sub-biotope may occur under moderately exposed lower estuarine conditions. The mobility of the sediment leads to a species-poor community, dominated by polychaetes, isopods and burrowing amphipods. *Scolelepis* spp. can tolerate well-drained conditions, and are often present in well-draining, coarser sand. Burrowing amphipods that often occur in this biotope include *Bathyporeia* spp., *Pontocrates arenarius*, and *Haustorius arenarius*. The isopod *Eurydice pulchra* is also often present. On semi-exposed beaches with a moderate tide range where there is a marked high-shore berm, there can be a marked seepage at the foot of the berm that probably carries the products of the organic matter derived from strand line breakdown. Here in a narrow zone, exceptionally high populations of *Bathyporeia pilosa*, sometimes above 10000 per square metre, may occur. The zone may be narrower than the strandline and could easily be missed on surveys were only a few levels are sampled. Three sub-biotopes are described for this biotope, based principally on differences in infaunal species composition.

Situation

Situated mainly on the mid and lower shore, sometimes upper shore, of exposed to moderately exposed beaches. Under more exposed conditions, it may occur below BarSa, or BarSh. Under more sheltered conditions, it may occur above the Po communities. Tal may be present on the same shores as AmSco, where driftlines of decomposing seaweed and other debris occur on the upper shore.

Temporal variation

Winter storms may reduce the number of or temporarily remove macroinvertebrates from exposed sandy beaches, with the sediment becoming re-colonised during the summer months.

Similar biotopes

LS.LSa.MoSa.BarSa	Occurs in more mobile, coarser sand, often higher on the shore. The mobility and degree of drainage of the sediments enables very few, if any, individuals of hardy species to survive.
LS.LSa.FiSa.Po	Occurs in more stable, finer sediments, sometimes lower on the shore. The increased sediment stability enables a more diverse infaunal community to survive, including a range of polychaetes such as *Arenicola marina* and *Nephtys* spp., and the bivalve *Angulus tenuis*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution*	*Abundance*

			to similarity	*(nos / m ^{2})*
Scolelepis squamata	●●●	Common	24	83
Pontocrates arenarius	●●●	Common	22	66
Bathyporeia pelagica	●●	Common	7	63
Bathyporeia pilosa	●●	Common	7	136
Haustorius arenarius	●●	Frequent	5	27
Eurydice pulchra	●●●	Frequent	30	78

LS.LSa.MoSa.AmSco.Sco *Scolelepis* spp. in littoral mobile sand

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Coarse to very fine sand
Zone:	
Height band:	Mid shore, Lower shore

Biotope description

Exposed and moderately exposed shores of fully marine mobile clean sand, with particle sizes ranging from coarse to very fine. The sediment is not always well sorted, and may contain a subsurface layer of gravel or shell debris. Usually no anoxic layer is present. The mobility of the sediment leads to a species-poor community, dominated by the polychaetes *Scolelepis squamata* and *S. foliosa*. The amphipod *Bathyporeia pilosa* may be present. Further species that may be present in this sub-biotope include the amphipods *B. pelagica* and *Haustorius arenarius*, and the isopod *Eurydice pulchra*. The lugworm *Arenicola marina* may also occur.

Situation

Situated mainly on the mid and lower shore, sometimes upper shore, of exposed to moderately exposed beaches. Under more exposed conditions, it may occur below AmSco.Eur, BarSa, or BarSh, and on the same shores as AmSco.Pon. Under more sheltered conditions, it may occur above the Po communities. Tal may be present on the same shores, where driftlines of wrack and other debris occur on the upper shore.

Temporal variation

Winter storms may reduce the number of or temporarily remove macroinvertebrates from exposed sandy beaches, with the sediment becoming re-colonised during the summer months.

Similar biotopes

LS.LSa.MoSa.BarSa	Occurs under more exposed conditions, and/or higher up on the shore. The mobility of the sediment leads to the virtual absence of infauna.
LS.LSa.MoSa.Ol	Occurs under similar conditions, but generally higher up on the shore. The infauna is sparse, dominated by oligochaetes.
LS.LSa.MoSa.AmSco.Eur	Occurs under slightly more sheltered conditions, leading to the presence of burrowing amphipod species as well as *Scolelepis* spp.
LS.LSa.MoSa.AmSco.Pon	Occurs mainly on the lower shore, in more sheltered conditions. The infauna is significantly more diverse, characterised by a range of polychaete and amphipod species.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Scolelepis foliosa	•••	Abundant	34	101
Scolelepis squamata	•••	Common	51	345
Bathyporeia pilosa	•	Present	2	9

LS.LSa.MoSa.AmSco.Eur *Eurydice pulchra* in littoral mobile sand

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	medium to fine sand
Zone:	
Height band:	Strandline, Upper shore, Mid shore, Lower shore

Previous code

LGS.S.AEur	97.06
LSND.AE	6.95

Biotope description

Well-draining beaches of medium- to fine-grained mobile sand, often (but not always) well sorted. Occasionally, a small fraction of coarse sand may be present. The biotope generally occurs on exposed open coasts, but sometimes in estuarine conditions, supporting populations of the isopod *Eurydice pulchra* and burrowing amphipods which frequently include *Bathyporeia pilosa* and *Haustorius arenarius*. The degree of drainage appears to be a critical factor in determining the presence of polychaetes, with only *Scolelepis squamata* capable of tolerating the well-drained sediments of this biotope. This biotope has two facies: drying upper and mid shore sands, and highly mobile lower shore and shallow sublittoral sand bars. Where this biotope occurs in estuarine conditions, *H. arenarius* is often highly abundant.

Situation

AmSco.Eur may occur on the mid and upper shore together with AmSco.Sco, below Ol, or above Amsco.Pon and the Po communities. Under more exposed, open conditions, AmSco.Eur may be restricted to the lower part of the shore, with Ol, barren sand (BarSa) or barren shingle (BarSh) on the upper shore. Tal may occur where driftlines of wracks or other debris accumulate on the upper shore.

Temporal variation

Winter storms may reduce the number of or temporarily remove macroinvertebrates from exposed sandy beaches, with the sediment becoming re-colonised during the summer months.

Similar biotopes

LS.LSa.MoSa.AmSco.Sco	Occurs under full salinity and more exposed conditions, in highly mobile sediment. The infauna is dominated by *S. foliosa* and *S. squamata*, amphipods are only present in a low proportion of samples.
LS.LSa.MoSa.AmSco.Pon	Occurs under fully marine, exposed conditions, tending to be present lower on the shore. The infauna is distinguished by the occasional presence of polychaete species such as *Paraonis fulgens*, in addition to *Scolelepis* spp., and most notably by common *Pontocrates arenarius*.
LS.LSa.MoSa.Ol.FS	Ol.FS often occurs in similar physical environments. It is distinguished from Amsco.Eur by the presence of oligochaetes and the absence of crustacean species.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Scolelepis squamata	●●●	Common	9	32
Bathyporeia pilosa	●●●	Common	21	345
Haustorius arenarius	●●●	Frequent	5	37
Eurydice pulchra	●●●●●	Common	60	155

LS.LSa.MoSa.AmSco.Pon *Pontocrates arenarius* in littoral mobile sand

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	
Substratum:	Medium sand; fine sand
Zone:	
Height band:	Upper shore, Mid shore, Lower shore

Previous code

LGS.AP.Pon (part)	97.06
LGS.S.AP.P (part)	97.06
LGS.S.AEur (part)	97.06

Biotope description

Mainly on the mid and lower shore on wave-exposed or moderately wave-exposed coasts of medium and fine sand, sometimes with a fraction of coarse sand, which remains damp throughout the tidal cycle and contains little organic matter. The sediment is often rippled and typically lacks an anoxic sub-surface layer. The infauna is dominated by burrowing amphipods, most notably *Pontocrates arenarius*, as well as *Bathyporeia pelagica, Haustorius arenarius* and the isopod *Eurydice pulchra*. The polychaete fauna is poor, dominated by *Scolelepis squamata*, which tolerates the exposed and mobile sediment conditions. The presence of polychaetes may be seen as coloured burrows running down from the surface of the sediment.

Situation

This biotope may be present on the lower shore, where BarSa, AmSco.Eur, or AmSco.Sco are present higher up. Where AmSco.Pon occurs on the mid shore in relatively sheltered conditions, Po may be present on the lower shore. Tal may be present where driftlines of fucoids and other debris occur on the upper shore.

Temporal variation

This biotope may change to AmSco.Eur, which is very similar in character, if *P. arenarius* decreases in abundance. Winter storms may reduce the number of or temporarily remove macroinvertebrates from exposed sandy beaches, with the sediment becoming re-colonised during the summer months.

Similar biotopes

LS.LSa.MoSa.AmSco.Eur	Occurs in similar physical environments, under slightly more sheltered conditions, and tending to be present higher up on the shore. Infauna is more sparse, dominated by *E. pulchra*, with *P. arenarius* absent.
LS.LSa.FiSa.Po.Pful	Occurs in more sheltered, occasionally estuarine, conditions, where sediments are more stable. The infauna is dominated by polychaete species, while burrowing amphipods occur less frequently.
LS.LSa.FiSa.Po.Aten	Occurs in more sheltered conditions. The sediments are even more stable than in the case of Po.Pful and therefore support bivalves, especially *Angulus tenuis*, in addition to a range of polychaete species similar to the Po.Pful assemblage. Burrowing amphipods occur less frequently than in AmSco.Pon.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Scolelepis	••	Abundant	3	22
Scolelepis squamata	••	Common	11	39
Pontocrates arenarius	•••••	Common	62	90
Bathyporeia pelagica	••	Common	6	37
Haustorius arenarius	••	Common	2	27
Eurydice pulchra	•••	Frequent	7	49

LS.LSa.FiSa Polychaete / amphipod dominated fine sand shores

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	
Substratum:	Sand
Zone:	
Height band:	Strandline, Upper shore, Mid shore, Lower shore

Biotope description

Shores of clean, medium to fine and very fine sand, with no coarse sand, gravel or mud present. Shells and stones may occasionally be present on the surface. The sand may be duned or rippled as a result of wave action or tidal currents. The degree of drying between tides is limited, and the sediment usually remains damp throughout the tidal cycle. Typically, no anoxic layer is present. Fine sand shores support a range of species including amphipods and polychaetes. On the lower shore, and where sediments are stable, bivalves such as *Angulus tenuis* may be present in large numbers. An exceptionally rich fine sand community has been recorded from very sheltered reduced salinity shores in Poole Harbour. Species recorded include *Anaitides maculata*, *Hediste diversicolor*, *Scoloplos armiger*, *Pygospio elegans*, *Tharyx killariensis*, oligochaetes, *Gammarus locusta*, *Hydrobia ulvae*, *Cerastoderma edule* and *Mya truncata*.

Situation

Fine sand communities may be present throughout the intertidal zone on moderately exposed beaches, or they may be present on the lower parts of the shore with mobile sand communities present along the upper shore. A strandline of talitrid amphipods (Tal) typically develops at the top of the shore where decaying seaweed accumulates.

Temporal variation

Fine sand shores may show seasonal changes, with sediment accretion during calm summer periods and beach erosion during more stormy winter months. There may be a change in sediment particle size structure, with finer sediment grains washed out during winter months, leaving behind coarser sediments.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
NEMERTEA	●●●	Present	2	19
Nephtys cirrosa	●●●	Common	8	42
Scoloplos armiger	●●	Common	1	19
Paraonis fulgens	●●	Abundant	5	72
Pygospio elegans	●●	Frequent	2	69
Spio filicornis	●●	Common	3	60
Spiophanes bombyx	●●	Common	1	20
Pontocrates arenarius	●●	Frequent	1	30
Bathyporeia pilosa	●●	Common	3	260
Angulus tenuis	●●●●	Abundant	57	313

LS.LSa.FiSa.Po Polychaetes in littoral fine sand

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	
Substratum:	Medium and fine sand
Zone:	
Height band:	Mid shore, Lower shore

Previous code

LGS.S.AP.Pon (part)	97.06
LGS.S.AP.P (part)	97.06
LSND.AP (part)	6.95

Biotope description

Moderately exposed or sheltered beaches of medium and fine, usually clean, sand, though the sediment may on rare occasions contain a small silt and clay fraction. The sediment is relatively stable, remains damp throughout the tidal cycle, and contains little organic matter. It is often rippled and typically lacks an anoxic sub-surface layer. Where an anoxic layer is present, it occurs at a depth below 10 cm and tends to be patchy. The biotope occurs mainly on the lower part of the shore, and relatively frequently on the mid shore. It is only rarely present above mid shore level, except where coastal defences cause backwash onto the upper shore. Conditions are usually fully marine, though the biotope can also occur in open lower estuarine conditions. The infaunal community is dominated by a range of polychaete species such as *Nephtys cirrosa*, *Paraonis fulgens*, *Spio* spp., *Pygospio elegans*, *Ophelia rathkei* and *Scoloplos armiger*. The presence of polychaetes may be seen as coloured burrows running down from the surface of the sediment, and *Arenicola marina* casts may be present on the sediment surface. The amphipods *Bathyporeia* spp. and *Pontocrates arenarius* frequently occur, and nemerteans are often present. On some North Wales shores, the presence of *Arenicola* species characterises the lowest part of the shore, with a range of species characteristic of the shallow sublittoral. These include sparsely distributed *Echinocardium*, *Amphiura brachiata*, *Ensis siliqua* and *Fabulina fabula*. The Po biotope is split into three sub-biotopes, between which there can be a large degree of overlap. The bivalve *Angulus tenuis* dominates the Po.Aten sub-biotope, which is characterised by slightly more stable and fine sediments than the other two sub-biotopes.

Situation

The Po biotopes may be present below the AmSco communities or Ol.FS on moderately exposed shores. BarSa may occur on the upper part of the shore if it is subject to drying in between tides. The strandline biotope Tal may be present on the same shore where driftlines of decomposing seaweed and other debris occur on the upper shore.

Temporal variation

The infauna of this biotope may be affected significantly by seasonal changes in degree of wave exposure. During stormy winters, the sediment may become de-stabilised, leading to the disappearance of some macroinfaunal species. The lugworm *A. marina* may be present occasionally, usually as a temporary recruitment and is likely to be washed out during storms.

Similar biotopes

LS.LSa.MoSa.AmSco	Occurs in more mobile, slightly coarser sands, sometimes higher on the shore or on more wave exposed beaches. The infaunal community is a lot less diverse, as fewer species are able to survive the harsher environmental conditions. The infauna is dominated by burrowing amphipods, and the polychaete *Scolelepis* spp.
LS.LSa.MuSa.Lan	Occurs lower on the shore. It is distinguished from the Po communities by the presence of *Lanice conchilega* as the main polychaete component at densities of common or above.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
NEMERTEA	●●●	Present	2	19
Nephtys cirrosa	●●●	Common	8	42
Scoloplos armiger	●●	Common	1	19
Paraonis fulgens	●●	Abundant	5	72
Pygospio elegans	●●	Frequent	2	69
Spio filicornis	●●	Common	3	60
Spiophanes bombyx	●●	Common	1	20
Pontocrates arenarius	●●	Frequent	1	30
Bathyporeia pilosa	●●	Common	3	260
Angulus tenuis	●●●●	Abundant	57	313

LS.LSa.FiSa.Po.Pful Polychaetes, including *Paraonis fulgens*, in littoral fine sand

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Medium and fine sand
Zone:	
Height band:	Upper shore, Mid shore, Lower shore

Previous code

LGS.S.AP.P (part)	97.06
LGS.S.AP.Pon (part)	97.06
LSND.AP	6.95

Biotope description

This biotope occurs mainly on the mid and lower shore of moderately wave-exposed coasts, with medium and fine clean sand which remains damp throughout the tidal cycle and contains little organic matter. The sediment is often rippled and typically lacks an anoxic sub-surface layer. Polychaetes make up the greater part of the community, and are dominated by *Paraonis fulgens*, *Capitella capitata*, *Pygospio elegans*, *Ophelia rathkei* and *Eteone longa.* The presence of polychaetes may be seen as coloured burrows running down from the surface of the sediment. Nemerteans may also be present. The amphipods *Bathyporeia pilosa* and *B. sarsi* are often present.

Situation

Po.Pful may be present higher up on the shore than Po.Aten, or lower down than the AmSco communities or Ol.FS. The strandline community Tal may be present on the same shore where driftlines of decomposing seaweed and other debris occur on the upper shore.

Temporal variation

The infauna of this biotope may be reduced during winter, as increased storminess and wave action increases sediment mobility and may lead to some species migrating or being washed out of the sediment. The lugworm *Arenicola marina* may be present occasionally, usually as a temporary recruitment and is likely to be washed out during storms.

Similar biotopes

LS.LSa.MoSa.AmSco.Eur	Occurs under more exposed conditions in more mobile sediments, and tending to be present higher up on the shore. Infauna is more sparse, dominated by *Eurydice pulchra*, with polychaetes virtually absent.
LS.LSa.MoSa.AmSco.Pon	Occurs in more exposed conditions, where sediments are less stable. The infauna is dominated by amphipod species, particularly *Pontocrates arenarius*, while the polychaete fauna is relatively sparse and dominated by *Scolelepis squamata*.
LS.LSa.FiSa.Po.Aten	Occurs in more sheltered conditions. The sediments are more stable than in the case of Po.Pful and therefore support bivalves, especially *Angulus tenuis*, in addition to a range of polychaete species similar to the Po.Pful assemblage.
LS.LSa.FiSa.Po.Ncir	Occurs lower on the shore. *P. fulgens* is not always present, the infauna is dominated by *Nephtys* spp.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
NEMERTEA	••••	Present	6	36
NEMATODA	••	Frequent	2	50
Eteone longa	•••	Abundant	4	50
Streptosyllis websteri	••	Present	2	27
Nephtys cirrosa	••	Present	1	8
Scoloplos armiger	••	Frequent	2	43
Aricidea	••	Present	2	31
Paraonis fulgens	•••••	Abundant	34	240
Pygospio elegans	•••	Common	6	288
Spio martinensis	•••	Present	2	102
Capitella capitata	••	Common	7	410
Arenicola marina	•••	Frequent	1	39
Ophelia rathkei	•••	Common	5	136
OLIGOCHAETA	••	Present	1	37
Bathyporeia pilosa	•••	Common	16	1102
Bathyporeia sarsi	••	Common	4	125
Haustorius arenarius	••	Frequent	1	13

LS.LSa.FiSa.Po.Aten Polychaetes and *Angulus tenuis* in littoral fine sand

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Fine sand
Zone:	
Height band:	Mid shore, Lower shore

Previous code

LGS.S.AP.Pon (part)	97.06
LGS.S.AP.P (part)	97.06
LSND.AP (part)	6.95

Biotope description

This biotope occurs on the mid and lower shore on moderately wave-exposed and sheltered coasts, with predominantly fine sand which remains damp throughout the tidal cycle. The sediment is often rippled, and an anoxic layer may occasionally occur below a depth of 10 cm, though it is often patchy. The infaunal community is dominated by the abundant bivalve *Angulus tenuis* together with a range of polychaetes. The presence of polychaetes may be seen as coloured burrows running down from the surface of the sediment. Polychaetes that are characterising for this biotope include *Nephtys cirrosa*, *Paraonis fulgens* and *Spio filicornis*. Burrowing amphipods *Bathyporeia* spp. may occur in some samples of this biotope.

Situation

Where it occurs under moderately exposed conditions, AmSco.Eur, Po.Pful or Ol.FS may be present higher up on the shore than Po.Aten. Where it occurs under more sheltered conditions, Po.Aten may occur below or alongside muddy sand biotopes such as CerPo and BatCare.

Temporal variation

The infauna of this biotope may be reduced during winter, as increased storminess and wave action increases sediment mobility and may lead to some species migrating or being washed out of the sediment.

Similar biotopes

LS.LSa.FiSa.Po.Pful	Occurs higher on the shore. The sediments of Po.Aten are more stable than in the case of Po.Pful and therefore support bivalves, especially *A. tenuis*.
LS.LSa.FiSa.Po.Ncir	Occurs lower on the shore in slightly coarser sand. *A. tenuis* is absent or occurs in very low abundance, *Nephtys* spp. dominate the infauna.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Nephtys cirrosa	●●●	Common	5	44
Paraonis fulgens	●	Abundant	1	40
Spio filicornis	●●●	Common	3	84
Bathyporeia elegans	●●	Common	2	54
Bathyporeia pilosa	●●	Common	1	96
Angulus tenuis	●●●●●	Abundant	74	434

LS.LSa.FiSa.Po.Ncir *Nephtys cirrosa* dominated littoral fine sand

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	medium to fine sand
Zone:	
Height band:	Mid shore, Lower shore

Previous code

LGS.AP.P (part)	97.06

Biotope description

This biotope occurs mainly on the mid and lower shore on moderately wave-exposed and sheltered coasts, with medium to fine clean sand which remains damp throughout the tidal cycle and contains little organic matter. The sediment is not usually well sorted and may contain a fraction of coarse sand. It is often rippled and typically lacks an anoxic sub-surface layer. The polychaete infauna is dominated by *Nephtys cirrosa*, *Magelona mirabilis*, *Spio martinensis*, *Spiophanes bombyx* and *Paraonis fulgens*. The presence of polychaetes may be seen as coloured burrows running down from the surface of the sediment. Nemertean worms may be present. The amphipods *Pontocrates* spp. and *Bathyporeia* spp., as well as *Cumopsis goodsiri* and the shrimp *Crangon crangon* are typically present. The bivalve *Angulus tenuis* is scarce or absent.

Situation

Po.Ncir may be present higher up on the shore than Po.Aten, or lower down than AmSco.Eur or Ol.FS.

Temporal variation

The infaunal community of this biotope may change seasonally, as increased storminess during winter months may reduce sediment stability and the ability of some species to survive. Some species, such as the shrimp *C. crangon* avoid these conditions by seasonal migration to deeper water (Moore, 1991).

Similar biotopes

LS.LSa.FiSa.Po.Aten	Occurs in slightly finer sediments, which are more stable and therefore support bivalves, especially *A. tenuis*, in addition to a range of polychaete species.
LS.LSa.FiSa.Po.Pful	Occurs higher on the shore. *Nephtys* spp. are scarce or absent, the infauna is dominated by *P. fulgens*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
NEMERTEA	●●●	Present	2	10
Nephtys	●●●	Common	6	73
Nephtys cirrosa	●●●●●	Common	30	79
Paraonis fulgens	●●	Common	2	16
Spio martinensis	●●●	Common	9	279
Spiophanes bombyx	●●●●	Frequent	9	55
Magelona mirabilis	●●●●	Frequent	11	206
Pontocrates altamarinus	●●	Present	1	16
Pontocrates arenarius	●●●●	Present	4	36
Bathyporeia elegans	●●	Common	2	31
Bathyporeia pelagica	●●	Present	2	48
Bathyporeia sarsi	●●	Present	1	13
Cumopsis goodsiri	●●●	Frequent	9	76
Crangon crangon	●●●	Present	2	17
Angulus tenuis	●●	Present	1	6

LS.LSa.MuSa Polychaete / bivalve dominated muddy sand shores

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt), Reduced (18-30ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Fine sand or muddy sand
Zone:	
Height band:	Strandline, Upper shore, Mid shore, Lower shore

Biotope description

Muddy sand or fine sand, often occurring as extensive intertidal flats on open coasts and in marine inlets. The sediment generally remains water-saturated during low water. The habitat may be subject to variable salinity conditions in marine inlets. An anoxic layer may be present below 5 cm of the sediment surface, sometimes seen in the worm casts on the surface. The infauna consists of a diverse range of amphipods, polychaetes, bivalves and gastropods.

Situation

Muddy sand communities are found predominantly on the mid and lower shore, though they may span the entire intertidal. Fine sand or mobile sand communities may be present on the upper shore with muddy sand communities present lower down. In sheltered mid estuarine conditions, muddy sand communities may be present on the upper part of the shore with mid estuarine muddy shore communities (LS.LMu.MEst) lower down.

Temporal variation

Not known.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
NEMATODA	••	Common	2	213
Eteone longa	•••	Abundant	6	114
Hediste diversicolor	•••	Common	5	229
Scoloplos armiger	••	Abundant	3	66
Pygospio elegans	••••	Common	15	670
Capitella capitata	••	Frequent	1	78
OLIGOCHAETA	•••	Abundant	6	1703
Bathyporeia pilosa	••	Common	3	446
Corophium arenarium	••	Common	3	437
Corophium volutator	••	Common	3	1074
Crangon crangon	••	Common	2	25
Hydrobia ulvae	•••	Abundant	11	2829
Cerastoderma edule	••••	Abundant	10	504
Macoma balthica	•••••	Common	22	786

LS.LSa.MuSa.MacAre *Macoma balthica* and *Arenicola marina* in littoral muddy sand

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Fine sand or muddy sand
Zone:	
Height band:	Upper shore, Mid shore, Lower shore

Previous code

LMS.MS.MacAre	97.06
LMS.AreBv	96.7

Biotope description

Muddy sand or fine sand, often occurring as extensive intertidal flats both on open coasts and in marine inlets. The sediment is often compacted, with a rippled surface, areas of standing water, and generally remains water-saturated during low water. Scattered stones, cobbles and boulders with attached fucoids may be present. An anoxic layer is usually present within 5cm of the sediment surface and is often visible in worm casts. The habitat may be subject to variable salinity conditions in marine inlets. The species assemblage is characterised by the lugworm *Arenicola marina* and the Baltic tellin *Macoma balthica*. The polychaetes *Scoloplos armiger* and *Pygospio elegans* are typically superabundant and common, respectively. Oligochaetes, probably mainly *Tubificoides benedii* and *T. pseudogaster*, may be common, and the cockle *Cerastoderma edule* may be abundant.

Situation

MacAre has broad transition areas with CerPo and HedMac, which tends to occur lower down on the shore.

Temporal variation

Not known.

Similar biotopes

LS.LMu.MEst.HedMac	Occurs in muddier substrata. HedMac is characterised by abundant Ragworms *H. diversicolor*, as well as *M. balthica*. The cockle *C. edule* tends to be less abundant, and the sand gaper *Mya arenaria* may be abundant.
LS.LSa.MuSa.CerPo	Occurs lower down on the shore, sometimes in variable salinity conditions. The lugworm *A. marina* tends to be absent, but there is a greater range of crustacean species, and *C. edule* is more consistently present.
LS.LSa.MuSa.BatCare	Occurs in muddier sediments, in more estuarine conditions. The infauna is characterised by *Bathyporeia pilosa* and *Corophium* spp.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Scoloplos armiger	••••	Super-abundant	13	75
Pygospio elegans	•••	Common	4	58
Arenicola marina	•••••	Common	6	24
OLIGOCHAETA	••	Common	4	48
Cerastoderma edule	•••	Abundant	11	116
Macoma balthica	•••••	Common	61	248

LS.LSa.MuSa.CerPo *Cerastoderma edule* and polychaetes in littoral muddy sand

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt), Reduced (18-30ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Fine sand or muddy sand
Zone:	
Height band:	Upper shore, Mid shore, Lower shore

Previous code

LMS.MS.PCer	97.06
LMS.MS.MacAre (part)	97.06
LMS.AreBv (part)	96.7

Biotope description

Extensive clean fine sand or muddy sand shores with abundant cockles *Cerastoderma edule*. The community consists of the polychaetes *Eteone longa*, *Scoloplos armiger*, *Pygospio elegans*, *Spio filicornis* and *Capitella capitata*, the crustaceans *Bathyporeia sarsi*, *Bodotria arenosa arenosa* and *Crangon crangon*, the spire shell *Hydrobia ulvae*, as well as the cockle *C. edule* and the baltic tellin *Macoma balthica*. This biotope carries commercially viable stocks of *C. edule*, and it is therefore possible to find areas of this habitat where the infauna may have been changed through recent cockle dredging. Cockle dredging can result in a reduced bivalve abundance and reduced densities of some polychaete species, including *P. elegans* (Moore, 1991). At the outer edges of large flats, there may be a zone between the cockle beds and more exposed sands, where there are fewer cockles and *B. sarsi* is the commoner species.

Situation

The community is found mainly on the mid and lower shore where the sediment is water-saturated most of the time. Where it occurs in muddy sand, CerPo has broad transition areas with MacAre and the LS.LMu.MEst communities, and where it occurs on clean sand shores, it may have broad transition areas with Myt.Sa. Higher on the shore, adjacent to this biotope, BatCare is found, with fewer polychaete and bivalve species due to the drier sediment found on the upper shore.

Temporal variation

A layer of mud with dense spionid polychaetes may build up on cockle beds in sheltered areas, creating a cohesive muddy layer 10-15 cm thick overlying the whole area. This may break up leaving a series of pits and patches with miniature cliffs, giving it an appearance similar to a stony shore when seen from a distance. It should be noted that where it occurs, *Hydrobia ulvae* tends to move a lot and may be highly variable in abundance.

Similar biotopes

LS.LSa.FiSa.Po	These biotopes occur under slightly more exposed, fully marine conditions, in sediments that have a lower silt/clay fraction. The principal infaunal difference is the absence of *C. edule* and *M. balthica*.
LS.LSa.MuSa.MacAre	Occurs on more sheltered shores with muddier sediments. The lugworm *Arenicola marina* is common, and *C. edule* is not always present.
LS.LSa.MuSa.HedMacEte	Tends to occur more in fully marine conditions, higher up on the shore. The principal differences in the infauna are that *Hediste diversicolor* is common and *E. longa* is abundant, whereas *C. edule* occurs only in about half of the samples.
LS.LMx.LMus.Myt.Sa	Occurs in similar physical conditions, with a similar infaunal community. The difference is that the mussel *M. edulis* is abundant, forming extensive clumps and beds on the surface of the sediment.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Eteone longa	••••	Common	2	67
Scoloplos armiger	•••	Abundant	4	70
Pygospio elegans	••••	Common	8	832
Capitella capitata	•••	Common	8	160
Bathyporeia sarsi	•••	Frequent	1	46
Bodotria arenosa arenosa	••	Common	2	69
Crangon crangon	••	Common	1	57
Hydrobia ulvae	•••	Common	1	25
Brachystomia suboblonga	••••	Abundant	41	5357
Cerastoderma edule	•••••	Abundant	17	715
Macoma balthica	•••••	Common	11	574

LS.LSa.MuSa.HedMacEte *Hediste diversicolor, Macoma balthica* and *Eteone longa* in littoral muddy sand

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	
Tidal streams:	
Substratum:	Muddy sand
Zone:	
Height band:	Upper shore, Mid shore

Previous code

LMU.SMu.HedMac.Mare (part)	97.06
LMU.SMu.HedMac.Are (part)	97.06
LMS.MS.MacAre (part)	97.06

Biotope description

Fine to very fine muddy sand on the mid shore at the lower extreme of estuaries, and in moderately exposed and sheltered bays and marine inlets, sometimes subject to variable salinity. The infauna is characterised by the polychaetes *Eteone longa*, *Hediste diversicolor* (ragworm) and *Pygospio elegans*, oligochaetes (mostly *Tubificoides benedii* and *T. pseudogaster*), the crustaceans *Corophium volutator* and *Crangon crangon*, the spire shell *Hydrobia ulvae* and the baltic tellin *Macoma balthica*. The cockle *Cerastoderma edule* may be abundant, and the sand gaper *Mya arenaria* may be superabundant, though these species are not always present, or may be missed in core samples due to their large size. The polychaetes *Arenicola marina*, *Polydora cornuta* and *Capitella capitata*, the shrimp *Crangon crangon*, and the Mussel *Mytilus edulis* are sometimes present.

Situation

HedMacEte can occur on the mid shore of sheltered, lower estuaries, with the LS.LMu.MEst communities in muddier sediments on the lower shore. Under moderately exposed conditions in lower estuaries and towards open coasts, it may occur alongside other muddy sand biotopes such as CerPo or BatCare.

Temporal variation

Enteromorpha spp. or *Ulva lactuca* may form mats on the surface of the sediment during the summer months, particularly in areas of freshwater influence and/or where there is nutrient enrichment.

Similar biotopes

LS.LSa.FiSa.Po	These biotopes occur in slightly more exposed, marine sediments which lack a silt/clay fraction. The principal infaunal difference is the absence of *C. edule* and *M. balthica*.
LS.LMu.MEst.HedMac	Occurs in more sheltered, less saline, mid-shore or lower shore sandy mud and mud. *E. longa* and *P. elegans* are less consistently present, but *Tubificoides* spp. are abundant.
LS.LMu.MEst.HedMacScr	Occurs in less saline, more sheltered muddy conditions on the lower shore, further towards the head of estuaries. There is a greater diversity of polychaetes, *M. balthica* is not always present, but *Scrobicularia plana* occurs in high densities.
LS.LMu.MEst.NhomMacScr	Occurs lower down on the shore, in muddier sediments. *H. diversicolor* occurs only occasionally, but *Nephtys hombergii* tends to be abundant. *Tubificoides* spp. are common.
LS.LSa.MuSa.MacAre	Occurs in similar environmental conditions, though on more sheltered coasts and only rarely where there is freshwater influence. *H. diversicolor* is absent, and fewer mollusc species are present. *M. arenaria* and *H. ulvae* do not occur.
LS.LMu.UEst.Hed.Str	Occurs in less saline, more sheltered muddy conditions on the lower shore, further towards the head of estuaries. *P. elegans* occurs less frequently, *Streblospio shrubsolii* is abundant. The only molluscs that occur are occasionally common *Hydrobia ulvae* and *S. plana*.
LS.LMu.UEst.Hed.Ol	Occurs in more sheltered, less saline, mid-and lower-shore sandy mud. The polychaete fauna is a lot poorer, and bivalves are virtually absent.

Characterising species

	% Frequency	***Abundance (SACFOR)***	***%Contribution to similarity***	***Abundance (nos / m ^{2})***
NEMATODA	••••	Common	5	536
Eteone longa	••••	Abundant	9	275
Hediste diversicolor	•••••	Abundant	14	665
Pygospio elegans	•••••	Common	17	1043
OLIGOCHAETA	•••••	Abundant	13	5060
Corophium volutator	••••	Abundant	6	2776
Crangon crangon	••	Common	1	25
Hydrobia ulvae	•••	Abundant	6	2514
Cerastoderma edule	•••	Abundant	4	741
Macoma balthica	•••••	Common	16	1722
Mya arenaria	•••	Super-abundant	3	346

LS.LSa.MuSa.BatCare *Bathyporeia pilosa* and *Corophium arenarium* in littoral muddy sand

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Medium to very fine sand, muddy sand
Zone:	
Height band:	Upper shore, Mid shore, Lower shore

Previous code

LMS.MS.BatCor	07.06

Biotope description

Wave-sheltered, mainly upper and mid shore flats of medium to fine sand, often muddy sand. The salinity, although predominantly recorded as variable, probably varies little from fully marine in these broad estuaries. The infauna is characterised by the amphipods *Bathyporeia pilosa*, *Corophium arenarium* and *C. volutator*, and the spire shell *Hydrobia ulvae*. Polychaetes and bivalves are limited in their abundance and variety, though the Baltic tellin *Macoma balthica* may occur. Tidal streams may be strong during spring tides, accounting for the presence of amphipods *B. pilosa* that are more commonly associated with open coast sandflats.

Situation

This biotope is typically found higher up the shore than sandflats with the cockle *Cerastoderma edule* (CerPo) in the large sandy estuaries of the west coast of England and Wales. In moderately exposed conditions, BatCare can occur on the mid shore below Tal and/or BarSa. In more sheltered conditions, BatCare may occur above NhomMacStr.

Temporal variation

Not known.

Similar biotopes

LS.LSa.FiSa.Po	These biotopes are slightly more exposed, with coarser sediments and more marine conditions. The principal infaunal difference is the absence of *C. edule* and *M. balthica*.
LS.LSa.MuSa.CerPo	Occurs in a broader range of salinities, in slightly more exposed and less muddy sediment types, sometimes lower on the same shores as BatCare. It has a higher species diversity, most notably a range of polychaetes, as well as the cockle *C. edule* and denser populations of the Baltic tellin *M. balthica*.
LS.LSa.MuSa.MacAre	This occurs in full salinity fine sand. The lugworm *Arenicola marina* and the Baltic tellin *M. balthica* are consistently present, and *Angulus tenuis* may occur. There tends to be a greater range of polychaetes, but amphipods are absent.
LS.LMu.UEst.Hed.Cvol	This occurs in muddier, more sheltered estuaries than BatCare. *B. pilosa* is absent in the muddy sediment, but the ragworm *Hediste diversicolor* is abundant.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Bathyporeia pilosa	●●●●●	Abundant	74	2644
Corophium arenarium	●●●●	Common	5	841
Corophium volutator	●●	Common	3	1144
Hydrobia ulvae	●●●●	Abundant	13	1591

LS.LSa.MuSa.Lan *Lanice conchilega* in littoral sand

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Very strong, Strong, Moderately strong, Weak, Very weak
Substratum:	Medium to fine muddy sand, mixed sediment
Zone:	
Height band:	Mid shore, Lower shore

Previous code

LGS.S.Lan	97.06
LMSND.LAN	6.95

Biotope description

This biotope usually occurs on flats of medium fine sand and muddy sand, most often on the lower shore but sometimes also on waterlogged mid shores. The sand may contain a proportion of shell fragments or gravel. Lan can also occur on the lower part of predominantly rocky or boulder shores, where patches of sand or muddy sand occur between scattered boulders, cobbles and pebbles. Conditions may be tide-swept, and the sediment may be mobile, but the biotope usually occurs in areas sheltered from strong wave action. The sediment supports dense populations of the sand mason *Lanice conchilega*. Other polychaetes present are tolerant of sand scour or mobility of the sediment surface layers and include the polychaetes *Anaitides mucosa*, *Eumida sanguinea*, *Nephtys hombergii*, *Scoloplos armiger*, *Aricidea minuta*, *Tharyx* spp. and *Pygospio elegans*. The mud shrimp *Corophium arenarium* and the cockle *Cerastoderma edule* may be abundant. The baltic tellin *Macoma balthica* may be present. On boulder shores, and where pebbles and cobbles are mixed in with lower shore tide-swept sand with dense *L. conchilega* between the cobbles, the infaunal component is rarely sampled. The infaunal community under these circumstances, provided that the cobbles are not packed very close together, is likely to be similar to that in areas without the coarse material.

Situation

Lan occurs mainly on the mid and lower shore of moderately exposed sand and muddy sand flats. Higher on the shore, other sand and muddy sand biotopes may be present, such as BarSa and AmSco on the upper shore and the Po communities on the mid shore. Tal may occur where driftlines of wracks and other debris accumulate. Where Lan occurs on areas of scattered boulders and cobbles on the lower shore, there may be broad transition areas with Salv and other boulder shore biotopes.

Temporal variation

Where *Lanice conchilega* becomes very abundant, especially on the low shore, this can lead to the build up of sediment mounds around their tubes, thus leading to a significant alteration in the surface appearance of the biotope.

Similar biotopes

LS.LSa.FiSa.Po	Lan tends to occur lower on the shore than Po. It is distinguished from the Po communities by the presence of *L. conchilega* as the main polychaete component at densities of common and above.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Anaitides mucosa	••••	Common	4	161
Eumida sanguinea	••	Present	1	211
Nephtys hombergii	•••	Present	2	77
Scoloplos armiger	••••	Common	9	329
Aricidea minuta	•••	Common	3	167
Tharyx	•••	Common	7	1484
Pygospio elegans	••••	Common	5	303
Lanice conchilega	•••••	Abundant	34	959
Corophium arenarium	•••	Abundant	23	1921
Cerastoderma edule	••••	Abundant	3	168
Macoma balthica	•••	Present	2	118

LS.LMu Littoral mud

Habitat (physical) description

Salinity:	Variable (18-35ppt), Reduced/low (0.5-30ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Sandy mud, mud
Zone:	
Height band:	Upper shore, Mid shore, Lower shore

Biotope description

Shores of fine particulate sediment, mostly in the silt and clay fraction (particle size less than 0.063 mm in diameter), though sandy mud may contain up to 40% sand (mostly very fine and fine sand). Littoral mud typically forms extensive mudflats, though dry compacted mud can form steep and even vertical structures, particularly at the top of the shore adjacent to saltmarshes. Little oxygen penetrates these cohesive sediments, and an anoxic layer is often present within millimetres of the sediment surface. Littoral mud can support communities characterised by polychaetes, bivalves and oligochaetes. Most muddy shores are subject to some freshwater influence, as most of them occur along the shores of estuaries. Mudflats on sheltered lower estuarine shores can support a rich infauna, whereas muddy shores at the extreme upper end of estuaries and which are subject to very low salinity often support very little infauna.

Situation

Muddy shores are principally found along the shores of estuaries where there is enough shelter from wave action to allow fine sediment to settle. Muddy shores may also be present in sheltered inlets, straits and embayments which are not part of major estuarine systems.

Temporal variation

Enteromorpha spp. and *Ulva lactuca* may form mats on the surface of the mud during the summer months, particularly in areas of nutrient enrichment or where there is significant freshwater influence.

LS.LMu.MEst Polychaete / bivalve dominated mid estuarine mud shores

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt), Reduced (18-30ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Sandy mud, mud
Zone:	
Height band:	Upper shore, Mid shore, Lower shore

Biotope description

Mid estuarine shores of fine particulate sediment, mostly in the silt and clay fraction (particle size less than 0.063 mm in diameter), though sandy mud may contain up to 40% sand (mostly very fine and fine sand). Littoral mud typically forms extensive mudflats, though dry compacted mud can form steep and even vertical structures, particularly at the top of the shore adjacent to saltmarshes. Little oxygen penetrates these cohesive sediments, and an anoxic layer is often present within millimetres of the sediment surface. Most mid estuarine muddy shores are subject to some freshwater influence, though at some locations more or less fully marine conditions may prevail. Mid estuarine muds support rich communities characterised by polychaetes, bivalves and oligochaetes.

Situation

Principally along mid estuarine shores. The mid estuarine communities may also be present in sheltered inlets, straits and embayments which are not part of major estuarine systems, though usually there is some freshwater influence.

Temporal variation

Enteromorpha spp. and *Ulva lactuca* may form mats on the surface of the mud during the summer months, particularly in areas of nutrient enrichment or where there is significant freshwater influence.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Eteone longa	●●●	Abundant	3	104
Hediste diversicolor	●●●●●	Abundant	16	899
Nephtys hombergii	●●●	Common	3	75
Pygospio elegans	●●●●	Common	8	719
Streblospio shrubsolii	●●●●	Common	8	731
Tharyx killariensis	●●	Common	2	429
Aphelochaeta marioni	●●	Abundant	2	1794
Manayunkia aestuarina	●●	Common	2	883
Tubificoides benedii	●●●●	Abundant	14	3690
Tubificoides pseudogaster	●●	Common	2	2095
Hydrobia ulvae	●●●●	Common	11	3031
Cerastoderma edule	●●●	Common	2	132
Macoma balthica	●●●●●	Common	15	591
Scrobicularia plana	●●●	Abundant	3	112
Abra tenuis	●●	Common	2	214

LS.LMu.MEst.NhomMacStr *Nephtys hombergii, Macoma balthica* and *Streblospio shrubsolii* in littoral sandy mud

Habitat (physical) description

Salinity:	Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Sandy mud
Zone:	
Height band:	Mid shore, Lower shore

Previous code

LMU.MU.HedStr (part)	97.06

Biotope description

Soft mud with a fine sand fraction, in variable salinity conditions, typically close to the head of estuaries. The infauna is dominated by the polychaete worm *Streblospio shrubsolii*, the polychaete *Nephtys hombergii*, oligochaetes of the genus *Tubificoides*, and the Baltic tellin *Macoma balthica*. The ragworm *Hediste diversicolor* and the spire shell *Hydrobia ulvae* are often common or abundant.

Situation

NhomMacStr occurs in mid estuary conditions, usually on the low shore. Tben and Hed.Ol may occur higher up the shore, as well as further towards the upper estuary.

Temporal variation

Enteromorpha spp. and *Ulva lactuca* may form mats on the surface of the mud during the summer months, particularly in areas of nutrient enrichment.

Similar biotopes

LS.LMu.UEst.Tben	Occurs in lower salinities, in mud with a smaller sand fraction, at the head of estuaries. The infauna is a lot poorer, consisting almost exclusively of oligochaetes and, in some cases, *Capitella capitata*.
LS.LMu.UEst.Hed.Ol	Tends to occur in more reduced salinities, further towards the head of estuaries. The polychaete assemblage is poorer, and molluscs are virtually absent. It is the presence of *M. balthica* and *H. ulvae* that primarily distinguishes NhomMacStr from Hed.Ol.
LS.LMu.MEst.HedMac	These communities occur further down estuaries towards the open coast, in more saline conditions. The infauna is similar, though the ragworm *H. diversicolor* is always abundant, and both *N. hombergii* and *S. shrubsolii* are often absent. The bivalve assemblage tends to be more diverse.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Hediste diversicolor	●●●	Common	1	124
Nephtys hombergii	●●●●	Abundant	6	133
Streblospio shrubsolii	●●●●●	Common	13	593
Tubificoides	●●●	Common	12	662
Tubificoides benedii	●●●●●	Common	10	999
Hydrobia ulvae	●●●●●	Abundant	43	5093
Macoma balthica	●●●●●	Common	12	373

LS.LMu.MEst.HedMac *Hediste diversicolor* and *Macoma balthica* in littoral sandy mud

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt), Reduced (18-30ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Sandy mud and mud
Zone:	
Height band:	Upper shore, Mid shore, Lower shore

Previous code

LMU.SMU.HedMac	97.06
LMU.HedMac.Nhom in part	96.7
LMUD.HM	6.95

Biotope description

Mainly mid and lower shore sandy mud or mud in lower estuaries, sheltered bays and marine inlets, often subject to variable salinity. The main characterising species are the ragworm *Hediste diversicolor*, the baltic tellin *Macoma balthica*, and the oligochaetes *Tubificoides benedii* and *T. pseudogaster*. Further polychaetes that are often common or abundant include *Pygospio elegans*, *Streblospio shrubsolii*, *Tharyx killariensis*, *Aphelochaeta marioni*, *Capitella capitata* and *Manayunkia aestuarina*. The oligochaete *Heterochaeta costata* and the mud shrimp *Corophium volutator* may be abundant. The spire shell *Hydrobia ulvae* is often common. Other species which occur in a significant proportion of samples include the polychaetes *Eteone longa* and *Nephtys hombergii*, and bivalves such as the cockle *Cerastoderma edule* and *Abra tenuis*. The sand gaper *Mya arenaria* is superabundant in about a quarter of the samples for this biotope. *M. arenaria* is probably present in a higher proportion of areas of this biotope, but may be missed in core samples due to its size.

Situation

HedMac may occur on the mid/lower shore of lower estuarine shores, with HedMacEte or MacAre on the upper shore. HedMacScr, Hed.Str, NhomAph, and Hed.Cvol may be present on the same shore.

Temporal variation

Enteromorpha spp. and *Ulva lactuca* may form mats on the surface of the mud during the summer months, particularly in areas of nutrient enrichmnent.

Similar biotopes

LS.LSa.MuSa.MacAre	Occurs in almost fully marine conditions on the upper shore of sheltered coasts. *H. diversicolor* is absent, but *Arenicola marina* is abundant. There are fewer mollusc species, and *H. ulvae* is absent.
LS.LMu.UEst.Hed.Str	Occurs under less saline and slightly more sheltered conditions, further towards inner estuaries. Molluscs are very rare, with the exception of occasionally common *Scrobicularia plana* and *H. ulvae*.
LS.LMu.MEst.HedMacScr	Occurs in similar physical conditions. The most notable difference is the presence of superabundant *S. plana*.
LS.LMu.MEst.NhomMacScr	Tends to occur lower on the shore in slightly more exposed conditions. There is a reduced infaunal diversity, *H. diversicolor* is not always present, and the bivalves *C. edule* and *M. arenaria* are absent.
LS.LMu.UEst.Hed.Ol	Occurs lower on the shore in less saline and more sheltered conditions, i.e. further towards the head of estuaries. The infauna is characterised purely by *H. diversicolor* and oligochaets. Molluscs are virtually absent.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Eteone longa	••	Common	2	111
Hediste diversicolor	•••••	Abundant	17	1168
Nephtys hombergii	••	Present	1	27
Pygospio elegans	••••	Common	7	679
Streblospio shrubsolii	••••	Common	7	1084
Tharyx killariensis	••	Common	1	422
Aphelochaeta marioni	••	Abundant	3	3457
Capitella capitata	••	Common	1	483
Manayunkia aestuarina	•••	Common	4	1861
Heterochaeta costata	••	Abundant	1	1082
Tubificoides benedii	•••••	Abundant	17	5233
Tubificoides pseudogaster	•••	Common	5	4396
Corophium volutator	••	Abundant	1	3488
Hydrobia ulvae	••••	Common	6	1539
Cerastoderma edule	•••	Common	2	138
Macoma balthica	•••••	Common	17	784
Abra tenuis	•••	Common	2	379
Mya arenaria	••	Super-abundant	1	333

LS.LMu.MEst.HedMacScr *Hediste diversicolor, Macoma balthica* and *Scrobicularia plana* in littoral sandy mud shores

Habitat (physical) description

Salinity:	Variable (18-35ppt), Reduced/low (0.5-30ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Mud or sandy mud
Zone:	
Height band:	Upper shore, Mid shore, Lower shore

Previous code

LMU.SMU.HedScr	97.06
LMS.SMu.HedMac (part)	97.06
LMUD.HS	6.95

Biotope description

Mainly mid shore mud or sandy mud subject to variable salinity on sheltered estuarine shores. Typically, the sediment is wet in appearance and has an anoxic layer below 1 cm depth. The surface of the mud has the distinctive 'crow's foot' pattern formed by the peppery furrow shell *Scrobicularia plana*. The infauna is additionally characterised by a range of polychaete and bivalve species, including the ragworm *Hediste diversicolor*, *Pygospio elegans*, *Streblospio shrubsolii*, *Tharyx killariensis* and the baltic tellin *Macoma balthica*. Oligochaetes, most notably *Tubificoides benedii*, and the spire shell *Hydrobia ulvae* may be abundant. Other species that sometimes occur in this biotope are the cockle *Cerastoderma edule*, the sand gaper *Mya arenaria* and the polychaetes *Eteone longa* and *Nephtys hombergii*.

Situation

HedMacScr may occur on the same shores as NhomMacStr, HedMac, NhomAph, Hed.Str and Hed.Cvol. Higher up on the shore, and/or further towards the head of the estuary, Hed.Ol may occur, changing to Tben at the upper extreme of the estuary.

Temporal variation

Enteromorpha spp. and *Ulva lactuca* may form mats on the surface of the mud during the summer months, particularly in areas of nutrient enrichment.

Similar biotopes

LS.LMu.UEst.Hed.Ol	Tends to occur in sandier sediments, in slightly more exposed conditions, on the lower shore. There is a reduced infaunal diversity, *H. diversicolor* is not always present, and the cockle *C. edule* does not occur.
LS.LMu.UEst.NhomStr	Tends to occur lower down on slightly more exposed, marine shores, with a reduced infaunal diversity. Bivalves are absent.
LS.LMu.UEst.Hed.Str	Occurs under more sheltered estuarine conditions. The infauna is less diverse, most notably bivalve species are rare.
LS.LMu.UEst.Hed.Cvol	Tends to occur slightly higher on the shore, in more sheltered conditions. The infauna is less diverse, with lower numbers of oligochaete and polychaete species. Bivalves are virtually absent.
LS.LMu.MEst.HedMac	Occurs in similar physical conditions. *S. plana* is absent.
LS.LMu.MEst.NhomMacScr	Occurs further towards inner estuaries, in less saline conditions. The infauna is similar, though the ragworm *H. diversicolor* is often absent, and both *N. hombergii* and *S. shrubsolii* are almost always abundant. No bivalves except *M. balthica* occur.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hediste diversicolor	●●●●●	Abundant	14	798
Pygospio elegans	●●●●	Common	8	929
Streblospio shrubsolii	●●●	Common	4	392
Tharyx killariensis	●●	Common	3	537
OLIGOCHAETA	●●	Super-abundant	7	1677
Tubificoides benedii	●●●	Abundant	25	2699
Hydrobia ulvae	●●●●●	Abundant	19	4118
Macoma balthica	●●●●	Common	5	438
Scrobicularia plana	●●●●●	Super-abundant	5	250

LS.LMu.UEst Polychaete / oligochaete dominated upper estuarine mud shores

Habitat (physical) description

Salinity:	Variable (18-35ppt), Reduced/low (0.5-30ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Sandy mud, mud
Zone:	
Height band:	Upper shore, Mid shore, Lower shore

Biotope description

Upper estuarine sandy mud and mud shores, in areas with significant freshwater influence. Littoral mud typically forms mudflats, though dry compacted mud can form steep and even vertical structures, particularly at the top of the shore adjacent to saltmarshes. Little oxygen penetrates these cohesive sediments, and an anoxic layer is often present within millimetres of the sediment surface. The upper estuarine mud communities support few infaunal species and are principally characterised by a limited range of polychaetes and oligochaetes.

Situation

There are three oligochaete dominated upper estuarine mud biotopes. Of these three, NhomStr occurs the furthest towards the mid estuary, and possibly lower on the shore than the other two. Tben is the most extreme upper estuarine biotope, occurring at the head of estuaries where there is no strong river flow and hence conditions are very sheltered, and there is a very strong freshwater influence. Further towards the mid estuary, this biotope may occur at the top of the shore, with Hed.Ol and NhomStr further down the shore.

Temporal variation

Enteromorpha spp. and *Ulva lactuca* may form mats on the surface of the mud during the summer months, particularly in areas of nutrient enrichment.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
NEMATODA	•	Common	2	558
Hediste diversicolor	•••••	Super-abundant	40	1584
Nephtys hombergii	•••	Common	1	30
Pygospio elegans	••	Common	2	121
Streblospio shrubsolii	•••	Common	9	1289
Manayunkia aestuarina	••	Common	4	1832
OLIGOCHAETA	••	Abundant	9	6871
Heterochaeta costata	••	Abundant	3	1699
Tubificoides benedii	••	Common	8	2031
Corophium volutator	••	Common	8	1811
Cyathura carinata	•	Common	2	121
Hydrobia ulvae	••	Common	2	294
Scrobicularia plana	••	Common	2	36

LS.LMu.UEst.NhomStr *Nephtys hombergii* and *Streblospio shrubsolii* in littoral mud

Habitat (physical) description

Salinity:	Variable (18-35ppt), Reduced (18-30ppt)
Wave exposure:	Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Mud with fine sand fraction
Zone:	
Height band:	Mid shore, Lower shore

Previous code

LMU.MU.HedStr (part)	97.06

Biotope description

Soft wet mud with a fine sand fraction, on the mid and lower shore of sheltered estuaries, usually with an anoxic layer present within the first 5 cm of the sediment. The infauna is relatively poor, dominated by the polychaetes *Nephtys hombergii*, *Streblospio shrubsolii*, and *Aphelochaeta marioni*. The oligochaete *Tubificoides benedii* is also characterising for this biotope, and *Hediste diversicolor* may be common.

Situation

NhomStr may occur on the same shores as the LS.LMu.MEst biotopes, Hed.Cvol or Hed.Str. Higher up on the shore, and/or further towards the head of the estuary, Hed.Ol may occur, changing to Tben at the upper extreme of the estuary.

Temporal variation

Enteromorpha spp. and *Ulva lactuca* may form mats on the surface of the mud during the summer months, particularly in areas of nutrient enrichment.

Similar biotopes

LS.LMu.UEst.Hed.Ol	Occurs in very similar, but often slightly less saline conditions, further towards the head of estuaries. The species assemblage is poorer, consisting virtually only of oligochaetes and abundant *H. diversicolor*.
LS.LMu.MEst.NhomMacScr	Tends to occur lower on the shore, in sediments with a greater sand fraction and often subject to more wave exposure, possibly lower down in estuaries. The polychaete assemblage is more diverse, and both *Hydrobia ulvae* and *Macoma balthica* are typically present. It is the presence these two species that primarily distinguishes NhomMacStr from similar estuarine mud biotopes.
LS.LMu.UEst.Hed.Str	Tends to occur in slightly less saline, more sheltered conditions, with a higher abundance of *H. diversicolor* and a greater range of polychaete and oligochaete species. *A. marioni* is absent.
LS.LMu.MEst.HedMacScr	Occurs over a greater range of shore heights, often on slightly less exposed shores, with an increased infaunal diversity. *H. diversicolor* is more abundant, and, most notably, the bivalves *M. balthica* and *Scrobicularia plana* are abundant.
.	Tends to occur lower on the shore. The infauna is a lot more diverse, dominated by *H. diversicolor* and *M. balthica*, with a range of other polychaetes and bivalves occurring frequently.
LS.LMu.UEst.Hed.Cvol	Occurs on slightly more exposed shores, with a reduced infaunal diversity. *H. diversicolor* and *Corophium volutator* are the only characterising species.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Nephtys hombergii	••••	Common	9	108
Streblospio shrubsolii	••••	Common	23	483
Aphelochaeta marioni	••••	Abundant	50	2790
Tubificoides benedii	••••	Common	10	1259

LS.LMu.UEst.Hed *Hediste diversicolor* in littoral mud

Habitat (physical) description

Salinity:	Variable (18-35ppt), Reduced (18-30ppt)
Wave exposure:	Extremely sheltered
Tidal streams:	
Substratum:	Sandy mud
Zone:	
Height band:	Mid shore, Lower shore

Previous code

LMU.MU.HedOl	97.06
LMU.MU.HedStr (part)	97.06
LMUD.HO (part)	6.95

Biotope description

Mud and sandy mud shores in sheltered marine inlets and estuaries subject to variable or reduced salinity. The biotope is typically found on the mid and lower shores in the upper and mid estuary. If present on the upper shore, the sediment may become firm and compacted as water drains out, though usually the biotope occurs lower on the shore and the sediment remains water saturated during low tide. An anoxic layer occurs within the upper 5 cm of the sediment. The infauna is dominated by abundant or superabundant ragworms *Hediste diversicolor*. Other species that occur in a significant number of samples include oligochaetes such as *Heterochaeta costata* and *Tubificoides* spp., polychaetes such as *Streblospio shrubsolii* and *Manayunkia aestuarina*, the mud shrimp *Corophium volutator*, and the spire shell *Hydrobia ulvae*.

Situation

Hed may occur on the same shores as HedMac, HedMacScr, or NhomAph. Higher up on the shore, and/or further towards the upper extreme of the estuary, Tben may occur.

Temporal variation

Enteromorpha spp. and *Ulva lactuca* may form mats on the surface of the sediment during the summer months, particularly in areas of freshwater influence and/or where there is nutrient enrichment.

Similar biotopes

LS.LMu.UEst.NhomStr	Occurs on slightly more marine shores, in sediments with a smaller sand fraction, with a higher diversity of polychaete and oligochaete species. *C. volutator* is absent.
LS.LMu.MEst.HedMac	Occurs in similar physical environments. The infauna of this biotope is more diverse, most notably a range of bivalves occur, including the baltic tellin *Macoma balthica*, in addition to *H. diversicolor* and the occasionally abundant *C. volutator*.
LS.LMu.UEst.Tben	Occurs in slightly muddier sediments and lower salinities, further towards the head of estuaries. The species assemblage is much poorer, consisting only of oligochaetes and, in some cases, *Capitella capitata*. *H. diversicolor* does not occur.
LS.LMu.MEst.HedMacScr	Occurs in similar physical environments. The infauna of this biotope is more diverse, characterised by a range of polychaetes including the ragworm *H. diversicolor* and a range of bivalves including the baltic tellin *M. balthica* and the peppery furrow shell *Scrobicularia plana*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hediste diversicolor	●●●●●	Super-abundant	45	1937
Streblospio shrubsolii	●●●	Abundant	8	1510
Manayunkia aestuarina	●●●	Common	3	2247
OLIGOCHAETA	●●●	Common	12	4100
Heterochaeta costata	●●	Abundant	5	2065
Tubificoides benedii	●●	Abundant	7	2289
Tubificoides pseudogaster	●	Common	1	506
Corophium volutator	●●●	Common	9	2220
Hydrobia ulvae	●●	Common	1	360

LS.LMu.UEst.Hed.Str *Hediste diversicolor* and *Streblospio shrubsolii* in littoral sandy mud

Habitat (physical) description

Salinity:	Variable (18-35ppt), Reduced/low (0.5-30ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Mud; sandy mud
Zone:	
Height band:	Mid shore, Lower shore

Previous code

LMU.Mu.HedStr (part)	97.06

Biotope description

Mud and sandy mud shores in sheltered marine inlets and estuaries subject to variable or reduced salinity. The biotope is typically found on the mid and lower shores and is often associated with shallow layers of cobbles and pebbles in the sediment in the upper and mid estuary. The sediment is anoxic close to the surface and remains water saturated during low tide. The infaunal polychaete community is dominated by dense *Hediste diversicolor*, as well as species with a limited salinity range tolerance such as *Streblospio shrubsolii* and *Manayunkia aestuarina*. Oligochaetes, including *Heterochaeta costata* and *Tubificoides benedii* are often abundant, and the amphipod *Corophium volutator* is often common.

Situation

Hed.Str may occur on the same shores as HedMacScr, HedMac, NhomAph or Hed.Cvol. Higher up on the shore, and/or further towards the head of the estuary, Hed.Ol may occur, changing to Tben at the upper extreme of the estuary.

Temporal variation

Enteromorpha spp. or *Ulva lactuca* may form mats on the surface of the sediment during the summer months, particularly in areas of freshwater influence and/or where there is nutrient enrichment.

Similar biotopes

LS.LMu.UEst.Hed.Ol	Occurs under more reduced salinity conditions. The infauna is a lot less diverse, dominated by *H. diversicolor* and oligochaetes. *S. shrubsolii* is absent.
LS.LMu.UEst.NhomStr	Occurs on slightly more marine, exposed shores, with a higher diversity of polychaete species, but hardly any other infauna.
LS.LMu.MEst.HedMacScr	Occurs at a greater range of shore heights on slightly more marine, exposed shores. The infauna is more diverse, most notably a range of bivalve species occur, including *Scrobicularia plana*.
LS.LMu.UEst.Hed.Cvol	Occurs under similar physical environments, sometimes higher on the shore. The infauna is less diverse, with lower numbers of oligochaete and polychaete species. *S. shrubsolii* is absent.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hediste diversicolor	●●●●●	Super-abundant	20	2020
Streblospio shrubsolii	●●●●	Abundant	23	3033
Manayunkia aestuarina	●●●●	Common	7	4526
OLIGOCHAETA	●●	Abundant	11	6592
Heterochaeta costata	●●	Abundant	5	2386
Tubificoides benedii	●●●	Abundant	18	4557
Corophium volutator	●●●	Common	6	2897

LS.LMu.UEst.Hed.Cvol *Hediste diversicolor* and *Corophium volutator* in littoral mud

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt), Reduced (18-30ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Sandy mud
Zone:	
Height band:	Upper shore, Mid shore, Lower shore

Previous code

LMU.Mu.HedOl (part)	97.06
LMUD.HO	6.95

Biotope description

Sheltered estuarine shores of sandy mud, which may become firm and compacted if present in the upper shore where there is more time for drainage between high tides. An anoxic layer is usually present within the first 5 cm of the sediment. The infauna is very sparse, usually only the ragworm *Hediste diversicolor* and the amphipod *Corophium volutator* are present in any abundance. Occasionally, oligochaetes or the spire shell *Hydrobia ulvae* may be present. *Corophium multisetosum* may also be found. There may be organic pollution of the sediment.

Situation

Hed.Cvol may occur on the same shores as HedMacScr, HedMac, NhomAph, and Hed.Str. Higher up on the shore, and/or further towards the head of the estuary, Hed.Ol may occur, changing to Tben at the upper extreme of the estuary.

Temporal variation

Enteromorpha spp. or *Ulva lactuca* may form mats on the surface of the sediment during the summer months, particularly in areas of freshwater influence and/or where there is nutrient enrichment.

Similar biotopes

LS.LMu.UEst.Hed.Ol	Occurs under more reduced salinity conditions. The principal difference is the absence of *C. volutator*, and the occasional presence of *Scrobicularia plana*.
LS.LMu.UEst.NhomStr	Occurs in sediments with a smaller sand fraction, with a higher diversity of polychaete and oligochaete species. *C. volutator* is absent.
LS.LMu.MEst.HedMac	Occurs in similar physical environments. The infauna of this biotope is a lot more diverse, and dominated by a range of bivalves, including the Baltic tellin *Macoma balthica*, in addition to *H. diversicolor* and the occasionally abundant *C. volutator*.
LS.LMu.MEst.HedMacScr	Occurs under similar, slightly more exposed conditions. The infauna is more diverse, with higher numbers of oligochaete and polychaete species, and the peppery furrow shell *S. plana*.
LS.LMu.UEst.Hed.Str	Occurs under similar physical environments, slightly lower on the shore. The infauna is more diverse, with higher numbers of oligochaete and polychaete species, most notably *Streblospio shrubsolii*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hediste diversicolor	●●●●●	Abundant	48	1783
Corophium volutator	●●●●●	Common	43	4257

LS.LMu.UEst.Hed.Ol *Hediste diversicolor* and oligochaetes in littoral mud

Habitat (physical) description

Salinity:	Variable (18-35ppt), Reduced (18-30ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Sandy mud
Zone:	
Height band:	Upper shore, Mid shore, Lower shore

Previous code

LMU.MU.HedOl (part)	97.06
LMU.MU.HedStr (part)	97.06
LMUD.HO	6.95

Biotope description

A species-poor community found in mud or slightly sandy mud in low salinity conditions, typically at the head of estuaries. The infauna is dominated by the ragworm *Hediste diversicolor* which is typically superabundant. Oligochaetes, including tubificids and *Heterochaeta costata*, can be abundant, as well as spionids. The peppery furrow shell *Scrobicularia plana* may be present in low abundances. The mud is often very soft and fluid, with a 'wet' surface appearance, or it may be compacted and form steep banks in the upper parts of macro-tidal estuaries and along saltmarsh creeks.

Situation

There are three oligochaete dominated upper estuarine mud biotopes. Tben is the most extreme upper estuarine biotope, occurring at the head of estuaries where there is a very strong freshwater influence. Further towards the mid estuary, this biotope may occur at the top of the shore, with Hed.Ol further down. NhomStr occurs furthest towards the mid estuary, or on the lower shore with Hed.Ol and Tben higher up.

Temporal variation

Enteromorpha spp. or *Ulva lactuca* may form mats on the surface of the sediment during the summer months, particularly in areas of freshwater influence and/or where there is nutrient enrichment.

Similar biotopes

LS.LMu.UEst.Tben	Occurs in similar physical conditions, but further up towards the head of estuaries. The species assemblage is much poorer, consisting only of oligochaetes and, in some cases, *Capitella capitata*.
LS.LMu.MEst.NhomMacScr	Occurs in similar physical conditions, but possibly lower down in estuaries (more saline). The polychaete assemblage is more diverse, and both *Hydrobia ulvae* and *Macoma balthica* are characterising species. It is the presence of these two species that primarily distinguishes NhomMacStr from upper estuarine mud biotopes.
LS.LMu.UEst.Hed.Str	Occurs in similar physical conditions. The infauna is more diverse, with abundant *Streblospio shrubsolii* and a range of oligochaetes.
LS.LMu.UEst.Hed.Cvol	Occurs in similar physical conditions. The main difference in the infaunal species composition is the presence of common *Corophium volutator*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hediste diversicolor	●●●●●	Super-abundant	54	1899
Spionidae	●●	Abundant	6	468
OLIGOCHAETA	●●	Abundant	11	2026
Tubificidae	●●●	Abundant	15	1840
Heterochaeta costata	●●	Abundant	1	2127

LS.LMu.UEst.Tben *Tubificoides benedii* and other oligochaetes in littoral mud

Habitat (physical) description

Salinity:	Reduced (18-30ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Fine sandy mud
Zone:	
Height band:	Upper shore, Mid shore, Lower shore

Previous code

LMU.MU.HedOl (part)	97.06
LMUD.HO (part)	6.95

Biotope description

Extreme upper estuarine fine sandy mud, sometimes with a fine sand fraction, in very sheltered conditions and subject to reduced salinity. An anoxic layer is usually present within the upper 3 cm of the sediment. The infaunal community is extremely poor, consisting almost exclusively of oligochaetes, including *Tubificoides benedii* and, more rarely, *Heterochaeta costata*. The only polychaete species that may occur is *Capitella capitata*, which may be common. The sediment may form steep banks in upper parts of macro-tidal estuaries or along saltmarsh creeks. *Vaucheria* species may form a film on the sediment surface along such creeks, and juvenile shore crabs *Carcinus maenas* may be common. At the very upper end of estuaries, the oligochaetes *Limnodrilus* spp. and *Tubifex tubifex* may be found.

Situation

There are three oligochaete dominated upper estuarine mud biotopes. Tben is the most extreme upper estuarine biotope, occurring at the head of estuaries where there is no strong river flow and hence conditions are very sheltered, and there is a very strong freshwater influence. Further towards the mid estuary, this biotope may occur at the top of the shore, with Hed.Ol further down. NhomStr occurs furthest towards the mid estuary, or on the lower shore with Hed.Ol and Tben higher up.

Temporal variation

Green algae such as *Enteromorpha* spp. may form mats on the surface of the mud during the summer months.

Similar biotopes

LS.LMu.UEst.Hed.Ol	Occurs in similar environmental conditions, possible slightly lower down in estuaries in slightly more saline conditions. Increased diversity of polychaetes, with superabundant Ragworms *Hediste diversicolor*.
LS.LSa.MoSa.Ol	Can occur in estuarine coarse sediments on lower shores where strong river flow leads to the absence of a mud fraction. The infauna is similarly poor, dominated by oligochaetes including enchytraeids, and nemerteans.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Capitella capitata	••	Common	1	65
OLIGOCHAETA	•••	Abundant	52	53741
Tubificoides benedii	•••	Common	45	42

LS.LMx Littoral mixed sediments

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt), Reduced/low (0.5-30ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Mixed sediment
Zone:	
Height band:	Strandline, Upper shore, Mid shore, Lower shore

Biotope description

Shores of mixed sediments ranging from muds with gravel and sand components to mixed sediments with pebbles, gravels, sands and mud in even proportions. By definition, mixed sediments are poorly sorted. Stable large cobbles or boulders may be present which support epibiota such as fucoids and green seaweeds commonly found on rocky and boulder shores. Mixed sediments which are predominantly muddy tend to support infauna similar to mud and sandy mud shores.

Situation

It is probable that there are broad transition areas between areas of mudflat or sandy mudflat, and mixed sediment biotopes where the sediment consists principally of mud but has significant proportions of gravel and sand mixed in. Gravelly mud may occur in patches on mudflats. Similarly, there is unlikely to be an easily defined boundary between areas of mixed sediment with stable cobbles and boulders, and boulder fields which fall into the rocky shore category.

Temporal variation

Not known.

LS.LMx.GvMu *Hediste diversicolor* dominated gravelly sandy mud shores

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt), Reduced (18-30ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Gravelly sandy mud
Zone:	
Height band:	Strandline, Upper shore, Mid shore, Lower shore

Biotope description

Sheltered gravelly sandy mud, subject to reduced salinity, mainly on the mid and lower shore. The infaunal community is dominated by abundant ragworms *Hediste diversicolor*. Other species of the infauna vary for the sub-biotopes described. They include polychaetes such as *Pygospio elegans*, *Streblospio shrubsolii*, and *Manayunkia aestuarina*, oligochaetes such as *Heterochaeta costata* and *Tubificoides* spp., the mud shrimp *Corophium volutator*, the spire shell *Hydrobia ulvae*, the baltic tellin *Macoma balthica* and the peppery furrow shell *Scrobicularia plana*. Sub-biotopes described in HedMx have equivalent communities in soft muddy sediments, but the sediment here is much firmer due to the gravel component. There are relatively few records in each sub-type, leading to uncertainty over the precise nature of the habitat, particularly regarding sediment type and salinity regime.

Situation

It is probable that there are broad transition areas between the sub-biotopes of HedMx, and the corresponding muddy sediment biotopes. The boundaries may be very indistinct, with the HedMx groups present in patches of gravelly mud on areas of mudflat where the main biotopes are their corresponding mud or sandy mud biotopes. Given the small number of records for each of the sub-biotopes, their spatial distribution is still uncertain.

Temporal variation

Not known.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hediste diversicolor	●●●●●	Abundant	62	1406
Pygospio elegans	●●	Common	2	207
Streblospio shrubsolii	●●●	Common	4	1099
Manayunkia aestuarina	●●	Common	1	1420
Heterochaeta costata	●●	Common	3	4198
Tubificoides benedii	●●●	Common	3	1759
Tubificoides pseudogaster	●●●	Abundant	6	1796
Corophium volutator	●●●	Common	5	2704
Hydrobia ulvae	●●	Common	2	366
Macoma balthica	●●	Common	2	72
Scrobicularia plana	●●●	Abundant	2	62

LS.LMx.GvMu.HedMx *Hediste diversicolor* in littoral gravelly muddy sand and gravelly sandy mud

Habitat (physical) description

Salinity:	Variable (18-35ppt), Reduced (18-30ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Gravelly sandy mud
Zone:	
Height band:	Strandline, Upper shore, Mid shore, Lower shore

Biotope description

Sheltered gravelly sandy mud, subject to reduced salinity, mainly on the mid and lower shore. The infaunal community is dominated by abundant ragworms *Hediste diversicolor*. Other species of the infauna vary for the sub-biotopes described. They include polychaetes such as *Pygospio elegans*, *Streblospio shrubsolii*, and *Manayunkia aestuarina*, oligochaetes such as *Heterochaeta costata* and *Tubificoides* spp., the mud shrimp *Corophium volutator*, the spire shell *Hydrobia ulvae*, the baltic tellin *Macoma balthica* and the peppery furrow shell *Scrobicularia plana*. Sub-biotopes described in HedMx have equivalent communities in soft muddy sediments, but the sediment here is much firmer due to the gravel component. There are relatively few records in each sub-type, leading to uncertainty over the precise nature of the habitat, particularly regarding sediment type and salinity regime.

Situation

It is probable that there are broad transition areas between the sub-biotopes of HedMx, and the corresponding muddy sediment biotopes. The boundaries may be very indistinct, with the HedMx groups present in patches of gravelly mud on areas of mudflat where the main biotopes are their corresponding mud or sandy mud biotopes. Given the small number of records for each of the sub-biotopes, their spatial distribution is still uncertain.

Temporal variation

Not known.

Similar biotopes

LS.LMu.MEst.HedMac	Occurs in lower estuarine muds and sandy muds, without a gravel fraction. The infauna is more diverse, particularly containing a greater number of bivalves (though that may be an artefact of greater number of samples in the HedMac biotope).
LS.LMu.UEst.Hed.Str	Occurs in estuarine muds, without a gravel fraction. The infauna is dominated by similar species.
LS.LMu.UEst.Hed.Cvol	Occurs in estuarine muds, without a gravel fraction. The infauna consists virtually entirely of *H. diversicolor* and *C. volutator*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hediste diversicolor	●●●●●	Abundant	62	1406
Pygospio elegans	●●	Common	2	207
Streblospio shrubsolii	●●●	Common	4	1099
Manayunkia aestuarina	●●	Common	1	1420
Heterochaeta costata	●●	Common	3	4198
Tubificoides benedii	●●●	Common	3	1759
Tubificoides pseudogaster	●●●	Abundant	6	1796
Corophium volutator	●●●	Common	5	2704
Hydrobia ulvae	●●	Common	2	366
Macoma balthica	●●	Common	2	72
Scrobicularia plana	●●●	Abundant	2	62

LS.LMx.GvMu.HedMx.Mac *Hediste diversicolor* and *Macoma balthica* in littoral gravelly mud

Habitat (physical) description

Salinity:	Reduced (18-30ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Gravelly mud
Zone:	
Height band:	Strandline, Upper shore, Mid shore, Lower shore

Biotope description

Sheltered gravelly mud shores, subject to reduced salinity. The infaunal community consists of the ragworm *Hediste diversicolor*, as well as the spire shell *Hydrobia ulvae* and the baltic tellin *Macoma balthica*. The presence of the gravel in the sediment is unlikely to have a large influence on the infaunal composition, which is driven mainly by the estuarine sandy mud conditions. Coarse material on the sediment surface may however enrich the biota with additional epifaunal species such as barnacles and algae. Given the low sample numbers for this biotope, more records are needed to confirm the characterising species list.

Situation

It is probable that there are broad transition areas between this biotope, and the corresponding muddy sediment biotope HedMac. The boundaries may be very indistinct, with HedMx.Mac present in patches of gravelly mud on areas of mudflat, where the main biotope is HedMac. This biotope has been found alongside its mud equivalent in the Stour estuary.

Temporal variation

Not known.

Similar biotopes

LS.LMu.MEst.HedMac	Occurs in lower estuarine muds and sandy muds, without a gravel fraction. The infauna is dominated by the same species, but is more diverse (though that may be an artefact of greater number of samples in the HedMac biotope).
LS.LMx.GvMu.HedMx.Str	Occurs in gravelly sandy mud lower down on the shore, under more sheltered conditions. The polychaete infauna is much more diverse, and a range of oligochaete species are found. *M. balthica* is rare.
LS.LMx.GvMu.HedMx.Scr	Occurs higher up on the shore under more sheltered conditions. The infaunal assemblage is more diverse, with a greater range of polychaetes and bivalves. *Scrobicularia plana* is abundant, though *M. balthica* is only occasionally present.
LS.LMx.Mx.CirCer	Occurs in slightly more sheltered gravelly sandy mud. The principal differences in the infaunal assemblage are the greater diversity of polychaete species, particularly *Tharyx killariensis*, the abundance of oligochaetes, and the comparative rarity of molluscs.
LS.LMx.GvMu.HedMx.Cvol	Occurs in more sheltered gravelly sandy mud. The principal differences in the infaunal assemblage are the abundance of oligochaetes and *Corophium volutator*, and the low frequency of occurrence of molluscs.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hediste diversicolor	●●●●●	Super-abundant	61	2388
Hydrobia ulvae	●●●●●	Common	25	2296
Macoma balthica	●●●●●	Common	11	413

LS.LMx.GvMu.HedMx.Scr *Hediste diversicolor* and *Scrobicularia plana* in littoral gravelly mud

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Gravelly mud
Zone:	
Height band:	Upper shore, Mid shore, Lower shore

Biotope description

Extremely sheltered gravelly mud on the mid and lower shore, containing little sand with occasional cobbles. The infaunal community includes the ragworm *Hediste diversicolor* and the peppery furrow shell *Scrobicularia plana*, as well as a range of polychaetes, oligochaetes, and molluscs. Given the low sample numbers for this biotope, more records are needed to confirm the characterising species list.

Situation

It is probable that there are broad transition areas between HedMx.Scr and the corresponding muddy sediment biotope HedMacScr. The boundaries may be very indistinct, with HedMx.Scr present in patches of gravelly mud on areas of mudflat, where the main biotope is HedMacScr.

Temporal variation

Not known.

Similar biotopes

LS.LMu.MEst.HedMacScr	Occurs in lower estuarine muds and sandy muds, without a gravel fraction. The infauna is dominated by the same species, but is more diverse (though that may be an artefact of greater sample numbers in the HedMacScr biotope).
LS.LMx.GvMu.HedMx.Mac	Occurs lower down on the shore under more exposed conditions. The infaunal assemblage is less diverse, with fewer polychaetes and bivalves. *S. plana* does not occur, though *Macoma balthica* is abundant.
LS.LMx.GvMu.HedMx.Str	Occurs in gravelly sandy mud lower down on the shore, under more variable salinity conditions. The polychaete infauna is similar, though there may be more crustacean species, including frequent *Corophium volutator*, and the bivalve infauna is much reduced.
LS.LMx.Mx.CirCer	Occurs in slightly more exposed gravelly sandy mud. The principal differences in the infaunal assemblage are the greater abundance of *Tharyx killariensis*, the abundance of oligochaetes, and the comparative rarity of molluscs, most notably the absence of *S. plana*.
LS.LMx.GvMu.HedMx.Cvol	Occurs in more sheltered gravelly sandy mud lower on the shore. The principal differences in the infaunal assemblage are the abundance of oligochaetes and *C. volutator*, and the low frequency of occurrence of molluscs, most notably the absence of *S. plana*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hediste diversicolor	●●●●●	Abundant	35	558
Pygospio elegans	●●	Abundant	2	616
Streblospio shrubsolii	●●	Abundant	7	594
Aphelochaeta vivipara	●●	Common	2	169
Arenicola marina	●●●	Common	1	17
Manayunkia aestuarina	●●	Common	1	116
Tubificoides benedii	●●●	Common	5	797
Tubificoides pseudogaster	●●	Abundant	20	1119
Hydrobia ulvae	●●●	Frequent	2	84
Macoma balthica	●●	Present	3	13
Scrobicularia plana	●●●●●	Abundant	21	131

LS.LMx.GvMu.HedMx.Str *Hediste diversicolor* and *Streblospio shrubsolii* in littoral gravelly sandy mud

Habitat (physical) description

Salinity:	Variable (18-35ppt), Reduced (18-30ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Gravelly sandy mud
Zone:	
Height band:	Mid shore, Lower shore

Biotope description

Extremely sheltered gravelly sandy mud, subject to variable salinity, on the mid and lower shore. The infaunal community consists of the ragworm *Hediste diversicolor*, *Pygospio elegans*, *Streblospio shrubsolii*, and *Ampharete grubei*, as well as oligochaetes and *Corophium volutator*. There are often low densities of *Scrobicularia plana*. Given the low sample numbers for this biotope, more records are needed to confirm the characterising species list.

Situation

It is probable that there are broad transition areas between this biotope and the corresponding muddy sediment biotope Hed.Str. The boundaries may be very indistinct, with HedMx.Str present in patches of gravelly mud on areas of mudflat, where the main biotope is Hed.Str. This biotope has been found along edges of tidal channels in the upper Stour estuary, below its equivalent mud biotope.

Temporal variation

Not known.

Similar biotopes

LS.LMu.UEst.Hed.Str	Occurs in estuarine muds, without a gravel fraction. The infauna is dominated by similar species.
LS.LMx.GvMu.HedMx.Mac	Occurs in gravelly mud under more exposed conditions. The main differences in the infaunal assemblage are the abundance of *Macoma balthica*, and the absence of oligochaetes and a range of polychaetes including *S. shrubsolii*.
LS.LMx.GvMu.HedMx.Scr	Occurs in muddy gravel, higher up on the shore and under less variable salinity conditions. The polychaete fauna is similar, but there are fewer oligochaetes. The bivalve infauna is more diverse, with more abundant *S. plana*.
LS.LMx.Mx.CirCer	Occurs in slightly more exposed gravelly sandy mud. The principal differences in the infaunal assemblage are the greater abundance of *Tharyx killariensis*, the abundance of oligochaetes, and the absence of *S. plana*.
LS.LMx.GvMu.HedMx.Cvol	Occurs in more sheltered gravelly sandy mud. The principal differences in the infaunal assemblage are the abundance of oligochaetes and *C. volutator*, and the absence of *S. plana*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hediste diversicolor	●●●●●	Super-abundant	55	1719
Pygospio elegans	●●●	Common	5	279
Streblospio shrubsolii	●●●●●	Common	14	219
Ampharete grubei	●●●	Abundant	3	193
OLIGOCHAETA	●●●●●	Common	20	1332

Corophium volutator	●●●●	Frequent	2	39

LS.LMx.GvMu.HedMx.Cir *Hediste diversicolor*, Cirratulids and *Tubificoides* spp. in littoral gravelly sandy mud

Habitat (physical) description

Salinity:	Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Gravelly sandy mud
Zone:	
Height band:	Upper shore, Mid shore, Lower shore

Biotope description

Sheltered gravelly sandy mud, subject to variable salinity. The infaunal community consists of the ragworm *Hediste diversicolor*, *Pygospio elegans*, *Streblospio shrubsolii*, and Cirratulids such as *Tharyx killariensis*. Nematodes and oligochaetes occur, as well as *Macoma balthica*. Given the low sample numbers for this biotope, more records are needed to confirm the characterising species list.

Situation

It is probable that there are broad transition areas between this biotope and the corresponding muddy sediment biotope HedMac. The boundaries may be very indistinct, with HedMx.Cir present in patches of gravelly mud on areas of mudflat, where the main biotope is HedMac.

Temporal variation

Not known.

Similar biotopes

LS.LMu.MEst.HedMac	Occurs in lower estuarine muds and sandy muds, without a gravel fraction. The infauna is dominated by similar species, though it is more diverse (this may be an artefact of greater sample numbers in the HedMac biotope).
LS.LMx.GvMu.HedMx.Mac	Occurs in gravelly mud under less saline and slightly more sheltered conditions. The main differences in the infaunal assemblage are the abundance of *M. balthica*, and the absence of oligochaetes and a range of polychaetes including *T. killariensis*.
LS.LMx.GvMu.HedMx.Scr	Occurs in gravelly mud, higher up on the shore and under more sheltered conditions. The polychaete fauna is similar, but there are fewer oligochaetes. The bivalve infauna is more diverse, with abundant *Scrobicularia plana*.
LS.LMx.GvMu.HedMx.Str	Occurs in more sheltered gravelly mud. The main differences in the infaunal assemblage are the absence of *T. killariensis*, fewer oligochaetes, and the presence of occasional *S. plana*.
LS.LMx.GvMu.HedMx.Cvol	Occurs in more sheltered gravelly sandy mud. The principal differences in the infaunal assemblage are the absence of *T. killariensis* and the abundance of *Corophium volutator*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
NEMATODA	●●●●	Frequent	6	166
Hediste diversicolor	●●●●●	Abundant	47	1040
Pygospio elegans	●●●	Present	1	15
Streblospio shrubsolii	●●●●	Present	3	984
Tharyx killariensis	●●●●●	Common	25	145
Heterochaeta costata	●●●●	Present	1	47
Tubificoides benedii	●●●●	Frequent	4	106
Tubificoides pseudogaster	●●●●	Present	5	150
Enchytraeidae	●●	Common	3	247
Macoma balthica	●●●	Present	2	44

LS.LMx.GvMu.HedMx.Cvol *Hediste diversicolor* and *Corophium volutator* in littoral gravelly sandy mud

Habitat (physical) description

Salinity:	Variable (18-35ppt), Reduced/low (0.5-30ppt)
Wave exposure:	Extremely sheltered
Tidal streams:	
Substratum:	Gravelly sandy mud
Zone:	
Height band:	Upper shore, Mid shore, Lower shore

Biotope description

Extremely sheltered gravelly sandy mud, subject to variable or reduced salinity. The infaunal community consists of the ragworm *Hediste diversicolor*, *Streblospio shrubsolii*, *Capitella capitata* and *Manayunkia aestuarina*. Oligochaetes and *Corophium volutator* are abundant. Given the low sample numbers for this biotope, more records are needed to confirm the characterising species list.

Situation

It is probable that there are broad transition areas between this biotope and the corresponding muddy sediment biotope Hed.Cvol. The boundaries may be very indistinct, with HedMx.Cvol present in patches of gravelly mud on areas of mudflat, where the main biotope is Hed.Cvol.

Temporal variation

Not known.

Similar biotopes

LS.LMu.UEst.Hed.Cvol	Occurs in estuarine muds, without a gravel fraction. The infauna is dominated by similar species.
LS.LMx.GvMu.HedMx.Mac	Occurs in gravelly mud under less saline and slightly less sheltered conditions. The main differences in the infaunal assemblage are the abundance of *M. balthica*, and *Hydrobia ulvae*, the absence of oligochaetes and a range of polychaetes, and lower abundances of *C. volutator*.
LS.LMx.GvMu.HedMx.Scr	Occurs in gravelly mud, higher up on the shore. The polychaete fauna is similar, but there are fewer oligochaetes. The bivalve infauna is more diverse, with abundant *Scrobicularia plana*.
LS.LMx.GvMu.HedMx.Str	Occurs in similar physical conditions. The main differences in the infaunal assemblage are fewer oligochaetes, a higher frequency of occurrence of *S. shrubsolii*, and the presence of occasional *S. plana*.
LS.LMx.Mx.CirCer	Occurs in less sheltered gravelly sandy mud. The principal differences in the infaunal assemblage are the abundance of *Tharyx killariensis* and the absence of *C. volutator*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hediste diversicolor	●●●●●	Super-abundant	13	1542
Streblospio shrubsolii	●●●	Common	2	2576
Capitella capitata	●●●	Abundant	2	1089
Manayunkia aestuarina	●●●●●	Common	7	4769
Heterochaeta costata	●●●●●	Abundant	21	14311
Tubificoides benedii	●●●●	Abundant	8	4791
Tubificoides pseudogaster	●●●●	Abundant	11	5291
Enchytraeidae	●●●	Abundant	8	2469
Corophium volutator	●●●●	Frequent	27	9057

LS.LMx.Mx Species-rich mixed sediment shores

Habitat (physical) description

Salinity:	Variable (18-35ppt)
Wave exposure:	Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Mixed sediments
Zone:	
Height band:	Mid shore, Lower shore

Biotope description

Sheltered mixed sediments, usually subject to variable salinity conditions. The infauna is very diverse, dominated by a range of polychaetes including *Exogone naidina*, *Sphaerosyllis taylori*, *Pygospio elegans*, *Chaetozone gibber*, *Cirriformia tentaculata*, *Aphelochaeta marioni*, *Capitella capitata*, *Mediomastus fragilis*, and *Melinna palmata*. The oligochaete worms *Tubificoides benedii* and *T. pseudogaster* are abundant, as is the cockle *Cerastoderma edule*. A large range of amphipods may occur, including *Melita palmata*, *Microprotopus maculatus*, *Aora gracilis* and *Corophium volutator*. The bivalves *Abra alba* and *A. nitida* may occur. The barnacle *Elminius modestus* may be abundant where the sediment has stones on the surface.

Situation

Mid shore, lower shore, as extension of shallow sublittoral biotope.

Temporal variation

Not known.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Exogone naidina	••••	Abundant	7	9504
Sphaerosyllis taylori	••••	Common	1	1530
Pygospio elegans	••••	Frequent	1	608
Chaetozone gibber	••••	Common	1	779
Cirriformia tentaculata	••••	Super-abundant	2	939
Aphelochaeta marioni	•••••	Abundant	38	18535
Capitella capitata	••••	Common	2	787
Mediomastus fragilis	••••	Common	1	268
Melinna palmata	•••••	Abundant	3	648
Tubificoides benedii	•••••	Abundant	20	7945
Tubificoides pseudogaster	•••••	Abundant	11	2938
Elminius modestus	••	Abundant	1	721
Cerastoderma edule	•••••	Abundant	2	638

LS.LMx.Mx.CirCer Cirratulids and *Cerastoderma edule* in littoral mixed sediment

Habitat (physical) description

Salinity:	Variable (18-35ppt)
Wave exposure:	Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Mixed sediments
Zone:	
Height band:	Mid shore, Lower shore

Biotope description

Sheltered mixed sediments, usually subject to variable salinity conditions. Banks of shell may be present. The infauna is very diverse, dominated by a range of polychaetes including *Exogone naidina*, *Sphaerosyllis taylori*, *Pygospio elegans*, *Chaetozone gibber*, *Cirriformia tentaculata*, *Aphelochaeta marioni*, *Capitella capitata*, *Mediomastus fragilis*, and *Melinna palmata*. The oligochaetes *Tubificoides benedii* and *T. pseudogaster* are abundant, as is the cockle *Cerastoderma edule*. A large range of amphipods may occur, including *Melita palmata*, *Microprotopus maculatus*, *Aora gracilis* and *Corophium volutator*. The bivalves *Abra alba* and *A. nitida* may occur. The barnacle *Elminius modestus* can be abundant where the sediment has stones on the surface. Epifaunal algae may occur attached to stable cobbles on the sediment surface.

Situation

On the mid and lower shore, sometimes as an extension of a shallow sublittoral biotope.

Temporal variation

Not known.

Similar biotopes

LS.LMx.GvMu.HedMx	Similar mixed sediment habitat, but dominated by *Hediste diversicolor* and with less diverse infauna, particularly fewer polychaete species.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Exogone naidina	••••	Abundant	7	9504
Sphaerosyllis taylori	••••	Common	1	1530
Pygospio elegans	••••	Frequent	1	608
Chaetozone gibber	••••	Common	1	779
Cirriformia tentaculata	••••	Super-abundant	2	939
Aphelochaeta marioni	•••••	Abundant	38	18535
Capitella capitata	••••	Common	2	787
Mediomastus fragilis	••••	Common	1	268
Melinna palmata	•••••	Abundant	3	648
Tubificoides benedii	•••••	Abundant	20	7945
Tubificoides pseudogaster	•••••	Abundant	11	2938
Elminius modestus	••	Abundant	1	721
Cerastoderma edule	•••••	Abundant	2	638

LS.LBR Littoral Biogenic Reefs

Habitat (physical) description

Salinity:	Full (30-35ppt); Variable (18-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Boulders; cobbles; pebbles; sand; bedrock
Zone:	Eulittoral - mid, Eulittoral - lower
Height band:	Mid shore, Lower shore

Biotope description

The Littoral Biogenic Reefs habitat complex contains two biotope complexes (littoral *Sabellaria* reefs, and mixed sediment shores with mussels), encompassing the littoral biotope dominated by the honeycomb worm *Sabellaria alveolata*, and littoral *Mytilus edulis*- dominated communities. *S. alveolata* can form honeycomb reefs on mid to lower shore on exposed coasts, where there is a plentiful supply of sediment. The underlying substratum may consist primarily of rock or stable cobbles and boulders, or of cobbles and boulders on sand. Mixed sediment shores characterised by beds of adult mussels *Mytilus edulis* occur principally on mid and lower eulittoral mixed substrata (mainly cobbles and pebbles on muddy sediments) in a wide range of exposure conditions. In high densities the mussels bind the substratum and provide a habitat for many infaunal and epifaunal species.

Situation

Where *S. alveolata* reefs occur on underlying substratum that is primarily rocky, biotopes dominated by ephemeral seaweeds, such as *Enteromorpha* spp. and *Porphyra* spp. or the perennial wrack *Fucus vesiculosus* on mixed substrata (FvesB; Fves.X; EphX; EntPor) may occur higher on the shore. Rockpool biotopes dominated by the red seaweed *Corallina officinalis* (Cor), by wracks such as *Fucus* spp. or by kelp such as *Laminaria* spp. (FK) may also be found above this biotope. Lower down, a community consisting of mixed scour-tolerant species like the kelp *Laminaria digitata* and opportunistic foliose red seaweeds such as *Polyides rotundus* and *Ahnfeltia plicata* (Ldig.Ldig; XKScrR; EphR; PolAhn) can occur. In adjacent sediment areas *Lanice conchilega* may dominante (Lan). Like *S. alveolata* reefs, adult mussel beds can found below a band of ephemeral green seaweeds (Eph.X) on more exposed, predominantly rocky shores. On sheltered, predominantly rocky shores either a *F. vesiculosus* dominated biotope or a biotope dominated by the wrack *Ascophyllum nodosum* (Fves.X; Asc.X) can be found above, or the barnacle dominated biotope (Sem.LitX).

Temporal variation

S. alveolata reefs may be susceptible to storm damage in the winter, although they can regenerate remarkably quickly in a season as long as some adults are left as they facilitate the larval settlement. *S. alveolata* is tolerant to burial under sand for several weeks. Changes in desiccation over a period of time can cause part of the population to die. One of the mussel-dominated sub-biotopes, Myt.Sa, could change to Myt.Mu over time as pseudofaeces build up forming a layer of mud. This cannot happen where wave action or tidal streams wash away pseudofaeces and prevent a build up. In areas where mussel spat ("mussel crumble") settles on the surface shell layer of cockle beds, the mussel cover may be ephemeral.

LS.LBR.Sab Littoral *Sabellaria* honeycomb worm reefs

Habitat (physical) description

Salinity:	Full (30-35ppt)	MLR.Sab	97.06
Wave exposure:	Exposed, Moderately exposed		
Tidal streams:			
Substratum:	Boulders; cobbles; pebbles; sand; bedrock		
Zone:	Eulittoral - mid, Eulittoral - lower		
Height band:	Mid shore, Lower shore		

Biotope description

The sedentary polychaete *Sabellaria alveolata* (honeycomb worm) builds tubes from sand and shell. On exposed shores, where there is a plentiful supply of sediment, *S. alveolata* can form honeycomb reefs on boulders and low-lying bedrock on the mid to lower shore. These *S. alveolata* reefs are quite distinct from the mosaic of seaweeds and barnacles or red seaweeds (FK; MB) generally associated with moderately exposed rocky shores though many of the same species are present. These include the anemone *Actinia equina*, the barnacles *Semibalanus balanoides* and *Elminius modestus*, the limpet *Patella vulgata*, the top shell *Gibbula cineraria* and the winkle *Littorina littorea*. The whelk *Nucella lappilus* and the mussel *Mytilus edulis* is also present on the boulders whereas the polychaete *Lanice conchilega* is restricted to the associated sediment areas. Scour resistent red seaweeds including *Palmaria palmata, Corallina ifficinalis, Mastocarpus stellatus, Chondrus crispus, Ceramium nodulosum, Osmundea pinnatifida, Polysiphonia* spp. and coralline crusts can also be present where suitable substrata exsist. Brown and green seaweeds also present include *Fucus serratus, Fucus vesioculosus, Cladostephus spongiosus, Enteromorpha intestinalis* and *Ulva lactuca*.

Situation

Above Salv are biotopes dominated either by ephemeral seaweeds, such as *Enteromorpha* spp. and *Porphyra* spp. or the perennial wrack *Fucus vesiculosus* on mixed substrata (FvesB; Fves.X; EphX; EntPor). Rockpool biotopes dominated by the red seaweed *Corallina officinalis* (Cor), by wracks such as *Fucus* spp. or by kelp such as *Laminaria* spp. (FK) can usually be found above this biotope. Beneath this biotope is a community consisting of mixed scour-tolerant like the kelp *Laminaria digitata* and opportunistic foliose red seaweeds such as *Polyides rotundus* and *Ahnfeltia plicata* (Ldig.Ldig; XKScrR; EphR; PolAhn).

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Actinia equina	●●●	Occasional	2
Sabellaria alveolata	●●●●●	Common	24
Lanice conchilega	●●	Occasional	1
Semibalanus balanoides	●●●●	Frequent	8
Elminius modestus	●●	Occasional	2
Carcinus maenas	●●	Occasional	1
Patella vulgata	●●●●	Occasional	5
Gibbula cineraria	●●	Rare	1
Littorina littorea	●●●●	Frequent	6
Nucella lapillus	●●●●	Frequent	7
Mytilus edulis	●●●	Occasional	3
Palmaria palmata	●●●	Occasional	2
Corallinaceae	●●●	Frequent	3
Corallina officinalis	●●●	Occasional	2
Mastocarpus stellatus	●●●	Occasional	2
Chondrus crispus	●●●	Occasional	2
Ceramium nodulosum	●●●	Occasional	2
Osmundea pinnatifida	●●●	Frequent	2
Polysiphonia	●●	Occasional	2
Cladostephus spongiosus	●●●	Occasional	2
Fucus serratus	●●●●	Frequent	5
Fucus vesiculosus	●●	Occasional	2
Enteromorpha intestinalis	●●	Occasional	1
Ulva lactuca	●●●●	Occasional	4

LS.LBR.Sab.Salv *Sabellaria alveolata* reefs on sand-abraded eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Cobbles; boulders; pebbles; sand
Zone:	Eulittoral - mid, Eulittoral - lower
Height band:	Mid shore, Lower shore
Other features:	Sand-abraded

Previous code

MLR.Sab.Salv	97.06
MLR.Sab	96.7
LMXD.SAB	6.95

Biotope description

Exposed to moderately exposed bedrock and boulders in the eastern basin of the Irish Sea (and as far south as Cornwall) characterised by reefs of the polychaete *Sabellaria alveolata*. The sand based tubes formed by *S. alveolata* form large reef-like hummocks, which serve to stabilise the boulders and cobbles. Other species in this biotope include the barnacles *Semibalanus balanoides* and *Elminius modestus* and the limpet *Patella vulgata*, the winkle *Littorina littorea*, the mussel *Mytilus edulis* and the whelk *Nucella lapillus*. The anemone *Actinia equina* and the crab *Carcinus maenas* can be present in cracks and crevices on the reef. Low abundance of seaweeds tend to occur in areas of eroded reef. The seaweed diversity can be high and may include the foliose red seaweeds *Palmaria palmata*, *Mastocarpus stellatus*, *Osmundea pinnatifida*, *Chondrus crispus* and some filamentous species e.g. *Polysiphonia* spp. and *Ceramium* spp. Coralline crusts can occur in patches. Wracks such as *Fucus vesiculosus*, *Fucus serratus* and the brown seaweed *Cladostephus spongiosus* may occur along with the ephemeral green seaweeds *Enteromorpha intestinalis* and *Ulva lactuca*. On exposed surf beaches in the south-west *S. alveolata* forms a crust on the rocks, rather than the classic honeycomb reef form, and may be accompanied by the barnacle *Balanus perforatus* (typically common to abundant). On wave-exposed shores in Ireland, the wrack *Himanthalia elongata* can also occur.

Situation

Above Salv are biotopes dominated either by ephemeral seaweeds, such as *Enteromorpha* spp. and *Porphyra* spp. or the perennial wrack *Fucus vesiculosus* on mixed substrata (FvesB; Fves.X; EphX; EntPor). Rockpool biotopes dominated by the red seaweed *Corallina officinalis* (Cor), by wracks such as *Fucus* spp. or by kelp such as *Laminaria* spp. (FK) can usually be found above this biotope. Beneath this biotope is a community consisting of mixed scour-tolerant like the kelp *Laminaria digitata* and opportunistic foliose red seaweeds such as *Polyides rotundus* and *Ahnfeltia plicata* (Ldig.Ldig; XKScrR; EphR; PolAhn). In adjacent sediment areas *Lanice conchilega* may dominante (Lan).

Temporal variation

These reefs may be susceptible to storm damage in the winter, although they can regenerate remarkably quickly in a season as long as some adults are left as they facilitate the larval settlement. *S. alveolata* is tolerant to burial under sand for several weeks. Changes in desiccation over a period of time can cause part of the population to die.

Similar biotopes

IR.MIR.KR.Lhyp.Sab	Occurs in the upper infralittoral zone. Kelp such as *Laminaria* spp. are present.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Actinia equina	●●●	Occasional	2
Sabellaria alveolata	●●●●●	Common	24
Lanice conchilega	●●	Occasional	1
Semibalanus balanoides	●●●●	Frequent	8
Elminius modestus	●●	Occasional	2
Carcinus maenas	●●	Occasional	1
Patella vulgate	●●●●	Occasional	5
Gibbula cineraria	●●	Rare	1
Littorina littorea	●●●●	Frequent	6
Nucella lapillus	●●●●	Frequent	7
Mytilus edulis	●●●	Occasional	3
Palmaria palmata	●●●	Occasional	2
Corallinaceae	●●●	Frequent	3
Corallina officinalis	●●●	Occasional	2
Mastocarpus stellatus	●●●	Occasional	2
Chondrus crispus	●●●	Occasional	2
Ceramium nodulosum	●●●	Occasional	2
Osmundea pinnatifida	●●●	Frequent	2
Polysiphonia	●●	Occasional	2
Cladostephus spongiosus	●●●	Occasional	2
Fucus serratus	●●●●	Frequent	5
Fucus vesiculosus	●●	Occasional	2
Enteromorpha intestinalis	●●	Occasional	1
Ulva lactuca	●●●●	Occasional	4

LS.LBR.LMus Mixed sediment shores with mussels

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)	SLR.Mx	97.06
Wave exposure:	Exposed, Moderately exposed, Sheltered, Very sheltered, Extremely sheltered		
Tidal streams:			
Substratum:	Mixed sediment, shell debris, mixed boulders, cobbles and pebbles on muddy sediment		
Zone:			
Height band:	Mid shore, Lower shore		

Biotope description

Mixed sediment shores characterised by beds of adult mussels *Mytilus edulis* occur principally on mid and lower eulittoral mixed substrata (mainly cobbles and pebbles on muddy sediments) in a wide range of exposure conditions. In high densities the mussels bind the substratum and provide a habitat for many infaunal and epifaunal species. This biotope is also found in lower shore tide-swept areas, such as in the tidal narrows of Scottish sealochs.

Situation

Adult mussel beds can be found below a band of ephemeral green seaweeds (Eph.X) on more exposed, predominantly rocky shores. On sheltered, predominantly rocky shores either a *F. vesiculosus* dominated biotope or a biotope dominated by the wrack *Ascophyllum nodosum* (Fves.X; Asc.X) can be found above or the barnacle dominated biotope (Sem.LitX).

Temporal variation

The temporal stability of mussel beds can vary a lot. Some beds are permanent, maintained by recruitment of spat in amongst adults. Other beds are ephemeral, an example of which are beds ocurring at South America Skear where large amounts of spat settle intermittently on a cobble basement. The mussels rapidly build up mud, and are unable to remain attached to the stable cobbles. They are then liable to be washed away during gales. A second example of ephemeral mussel dominated biotopes occurs when mussel spat ("mussel crumble") settles on the superficial shell of cockle beds, such as is known to occur in the Burry Inlet.

LS.LMx.LMus.Myt *Mytilus edulis* beds on littoral sediments

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	mixed sediment, sand, mud
Zone:	
Height band:	Mid shore, Lower shore

Previous code

SLR.MX.MytX	97.06
LMXD.MYT	6.95

Biotope description

Dense aggregations of *Mytilus edulis* on the mid and lower shore, on mixed substrata (mainly cobbles and pebbles on fine sediments), on sand, or on sheltered muddy shores. In high densities the mussels bind the substratum and provide a habitat for many infaunal and epifaunal species. The wrack *Fucus vesiculosus* is often found attached to either the mussels or cobbles and it can be abundant. The mussels are often encrusted with the barnacles *Semibalanus balanoides*, *Elminius modestus* or *Balanus crenatus*. Where boulders are present they can support the limpet *Patella vulgata*. The winkles *Littorina littorea* and *L. saxatilis* and small individuals of the crab *Carcinus maenas* are common amongst the mussels, whilst areas of sediment may contain the lugworm *Arenicola marina*, the sand mason *Lanice conchilega*, the cockle *Cerastoderma edule*, and other infaunal species. The characterising species list shown below is based on data from epifaunal sampling only. Three sub-biotopes are recognised for this biotope, distinguished principally on the basis of the sediment type associated with the mussel beds. The three types of intertidal mussel beds may be part of a continuum on an axis that is most strongly influenced by the amount of pseudofaeces that accumulate amongst the mussels. The differences may not always be directly connected to the underlying substratum on which the mussel bed may have started a long time ago. It should be noted that there are few data available for the muddy (Myt.Mu) and sandy (Myt.Sa) sub-biotopes, therefore there are no characterising species lists or comparative tables for these two sub-biotopes.

Situation

On more exposed, predominantly rocky shores this biotope can be found below a band of ephemeral green seaweeds (Eph.X). On sheltered, predominantly rocky shores either a *F. vesiculosus* dominated biotope or a biotope dominated by the wrack *Ascophyllum nodosum* (Fves.X; Asc.X) can be found above or the barnacle dominated biotope (Sem.LitX). On mudflats and sandflats, this biotope may be found alongside *Cerastoderma edule* beds (CerPo) and other LMU and LSA biotopes. The intertidal Myt biotope can extend seamlessly into the subtidal.

Temporal variation

The temporal stability of mussel beds can vary a lot. Some beds are permanent, maintained by recruitment of spat in amongst adults. Other beds are ephemeral, an example of which are beds ocurring at South America Skear where large amounts of spat settle intermittently on a cobble basement. The mussels rapidly build up mud, and are unable to remain attached to the stable cobbles. They are then liable to be washed away during gales. A second example of ephemeral mussel dominated biotopes occurs when mussel spat ("mussel crumble") settles on the superficial shell of cockle beds, such as is known to occur in the Burry Inlet.

Similar biotopes

LR.HLR.MusB.Sem.LitX	Occurs exclusively on rock, sometimes higher on the shore than Myt. It has a similar species composition, but *M. edulis* occurs in low abundance (Occasional) while *L. saxatilis* occurs at an abundance of frequent or above.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Lanice conchilega	••	Frequent	2	
Semibalanus balanoides	•••••	Frequent	15	
Elminius modestus	•••	Frequent	5	
Carcinus maenas	•••	Occasional	3	
Patella vulgata	••	Occasional	1	
Littorina littorea	•••••	Common	20	
Littorina saxatilis	••	Occasional	1	
Mytilus edulis	•••••	Abundant	39	
Fucus vesiculosus	•••	Occasional	4	

LS.LMx.LMus.Myt.Mx *Mytilus edulis* beds on littoral mixed substrata

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered, Very sheltered
Tidal streams:	
Substratum:	Mixed boulders, cobbles and pebbles on sand and muddy sand
Zone:	
Height band:	Mid shore, Lower shore

Previous code

SLR.MX.MytX (part)	97.06
LMXD.MYT (part)	6.95

Biotope description

Mid and lower shore mixed substrata (mainly cobbles and pebbles on fine sediments) in a wide range of exposure conditions and with aggregations of the mussel *Mytilus edulis* colonising mainly the sediment between cobbles, though they can extend onto the cobbles themselves. The mussel aggregations can be very dense and support various age classes. In high densities the mussels bind the substratum and provide a habitat for many infaunal and epifaunal species. The wrack *Fucus vesiculosus* is often found attached to either the mussels or the cobbles and it can occur at high abundance. The mussels are also usually encrusted with the barnacles *Semibalanus balanoides*, *Elminius modestus* or *Chtamalus* spp., especially in areas of reduced salinity. The winkles *Littorina littorea* and *L. saxatilis* and small individuals of the crab *Carcinus maenas* are common amongst the mussels, whilst areas of sediment may contain the lugworm *Arenicola marina*, the sand mason *Lanice conchilega* and other infaunal species. Pools are often found within the mussel beds that support algae such as *Chondrus crispus*. Where boulders are present they can support the limpet *Patella vulgata*, the dogwhelk *Nucella lapillus* and the anemone *Actinia equina*. *Ostrea edulis* may occur on the lowest part of the shore. There are few infaunal samples for this biotope, hence the characterising species list below shows only epifauna. Where infaunal samples have been collected for this biotope, they contain a highly diverse range of species including nematodes, *Anaitides mucosa*, *Hediste diversicolor*, *Polydora* spp., *Pygospio elegans*, *Eteone longa*, oligochaetes such as *Tubificoides* spp., *Semibalanus balanoides*, a range of gammarid amphipods, *Corophium volutator*, *Jaera forsmani*, *Crangon crangon*, *Carcinus maenas*, *Hydrobia ulvae* and *Macoma balthica*.

Situation

On more exposed, predominantly rocky shores this biotope can be found below a band of ephemeral green seaweeds (Eph.X). On sheltered, predominantly rocky shores either a *F. vesiculosus* dominated biotope or a biotope dominated by the wrack *Ascophyllum nodosum* (Fves.X; Asc.X) can be found above or the barnacle dominated biotope (Sem.LitX). This biotope is also found in lower shore tide-swept areas, such as in the tidal narrows of Scottish sealochs.

Temporal variation

Under sheltered conditions, pseudofaeces may build up over time, creating a layer of mud and changing the biotope to Myt.Mu. Where the stability of the mussed bed depends on the mussels being attached to stable cobbles, a build-up of mud from pseudofaeces may prevent this attachment, making the mussel bed unstable and liable to be washed away during storms.

Similar biotopes

LR.HLR.MusB.Sem.LitX	Occurs exclusively on rock, sometimes higher on the shore than Myt. It has a similar species composition, but *M. edulis* occurs in low abundance (Occasional) while *L. saxatilis* occurs at an abundance of frequent or above.
LS.LMx.LMus.Myt.Sa	Occurs on sand and muddy sand flats where no cobbles and boulders are present. Rocky shore epifauna does not occur, but the sediment infauna is a lot more diverse, characterised by a range of bivalve and polychaete species.
LS.LMx.LMus..Myt.Mu	Occurs in sheltered conditions on mudflats. Rocky shore epifauna does not occur. The sediment is anoxic and therefore relatively few infaunal species are present.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Lanice conchilega	••	Frequent	2	
Semibalanus balanoides	•••••	Frequent	15	
Elminius modestus	•••	Frequent	5	
Carcinus maenas	•••	Occasional	3	
Patella vulgata	••	Occasional	1	
Littorina littorea	•••••	Common	20	
Littorina saxatilis	••	Occasional	1	
Mytilus edulis	•••••	Abundant	39	
Fucus vesiculosus	•••	Occasional	4	

LS.LMx.LMus.Myt.Sa *Mytilus edulis* beds on littoral sand

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	
Substratum:	Sand and muddy sand
Zone:	
Height band:	Mid shore, Lower shore

Previous code

SLR.MX.MytX (part)	97.06
LMXD.MYT (part)	6.95

Biotope description

This sub-biotope occurs on mid to lower shore sand and muddy sand. Mussels *Mytilus edulis* grow attached to shell debris and live cockles *Cerastoderma edule*, forming patches of mussels on consolidated shell material, and often growing into extensive beds. The mussel valves are usually encrusted with barnacles such as *Elminius modestus* and *Semibalanus balanoides*, and the mussel bed provides a habitat for a range of species including *Littorina littorea*. The sediment infaunal community is usually rich and very similar to that of cockle beds (CerPo), including cockles *Cerastoderma edule*, the baltic tellin *Macoma balthica*, and a range of burrowing crustaceans and polychaetes typical for CerPo. Further species may be present are the sand mason *Lanice conchilega*, the sand gaper *Mya arenaria*, the peppery furrow shell *Scrobicularia plana*, *Nephtys* spp., and the ragworm *Hediste diversicolor*. Scattered fronds of eelgrass *Zostera noltii* may occur.

Situation

This biotope often occurs in large sandy estuaries, or on enclosed shores, alongside other sand and muddy sand biotopes, most notably CerPo. It is possible that Lanice beds (Lan) occur lower down on the shore.

Temporal variation

Where this sub-biotope occurs in very sheltered conditions on muddy sand, it could change to Myt.Mu over time as pseudofaeces build up forming a layer of mud. This cannot happen where wave action or tidal streams wash away pseudofaeces and prevent a build up. In areas where mussel spat ("mussel crumble") settles on the surface shell layer of cockle beds, the mussel cover may be ephemeral, as is the case in the Burry Inlet.

Similar biotopes

LS.LSa.MuSa.CerPo	Occurs in very similar physical conditions. *M. edulis* is not present or only present in low abundances, and does not form beds on the sediment surface. The infaunal community is very similar.
LS.LMx.LMus.Myt.Mx	Occurs on mixed substrata, often in more exposed conditions near predominantly rocky areas. Cobbles and boulders support epifaunal species typical of rocky shores, whereas the sediment infauna is more limited.
LS.LMx.LMus.Myt.Mu	Occurs in more sheltered conditions on mudflats. The sediment is anoxic and the infauna therefore a lot less diverse than that of Myt.Sa. Cockles *C. edule* do not occur.

LS.LMx.LMus.Myt.Mu *Mytilus edulis* beds on littoral mud

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	
Substratum:	Sandy mud and mud
Zone:	
Height band:	Mid shore, Lower shore

Previous code

SLR.MX.MytX (part)	97.06
LMXD.MYT (part)	6.95

Biotope description

Dense mussel beds found in sheltered conditions on mud. There is a build up of pseudofaeces that results in a bed that is very soft to walk on, and sediment which is anoxic to the surface. Pools are often present in the mussel bed but they tend to contain few species. The sediment infauna is very poor as a result of anoxic conditions. The mussel valves are usually clean, without epifaunal growth. Where this biotope occurs naturally, all age classes are found within the mussel bed. This biotope also includes commercially laid mussel beds on soft sediments, which tend to be of uniform age structure. The species diversity of this sub-biotope is a lot lower than that of the other Myt sub-biotopes.

Situation

Occurs on sheltered mudflats, or areas that were previously rocky or cobble fields, but where pseudofaeces have accumulated, leading to the presence of a thick layer of mud.

Temporal variation

Mussels may settle on areas of cobble or mixed sediment (Myt.Mx), and lead to the build-up of a thick layer of pseudofaeces, changing the biotope to Myt.Mu over time. The layer of mud can prevent the attachment of mussels to the underlying stable substratum, thus making the mussel bed liable to be washed away during storms. This is known to occur in areas of Morecambe Bay.

Similar biotopes

LS.LMx.LMus.Myt.Mx	Occurs on mixed substrata, often in more exposed conditions near predominantly rocky areas. Species diversity is higher, with cobbles and boulders supporting epifaunal species typical of rocky shores, and limited infauna present in sediment patches.
LS.LMx.LMus.Myt.Sa	Occurs on sand and muddy sand. As well as mussel beds, there is a diverse infaunal community including a range of bivalves such as *Cerastoderma edule* and *Macoma balthica*, and a range of polychaetes.

LS.LMp Littoral macrophyte-dominated sediment

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt), Reduced (18-30ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Sandy or muddy sediments
Zone:	Littoral fringe
Height band:	Strandline, Upper shore, Mid shore

Biotope description

Littoral macrophyte-dominated sediment biotopes include saltmarshes on the upper shore and seagrass beds on the mid and upper shore. These higher plant-dominated communities develop on sheltered shores with fine, often muddy, sediments. The character of saltmarsh communities is affected by height up the shore, resulting in a zonation pattern related to the degree or frequency of immersion in seawater. Saltmarsh and seagrass bed vegetation is generally well studied; its classification is fully covered by the UK National Vegetation Classification, where 26 types are defined (Rodwell, 2000). Users are referred to the chapter on saltmarsh communities in Rodwell (2000) for details on the plant communities which characterise the different littoral macrophyte-dominated biotopes.

Situation

Saltmarshes are found on the upper shore above sheltered sand, muddy sand, and mud biotopes, generally confined to estuaries and other sheltered marine inlets. Seagrass beds are most frequently found on lower estuary and sheltered coastal muddy sands.

Temporal variation

There may be seasonal variation in the area covered by intertidal seagrass beds and saltmarshes, as plants die back during cold temperatures in winter. Intertidal seagrass beds may also be subject to heavy grazing by geese, which can reduce the extent of the plant cover significantly.

LS.LMp.Sm Saltmarsh

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt), Reduced (18-30ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Sandy or muddy sediments
Zone:	Littoral fringe
Height band:	Strandline, Upper shore

Previous code

LMU.SM	97.06
LMUD.SAL	6.95

Biotope description

Angiosperm-dominated stands of vegetation, occurring on the extreme upper shore of sheltered coasts and periodically covered by spring high tides. The vegetation develops on a variety of sandy and muddy sediment types and may have admixtures of coarser material. The character of the saltmarsh communities is affected by height up the shore, resulting in a zonation pattern related to the degree or frequency of immersion in seawater. Saltmarsh vegetation is generally well studied; its classification is fully covered by the UK National Vegetation Classification, where 26 types are defined (Rodwell, 2000). The species listed below give a general indication of the infaunal component of saltmarsh communities. Users are referred to the chapter on saltmarsh communities in Rodwell (2000) for details on the plant communities which characterise the different saltmarsh biotopes.

Situation

On the upper shore above sheltered sand, muddy sand, mud, and more marine biotopes. Saltmarshes are generally confined to estuaries and other sheltered marine inlets.

Temporal variation

Saltmarsh vegetation tends to die back during the winter season due to cold temperatures and increased storminess, and saltmarshes may increase in area during the growing period in summer. This is particularly the case for the *Salicornia* spp. - dominated pioneer saltmarsh communities at the lower end of the saltmarsh zone.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Hediste diversicolor	••	Abundant	19	110
Manayunkia aestuarina	••	Frequent	3	333
Enchytraeidae	•••	Common	53	728
Corophium volutator	•••	Abundant	18	165
Hydrobia ulvae	••	Common	4	603

LS.LMp.LSgr Seagrass beds on littoral sediments

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Muddy sand
Zone:	
Height band:	Mid shore

Previous code

LMU.Zos	97.06

Biotope description

Mid and upper shore wave-sheltered muddy fine sand or sandy mud with narrow-leafed eel grass *Zostera noltii* at an abundance of frequent or above. Exactly what determines the distribution of *Z. noltii* is not entirely clear. It is often found in small lagoons and pools, remaining permanently submerged, and on sediment shores where the muddiness of the sediment retains water and stops the roots from drying out. An anoxic layer is usually present below 5 cm sediment depth. The infaunal community is characterised by polychaetes *Scoloplos armiger, Pygospio elegans* and *Arenicola marina*, oligochaetes, spire shell *Hydrobia ulvae*, and bivalves *Cerastoderma edule* and *Macoma balthica*. The green algae *Enteromorpha* spp. may be present on the sediment surface. The characterising species lists below give an indication both of the epibiota and of the sediment infauna that may be present in intertidal seagrass beds. The biotope is described in more detail in the National Vegetation Classification (see the chapter on saltmarsh communities in Rodwell, 2000).

Situation

Znol is most frequently found on lower estuary and sheltered coastal muddy sands, together with biotopes such as CerPo.

Temporal variation

There may be seasonal variation in the area covered by intertidal seagrass beds, as plants die back during cold temperatures in winter. Intertidal seagrass beds may also be subject to heavy grazing by geese, which can reduce the extent of the plant cover significantly. The rhizomes of the plants will remain in place within the sediment in both situations.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Scoloplos armiger	••••	Super-abundant	23	327
Pygospio elegans	•••	Common	5	371
Arenicola marina	•••••	Abundant	11	39
Arenicola marina	••	Abundant	7	
OLIGOCHAETA	••	Common	1	50
Hydrobia ulvae	••	Common	2	1322
Cerastoderma edule	•••	Abundant	4	138
Macoma balthica	•••••	Common	47	202
Enteromorpha	••	Present	2	
Zostera	••••	Present	82	
Zostera noltii	••	Common	2	

LS.LMp.LSgr.Znol *Zostera noltii* beds in littoral muddy sand

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Muddy sand
Zone:	
Height band:	Mid shore

Previous code

LMS.Zos.Znol	97.06
LMS.PCer.Znol	96.7
LMUD.HS.Z	6.95

Biotope description

Mid and upper shore wave-sheltered muddy fine sand or sandy mud with narrow-leafed eel grass *Zostera noltii* at an abundance of frequent or above. It should be noted that the presence of *Z. noltii* as scattered fronds does not change what is otherwise a muddy sand biotope. Exactly what determines the distribution of *Z. noltii* is not entirely clear. It is often found in small lagoons and pools, remaining permanently submerged, and on sediment shores where the muddiness of the sediment retains water and stops the roots from drying out. An anoxic layer is usually present below 5 cm sediment depth. The infaunal community is characterised by the polychaetes *Scoloplos armiger*, *Pygospio elegans* and *Arenicola marina*, oligochaetes, the spire shell *Hydrobia ulvae*, and the bivalves *Cerastoderma edule* and *Macoma balthica*. The green algae *Enteromorpha* spp. may be present on the sediment surface. The characterising species lists below give an indication both of the epibiota and of the sediment infauna that may be present in intertidal seagrass beds. The biotope is described in more detail in the National Vegetation Classification (see Rodwell, 2000).

Situation

Znol is most frequently found on lower estuary and sheltered coastal muddy sands, together with biotopes such as CerPo.

Temporal variation

There may be seasonal variation in the area covered by intertidal seagrass beds, as plants die back during cold temperatures in winter. Intertidal seagrass beds may also be subject to heavy grazing by geese, which can reduce the extent of the plant cover significantly. The rhizomes of the plants will remain in place within the sediment in both situations.

Similar biotopes

LS.LSa.MuSa.CerPo	Occurs under more estuarine but otherwise similar conditions. The infaunal communities are similar, but *Zostera* spp. are absent.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Scoloplos armiger	••••	Super-abundant	23	327
Pygospio elegans	•••	Common	5	371
Arenicola marina	•••••	Abundant	11	39
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OLIGOCHAETA	••	Common	1	50
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Macoma balthica	•••••	Common	47	202
Enteromorpha	••	Present	2	
Zostera	••••	Present	82	
Zostera noltii	••	Common	2	

Hierarchical Structure Diagram for Littoral Sediment

Littoral sediment LS											
Littoral coarse sediment LCS	Littoral sand LSa				Littoral mud LMu		Littoral mixed sediment LMx		Littoral macrophyte-dominated sediment LMp		Littoral biogenic reefs LBR	
Shingle and gravel shores Sh	Strandline St	Barren or amphipod dominated mobile sand shores MoSa	Polychaete / amphipod dominated fine sand shores FiSa	Polychaete / bivalve dominated muddy sand shores MuSa	Polychaete / bivalve dominated mid estuarine mud shores MEst	Polychaete / oligochaete dominated upper estuarine mud shores UEst	Hediste diversicolor-dominated gravelly-sandy mud shores GvMu	Species-rich mixed sediment shores Mx	Saltmarsh Sm	Littoral seagrass beds LSgr	Littoral *Sabellaria alveolata* reefs Sab	Mixed sediment shores with mussels LMus
BarSh	Tal	BarSa	Po	MacAre	NhomMacStr	NhomStr	HedMx	CirCer	NVC types	Znol	Salv	Myt
Pec	MytFab	Ol	Po.Pful	CerPo	HedMac	Hed	HedMx.Mac					Myt.Mx
		Ol.FS	Po.Aten	HedMacEte	HedMacScr	Hed.Str	HedMx.Scr					Myt.Sa
		Ol.VS	Po.Ncir	BatCare		Hed.Cvol	HedMx.Str					Myt.Mu
		AmSco		Lan		Hed.Ol	HedMx.Cir					
		AmSco.Sco				Tben	HedMx.Cvol					
		AmSco.Eur										
		AmSco.Pon										

Littoral sediment
LS

Littoral coarse sediment LCS		Littoral sand LSa					Littoral mud LMu			Littoral mixed sediment LMx			Littoral macrophyte-dominated sediment LMp			Littoral biogenic reefs LBR	
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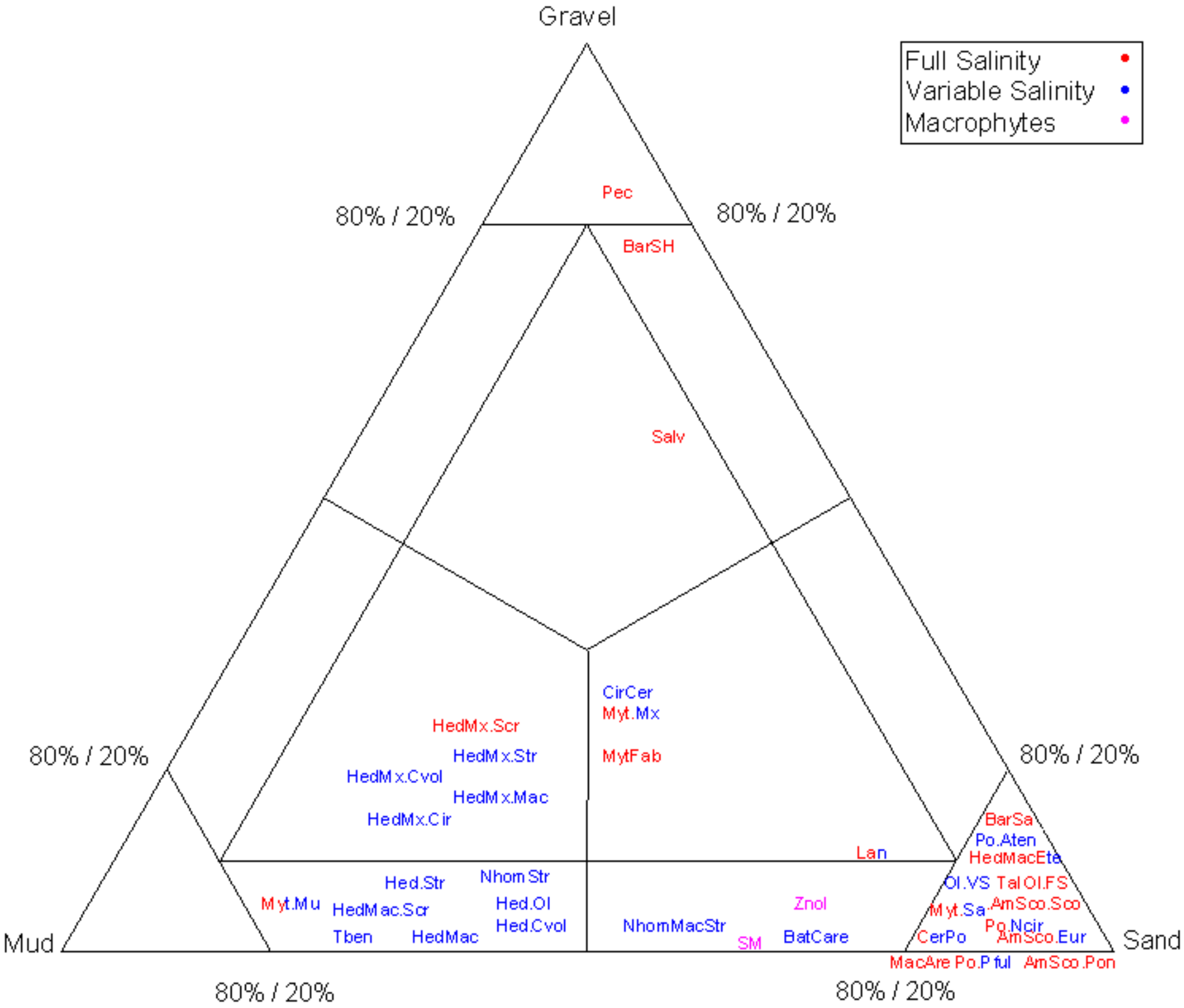
BarSh		Tal	BarSa	Po	MacAre		NhomMacStr	NhomStr		HedMx	CirCer		NVC types	Znol		Salv	Myt
Pec		MytFab	Ol	Po.Pful	CerPo		HedMac	Hed		HedMx.Mac							Myt.Mx
			Ol.FS	Po.Aten	HedMacEte		HedMacScr	Hed.Str		HedMx.Scr							Myt.Sa
			Ol.VS	Po.Ncir	BatCare			Hed.Cvol		HedMx.Str							Myt.Mu
			AmSco		Lan			Hed.Ol		HedMx.Cir							
			AmSco.Sco					Tben		HedMx.Cvol							
			AmSco.Eur														
			AmSco.Pon														


Gravel
Full Salinity
Variable Salinity
Macrophytes
Pec
80% / 20%
80% / 20%
BarSH
Salv
CirCer
Myt.Mx
HedMx.Scr
HedMx.Str
MytFab
80% / 20%
80% / 20%
HedMx.Cvol
HedMx.Mac
HedMx.Cir
BarSa
Po.Aten
HedMacEte
Lan
Hed.Str
NhomStr
Ol.VS TalOl.FS
Myt.Mu
HedMac.Scr
Hed.Ol
Znol
Myt.Sa
AmSco.Sco
Hed.Cvol
NhomMacStr
Po.Ncir
Tben
HedMac
SM
BatCare
CerPo
AmSco.Eur
Mud
Sand
MacAre Po.P ful
AmSco.Pon
80% / 20%
80% / 20%

SALT-MARSH COMMUNITIES

INTRODUCTION TO SALT-MARSH COMMUNITIES

The sampling and analysis of salt-marsh vegetation

The herbaceous vascular vegetation on the intertidal silts and sands of salt-marshes is one of the most frequently used illustrations of ecological pattern but there are considerable difficulties in producing an adequate national classification of the plant communities of this distinctive habitat.

First, much salt-marsh vegetation is species-poor. There is little problem in sampling and sorting monospecific stands but, in many cases, a small number of species occur with varying abundance in a wide variety of combinations on salt-marshes. Early accounts of this vegetation (e.g. Tansley 1911, 1939) relied heavily on dominance in an attempt to make sense of such variation, but, as Dalby (1970) noted, this may obscure patterning among less conspicuous species that it is sensible to try and interpret. Furthermore, there has been a tendency in Britain to lump more complex vegetation, less susceptible to analysis, into a 'general salt-marsh' community. This term has sometimes been applied in its original, broad sense (Tansley 1911) to vegetation 'not dominated by any single species, except locally' and varying 'from place to place according to local conditions and to the accidents of colonisation by different species'; on other occasions (e.g. Chapman 1934), it has been used to denote a more clearly-defined community.

Second, on many salt-marshes there is a site-related element in the floristic variation among the communities which reflects particular local histories of marsh use or unique combinations of environmental conditions. Detailed studies of limited areas of salt-marsh (e.g. Yapp & Johns 1917, Chapman 1934, Dalby 1970, Packham & Liddle 1970, Gray & Bunce 1972) can be particularly valuable in elucidating such local patterns of variation but the use of a single suite of salt-marshes as a reference point for interpreting floristic variation throughout the country can be misleading. The especially attractive and varied salt-marshes of the north Norfolk coast have been frequently employed in such a way and this has bequeathed to us a perspective in which the salt-marshes of the north and west tend to be underrated. On the other hand, to treat all local variation on an equal level would produce a very cumbersome national classification.

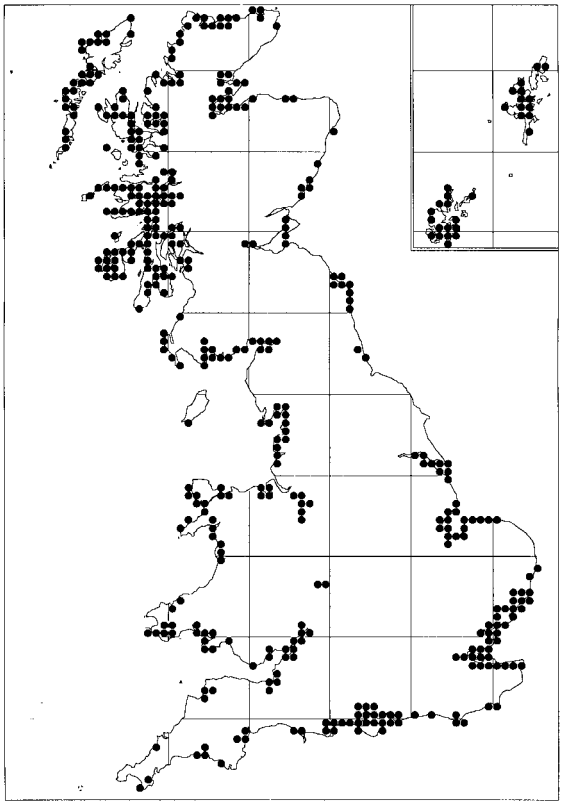
A third point is that 'salt-marsh' is as much a habitat as a group of plant communities and, although the vegetation itself plays some part in salt-marsh development, the physiographic boundaries of the habitat do not exactly coincide with a well-circumscribed range of communities. The salt-marsh flora has two major components: a halophyte element more or less confined to this particular kind of saline environment and an element comprising species which are widespread in inland, non-saline habitats. The latter species are commonly referred to as glycophytes, although it is possible that they include some distinct ecotypes which differ markedly from their inland counterparts in their physiological tolerances. Communities consisting predominantly or entirely of halophytes can sensibly be termed salt-marsh vegetation types but, towards the upper marsh limit and, in some areas (like the grazed marshes of the north and west) more extenstively, communities consisting mainly or exclusively of glycophytes also occur in the salt-marsh habitat. These may extend well into the zone of tidal influence but they are often far from the common conception of salt-marsh vegetation. Some are perhaps best seen as highly modified forms of more typical salt-marsh communities produced by specialised treatments. Others probably reflect coincidences of environmental conditions which, though not especially coastal, occur only on salt-marshes. Deciding whether a particular vegetation type is more closely related to a mainstream salt-marsh community or a predominantly inland community is sometimes very difficult.

Finally, algae are often a conspicuous feature of salt-marsh vegetation and a decision has to be taken about whether or not to record them with the vascular flora and employ them in the analysis of data. Although there are some difficulties of identification with these taxa,

especially among the microscopic species, a number of schemes have been proposed for the classification of algal communities on salt-marshes (e.g. Cotton 1912, Carter 1932, 1933*a*, *b*, Chapman 1974, Polderman 1979, Polderman & Polderman-Hall 1980). These suggest that the concordance of algal assemblages with vascular plant communities may not be precise. In addition, algal communities appear to be subject to greater seasonal changes and, at least where the smaller species are concerned, to be organised on a finer scale. For the most part, therefore, vascular communities appear to be superimposed upon a distinct, more changeable and finer pattern of algal vegetation.

In an attempt to take account of such difficulties, Adam (1976, 1981) collected almost 3000 new samples of vegetation from British salt-marshes and his classification forms the basis of the scheme presented here. Adam's geographical coverage was extensive but some stretches of coastline were sparsely sampled (the Hampshire coast and south-west England) and others unvisited by him (the Thames estuary, the Humber and eastern Scotland). Where possible, this under-representation has been rectified by our own sampling programme and by the generous donation of external data, most notably from Birse & Robertson (1976), Hilliam (1977) and Birse (1980), which considerably extended coverage, particularly in eastern Scotland, Orkney and Shetland (Figure 4).

Figure 4. Distribution of samples available from salt-marshes.



Adam did not include the *Zostera* vegetation of flats in his survey but some very limited sampling by the survey team and a good deal of qualitative information forms the basis of an outline description included here. The work of Lee (1975, 1977) has also enabled a fuller account to be given of those communities represented in inland saline habitats. It has been possible, too, to integrate Adam's data with samples of swamps, mires and mesotrophic grasslands widely distributed inland and so produce a coherent account of some of the communities of the upper salt-marsh. However, the vegetation of brackish pools and ditches and the grassy sea-banks and walls characteristic of many reclaimed sites (Beeftink 1975, Gray 1977, Adam & Akeroyd 1978) remains under-sampled.

As with other sections of the National Vegetation Classification, floristic data alone were used to characterise the vegetation types, any available environmental or site information being employed afterwards to help provide an ecological interpretation to the various sample groups distinguished.

The description of salt-marsh communities

Adam warned about the difficulty of generalising from a national scheme to a particular local situation and the same caution should be applied to this expanded and modified classification. Two of the communities distinguished are especially problematic in this respect: the *Puccinellia maritima* salt-marsh (SM13, *Puccinellietum maritimae* (Warming 1906) Christiansen 1927) and the *Festuca rubra* salt-marsh (SM16, *Juncetum gerardi* Warming 1906). These both encompass a very wide range of floristic variation, the internal differences between the sub-communities being almost as great as those features which distinguish these vegetation types from other salt-marsh communities. Although the sub-communities characterised should be useful in discussing national variation, they may well be of less value in local small-scale studies and, in certain cases, it might be appropriate to devise *ad hoc* classifications within these major types for particular sites.

Although Adam's approach was phytosociological, it was an important feature of his work that he classified the samples without prior reference to existing schemes devised for salt-marshes in other parts of Europe (e.g. Beeftink 1962, 1965, 1966, Géhu 1975). Nevertheless, there is a striking similarity between many of his final groups and the salt-marsh associations of Continental classifications and much British vegetation of this kind can be seen as extending the known distribution of

previously-described communities. It is less easy to relate the vegetation types characterised here to those in earlier descriptive accounts of British salt-marshes where floristic definition was sometimes vague and units often rather heterogeneous.

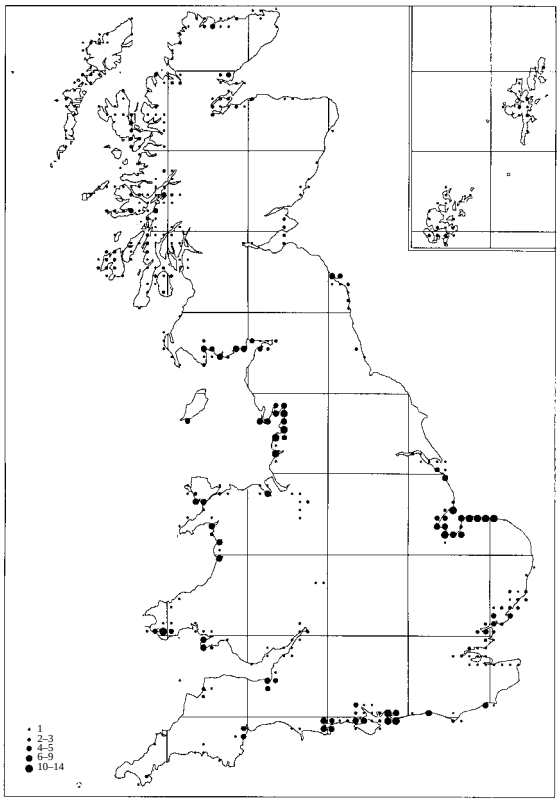
A total of 28 communities of salt-marsh vegetation has been characterised from the available data (Figure 5). These can be conveniently reviewed under four main heads: eel-grass and tassel-weed communities of tidal flats, pools and ditches (3 communities), communities of the lower salt-marsh (13), communities of the middle salt-marsh (9) and communities of the upper salt-marsh (3). Brief mention is also made below of vegetation types that are treated in other volumes but which sometimes figure prominently on salt-marshes.

Eel-grass and tassel-weed communities of tidal flats, pools and ditches

Our three native species of *Zostera* (*Z. marina*, *Z. angustifolia* and *Z. noltii*) are prominent, usually with very few other vascular species but often with abundant algae, in vegetation that occurs on the eu-littoral and sub-littoral zones of sand and silt flats. Without extensive floristic data, separate communities have not been defined here but these vegetation types are the British representatives of the eel-grass communities of the Mediterranean, west European and Baltic coasts placed in the alliance Zosterion Christiansen 1934 of the class Zosteretea marinae.

Ruppia maritima and the much rarer *Eleocharis parvula* can each occur prominently in communities of brackish pools, pans, and creeks and, in certain parts of their ranges in Britain, on the open surface of salt-marshes. Comparable vegetation elsewhere in Europe has been characterised as a *Ruppietum maritimae* Hocquette 1927 (SM2) and an *Eleocharetum parvulae* (Preuss 1911/12) Gillner 1960 (SM3) and grouped in the alliance Ruppion maritimae Br.-Bl. 1931 of the class Ruppietea maritimae J. Tüxen 1960.

Figure 5. Distribution of vegetation types characterised from salt-marshes.



Lower salt-marsh communities

Although the distinction between low, mid- and upper marsh is not a simple one, it is convenient to group together thirteen communities in which either *Spartina* spp., annual *Salicornia* spp., *Suaeda maritima* and/or *Puccinellia maritima* generally form a prominent component of the vegetation with, more unevenly, *Aster tripolium* and *Halimione portulacoides*.

Three communities dominated by *Spartina* spp. occur in Britain. By far the commonest is the *Spartina anglica* salt-marsh (SM6, *Spartinetum townsendii* (Tansley 1939) Corillion 1953), dominated by *S. townsendii sensu lato* (generally the fertile amphidiploid *S. anglica* but also occasionally with its male sterile F_1 precursor *S.* × *townsendii*). Although *S. anglica* can be found as a scattered associate in almost every salt-marsh community, the spread over the last 100 years of dense stands of this species is one of the most spectacular recent changes in the vegetation of the maritime zone of Britain. Communities dominated by its presumed parents, the native *S. maritima* (SM4, *Spartinetum maritimae* (Emb. & Regn. 1926) Corillion 1953) and the naturalised alien *S. alterniflora* (SM5, *Spartinetum alterniflorae* Corillion 1953), appear to be declining and are now much restricted in their distribution. Cord-grass vegetation of these types through western Europe and on the east coast of North America has been placed in the alliance Spartinion Conrad 1933 of the class Spartinetea maritimae R.Tx. 1961.

Annual *Salicornia* spp., *Suaeda maritima* and *Puccinellia maritima* occur together in various combinations as colonising vegetation towards the lower limit of salt-marshes and in open and disturbed areas at higher levels. Three communities have been distinguished according to the balance of the various components: the annual *Salicornia* salt-marsh (SM8, *Salicornietum europaeae* Warming 1906), *Suaeda maritima* salt-marsh (SM9, *Suaedetum maritimae* (Conrad 1935) Pignatti 1953) and

the transitional *Puccinellia-Salicornia-Suaeda* salt-marsh (SM10). Predominantly low-marsh vegetation of these kinds in which annual chenopods are prominent is grouped in the alliance Thero-Salicornion strictae Br.-Bl. 1933 *emend*. R.Tx. 1950 of the class Thero-Salicornietea Pignatti 1953 *emend*. R.Tx. in R.Tx. & Oberdorfer 1958.

The perennial relative of *Salicornia*, now termed *Arthrocnemum perenne*, occurs occasionally in Britain in a variety of salt-marsh communities but locally forms dense stands which are best treated as a distinct vegetation type similar to the *Salicornietum radicantis* Br.-Bl. 1931, traditionally separated off from the annual chenopod communities into the Salicornion fruticosae Br.-Bl. 1931 alliance of the Salicornietea fruticosae.

The five remaining low-marsh communities are all richer and more varied vegetation types than these, composed largely of perennial halophytes and, among these, the grass *Puccinellia maritimae* is of prime importance with, less frequently and more unevenly throughout, *Aster tripolium*, *Halimione portulacoides*, *Glaux maritima*, *Plantago maritima*, *Limonium* cf. *vulgare*, *Triglochin maritima*, *Armeria maritima* and *Spergularia media*.

The general relationship of these communities to phytosociological units defined from mainland Europe is fairly clear. They fall within the class Juncetea maritimae R.Tx. & Oberdorfer 1958 which also takes in much perennial mid-marsh and sea-cliff vegetation extending from the Arctic to the Mediterranean. West European salt-marsh communities are assigned to the order Glauco-Puccinellietalia Beeftink & Westhoff 1962 but, in Britain, the floristic distinction between the two major alliances, the Puccinellion maritimae Christiansen 1927 of the low-marsh and the Armerion maritimae Br.-Bl. & de Leuuw 1936 of the mid-marsh, is not as clear as on the Continent. In this country, *Armeria maritima* and, to a lesser extent, *Glaux maritima*, both considered good diagnostic species for the Armerion elsewhere in Europe, extend on to the low marsh and, indeed, are important components of some of the Puccinellion communities. Within Britain, a better general distinction between low- and mid-marsh vegetation types is the separation between the dominant role of *Puccinellia maritima* on the one hand and *Festuca rubra* and *Juncus gerardii* on the other, although, in particular situations, this too may be an unclear criterion.

In this scheme, the bulk of this remaining low-marsh vegetation is included in a single large and varied community, the *Puccinellia maritima* salt-marsh (SM13, *Puccinellietum maritimae* (Warming 1906) Christiansen 1927). This is the most widespread of all British salt-marsh vegetation types and it spans swards which grade, in one direction, to the Thero-Salicornion through an increased representation of annual chenopods and, in another, to the Armerion communities with a switch in dominance to *F. rubra*, *J. gerardii* and *Agrostis stolonifera*. As well as some rather species-poor *Puccinellia*-dominated swards, it also includes a variety of richer vegetation types, some previously considered within the ambit of a 'general salt-marsh' community and others representing local variation in which individual species attain prominence.

A second major community, especially on ungrazed sites to the south and east, is the *Halimione portulacoides* salt-marsh (SM14, *Halimionetum portulacoidis* (Kuhnholtz-Lordat 1927) Des Abbayes & Corillion 1949). This shares many species with the *Puccinellietum* and grades floristically to it, but it is generally distinct in the partial or total dominance of *H. portulacoides*. Also predominantly on ungrazed south-eastern sites, though somewhat more restricted in its distribution, is the *Aster tripolium* var. *discoideus* salt-marsh (SM11, *Asteretum tripolii* Tansley 1939). Like the *Halimionetum*, this community is often prominent on creek-sides, though it is also frequent low down on salt-marshes and shows some floristic overlap with Thero-Salicornion vegetation. Variation within *A. tripolium* is complex but a provisional community has been erected to contain stands dominated by the rayed form (SM12, cf. Sociatie van *Aster tripolium* Beeftink 1962). This is of local distribution and it shows some affinities with vegetation of brackish waters but further sampling is needed to establish its exact status and relationships. With a similar range and also showing close floristic relationships to the *Halimionetum* is vegetation with a striking local dominance of *Inula crithmoides* (SM26), a plant more geographically confined on salt-marshes than its occurrences on sea cliffs in Britain.

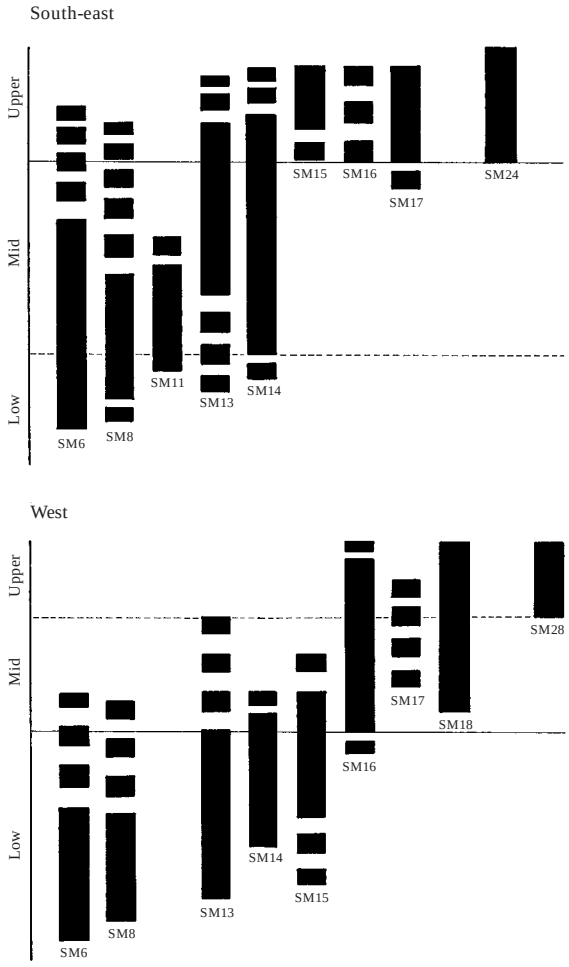
Finally, Puccinellion species form an understorey to one of the British salt-marsh communities in which *Juncus maritimus* is a physiognomic dominant. The classification of these vegetation types is problematic (Adam 1977): *J. maritimus* is dominant in certain mid-marsh communities as well as in sub-communities of the *Halimionetum* and the upper-marsh *Atriplici-Elymetum pycnanthi* (see below). However, the *Juncus maritimus-Triglochin maritima* salt-marsh (SM15) is a distinct type floristically, is the most widespread of all British *J. maritimus* communities and satisfactorily incorporates those stands in which *J. maritimus* reaches its lowest limit around our coasts. Vegetation of this type has sometimes been separated off into a separate alliance, the Halo-Scirpion (Dahl & Hadač 1971) den Held & Westhoff 1969 *nom. nov*.

Middle salt-marsh communities

Eight communities are distinguished from the middle salt-marsh zone (Figure 6). Three have a generally high frequency of *Festuca rubra*, *Juncus gerardii* and *Agrostis*

stolonifera with *Glaux maritima* and *Plantago maritima* and, more unevenly, *Armeria maritima* and *Triglochin maritima*. *Cochlearia officinalis*, *Plantago coronopus*, *Carex extensa* and *C. distans* occur patchily throughout and a variety of glycophytes, notably *Trifolium repens*, *Potentilla anserina*, *Holcus lanatus* and *Leontodon autumnalis*, attain prominence in some communities. Thero-Salicornion species such as *Puccinellia maritima*, *Halimione portulacoides* and *Limonium* cf. *vulgare* are infrequent. These communities correspond approximately to the Armerion alliance within the Glauco-Puccinellietalia.

Figure 6. Generalised salt-marsh zonations in the south-east and west of Britain. The figure shows the relative extent of the major communities with an indication of the clarity of distinctions between low, mid and upper marsh.
SM6 *Spartinetum townsendii*
SM8 *Salicornietum europaeae*
SM11 *Asteretum tripolii*
SM13 *Puccinellietum maritimae*
SM14 *Halimionetum portulacoidis*
SM15 *Juncus maritimus-Triglochin maritima* salt-marsh
SM16 *Juncetum gerardi*
SM17 *Artemisietum maritimae*
SM18 *Juncus maritimus* salt-marsh
SM24 *Atriplici-Elymetum pycnanthi*
SM28 *Elymetum repentis*



The *Festuca rubra* salt-marsh (SM16, *Juncetum gerardi* Warming 1906) is, like the *Puccinellietum*, a large and varied vegetation type with a wide distribution, especially on the grazed marshes of the north and west of Britain. It includes swards which, on the one hand, grade to the *Puccinellietum* and, on the other, show diverse affinities with brackish and freshwater inundation communities of the Elymo-Rumicion crispi, Cynosurion pastures and Caricion davallianae mires. These reflect its considerable vertical range on salt-marshes, its widespread use for grazing and turf-cutting and the disturbance and freshwater flushing which it often experiences at higher levels.

Juncetum gerardi species form an understorey to a second community, the *Juncus maritimus* salt-marsh (SM18) which includes the bulk of those mid-marsh stands in which *J. maritimus* is dominant, often with abundant *Oenanthe lachenalii* and Elymo-Rumicion species such as *Elymus repens*, *Rumex crispus* and *Atriplex prostrata*. An *Artemisia maritima* salt-marsh (SM17, *Artemisietum maritimae* Hocquette 1927) has not traditionally been characterised in British accounts but it is a distinct vegetation type which shows affinities with both the Armerion communities (especially the *F. rubra*-dominated form of the *Juncetum gerardi*) and the Puccinellion (particularly the *Halimionetum*).

The six remaining mid-marsh communities are rather specialised vegetation types of either widespread but local occurrence or restricted geographical distribution. Two are dominated by colonial members of the Cyperaceae and are especially characteristic of damp depressions and brackish sites, especially to the north and west. The *Blysmus rufus* salt-marsh (SM19, *Blysmetum rufi* (G. E. & G. Du Rietz 1925) Gillner 1960) and the *Eleocharis uniglumis* salt-marsh (SM20, *Eleocharitetum uniglumis* Nordhagen 1923) are sometimes accommodated within a distinct alliance, the Eleocharion uniglumis, and they represent a phytogeographical affinity with predominantly north European salt-marsh communities.

Two further communities are unique to Britain, and within the country confined to north Norfolk and Sussex, and are characterised by the occurrence of Mediterranean plants in highly distinctive salt-marsh/sand-dune/shingle transitions. The *Suaeda vera-Limonium binervosum* salt-marsh and the *Halimione portulacoides-Frankenia laevis* salt-marsh (SM22, perhaps equivalent

to the *Limonio vulgaris-Frankenietum laevis* Géhu & Géhu-Franck 1975) can be seen as the northernmost outpost of the vegetation of the Frankenio-Armerenion, proposed as a sub-alliance of the Armerion.

Also, within the Glauco-Puccinellietalia is the *Spergularia marina-Puccinellia distans* salt-marsh (SM23, *Puccinellietum distantis* Feekes (1934) 1945), a community which is especially characteristic of the hypersaline conditions developing in drying pans and depressions on salt-marshes, in inland saline sites and, increasingly now, along the edges of inland roads which have received heavy applications of rock-salt in frosty weather. This kind of vegetation is usually placed in the alliance Puccinellio-Spergularion salinae Beeftink 1965. Finally, among the mid-marsh communities, it is sensible to include ephemeral vegetation with *Sagina maritima*, *S. nodosa* and various local annuals which finds a place in turf-cuttings and other breaks in the salt-marsh swards of the *Puccinellietum* and *Juncetum gerardi* as an early stage in recolonisation. We have not characterised any separate communities here but referred the assemblages (SM27) more generally to the Saginion maritimae Westhoff, van Leeuwen & Adriani 1962, an alliance placed in its own class.

Upper salt-marsh communities

Of the considerable variety of vegetation types which occur on salt-marshes towards the upper limit of tidal influence, three are described in this volume. They are characterised by the general prominence of *Elymus pycnanthus* and/or *E. repens*, patchy representation of Puccinellion and Armerion species and the scattered occurrence throughout of nitrophilous weeds and plants of fresh-water inundation communities. Predominantly perennial vegetation of this kind, characteristic of European drift-lines, has been variously placed in the alliance Elymion pycnanthi of the Elymetea pycnanthi or the Elymo-Rumicion crispi Nordhagen 1940 of the Molinio-Arrhenatheretea.

Two of the communities are grass-dominated. The *Elymus pycnanthus* salt-marsh (SM24, *Atriplici-Elymetum pycnanthi* Beeftink & Westhoff 1962) is the vegetation type which commonly terminates the salt-marsh zonation in the south and east. To the north and west, it is replaced by the *Elymus repens* salt-marsh (SM28, *Elymetum repentis maritimum* Nordhagen 1940) which has a less conspicious representation of salt-marsh species and which shows more obvious floristic affinities with the halophyte forms of Elymo-Rumicion vegetation. On drift-lines on the salt-marsh/sand-dune transition at scattered localities in the south-east, a third vegetation type, the *Suaeda vera* community (SM25, *Elymo pycnanthi-Suaedetum verae* (Arènes 1933) Géhu 1975), is characteristic.

Other vegetation types on salt-marshes

A variety of vegetation types described fully in other sections of *British Plant Communities* occurs on salt-marshes where there is a combination of little tidal influence and low soil salinity with either some influence of fresh-water or types of treatment and/or disturbance characteristic of other habitats (Figure 9).

Three mesotrophic grasslands occur commonly on salt-marshes (see Rodwell 1992). Both the *Festuca rubra-Agrostis stolonifera-Potentilla anserina* inundation community (MG11) and the *Festuca arundinacea* coarse grassland (MG12, *Potentillo-Festucetum arundinaceae* Nordhagen 1940) have distinct halophyte sub-communities and are found at scattered localities, mainly on the west coast, the former sometimes extensively on the grazed open marsh, the latter more patchily on ungrazed sites and on ditch-banks where there is some brackish influence. The *Agrostis stolonifera-Alopecurus geniculatus* inundation grassland (MG13) is also widespread as small stands in areas where there is some brackish influence and poaching by stock.

Swamp vegetation may occur in estuaries and in salt-marsh ditches and pools where there is slow-moving or standing brackish water and is also occasionally encountered on the open surface of salt-marshes and around saline springs inland (Rodwell 1994*a*). Two such communities are largely confined to such situations: the *Scirpus maritimus* swamp (S21, *Scirpetum maritimi* (Br.-Bl. 1931) R.Tx. 1937), which is widespread and sometimes extensive and the *Scirpus lacustris* ssp. *tabernaemontani* swamp (S20, *Scirpetum tabernaemontani* Passarge 1964) which is more local. The *Phragmites australis* swamp (S4, *Phragmitetum australis* Gams (1927) Schmale 1939), the *Typha latifolia* swamp (S12, *Typhetum latifoliae* Soó 1927) and the *Phalaris arundinacea* tall-herb fen (S28, *Phalaridetum arundinaceae* Libbert 1931) are much more widely distributed in fresh-water habitats and salt-marsh stands are often only marginally halophyte in character.

Finally here, the *Iris pseudacorus-Filipendula ulmaria* tall-herb fen (M28, *Filipendulo-Iridetum pseudacori* Adam 1976) is a very conspicuous feature of the upper-marsh and some raised beaches on the west coast of Scotland where stands may be extensive and rich around freshwater flushes.

KEY TO SALT-MARSH COMMUNITIES

With something as complex and variable as vegetation, no key can pretend to offer an infallible short cut to diagnosis. The following should thus be seen as simply as a crude guide to identifying the types of vegetation found on salt-marshes and must always be used in conjunction with the data tables and community descriptions. It relies on floristic (and, to a lesser extent, physiognomic) features of the vegetation and demands a knowledge of the British vascular flora. It does not make primary use of any habitat features, though these may provide a valuable confirmation of a diagnosis.

Because the major distinctions between the vegetation types in the classification are based on inter-stand frequency, the key works best when sufficient samples of similar composition are available to construct a constancy table. It is the frequency values in this (and, in some cases, the ranges of abundance) which are then subject to interrogation with the key.

Samples should always be taken from homogeneous stands and be 2×2 m or 4×4 m according to the scale of the vegetation or, where stands are irregular, of identical size but different shape.

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1 Open or closed vegetation of, or overwhelmingly dominated by, a single species 2

Vegetation with two or more co-dominants or, if with a single dominant, then some other species with cover values of Domin 4–7 3

2 Open or closed vegetation of, or overwhelming dominated by:

Zostera marina, *Z. angustifolia* or *Z. noltii* on sub- or eulittoral flats, often with no other vascular plants but commonly with some fucoids and green algae

SM1 *Zostera* communities
Zosterion Christiansen 1934

Ruppia maritima, sometimes with *Potamogeton pectinatus*, *Zannichellia palustris* and/or *Ranunculus baudotii* as submerged vegetation in brackish pools, in dried-up pans or, more rarely, on open flats

SM2 *Ruppia maritima* salt-marsh
Ruppietum maritimae Hocquette 1927

Suaeda maritima in usually somewhat open vegetation and often in small stands

SM9 *Suaeda maritima* salt-marsh
Suaedetum maritimae (Conrad 1935) Pignatti 1953

Aster tripolium var. *discoideus*

SM11 *Aster tripolium* var. *discoideus* salt-marsh
Asteretum tripolii Tansley 1939

Rayed *Aster tripolium*

SM12 Rayed *Aster tripolium* stands

Variation within *Aster tripolium* is complex and the phytosociological relationships of the forms are unclear.

Puccinellia maritima in low, open or closed vegetation or occasionally in dense, tall swards but with no extensive understorey of turf fucoids

SM13 *Puccinellia maritima* salt-marsh
Puccinellietum maritimae (Warming 1906) Christiansen 1927
Puccinellia maritima dominated sub-community

In hot dry summers on the upper marsh, when the shoots of *Glaux maritima* may become shrivelled, some stands of the *Puccinellietum maritimae*, *Glaux maritima* sub-community may key out here.

Eleocharis parvula in a very diminutive sward, sometimes obscured by algae or freshly-deposited silt

SM3 *Eleocharis parvula* salt-marsh
Eleocharetum parvulae (Preuss 1911/12) Gillner 1960

Spartina maritima in isolated clumps or as extensive stands

SM4 *Spartina maritima* salt-marsh
Spartinetum maritimae (Emb. & Regn. 1926) Corillion 1963

Spartina alterniflora in a dense cover with a little *S. anglica*, *Puccinellia maritima* and *Aster tripolium*

SM5 *Spartina alterniflora* salt-marsh
Spartinetum alterniflorae Corillion 1953

Spartina anglica, sometimes with *S.* × *townsendii*, often in very extensive stands

SM6 *Spartina anglica* salt-marsh
Spartinetum townsendii (Tansley 1939) Corillion 1953

Arthrocnemum perenne in dense pure stands or as open mosaic with *Halimione portulacoides*, *Puccinellia maritima* and *Suaeda maritima*

SM7 *Arthrocnemum perenne* stands

Annual *Salicornia* spp. in usually somewhat open vegetation

SM8 Annual *Salicornia* spp. salt-marsh
Salicornietum europaeae Warming 1906

Puccinellia maritima or *Plantago maritima* with an extensive understorey of diminutive turf fucoids

SM13 *Puccinellietum maritimae*
Puccinellia maritima-turf fucoid sub-community

Glaux maritima in often small and fragmentary stands

SM13 *Puccinellietum maritimae*
Glaux maritima sub-community

Halimione portulacoides as an even-topped bushy canopy or discrete hemispherical bushes in species-poor vegetation without *Juncus maritimus*

SM14 *Halimione portulacoides* salt-marsh
Halimionetum portulacoidis (Kuhnholtz-Lordat 1927) Des Abbayes & Corillion 1949
Halimione portulacoides-dominated sub-community

Halimione portulacoides with some *Juncus maritimus* as scattered shoots or small dense patches

SM14 *Halimionetum portulacoidis*
Juncus maritimus sub-community

Small but discrete patches of these two sub-communities of the *Halimionetum* may occur in mosaics with the *Puccinellietum maritimae* and these should be distinguished from the intimate mixtures of *H. portulacoides* and *P. maritima* that characterise the *Puccinellia maritima* sub-community of the *Halimionetum*.

Juncus maritimus as small dense patches within a ground of *Halimione portulacoides*

SM14 *Halimionetum portulacoidis*
Juncus maritimus sub-community

Juncus maritimus as tall dense patches with little or no *Halimione portulacoides*

SM15 *Juncus maritimus-Triglochin maritima* salt-marsh

Juncus maritimus may also be locally dominant in the *Juncus maritimus* salt-marsh but the consistent presence there of *Festuca rubra*, *Agrostis stolonifera* and *Juncus gerardii* as an often thick understorey usually serves to separate this vegetation from the two above. *J. maritimus* may also be locally abundant in the *Atriplici-Elymetum pycnanthi* but there *Elymus pycnanthus* is consistently dominant.

Juncus gerardii as generally small and often roughly circular patches of sometimes tall vegetation

SM16 *Festuca rubra* salt-marsh
Juncetum gerardi Warming 1906
Juncus gerardii-dominated sub-community

Juncus gerardii may also be locally abundant in other sub-communities of the *Juncetum gerardi*.

Festuca rubra as a thick springy mattress of tall and dense vegetation

SM16 *Juncetum gerardi*
Sub-community with tall *Festuca rubra* dominant

Festuca rubra may also be locally abundant in the shorter swards of other sub-communities of the *Juncetum gerardi*.

Blysmus rufus in often small stands of sometimes open vegetation

SM19 *Blysmus rufus* salt-marsh
Blysmetum rufi (G. E. & G. Du Rietz 1925) Gillner 1960

Eleocharis uniglumis in often small stands of sometimes open vegetation

SM20 *Eleocharis uniglumis* salt-marsh
Eleocharitetum uniglumis Nordhagen 1923

Suaeda vera as an open bushy canopy with one or more of *Limonium binervosum*, *L. bellidifolium* or *Frankenia laevis* beneath

SM21 *Suaeda vera-Limonium binervosum* salt-marsh

Suaeda vera as a more or less closed canopy in strandline vegetation without the above species

SM25 *Suaeda vera* salt-marsh
Elymo pycnanthi-Suaedetum verae (Arènes 1933) Géhu 1975

Spergularia marina or *Puccinellia distans* in often small stands of usually somewhat open vegetation

SM23 *Spergularia marina-Puccinellia distans* salt-marsh
Puccinellietum distantis Feekes (1934) 1945

Elymus pycnanthus as stiff clumps, usually without any *Suaeda vera* or *Inula crithmoides*

SM24 *Elymus pycnanthus* salt-marsh
Atriplici-Elymetum pycnanthi Beeftink & Westhoff 1962

Elymus repens in a closed grassy sward

SM28 *Elymus repens* salt-marsh
Elymetum repentis maritimum Nordhagen 1940

Inula crithmoides, usually with some *Halimione portulacoides*

SM26 *Inula crithmoides* stands

Sagina maritima or *Plantago coronopus* in often open or fragmentary vegetation in breaks within swards of other communities, especially the *Juncetum gerardi*

SM27 Ephemeral *Sagina maritima* vegetation
Saginion maritimae Westhoff, van Leeuwen & Adriani 1962

Potentilla anserina as small stands colonising breaks within swards of other mid- and upper-marsh vegetation

SM16 *Juncetum gerardi* phase of sward regeneration in turf-cuttings

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Vegetation dominated by swamp species such as *Scirpus maritimus*, *S. lacustris* ssp. *tabernaemontani*, *Phragmites australis*, *Typha latifolia* and *Phalaris arundinacea* may be encountered on salt-marshes but these communities are included in Rodwell (1994*a*).

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3 Low swards, sometimes rather open, dominated by various mixtures of annual *Salicornia* spp., *Suaeda maritima* and *Puccinellia maritima* 4

Annual *Salicornia* spp. and *Suaeda maritima* not dominant or co-dominant 5

4 *Suaeda maritima* and annual *Salicornia* spp. co-dominant with less than 10% *Puccinellia maritima*

SM9 *Suaedetum maritimae*

Annual *Salicornia* spp., *Suaeda maritima* and *Puccinellia maritima* co-dominant in various proportions, often with a little *Aster tripolium*

SM10 Transitional low-marsh vegetation

Vegetation of this kind frequently occurs as mosaics between the *Salicornietum europaeae* and the *Puccinellietum maritimae*, *Spartinetum maritimae* and, especially in the south-east, the *Asteretum tripolii* and *Halimionetum portulacoidis*.

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5 *Aster tripolium* var. *discoideus* or rayed *Aster tripolium* dominant 6

Aster tripolium absent or present in small amounts 7

6 *Aster tripolium* var. *discoideus* dominant

SM11 *Asteretum tripolii*

Rayed *Aster tripolium* dominant

SM12 Rayed *Aster tripolium* stands

Variation within *Aster tripolium* is complex and the phytosociological relationships of the different forms are unclear.

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7 *Arthrocnemum perenne* co-dominant with *Halimione portulacoides* and some *Puccinellia maritima*

SM7 *Arthrocnemum perenne* stands

Arthrocnemum perenne absent or present in small amounts 8

8 *Puccinellia maritima* a major constituent of the vegetation 9

Puccinellia maritima absent or present in small amounts 16

9 Any of *Festuca rubra*, *Agrostis stolonifera* and *Juncus gerardii* present in more than a trace and often co-dominant with *Puccinellia maritima*

SM16 *Juncetum gerardi*
Puccinellia maritima sub-community

Above species usually comprising less than 10% of the sward 10

10 *Limonium binervosum* and/or *Frankenia laevis* present with *Halimione portulacoides* 11

Neither *Limonium binervosum* nor *Frankenia laevis* present 12

11 *Suaeda vera* present as a conspicuous component

SM21 *Suaeda vera-Limonium binervosum* salt-marsh

Suaeda vera absent

SM22 *Halimione portulacoides-Frankenia laevis* salt-marsh
Limonio vulgaris-Frankenietum laevis Géhu & Géhu-Franck 1975

12 *Puccinellia maritima* dominant or co-dominant with *Plantago maritima* and/or *Armeria maritima* with a conspicuous understorey of diminutive turf fucoids

SM13 *Puccinellietum maritimae*
Puccinellia maritima-turf fucoid sub-community

Turf fucoids absent or with low cover 13

13 *Spartina maritima* present

SM13 *Puccinellietum maritimae*
Puccinellia maritima-Spartina maritima sub-community

Spartina maritima absent 14

14 *Halimione portulacoides* co-dominant with *Puccinellia maritima* in intimate mixtures in which shoots of the latter emerge through an open network of shoots of the former; *Festuca rubra* rare and never abundant

SM14 *Halimionetum portulacoidis*
Puccinellia maritima sub-community

Prostrate *Halimione portulacoides* is also sometimes abundant in the *Limonium vulgare-Armeria maritima* sub-community of the *Puccinellietum maritimae* but other dicotyledons are usually co-dominant there and *P. maritima* itself rarely comprises more than 10% of the swards. Intimate mixtures of *Halimione portulacoides* and *Puccinellia maritima* such as are included here should be distinguished from mosaics of discrete patches of the *Halimionetum portulacoidis* and the *Puccinellietum maritimae*.

Halimione portulacoides infrequent and never co-dominant 15

15 *Puccinellia maritima* and *Glaux maritima* co-dominant in species-poor vegetation usually in small stands

SM13 *Puccinellietum maritimae*
Glaux maritima sub-community

Puccinellia maritima dominant in open vegetation with *Spergularia marina* and/or *Puccinellia distans*

SM23 *Puccinellietum distantis*

16 Varied swards dominated by mixtures of dicotyledons including *Armeria maritima*, *Triglochin maritima* and *Plantago maritima* with usually less than 10% *Puccinellia maritima* and without *Frankenia laevis*, *Limonium binervosum*, *L. bellidifolium* and *Suaeda vera* 17

Vegetation not dominated by mixtures of the listed dicotyledons or, if so, then some of *Frankenia laevis*, *Limonium binervosum*, *L. bellidifolium* and *Suaeda vera* also present 18

17 *Limonium vulgare* (or, locally, *L. humile*), *Halimione portulacoides* and annual *Salicornia* spp. present and sometimes abundant

SM13 *Puccinellietum maritimae*
Limonium vulgare-Armeria maritima sub-community

Glaux maritima and rayed *Aster tripolium* constant and sometimes abundant with no *Limonium vulgare* and little *Halimione portulacoides*

SM13 *Puccinellietum maritimae*
Plantago maritima-Armeria maritima sub-community

18 *Suaeda vera* and *Limonium binervosum* present and/or *Frankenia laevis* 19

Not as above 21

19 *Frankenia laevis* present 20

Frankenia laevis absent

SM21 *Suaeda vera-Limonium binervosum* salt-marsh
Typical sub-community

20 *Suaeda vera* present

SM21 *Suaeda vera-Limonium binervosum* salt-marsh
Frankenia laevis sub-community

Suaeda vera absent

SM22 *Limonio vulgaris-Frankenietum laevis*

21 *Artemisia maritima* prominent in usually small stands of somewhat variable vegetation ranging from rank grassy swards with much *Festuca rubra* to open bushy canopy of *A. maritima* over low *Halimione portulacoides*

SM17 *Artemisietum maritimae*

Artemisia maritima absent or inconspicuous 22

22 Grassy swards in which *Festuca rubra*, *Agrostis stolonifera* and *Juncus gerardii* are generally important components in the absence of *Juncus maritimus* 23

Juncus maritimus an important component of the vegetation 25

23 *Trifolium repens*, *Leontodon autumnalis* and *Potentilla anserina* present and often abundant in various combinations, sometimes with *Carex distans* and/or *C. flacca* 24

Short swards of very variable composition but usually dominated by *Festuca rubra* and *Agrostis stolonifera* with some *Juncus gerardii*, *Glaux maritima*, *Triglochin maritima*, *Armeria maritima* and *Plantago maritima* and with the above species absent or at less than 10% cover

SM16 *Juncetum gerardi*
Festuca rubra-Glaux maritima sub-community

On heavily-grazed marshes, especially in north-west England, swards lacking *Trifolium repens*, *Leontodon autumnalis* and *Potentilla anserina* may also have a very low cover of either *Festuca rubra* or *Agrostis stolonifera* or *Juncus gerardii*. These are best considered as derivatives of the *Festuca-Glaux* sub-community of the *Juncetum gerardi*.

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24 *Carex flacca* constant and sometimes abundant

SM16 *Juncetum gerardi*
Carex flacca sub-community

Carex flacca infrequent

SM16 *Juncetum gerardi*
Leontodon autumnalis sub-community

On heavily-grazed marshes, especially in north-west England, swards lacking *Carex flacca* but also poor in *Leontodon autumnalis* and *Potentilla anserina* may be encountered. *Trifolium repens* remains a conspicuous component and such swards are best considered as derivatives of the *Leontodon autumnalis* sub-community of the *Juncetum gerardi*.

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25 *Oenanthe lachenalii* constant and often abundant 26

Oenanthe lachenalii rare and never abundant but *Plantago maritima* and rayed *Aster tripolium* often conspicuous

SM18 *Juncus maritimus* salt-marsh
Plantago maritima sub-community

26 *Festuca arundinacea* constant and often co-dominant with *Juncus maritimus*

SM18 *Juncus maritimus* salt-marsh
Festuca arundinacea sub-community

Festuca arundinacea infrequent and never abundant

SM18 *Juncus maritimus* salt-marsh
Oenanthe lachenalii sub-community

A variety of other vegetation types encountered on salt-marshes may fail to key out here. These are most likely to be certain kinds of driftline vegetation, of mires and of mesotrophic grasslands. The mesotrophic grasslands are likely to be the most troublesome to distinguish as they often grade into forms of the *Juncetum gerardi* which have been much altered by agricultural treatment or into the communities of brackish pools with an increase in soil water salinity.

COMMUNITY DESCRIPTIONS

SM1
Zostera communities
Zosterion Christiansen 1934

In Britain, three species of eel-grass, *Zostera marina*, *Z. angustifolia* and *Z. noltii*, form distinctive stands in the sub-littoral and eu-littoral zones of sand and mud flats. Very few samples of this vegetation were taken and the following account relies heavily on published and unpublished material relating in particular to The Solent (C. R. & J. M. Tubbs), the Thames estuary and Essex (Wyer & Waters 1975; Charman 1975, 1977*b*, 1979), north Norfolk (Ranwell & Downing 1959, Charman & Macey 1978), Lindisfarne (D. O'Connor), the Moray Firth (Rae 1979), and the west coast of Scotland (A. Currie). There are two difficulties in making use of existing information. First, *Z. angustifolia* is not consistently distinguished from narrow-leaved forms of *Z. marina*: this partly reflects the long-standing discussion on the taxonomic status of plants variously described as *Z. marina* var. *angustifolia*, *Z. hornemanniana* or *Z. angustifolia*. Second, eu-littoral stands have often been described simply as '*Zostera*' irrespective of whether they comprise *Z. angustifolia*, *Z. noltii* or both these species. This has been particularly true of accounts of the grazing of *Zostera* spp. by wildfowl and a separate note on this important aspect of the conservation value of the vegetation has therefore been appended.

Zostera marina stands
Zosteretum marinae Harmsen 1936

Zostera marina forms stands with a cover of trailing leaves up to 1 m long. Algae, especially *Enteromorpha* spp., are usually the sole associates. *Z. marina* is essentially a sub-littoral species, extending from 1–4 m below to just above low water of spring tides, although it also occurs in lagoons. The lower salinity limit for the species is about 35 g l^{-1} (chloridity 24 g l^{-1}) but the exact limits of its distribution may be controlled by light requirement below and susceptibility to dessication above. Around The Solent, plants are exposed for only 1½ hours even at low water of spring tides.

Z. marina shows considerable morphological variation with a decrease in leaf size and density upshore. Narrow-leaved plants from the lower eu-littoral have been described as *Z. marina* var. *angustifolia* or confused with *Z. angustifolia*. There also appears to be some variation in phenology in relation to the position of the plants on the shore. *Z. marina* shows considerable leaf loss in autumn and early winter but this may be much more apparent in eu-littoral plants than in those which are permanently submerged where a dense cover is maintained throughout the winter. Regrowth occurs in all plants in spring and early summer. Flowering seems to be most frequent in eu-littoral plants and in those sheltered from wave action with larger sub-littoral plants reproducing vegetatively.

In Britain, *Z. marina* always grows on a firm substrate, usually sand or sandy mud, though sometimes with an admixture of fine gravel.

Where their ranges overlap, as in The Solent, *Z. marina* passes upshore to *Z. noltii*; elsewhere *Z. marina* stands may be separated by a considerable expanse of bare substrate from salt-marsh vegetation proper. In The Solent, *Z. marina* may have a potential competitor in the sub-littoral brown alga *Sargassum muticum*, a native of Japan which has colonised some sites once occupied by *Z. marina*.

Z. marina was much reduced in the early 1930s by a wasting disease which seems to have been a combination of attack by a protozoan and an ascomycete fungus. Butcher (1934, 1941) catalogued the most substantial decrease on the East Anglian and north Kent coasts and around The Solent. In recent years, the species has certainly reappeared in abundance in The Solent but seems to have remained rare elsewhere in the south-east. Butcher (1934) did not examine changes on the Scottish coast but *Z. marina* is now abundant down the western coast of the mainland and the Outer Hebrides and also in the Moray Firth. The map shows the distribution of the species in Perring & Walters (1962) with modifications.

Zosteretum marinae has been widely reported from throughout Europe though its exact status following the 1930s disease and subsequent erosion of substrates is uncertain. In The Netherlands, Beeftink (1962) records the association as rare; in France it appears to have recovered somewhat (Géhu 1975).

***Zostera angustifolia* stands**

Zostera angustifolia forms stands with a cover of trailing leaves up to about 25 cm long. It may occur pure, though it is often mixed with the smaller *Z. noltii* and with a variety of algae among which species of *Ulva*, *Chaetomorpha* and *Enteromorpha* are often abundant. The table lists some samples of mixed *Zostera* vegetation from the Exe estuary, Devon. On the extensive estuarine flats of the Cromarty Firth, it occurs with *Ruppia maritima* and annual *Salicornia* spp.

Z. angustifolia can behave as a short-lived perennial. Around the Moray Firth, Rae (1979) noted that few plants lasted longer than two years and, throughout its British range, the species seems to suffer heavy leaf loss in autumn and early winter by a combination of natural shedding, storm damage and wildfowl grazing. Regrowth in spring can be largely by seedling germination (Ranwell & Downing 1959, Wyer & Waters 1975, Rae 1979) though good regeneration from existing rhizomes has also been reported.

Z. angustifolia is a plant of the lower and middle eulittoral zone, extending to well above low water of neap tides and sometimes to high water of neap tides. Its optimal salinity is about 25–34 g l^{-1} (chloridity 16–20 g l^{-1}; Proctor 1980) and, as with *Z. marina*, its exact limits seem to be controlled by light requirement below and susceptibility to desiccation above. In The Solent, it is exposed for a maximum of about 6½ hours on the spring tides. It certainly grows best in sites which are never deeply submerged at high tide nor ever fully dry at low tide and is particularly characteristic of shallow depressions on tidal flats, often with some standing water at low tide. In such situations, it may form distinctive mosaics with *Z. noltii* which prefers the drier tops of low marsh ridges (Tutin, 1942, Wyer & Waters 1975, Rae 1979). It also occurs in the wet bottoms of deep marsh creeks (Chapman 1959).

Z. angustifolia is most characteristic of muds and muddy sands. These may be quite firm and contain some fine gravel but the species is typically associated with very sloppy mud on which even duck boards are an unsuccessful aid to sampling.

Z. angustifolia may pass upshore to stands of *Z. noltii* through mosaics of the two species; elsewhere it may give way to salt-marsh vegetation proper with an expanse of bare substrate between or through *Salicornietum europaeae*. In the Exe estuary, *Z. angustifolia* is replaced upshore by *Spartinetum townsendii* (Proctor 1980).

The disease of the 1930s seems to have left *Z. angustifolia* largely untouched and, at present, the species is widespread along the south and east coasts of England and the east coast of Scotland (Perring & Walters 1962). It is all but absent from the west coast of Scotland. There are very extensive stands in the Cromarty Firth (Figure 7) and also along the Essex and north Kent coasts.

In Europe, the equivalent community *Zosteretum marinae stenophyllae* Harmsen 1936 has been recorded from The Netherlands (Beeftink 1962) and France (Géhu 1975).

***Zostera noltii* stands**

Zosteretum noltii Harmsen 1936

Zostera noltii forms stands with a cover of delicate trailing narrow leaves up to about 20 cm long. It may occur pure or with *Z. angustifolia* (see table) and occasional plants of lower salt-marsh species such as annual *Salicornia* spp. or *Spartina anglica*. *Ruppia maritima* occurs with *Z. noltii* on the estuarine flats of the Cromarty Firth (Rae 1979).

Like *Z. angustifolia*, *Z. noltii* experiences considerable leaf loss in autumn and early winter through natural shedding, storm damage and wildfowl grazing but plants towards the lower limit may remain winter-green (Wyer & Waters 1975, Rae 1979). Unlike *Z. angustifolia*, expansion in spring seems to occur more consistently by the regrowth of existing rhizomes (Wyer & Waters 1975, Rae 1979) as well as by the germination of seed, production of which may be prolific, especially at higher levels.

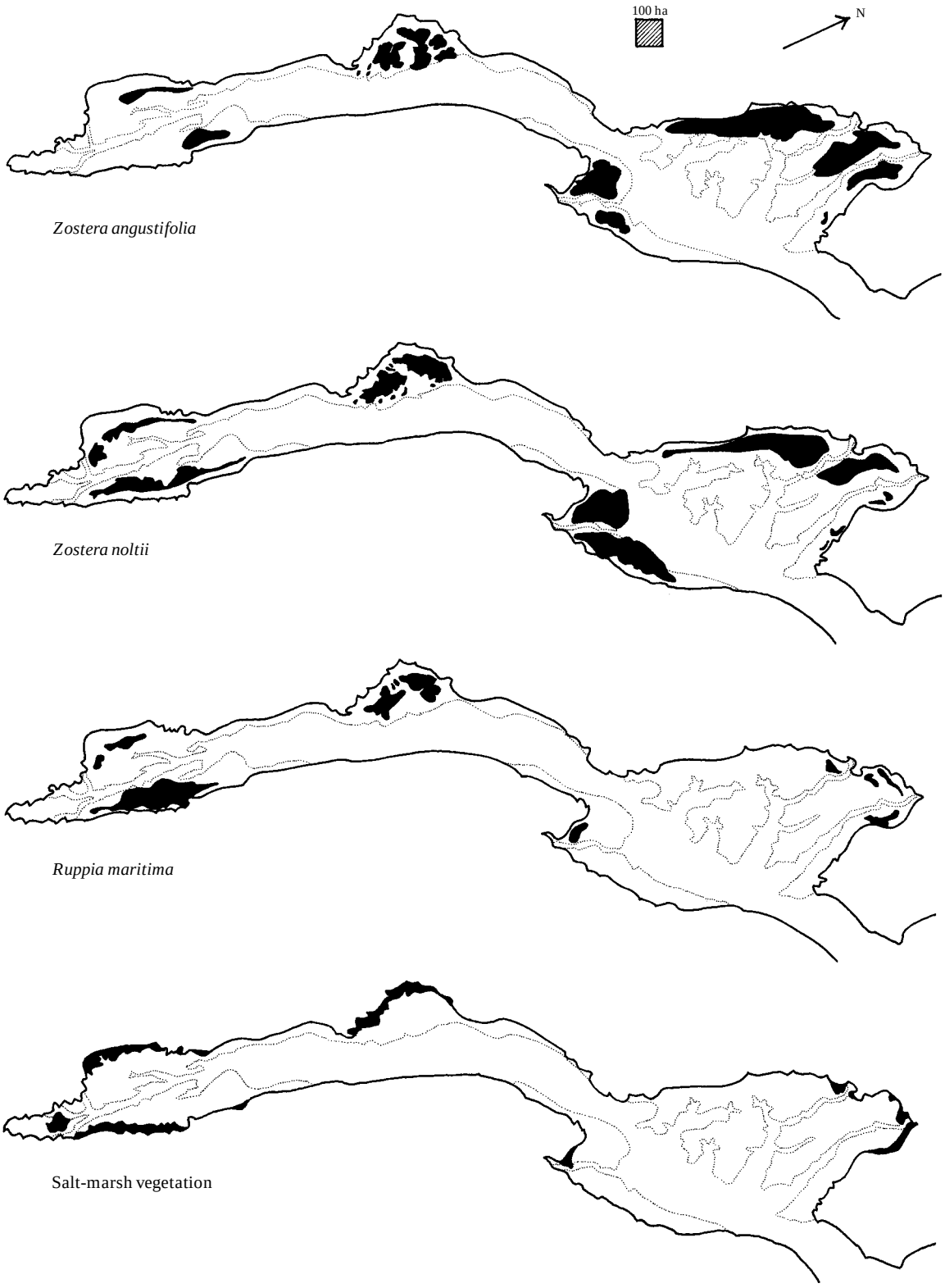
In general, *Z. noltii* is a species of the middle and upper eu-littoral zone and its lower salinity limit is about 15 g l^{-1} (chloridity 9 g l^{-1}; Mathiesen & Nielsen 1956). It occurs on mud/sand mixtures of a variety of consistencies from very soft to quite firm. It is most characteristic of situations where the substrate dries out somewhat on exposure and on flats with a gentle bar/hollow topography it forms distinctive mosaics with *Z. angustifolia*. It can also occur in shallow standing water.

Stands of *Z. noltii* pass downshore to *Z. angustifolia* and above may grade to communities of the lower salt-marsh, notably the *Salicornietum europaeae*. *Spartina anglica* is known to have invaded stands of *Z. noltii* at various sites (Chapman 1959, Goodman *et al*. 1959, Bird & Ranwell 1964, Hubbard & Stebbings 1968).

The British distribution of *Z. noltii* is similar to that of *Z. angustifolia* (Perring & Walters 1962) and there are particularly extensive stands in the Cromarty Firth (Rae 1979: Figure 7) and along the Essex and north Kent coasts (Wyer & Waters 1975).

In Europe the *Zosteretum noltii* is widespread in similar situations to those in Britain (e.g. Beeftink 1962, Géhu 1975).

Figure 7. Distribution of mud-flat and salt-marsh vegetation in the Cromarty Firth, Scotland.



Zostera and wildfowl grazing

Zostera spp. provide an important source of food for certain wildfowl, notably in Britain for overwintering brent goose (*Branta bernicla*) and wigeon (*Anas penelope*) and, to a lesser extent, of mute swan (*Cygnus olor*) and whooper swan (*Cygnus cygnus*).

The early wildfowling literature and some recent studies (e.g. Charman 1977*a*) consider *Z. marina* to have been the species most frequently eaten by brent in the past but it seems likely that, at the present time at least, *Z. angustifolia* and *Z. noltii* account for the bulk of the *Zostera* consumed. There is some suggestion (e.g. Ranwell & Downing 1959; Charman 1977*a*, 1979) that of these *Z. noltii* is the preferred species for brent. This may reflect its generally longer periods of exposure on flats but *Z. noltii* appears to reach its standing crop maximum later in the year than *Z. angustifolia*, around September/October (Wyer & Waters 1975, Rae 1979) just when brent are beginning to gather in their winter haunts. *Z. angustifolia* may be preferentially grazed by wigeon: its standing crop peak, in July/August, coincides with the gathering of that species.

A number of studies (Ranwell & Downing 1959; Charman 1975, 1977*a*, *b*, 1979; Charman & Macey 1978) have demonstrated a distinctive sequential exploitation of flat and salt-marsh food sources by brent. The accumulating birds begin feeding on *Zostera* in September/October and only when their numbers reach a peak and the *Zostera* is largely consumed do they move on, first to *Enteromorpha*, then to salt-marsh vegetation and sometimes to arable and pasture. This timing coincides to some extent with the maximum availability of nutritious food, though Charman (1979) has suggested that, among the various foods, only *Zostera* can provide an adequate daily energy requirement for brent.

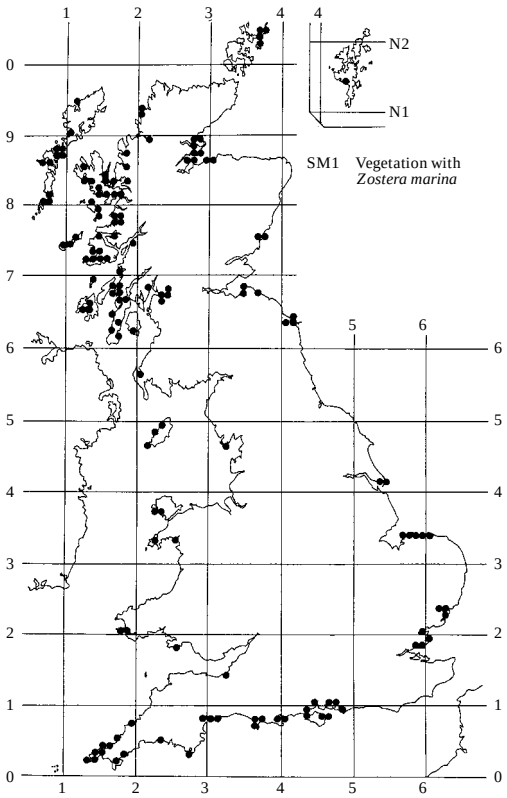
Zostera stands therefore provide what seems to be an indispensible resource for some wintering wildfowl and vast numbers of birds exploit the larger beds. The 820 ha of *Zostera* along the coasts of south Suffolk, Essex and north Kent (Wyer & Waters 1975) receive about 30000 dark-bellied brent (*Branta bernicla bernicla*) (Ogilvie 1978), the expanding stands of The Solent foreshore and harbours about 23000 (figure for 1979/80), north Norfolk about 5000 and The Wash about 6000 (Ogilvie 1978), in total about half of the world population of this race. Smaller numbers of light-bellied brent (*Branta bernicla hrota*), between 200 and 1100, winter at Lindisfarne NNR. What is probably the largest total area of *Z. noltii* and *Z. angustifolia* in Britain, the 1200 ha in the Cromarty Firth, is outside the winter range of the brent goose but the estuary is visited by enormous numbers of wigeon.

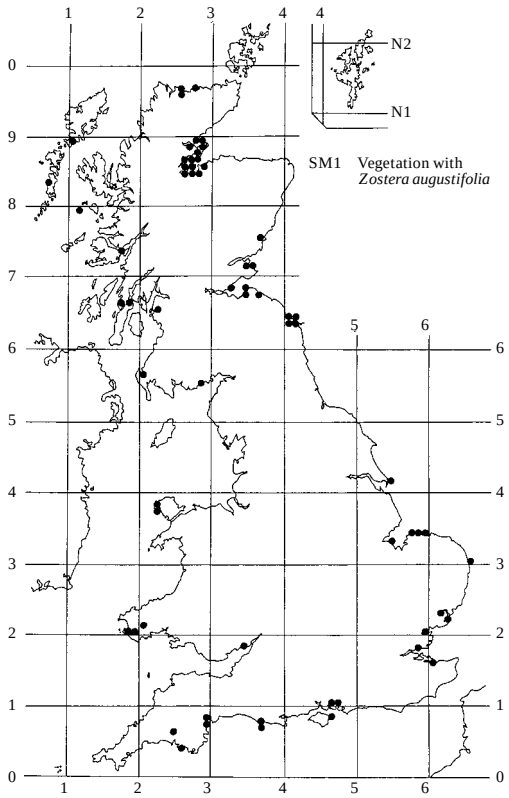
Although wildfowl sometimes uproot *Zostera* while feeding they seem mostly to eat the leaves and flowering shoots. Beds appear able to recover even from very heavy grazing and the resource to renew itself adequately from year to year by vegetative expansion and/or seed germination.

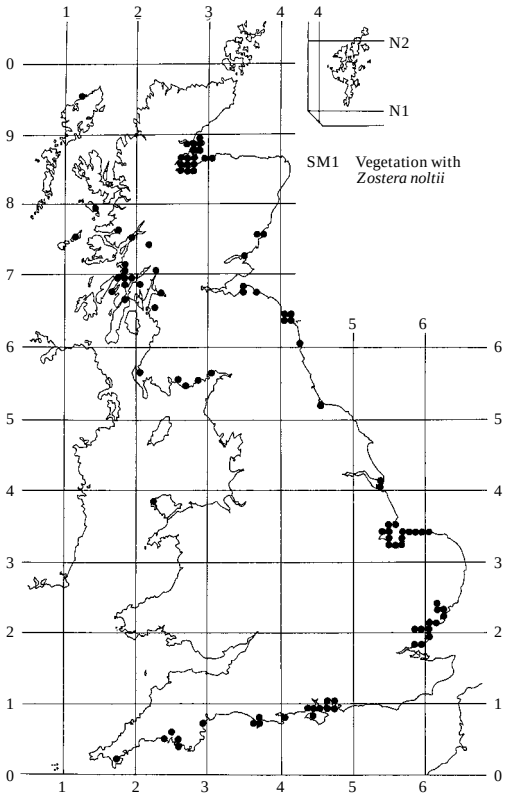
Floristic table SM1

Zostera angustifolia	V (2–8)
Zostera noltii	V (4–10)
Fucus spiralis	IV (1–4)
Enteromorpha cf. *E. marginata*	IV (1–7)
Ulva lactuca	III (1–4)
Chaetomorpha linum	II (1–6)
Polysiphonia cf. *P. insidiosa*	I (2)
Ceramium rubrum	I (1–2)
Polyneura gmelinii	I (1)
Fucus vesiculosus	I (1–2)
Cladophora sp.	I (4)
Chondria dasyphylla	I (1)
Polysiphonia cf. *P. nigrescens*	I (1)
Enteromorpha intestinalis	I (1–2)
Ectocarpus sp.	I (1)
Chaetomorpha cf. *C. tortuosa*	I (2)
Porphyra umbilicalis	I (2)
Spartina anglica	I (4)
Number of samples	15

Shells of the cockle (*Cerastoderma edule*) and common periwinkle (*Littorina littorea*) and casts of the lugworm (*Arenicola marina*) occasional to very abundant in the samples; spire shell (*Hydrobia ulvae*), mussel (*Mytilus edulis*) and shore crab (*Carcinus maenas*) recorded less frequently.


N2
N1
SM1 Vegetation with
Zostera marina


N2
N1
SM1 Vegetation with
Zostera augustifolia


N2
N1
SM1 Vegetation with
Zostera noltii

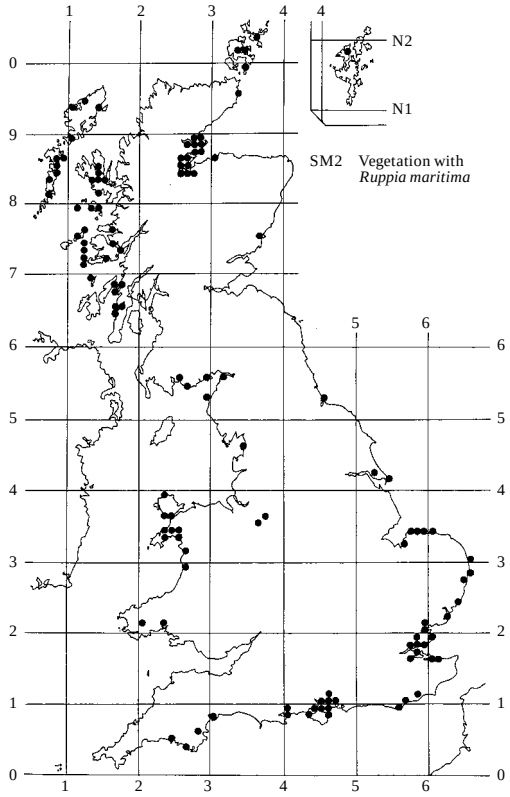
SM2

Ruppia maritima salt-marsh community
Ruppietum maritimae Hocquette 1927

Ruppia maritima is a monocotyledonous perennial which can occur as the dominant in a submerged aquatic community with *Zannichellia palustris*, *Potamogeton pectinatus*, *Ranunculus baudotii* and, within its rather restricted range, *Ruppia spiralis*. The community occurs locally in permanently-filled pans and creeks on coastal salt-marshes, at some inland saline sites (Lee 1977) and also in brackish counter-dykes behind sea walls (Rose & Géhu 1964, Jermyn 1974). In the tidal portion of the outlet stream of the Loch of Wester in Caithness there is a zonation from *R. maritima*-dominated vegetation through *Potamogeton pectinatus* to *Hippuris vulgaris* at the tidal limit.

R. maritima can also occur as a plant of estuarine flats and it is particularly abundant in this habitat in the Cromarty Firth (A. Currie, P. Steele, pers. comm.: Figure 7) where it forms a belt of varying width between the salt-marsh proper, sometimes overlapping with *Salicornietum europaeae*, and stands of *Zostera noltii*. Here *R. maritima* seems to behave as an annual (P. Steele, pers. comm.), disappearing very rapidly from September onwards. It is known to be a food source for wigeon (*Anas penelope*) but frost sensitivity may also play a part in its behaviour.

The *Ruppietum maritimae* has been described from The Netherlands (Beeftink 1962) and from France (Géhu 1975) and in the latter it occurs on coastal flats.



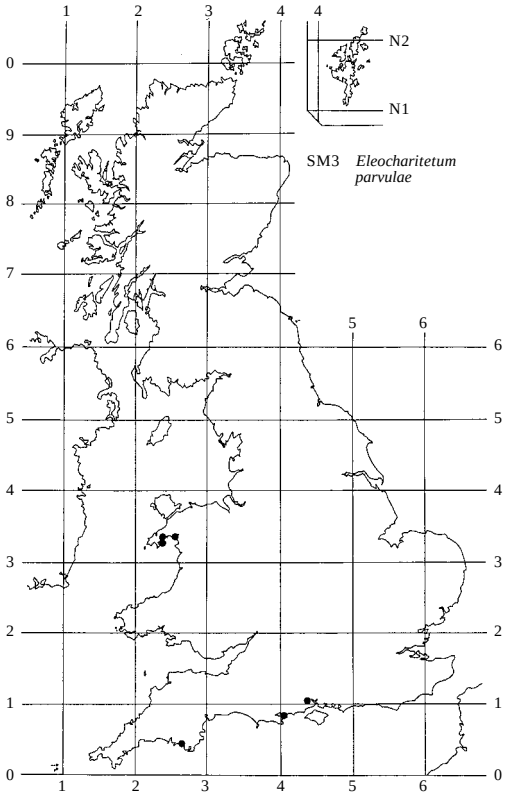
SM3

Eleocharis parvula salt-marsh community

Eleocharitetum parvulae (Preuss 1911/12) Gillner 1960

Eleocharis parvula occurs as a short open sward which is 'physiognomically the least conspicuous of all sea-shore communities' (Tyler 1969*b*). The diminutive shoots, only 1–2 cm tall, are frequently matted with (mainly green) algae and obscured by freshly-deposited silt (cf. Praeger 1934). At Beaulieu in Hampshire, stands occur at the limit of tidal influence with some input of fresh-water from land drainage at low tide (Géhu 1973*a*) but in Ireland the species may extend further downshore (Praeger 1934; C. D. Pigott, pers. comm.).

E. parvula is a very rare species in Britain with records for Beaulieu, Poole Harbour in Dorset, Bigbury Bay in Devon and Tremadoc Bay in Gwynedd. It has a similarly disjunct distribution throughout much of Europe (Beeftink 1972) but the *Eleocharitetum parvulae* has been recorded from the Biscay coast of France and Spain, from northern Portugal and the Mediterranean and Black Seas. The association is widespread in the Baltic where it frequently contains *Ruppia maritima* and *Zannichellia palustris* (Gillner 1960, Tyler 1969*a*). This led Gillner (1960) to place the association alongside the *Ruppietum maritimae* in the Ruppion maritimae, a view which is now generally accepted.



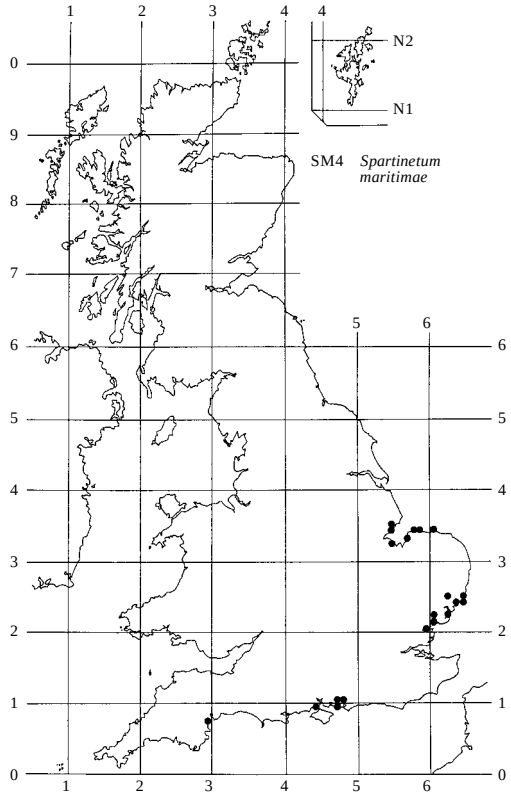
SM4

Spartina maritima salt-marsh community

Spartinetum maritimae (Emb. & Regn. 1926) Corillion 1953

Spartina maritima is a native species which seems to have reached a peak of abundance in the late nineteenth and early twentieth centuries when it grew in every harbour between Beaulieu in Hampshire to Chichester in Sussex and plentifully along the coasts of Kent, Essex and south Suffolk and around The Wash (Marchant & Goodman 1969*a*). It declined rapidly thereafter and now survives often as isolated clumps around The Solent and on the north Isle of Wight coast (Marchant & Goodman 1969*a*) though extensive stands remain in parts of Essex (Jermyn 1974, Boorman & Ranwell 1977). The population at Scolt Head Island in Norfolk (Deighton & Clapham 1925, Chapman 1934) is now extinct.

S. maritima grows as clumps of stiff shoots and at Wittering in Sussex it has some *Spartina anglica* and a little *Arthrocnemum perenne*, *Puccinellia maritima*, *Suaeda maritima* and *Salicornia* agg. (Géhu & Delzenne 1975). It is a pioneer community throughout its European range which runs south from The Netherlands to Portugal (Beeftink & Géhu 1973). The cause of its demise in Britain is not fully understood. It may partly be due to competition with *S. anglica*: Some former *S. maritima* sites are now occupied by *S. anglica* and the former seems to survive best where the latter is least aggressive, on drier sites above mean high water of spring tides (Marchant & Goodman 1969*a*). However, *S. maritima* is at the northern limit of its range in Britain and small climatic fluctuations may have played a part in its reduction (Marchant 1967). Certainly, little viable seed is produced at the present time (Marchant & Goodman 1969*a*).



SM5

Spartina alterniflora salt-marsh community
Spartinetum alterniflorae Corillion 1955

Spartina alterniflora is a naturalised alien in Europe first recorded in Britain in 1829 from the river Itchen, Hampshire (Marchant & Goodman 1969*b*). By the turn of the century, it had spread to occupy extensive areas of Southampton Water and occurred as far east as Chichester Harbour in Sussex (Rankin in Tansley 1911, Marchant & Goodman 1969*b*). Since then it has declined, at least partly in response to land reclamation (Marchant 1967) though perhaps also as a result of invasion by *Spartina anglica*, the fertile amphidiploid which arose from hybridisation between *S. alterniflora* and *S. maritima*.

S. alterniflora now survives only at Marchwood, Hampshire, and as transplanted clumps in the *Spartina* Garden in Poole Harbour, Dorset (Marchant & Goodman 1969*b*). The natural stand comprises a dense cover of *S. alterniflora* shoots with some *Spartina anglica*, *Puccinellia maritima* and *Aster tripolium* (Beeftink & Géhu 1973, Géhu & Delzenne 1975). The association occurs in scattered localities down the Atlantic coast of western Europe and is characteristic of situations with a lower and more variable salinity than other *Spartina*-dominated communities (Beeftink & Géhu 1973). The Marchwood stand has been placed in the sub-association *asteretosum tripolii* which has also been recorded from Brittany and Spain (Beeftink & Géhu 1973, Géhu & Delzenne 1975, Kortekaas *et al.* 1976).

SM6

Spartina anglica salt-marsh community

Spartinetum townsendii (Tansley 1939) Corillion 1953

Constant species

Spartina townsendii sensu lato comprises the male sterile F_1 hybrid *S.* × *townsendii* and the much commoner fertile amphidiploid from the same cross, *S. anglica*. The latter alone was recorded in our samples and is the sole constant of the community.

Rare species

Arthrocnemum perenne

Physiognomy

S. anglica always dominates as scattered tussocks, coalescing clumps or a continuous sward up to 1 m in height. The community is species-poor though the associates are somewhat varied. *Puccinellia maritima* and annual Salicornias occur frequently and may account for up to 50% cover and beneath them there is often an algal mat. Free-living fucoids such as *Fucus vesiculosus* ecad *caespitosus* and ecad *volubilis* may be locally abundant. *S.* × *townsendii* may be recognised within *S. anglica* swards by its denser tussocks of shorter shoots. It sometimes forms extensive swards as at Hythe and Poole (Marchant 1967) and may occur as a landward fringe to *S. anglica* (Hubbard 1965). In such cases the associates of *S.* × *townsendii* are the same as in the community as a whole.

Sub-communities

Beeftink & Géhu (1973) and Kortekaas *et al*. (1976) have characterised a variety of sub-communities within the European *Spartinetum townsendii*. Some corresponding distinction could be made within the British stands but their general species poverty, their capacity for rapid floristic change and the unchallenged dominance of *S. anglica* throughout argue for retaining a single community at national level. Sub-division may be more appropriate in detailed studies of particular marshes: a few sites, for example, have a distinctive phase with *Atriplex hastata* and *Suaeda maritima* conspicuous.

Habitat

Although scattered plants of *S. anglica* can be found in almost every salt-marsh community, the distinctive situations of the community are towards the seaward fringes of marshes, on creek sides, colonising old pans in the upper-marsh zone and, more rarely, in brackish seepage areas behind sea walls. The *Atriplex hastata-Suaeda maritima* phase is characteristic of tidal drift.

A wide variety of substrates is colonised, from extremely soft mud to shingle. There is some evidence of more rapid vegetative spread through finer material (Chater & Jones 1957). The pH is generally above 7.0 and loss-on-ignition varies from 0.2% to 36.3% (Adam 1976). The sediment is generally strongly reduced although there may be a narrow zone of oxidation around the roots. *S. anglica* is extremely tolerant of tidal submergence. In general, its lower limit seems to be around mean high water of neap tides, which implies about 6 hours' submersion/day at spring tides (Goodman *et al*. 1969, Dalby 1970, Morley 1973, Proctor 1980) but in exceptional situations, as in the shelter of Poole Harbour with its narrow tidal range, the community may extend down to mean low water of neap tides, with as much as 23½ hours' submersion/day at neap tides (Hubbard 1969). The lower limit of colonisation is therefore probably controlled by factors other than submersion tolerance and it appears most likely that exposure to the physical effects of wave or tidal action is responsible. Goodman *et al*. (1959) and Goodman (1960) have shown how *S. anglica* may become dwarfed by such a process where the maximum fetch is short. Such stunted plants resume normal growth under culture (Goodman *et al*. 1969) and should be distinguished from the dwarf brown mutants described from certain sites (e.g. Chater 1965). It is also possible that the nature of the substrate may influence the seaward limit of the species but data are lacking. The landward limit of extension may be controlled by the juxtaposition of existing communities up the shore. *S. anglica* can tolerate up to about 2.5% chloridity

(Ranwell *et al*. 1964, Proctor 1980) and this may give it more competitive advantage in the hypersaline conditions when dry weather follows high tides on the upper marsh.

The community occurs on both grazed and ungrazed marshes. Although less heavily exploited than some marsh communities, it appears to be eaten by rabbits, sheep and cattle and *S.* × *townsendii* may actually be encouraged or maintained by grazing (Hubbard 1965) and its growth favoured against invasion by *S. anglica* where the two species occur contiguously. Hubbard & Ranwell (1966) showed that cut and ensilaged *S. anglica* had a similar intake, digestibility and crude protein content to medium quality hay when fed *ad libitum* to Halfbred × Suffolk wethers, though they recognised that marsh physiography would usually militate against its widespread exploitation as a crop. Despite its dramatic spread, *S. anglica* rarely seems to pose a navigational hazard though its presence in coastal resorts or nature reserves may be undesirable. Some control has been achieved by helicopter spraying with dalapon (Ranwell 1967) though assiduous digging is usually necessary to ensure eradication.

Zonation and succession

S. × *townsendii* was first noticed around Southampton Water in the 1870s and is presumed to be a natural hybrid between the native *Spartina maritima* and the introduced *S. alterniflora* (Marchant 1967). Its slow natural spread was quickly overtaken by the much more vigorous fertile amphidiploid *S. anglica* which, in the 20 years after its first appearance in Southampton Water and The Solent probably around 1890, had colonised every estuary and salt-marsh between Chichester and Poole (see, for example, Goodman *et al*. 1959, 1969, Hubbard 1965, Ranwell 1967, Hubbard & Stebbings 1967). Widespread planting for reclamation after 1910 extended the distribution of *S. anglica* in Britain and natural spread from these centres has filled many gaps.

S. × *townsendii* appears to have been transmitted to a number of scattered localities by inclusion of sterile material in transplant consignments but this species probably accounted for less than 20 ha out of a total of over 12000 ha of marsh dominated by *S. townsendii s. l.* in Great Britain at the last detailed survey (Hubbard & Stebbings 1967).

Once established, the plants perennate and reproduce naturally by rhizome fragmentation, especially where the tidal run is fast, as at Bridgwater Bay (Ranwell 1964*a*) and, in the case of *S. anglica*, by seed, the set of which is regular though variable in quantity (Goodman *et al*. 1969). Spread from such fragments or seedlings can be rapid in *S. anglica* with clonal patches expanding and coalescing into clumps and then closing to a sward; in other cases discrete patches may persist for long periods.

In many places *S. anglica* has become established on previously bare substrates and initiated the development of new marshes. Accretion of material has been found to vary between 0.5 and 10 cm/year (Ranwell 1964*a*, Bird & Ranwell 1964); at the higher rates something like 500 cm/ha/year of material is deposited. Accretion rate may depend on local climate, the tidal pattern and perhaps the seasonal microflora (Ranwell 1964*a*) and the subsequent marsh drainage pattern may be influenced by the slope, tidal range and substrate type (Braybrooks & J. M. Lambert, unpublished). Accretion eventually raises the marsh surface to a level at which other species can theoretically compete with the *S. anglica* but, although species from *Puccinellietum maritimae* and *Juncetum gerardi* communities occur occasionally within swards, they are never particularly abundant and competition with the tall and vigorous *S. anglica* may prevent overtopping and the replacement of the community. Litter accumulation or frost action (Hubbard & Stebbings 1967, Ranwell 1972) and grazing (Ranwell 1961, Goodman *et al*. 1969) may initiate the opening up of the *S. anglica* sward and allow the spread of *Puccinellia maritima*.

On the higher parts of ungrazed marshes there is evidence of invasion by a variety of plants. At Bridgwater Bay, a short-period sub-seral alternation of *S. anglica* and *Atriplex hastata* has been observed on accumulated drift with sand (Ranwell 1961, 1964*b*). *A. hastata* has also invaded the upper part of a *S. anglica* marsh at Lytham on the Ribble estuary. At Keysworth in Poole Harbour, *Elymus pycnanthus* has invaded (Hubbard & Stebbings 1968). There and at Bridgwater, *Scirpus maritimus* and *Phragmites australis* have also appeared at higher levels and replaced about 50% of the *S. anglica* sward in 12 years. Ranwell (1972) has suggested that such a process is favoured by the development of less saline conditions consequent upon land-drainage seepage but this has not been widely investigated. *Halimione portulacoides* can establish itself along creek margins within *S. anglica* marshes (Goodman *et al*. 1959).

S. anglica has also become established on existing marshes. Invasion of *Zostera noltii* swards has been recorded on the south and east coasts (Goodman *et al*. 1959; Bird & Ranwell 1964; Hubbard & Stebbings 1968) and Chapman (1959) mapped such a process in North Cockle Bight at Scolt Head between 1932 and 1959. At that site, *Z. angustifolia* on very soft mud was not invaded; neither is there any evidence that *S. anglica* has anywhere replaced *Z. marina* which occurs at lower levels than *Z. noltii*. At Keysworth in Poole Harbour, a *Ruppia maritima-Potamogeton pectinatus* community has been replaced by *S. anglica* (Hubbard & Stebbings 1968). *S. anglica* can flourish at the same level as the *Salicornietum europaeae* and, as a result, pioneer vegetation

of this kind is now of local occurrence throughout south-east England.

The extent to which *S. anglica* invades other existing marsh communities is uncertain. Pans and creeks in vegetation higher up the marsh may be grown over and scattered plants are widespread throughout marshes, but the wholesale replacement of other communities is not well documented. Chater & Jones (1957) provide some evidence for a slow advance into *Puccinellietum maritimae* and *Juncetum gerardi* in the Dovey estuary but this is not apparent at many sites. Similarly there is little evidence as to how much invasion into *S. anglica* swards takes place from contiguous communities. On grazed marshes in the Dovey, creek levees have become colonised by *Festuca rubra* which has eventually ousted *S. anglica*; because of the frequency of creeks there, the total area of marsh affected is considerable (Chater 1973). Heavily grazed and poached upper levels of *S. anglica* have elsewhere been invaded by *Puccinellia maritima*. It is not known how far the development of a *S. anglica* community to seaward of an existing marsh complex affects the overall nature of the marsh but it might be expected that alterations in drainage would be of prime importance.

In general, *S. anglica* has consolidated its early initial spread but the patchy degeneration of sward which became known as 'die-back' was noticed as early as 1928 and in some sites has made a considerable impression. It is still mainly restricted to Channel coast marshes and its exact cause remains unknown. Pathogens and pollution have been ruled out (Goodman *et al*. 1959) and it seems possible that the process is caused by a toxic reduced inorganic ion (perhaps sulphide) produced in anaerobic waterlogged root environments (Goodman & Williams 1961). Alternatively, the switch from accretion to ablation under *S. anglica* may be responsible for its demise.

Distribution

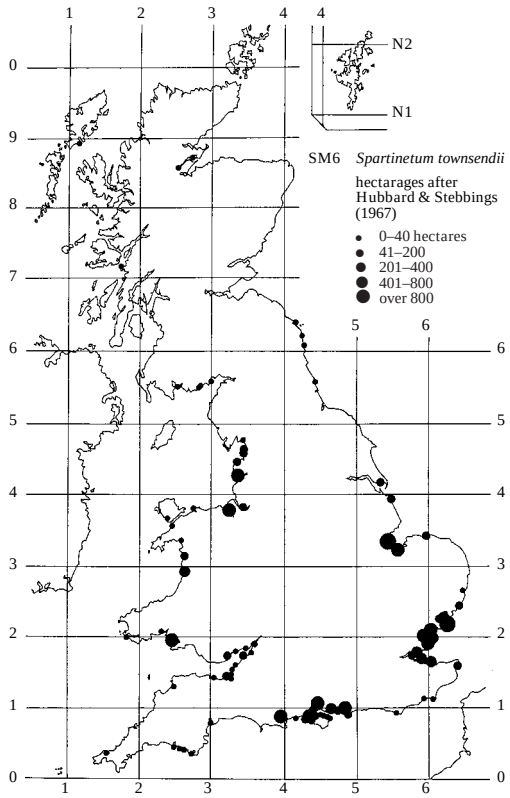
Spartinetum townsendii is widespread around the English and Welsh coasts and is still expanding vigorously at a number of sites along the Scottish shore of the Solway. *S.* × *townsendii* in itself present in abundance only below Hythe in Southampton Water (Hubbard & Stebbings 1967) though there is F_1 material scattered through *S. anglica* swards from Poole to Wittering and on the Isle of Wight. This natural limit is probably set by the slow vegetative spread of the species. There are also small quantities, probably transmitted with *S. anglica* for transplant, in Norfolk, Somerset, Merioneth and Dublin. The limit of *S. anglica* and of the association as a whole, may be related to temperature: in the northern hemisphere, really successful plantings occur south of the 13–18 °C July isotherms (Goodman *et al*. 1969). The far northern stations of the species in Argyll and Harris (Hubbard & Stebbings 1967) have not been checked but it is known that growth in these localities is very slow and seedling establishment poor because of winter storms, cold and bird damage (Shaw, *pers. comm*. in Goodman *et al*. 1969). The European distribution of the community is discussed by Beeftink (1972), Géhu (1972) and Beeftink & Géhu (1973).

Affinities

The association is easily defined floristically by the dominance of *S. anglica* and in phytosociological schemes the community has been placed in a separate class, the Spartinetea, with other communities based on *S. maritima* and *S. alterniflora*.

Floristic table SM6

Spartina anglica	V (5–10)
Algal mat	III (2–9)
Puccinellia maritima	III (1–7)
Salicornia agg.	III (1–7)
Suaeda maritima	II (1–5)
Aster tripolium var. *discoideus*	I (1–7)
Aster tripolium (rayed)	I (2–6)
Aster tripolium	I (1–5)
Atriplex prostrata	I (2–7)
Limonium cf. *L. vulgare*	I (1–3)
Plantago maritima	I (3–5)
Fucus vesiculosus ecad *caespitosus*	I (2–5)
Fucus vesiculosus ecad *volubilis*	I (2–6)
Catenella repens	I (2)
Cochlearia anglica	I (2–5)
Spergularia media	I (1–5)
Halimione portulacoides	I (2–6)
Number of samples	136
Mean number of species/sample	3 (1–10)
Mean vegetation height (cm)	34 (8–10)
Mean total cover (%)	84 (25–100)


N2
N1
SM6 *Spartinetum townsendii*
hectarages after Hubbard & Stebbings (1967)
0–40 hectares
41–200
201–400
401–800
over 800

SM7
Arthrocnemum perenne stands

Arthrocnemum perenne is a perennial halophyte with a restricted distribution in Britain: it occurs around the coast of south-east England from The Wash to Poole Harbour with isolated records from North Wales and Teesmouth (Perring & Walters 1962). It is encountered as an occasional in a variety of communities from both low and high marsh and only very locally is it an important constituent of salt-marsh vegetation.

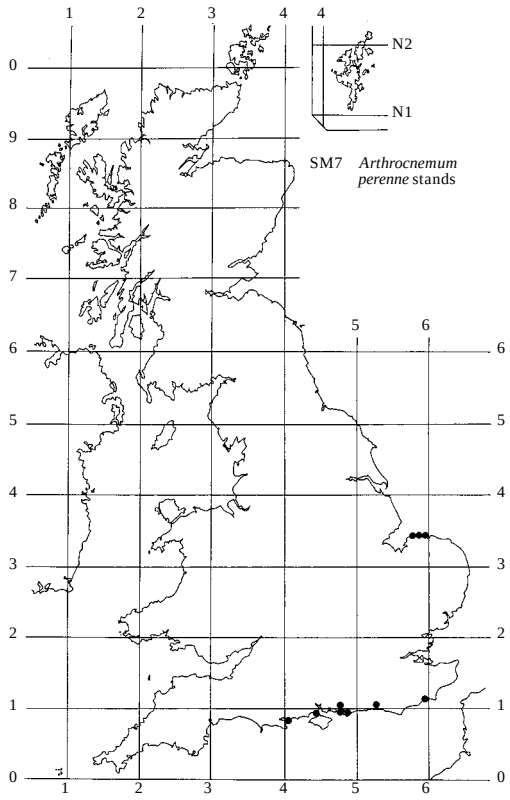
At a number of sites in north Norfolk, *A. perenne* forms an open mosaic with *Halimione portulacoides*, *Puccinellia maritima* and *Suaeda maritima* at the lower limit of *Halimionetum* on sand or firm silt with abundant gravel and shell fragments. A similar community occurs very locally on firm clays with shell fragments elsewhere in south-east England.

Dense pure stands of *A. perenne* are found on drift litter over shell banks at a few sites, particularly around Chichester Harbour, Hampshire. Scattered bushes of *A. perenne* are associated with local erosion within low-marsh communities, especially where these occur on gravel-rich substrates (Beeftink 1965, 1977*a*; Beeftink & Géhu 1973).

Although Beeftink (1965, 1977*a*) recognises the occurrence of *Salicornietum radicantis* Br.-Bl. 1931 in Britain we have insufficient data to characterise a community. The *A. perenne-Halimione portulacoides* mosaics could perhaps be regarded as an extreme form of *Halimionetum*.

Floristic table SM7

Arthrocnemum perenne	V (2–9)
Halimione portulacoides	V (2–9)
Puccinellia maritima	V (2–6)
Suaeda maritima	IV (2–4)
Salicornia agg.	III (2–6)
Algal mat	III (4–8)
Limonium cf. *L. vulgare*	III (2–5)
Aster tripolium var. *discoideus*	III (2–7)
Aster tripolium	I (1–3)
Bostrychia scorpioides	I (4–5)
Spergularia media	I (1)
Number of samples	12
Mean number of species/sample	6 (3–9)
Mean vegetation height (cm)	19 (8–30)
Mean total cover (%)	76 (40–100)


N2
N1
SM7 *Arthrocnemum perenne* stands

SM8

Annual *Salicornia* salt-marsh community *Salicornietum europaeae* Warming 1906

Constant species

Several distinct taxa can be recognised among the British annual Salicornias but diagnosis below the level of the three groups *S. europaea*, *S. procumbens* and *S. pusilla* is difficult for non-specialists. Here, all annual taxa encountered are described under *Salicornia* agg. and this is the sole constant of the community.

Rare species

Arthrocnemum perenne.

Physiognomy

The community comprises ephemeral stands of annual Salicornias sometimes with no other species. The vegetation is invariably somewhat open and though *Salicornia* agg. is always conspicuous, the density of plants is variable: around The Wash, for example, *Salicornia* agg. cover is high whereas at sites with sandier substrates the density can be very low. There is often an algal mat over the substrate surface but vascular companions are usually very few. Scattered plants of *Puccinellia maritima*, *Suaeda maritima* and *Spartina anglica* occur frequently with occasional records for a variety of other lower marsh species. At a few sites (Blakeney Point, for example), *Fucus vesiculosus* ecad *caespitosus* is abundant.

Sub-communities

With careful identification of distinct taxa, it may be possible to define a range of communities within this broad general unit as a number of Continental authors have done (see, for example, Géhu & Delzenne 1975). Ball & Tutin (1959) recommend collecting a dozen specimens from populations in September/October when the characteristic colours have developed. Where particular taxa have been ascribed distinct ecological preferences *in litt*. these have been noted below.

Habitat

Annual Salicornias germinate in May from seeds widely dispersed over whole marsh surfaces. The lower limit of establishment appears to be set by the time necessary for the seedlings to become firmly anchored: Wiehe (1935) showed that, in the Dovey estuary, two to three days' exposure between tidal flooding was necessary for sufficient root growth to take place. The speedier radical growth of *Salicornia dolichostachya* over *S. europaea sensu stricto* may give the former an establishment advantage in such situations: in the Dee estuary, *S. dolichostachya* is certainly the commoner species in the open habitats of the lower marsh (Ball & Brown 1970; see also Ball & Tutin 1959).

Salicornia agg. is tolerant of frequent tidal submersion, enduring around 600 flooding tides/year at its lower limits where it forms the familiar pioneer stands. The community is also characteristic of other bare marsh habitats such as creek sides, borrow pits and other disturbed areas in the upper marsh. Here seedlings grow rapidly and by August the plants are bushy, green and up to 15–20 cm high. Although certain taxa, *S. europaea s. s.* for example, appear less susceptible than others to competition from perennial grasses (Ball & Brown 1970), growth in the upper marsh is generally slow and the restrictions may be due to the lack of competition for sediment nutrients, especially nitrogen, with established perennials (Pigott 1969, Stewart *et al*. 1972). Addition of nutrients to *Salicornia* plants within the other high marsh communities stimulates growth to levels characteristic of the lower marsh stands, though a lag in response is suggestive of a determinate growth pattern genetically adapted to an environment with a cyclical but delayed suitability: such sites are not flooded again after *Salicornia* germination until the autumn equinox (Jefferies *et al*. 1979).

Within suitable sites, the community can flourish on a variety of substrates from hard clay to shelly sand, occasionally even on shingle but only rarely are very soft sediments colonised. Where *Spartina anglica* has become well established, the low-marsh *Salicornia* stands tend to be restricted to thin gravels or shingles over hard clay (Perraton 1953). Where wind-blown sand is abundant,

plants tend to adopt a decumbent habit and can survive virtual burial for most of the summer (Tüxen 1974). In brackish areas behind sea walls, which we have not examined closely but where annual Salicornias may flourish, *S. ramosissima* and *S. prostrata* appear to be the common taxa (Ball & Tutin 1959).

Annual *Salicornia* stands occur on both grazed and ungrazed marshes. All species are highly susceptible to oil and refinery effluent spills being killed by a single inundation (Baker 1979). On a few marshes in south-east England (principally around The Wash) Salicornias are harvested as 'samphire' for human consumption.

Zonation and succession

Salicornia stands may form a distinct zone in the lower marsh, sometimes hundreds of metres deep. At some sites, particularly those on sandy substrates, patches of *Salicornia* may be separated from the main marsh front by several hundred metres of bare flat. The community can also occur in a mosaic with the *Puccinellietum maritimae* or with the *Spartinetum townsendii*. The expansion of the latter has much reduced the area of lower marsh available for pioneer *Salicornia* establishment especially in south-east England.

Although the annual *Salicornietum* is generally the lowest marsh community proper it may rarely initiate a succession because summer accretion can be offset by ablation after the stands have disappeared in the winter. Chapman (1957) has, however, produced a cartographic record of changes in the distribution of *Salicornia* marsh at Scolt Head, Norfolk with ageing of open and closed marshes.

Distribution

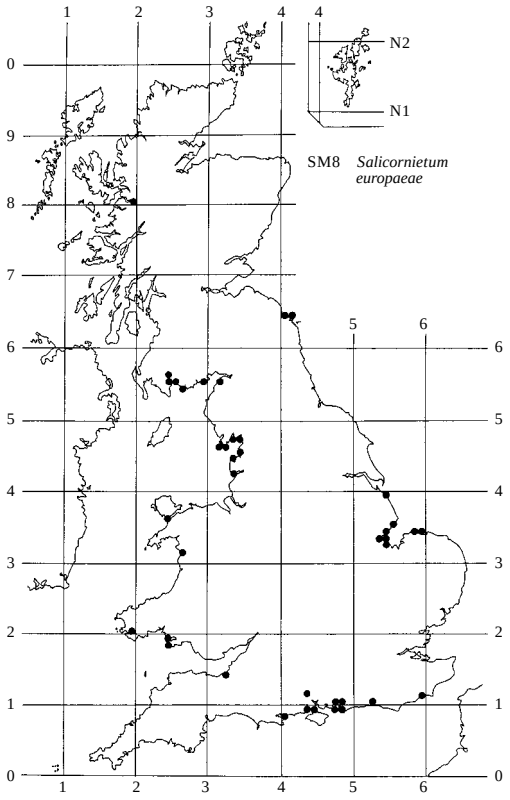
The community is widely distributed around the British coastline. On the sandy marshes of the west coast occurrences are local, though extensive open stands occur in some estuaries. The very local distribution in western Scotland is largely a reflection of the lack of suitable habitats: many loch-head marshes are fronted by cobble beaches rather than sand flats and these carry a dense cover of free-living fucoids.

Affinities

Equivalent communities have a widespead distribution in Europe. Although various divisions have been made with the *Salicornietum europaeae*, the general composition and habitat relationships of the vegetation types accord with the British community (see, for example, Beeftink 1962, 1965, 1972, 1977*a*).

Floristic table SM8

Salicornia agg.	V (4–9)
Algal mat	III (3–8)
Puccinellia maritima	III (1–7)
Suaeda maritima	II (1–5)
Spartina anglica	II (1–5)
Halimione portulacoides	I (1–3)
Aster tripolium var. *discoideus*	I (1–4)
Aster tripolium (rayed)	I (1–3)
Number of samples	81
Mean number of species/sample	3 (1–7)
Mean vegetation height (cm)	7 (2–20)
Mean total cover (%)	53 (5–95)



SM9

Suaeda maritima salt-marsh community
Suaedetum maritimae (Conrad 1935) Pignatti 1953

Synonymy
Suaeda maritima nodum Adam 1976; *Salicornietum auct. p.p.*

Constant species
Suaeda maritima is a variable taxon within which a number of distinct forms have been recognised. These are sometimes treated as varieties (e.g. Chapman 1947, Clapham *et al.* 1962) or as species. Ball (1964) has a single sub-species *S. maritima maritima* to include all British material. This is the only constant taxon of the community.

Physiognomy
This is a species-poor community, generally open, though always dominated by *Suaeda maritima* the density of which is normally high. There is sometimes a little annual *Salicornia*, *Puccinellia maritima*, *Spartina anglica*, *Halimione portulacoides* and *Aster tripolium* var. *discoideus*. An algal mat is quite common and Chapman (1947) lists seven different algal assemblages associated with abundant *Suaeda maritima*.

Sub-communities
Variation within the community is continuous, though the predominance in particular stands of different forms of *Suaeda maritima* has been used by some (e.g. Géhu 1975) to assign such stands to different communities. However, diagnosis is often difficult and there seem to be few consistent ecological differences between the taxa.

Habitat
Suaeda maritima is an annual and it is tolerant of a wide range of soil types subject to various submersion regimes: Chapman (1947) reported it dominant on Norfolk marshes with between 290 and 430 submergences/year. Like the annual Salicornias, its growth appears heavily dependent upon sediment nutrients, especially nitrogen (Pigott 1969, Stewart *et al.* 1972), and it is particularly characteristic of open situations free of competition from established perennials. On the lower marsh it is especially distinctive of rather gravelly mud where it forms mosaics with stands of annual Salicornias. Fragmentary stands are found around the base of the shell banks which occur at low levels in a few sites. Pure stands of *S. maritima* are a distinctive feature of disturbed situations such as the piles of sediment dumped on marshes during the construction of sea walls and drainage channels. Creek sides can also carry the community. Two further distinctive habitats are the accumulations of drift litter that occur at the foot of sea walls where dense stands can exploit the release of nutrients upon decomposition of the litter (see Beeftink 1966) and brackish areas behind sea walls where prostrate forms of *S. maritima* are common.

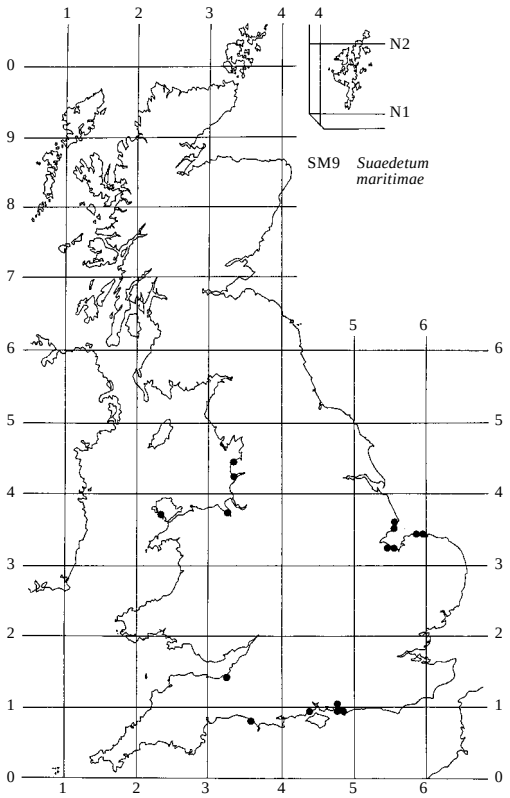
Zonation and succession
The habitat diversity of the community makes it difficult to generalise about the successional status of the community. In situations subject to repeated disturbance it can recur every year but increased stabilisation leads to replacement by the community appropriate for the particular level of the marsh.

Distribution
The community is widespread but many stands are fragmentary. It is most frequent in south-east England and very local in west Scotland.

Affinities
Although sometimes considered as part of a *Salicornietum*, stands dominated by *Suaeda maritima* are sufficiently distinctive to be worthy of considering as a separate community. Certain authors (e.g. Beeftink 1962, 1965, 1977*a*; Westhoff & den Held 1969) consider the nitrophilous character of the vegetation warrants placing the community with the ephemeral driftline associations of the Cakiletea but the floristic affinities to that class are few. The low-marsh occurrences are seen by others (e.g. Géhu 1975, Géhu & Delzenne 1975) as indicating a similarity to the communities of the Thero-Salicornieta which then becomes the class for all ephemeral chenopod-dominated vegetation types of the low marsh.

Floristic table SM9

Suaeda maritima	V (6–10)
Salicornia agg.	IV (2–7)
Puccinellia maritima	II (2–4)
Algal mat	II (5–8)
Spartina anglica	II (2–3)
Halimione portulacoides	II (1–4)
Aster tripolium var. *discoideus*	II (1–3)
Aster tripolium (rayed)	I (2)
Number of samples	18
Mean number of species/sample	3 (2–8)
Mean vegetation height (cm)	27 (8–50)
Mean total cover (%)	69 (30–100)



SM10

Transitional low-marsh vegetation with *Puccinellia maritima*, annual *Salicornia* species and *Suaeda maritima*

Adam (1976) recognised a number of vegetation types of the low marsh in which *Puccinellia maritima* was co-dominant with annual *Salicornia* species and/or *Suaeda maritima* during the growing season but which during the winter took on the appearance of very open *Puccinellia maritima* swards. Such transitional vegetation can be regarded as one extreme of variation within the *Puccinellietum maritimae* but, particularly in detailed studies of individual marshes, separate recognition might be appropriate. The description below refers to stands in which all three taxa are present.

Synonymy
Puccinellietum maritimae (Warming 1906), W. Christiansen 1927 *auct. p.p.*; *Puccinellia-Salicornia-Suaeda* nodum Adam 1976; *Suaedetum maritimae auct. p.p.*

Constant species
Puccinellia maritima, annual *Salicornia* spp., *Suaeda maritima*.

Rare species
Arthrocnemum perenne.

Physiognomy
Stands of the community are invariably species-poor and always dominated by complementary proportions of the three constants which during the growing season form a fairly low sward of rather variable total cover. Rayed *Aster tripolium* and *A. tripolium* var. *discoideus* are quite frequent though never abundant. There is sometimes an algal mat which can cover up to 50% of the substrate surface.

Habitat
At its lower limit the number of tides flooding the community is probably similar to that experienced by the lower part of the *Puccinellietum maritimae*. Soils vary from firm clays to coarse sands with a pH range of 7.0–8.0 and high levels of free calcium carbonate.

On sandy substrates, the community may occur as a pioneer. It is then rarely extensive, forming patches in a mosaic with the *Salicornietum europaeae*, the *Spartinetum townsendii* or the *Puccinellietum maritimae*. Where the lower marsh consists of a hummocky *Puccinellia maritima* community, a situation confined to sandy marshes which are normally heavily grazed, this transitional community may be found on the hummock tops (cf. Oliver 1907, Hill 1909, Tansley 1911).

On muddier marshes in south-east England, the community behaves in the contrary fashion, occurring in slight depressions within the *Puccinellietum maritimae*, *Spartinetum townsendii*, *Asteretum tripolii* and *Halimionetum portulacoidis*.

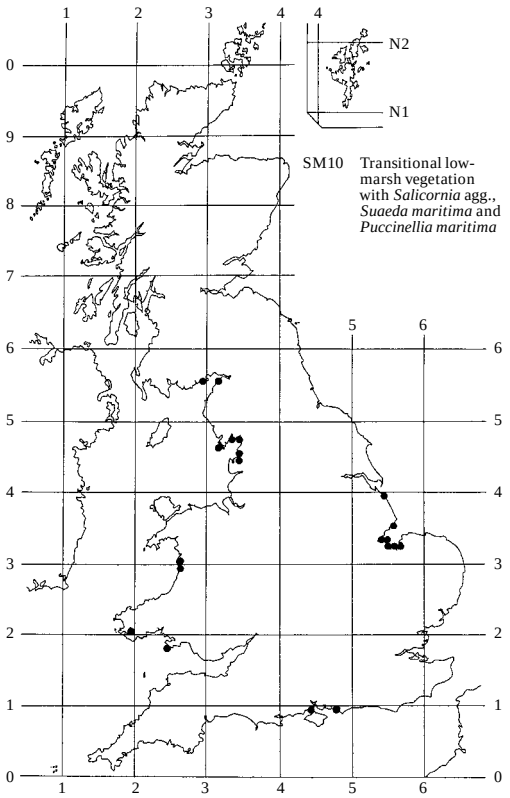
The community is also widespread on the sides of large creeks where it occupies a distinct zone above the *Salicornietum europaeae*. The majority of such occurrences are on ungrazed or cattle-grazed marshes; on sheep-grazed marshes, the community is confined to inaccessible creek sides.

Zonation and succession
In the low marsh, the community will be replaced by others as accretion progresses: in the south-east most probably by the *Puccinellietum maritimae* or the *Halimionetum portulacoidis*, in the west by the former or, more rarely, by the *Juncetum gerardi*. Creekside occurrences are part of what is probably a static zonation rather than a successional sequence.

Distribution
Apart from along the western Scottish coast, where occurrences are relatively rare, the community is widespread, although stands are often small.

Floristic table SM10

Puccinellia maritima	V (2–9)
Salicornia agg.	V (2–8)
Suaeda maritima	V (2–8)
Aster tripolium var. *discoideus*	III (2–5)
Aster tripolium (rayed)	III (1–4)
Algal mat	II (4–7)
Spartina anglica	I (1–4)
Halimione portulacoides	I (1–2)
Triglochin maritima	I (3–4)
Spergularia media	I (2–3)
Limonium cf. *L. vulgare*	I (2)
Armeria maritima	I (1–4)
Number of samples	50
Mean number of species/sample	5 (3–8)
Mean vegetation height (cm)	15 (4–40)
Mean total cover (%)	88 (30–100)



SM11

Aster tripolium var. *discoideus* salt-marsh community

Asteretum tripolii Tansley 1939

Synonymy

Asteretum and Creek *Asteretum* Chapman 1934; *Aster tripolium* var. *discoideus* nodum Adam 1976; descriptions of Great *Aster* marsh, Scolt Head, Norfolk.

Constant species

Aster tripolium var. *discoideus*, *Puccinellia maritima*, *Salicornia* agg.

Rare species

Arthrocnemum perenne.

Physiognomy

The association is dominated by the rayless *Aster tripolium* var. *discoideus* which is especially distinctive in the late summer–early autumn flowering season when its stems may attain a height of about 1 m; at other times the vegetation is 10–20 cm tall. The stands are generally rather species-poor though there is usually some *Salicornia* agg., *Puccinellia maritima* and *Suaeda maritima*. The substrate surface is frequently dissected by small drainage runnels threading between the *A. tripolium* rootstocks and locally may be carpeted by free-living fucoids, mainly *Fucus vesiculosus* ecad *caespitosus* and *Pelvetia canaliculata* ecad *libera*.

Although there is a floristic gradation between low-level stands with abundant *Salicornia* agg. and those at higher levels with abundant *Puccinellia maritima*, no sensible subdivisions can be made within the association. The floristic disinctions catalogued by Chapman (1934) between a low-marsh *Asteretum* and a Creek *Asteretum* are not borne out in the samples.

Habitat

The association occurs as an extensive zone in the low marsh or on creek sides at varying levels in the marsh. At its lower limits, the association seems able to tolerate upwards of 500 submergences/year (Chapman 1960*a*) with a maximum development around 350 submergences/year (Clapham *et al*. 1942). The sediments are predominantly firm clays or silts low in organic matter but with a high proportion of fine shell fragments and a pH between 7.0 and 8.0. Most of the sites are ungrazed or only lightly cattle-grazed.

Zonation and succession

In the low marsh the association forms a distinct zone above the *Salicornietum europaeae* or the *Spartinetum townsendii* or, occasionally, at the most seaward limit. Upwards it passes into the *Puccinellietum maritimae* or the *Halimionetum portulacoidis*. Landward boundaries are diffuse and patches of the association are frequently found in the lower part of the zone above.

Although *A. tripolium* var. *discoideus* can grow at lower levels on the shore than many salt-marsh species, it is not a successful primary coloniser. Gray (1971) has suggested that it has spread in recent years, possibly following *Spartina anglica* invasion of bare substrates, but the evidence for this is inconclusive. At Scolt Head, Norfolk, Chapman (1959) has shown the association developing from the *Salicornietum europaeae* in about 25 years.

Distribution

The association is predominantly south-eastern in its distribution, being frequent in The Wash, north Norfolk and Essex. Old records have *A. tripolium*-dominated communities on Canvey Island (Carter 1932) and in the Humber (Good & Waugh 1934). It is local on the south coast and in the Bristol Channel (but see Thompson 1922, 1930) and its general absence from the west may reflect climatic limitations, the scarcity of muddy marshes or the higher incidence of grazing there.

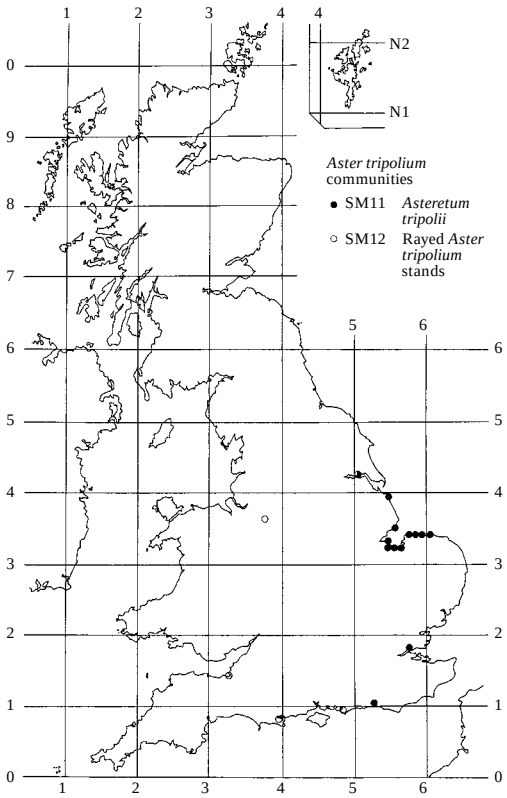
Affinities

The position of the association in the salt-marsh zonation places it between the annual communities of the Salicornietea and the perennial communities of the Asteretea but the perennial nature of *A. tripolium* var. *discoideus* itself suggests that it is best seen alongside the *Puccinellietum maritimae* and the *Juncetum gerardi* of the latter class.

Floristic table SM11 & SM12

	11	12a	12b
Aster tripolium var. *discoideus*	V (4–10)	III (4–7)	
Puccinellia maritima	V (1–9)	V (3–7)	
Salicornia agg.	V (3–9)	III (2–4)	
Suaeda maritima	III (2–8)	III (2–4)	
Algal mat	II (2–8)	I (6)	
Halimione portulacoides	II (1–5)		
Arthrocnemum perenne	I (1–5)		
Fucus vesiculosus ecad *caespitosus*	I (5–8)		
Pelvetia canaliculata	I (4–9)		
Bostrychia scorpioides	I (3–7)		
Aster tripolium (rayed)		V (5–8)	V (7–10)
Spartina anglica	II (1–6)	IV (2–3)	
Plantago maritima	I (4)	III (2–6)	
Spergularia media	I (3–4)	III (4–6)	
Triglochin maritima		II (5)	
Puccinellia distans			V (3–4)
Spergularia marina			III (1–3)
Atriplex prostrata		I (5)	III (2–3)
Scirpus lacustris tabernaemontani			II (2–7)
Juncus bufonius			II (2–3)
Number of samples	53	7	9
Mean number of species/sample	5 (3–8)	6 (4–9)	4 (2–6)
Mean vegetation height (cm)	28 (5–150)	43 (15–80)	68 (60–100)
Mean total cover (%)	80 (45–100)	81 (50–90)	99 (90–100)

11 *Aster tripolium* var. *discoideus* salt-marsh
12a Coastal stands of rayed *Aster tripolium*
12b Inland stands of rayed *Aster tripolium*


N2
N1
Aster tripolium communities
SM11 *Asteretum tripolii*
SM12 Rayed *Aster tripolium* stands

SM12
Rayed *Aster tripolium* on salt-marshes

Stands dominated by rayed *Aster tripolium* have been encountered in situations with some freshwater influence such as brackish ditches behind sea walls where *Spartina anglica* and *Puccinellia maritima* are frequent associates. Beeftink (1962, 1965) has described similar vegetation from sites with local freshwater flushing as a distinct *Aster tripolium* sociatie. Rayed *A. tripolium* is also abundant on periodically-flooded saline muds in inland salt-marshes with *Spergularia marina* and *Puccinellia distans* (see the *Puccinellietum distantis astereto-sum* of Lee 1977; also Edees 1972).

Although some floras note a certain habitat distinction between rayed forms of *A. tripolium* and the var. *discoideus* (e.g. Petch & Swann 1968, Jermyn 1974, Gibbons 1975), the situation is far from simple. The var. *discoideus* can also occur in brackish habitats and Jermy & Crabbe (1978) have recorded vegetation rich in dwarf rayed *A. tripolium* and *Suaeda maritima* from Salen Marsh, Mull, where there is little freshwater influence (cf. the intertidal *Suaedeto maritimae-Asteretum tripolii* Hocquette & Géhu 1965 in Ghestem 1972). Furthermore, even within the rayed form there appears to be a complex of genetically determined variation adapted to different environmental conditions (Gray 1971, 1974; Gray *et al*. 1979). Further sampling is needed to establish the ecological implications of this variation and to check the validity of erecting separate communities for the different forms.

SM13

Puccinellia maritima salt-marsh community

Puccinellietum maritimae (Warming 1906) Christiansen 1927

Synonymy

The *Puccinellietum maritimae* includes a considerable range of closely-related vegetation types. The limits of the association as a whole are similar to those adopted in recent Continental accounts (e.g. Beeftink 1965, Westhoff & den Held 1969) and, as such, would include all or part of a variety of salt-marsh types in earlier British descriptions. The synonmy of the communities is complex and, as many synonyms would be partial, a complete list is not attempted here. Where a particular sub-community has a clear counterpart *in litt*. a note is given below.

Constant species

Puccinellia maritima.

Rare species

The association does not provide the sole, or even major, context for any national rarity but the following occur occasionally: *Arthrocnemum perenne*, *Limonium bellidifolium*, *L. binervosum*, *Salicornia pusilla*, *Spartina maritima* and *Suaeda vera*.

Physiognomy

Mostly, the association occurs as a closed species-poor grassland but the complete range includes very open pioneer vegetation and herb-dominated stands in which *Puccinellia maritima* is of minor importance or even absent. The sward varies from a tight low turf 1–2 cm high to a rank mattress up to 50 cm tall. Although grazing is important in controlling the physiognomy (see below), a considerable range of genetically determined morphotypes of *P. maritima* is present in Britain (Gray & Scott 1977*a*; 1980). Although species from low- and high-marsh communities occur as associates, the *Puccinellietum maritimae* as a whole is differentiated from the low-marsh communities by the reduced frequency and cover/abundance of annual *Salicornia* species and *Spartina anglica* and from the high marsh by low levels of *Festuca rubra*, *Agrostis stolonifera* and *Juncus gerardii*. The most common associates throughout are *Triglochin maritima*, *Plantago maritima* and *Armeria maritima* and there is frequently an algal mat, often floristically varied and comprising a number of distinct species assemblages (Carter 1932, 1933*a*, *b*; Chapman 1934, 1937; Polderman 1979).

Sub-communities

Although the association is of widespread occurrence and individual stands are often great in extent and highly distinctive, the general species-poverty of the vegetation and the site-specific nature of much variation makes it difficult to attain an entirely satisfactory national subdivision. The sub-communities described below should be regarded as provisional and independent local schemes may sometimes be preferable. Alternative national classifications would also be possible: the scheme of Beeftink (1962, 1965) could, for example, be applied here with the addition of units to accommodate communities of northern and western Britain.

Sub-community with *Puccinellia maritima* dominant: *Puccinellietum* (*Glycerietum*) *maritimae* Tansley 1911. This is the most extensive and widespread perennial community of the lower salt-marsh in the British Isles. *P. maritima* is constant and dominant throughout forming a fairly closed sward in which other species are generally poorly represented. Adam (1976) recognised two noda, making a distinction between samples which are less and more species-rich but such a division is somewhat arbitrary and it is probably preferable to recognise a single rather diverse unit. The associate species vary with the level in the marsh and the geographical locality of the sub-community. At the lowest levels, annual *Salicornia* spp. and *Suaeda maritima* are most frequent: at higher levels, *Triglochin maritima*, *Plantago maritima* and *Aster tripolium* are found. *Limonium vulgare* is more frequent in the south and east and *Armeria maritima* in the west. *Glaux maritima* is virtually absent from this vegetation in south-east England. Locally, very dense stands of tall

Puccinellia maritima occur at relatively high levels in the marsh, most notably around The Wash; these stands are often monospecific but may have *Atriplex hastata*.

***Glaux maritima* sub-community:** *Glaucetum maritimae* Dahl & Hadač 1941; *Glaux maritima* isozion Dahlbeck 1945; *Glaux maritima* sociatie Beeftink 1962. Although *G. maritima* occurs at varying levels throughout the association, it is here constant and co-dominant with *Puccinellia maritima* in a low generally species-poor sward. The frequency and cover/abundance of *Triglochin maritima*, *Plantago maritima* and *Armeria maritima* stand between their low levels in the *Puccinellia*-dominated sub-community and the high values they attain in the *Limonium-Armeria* sub-community. *L. vulgare* itself and *Halimione portulacoides* are rare. Stands of this sub-community are often small and fragmentary but at some sites cover large areas. During hot dry summers, the shoots of *Glaux maritima* may become shrivelled by late July in upper-marsh sites. Further, although *G. maritima* is a perennial, its aerial parts die back completely in the winter when stands may appear virtually devoid of vegetation.

***Limonium vulgare-Armeria maritima* sub-community:** General Salt Marsh Tansley 1911 & Chapman 1934 (but not Chapman 1960); *Puccinellietum* (*Glycerietum*) *maritimae* Tansley 1911 *p.p.*; *Statice & Armeria* societies Marsh 1915; *Plagntag*(*in*)*etum* Chapman 1934 *p.p.*; *Limonietum & Armerietum* Tansley 1939 (but not *Armerietum* Yapp & Johns 1917); *Plantagini-Limonietum* Westhoff & Segal 1961; forb salt marsh Dalby 1970. This is one of the most distinctive communities of British salt-marshes with a varied sward dominated by herbaceous dicotyledons which present a colourful spectacle when flowering. *Limonium vulgare*, *Armeria maritima*, *Triglochin maritima*, *Plantago maritima*, *Halimione portulacoides* and annual *Salicornia* spp. (including locally the uncommon *S. pusilla*) are all constant and can be abundant. *Puccinellia maritima*, though also constant, rarely comprises more than 10% of the sward. There is often an algal mat and frequent scattered plants of *Spergularia media* and *Suaeda maritima*. *Limonium humile*, though of only occasional occurrence in this sub-community in south-east England, sometimes replaces *Limonium vulgare*, as in Milford Haven (Dalby 1970) and, to a lesser extent, in south-west Scotland. At the highest levels to which the sub-community extends, *Festuca rubra* and *Juncus gerardii* may occur.

The vitality of the common species is variable. Both *Limonium vulgare* and *Armeria maritima* flower profusely but *Aster tripolium* and, at some sites, *Plantago maritima* flower infrequently. *Halimione portulacoides* occurs not in shrubby form but as scattered prostrate shoots with small fleshy leaves which tend to be shed in late summer. Annuals, such as the *Salicornia* spp. and *Suaeda maritima*, persist as small plants which often turn red in early summer, possibly reflecting their inability to compete with established perennials for nutrients, particularly nitrogen.

***Plantago maritima-Armeria maritima* sub-community:** *Armerietum* Yapp & Johns 1917 *p.p.*; *Plantag*(*in*)*etum* Chapman 1934 *p.p.*; *Plantago maritima* isozion Dahlbeck 1945. This resembles the *Limonium-Armeria* sub-community in being dominated by herbaceous dicotyledons. *Plantago maritima*, *Armeria maritima* and *Triglochin maritima* are again constant and abundant and *Puccinellia maritima* is, as there, a relatively inconspicuous contributor to the sward. Here, however, *Halimione portulacoides* is rare and *Limonium vulgare* absent while *Glaux maritima* and rayed *Aster tripolium* are constant. Although always virtually closed, the vegetation exists in two physiognomic forms based on variation in *Plantago maritima* which sometimes has long leaves and an upright habit (Chapman 1934), sometimes short leaves appressed to the soil surface.

***Puccinellia maritima*-turf fucoid sub-community.** Turf fucoids occur at low levels in various types of *P. maritima* salt-marsh, but here they comprise an extensive dense understorey of diminutive plants beneath a sward often dominated by *Plantago maritima* but also with constant and abundant *Puccinellia maritima*, *Glaux maritima* and *Armeria maritima*. *Fucus vesiculosus* ecad *muscoides* is the principal fucoid and Cotton (1912) and Polderman & Polderman-Hall (1980) have both described the understorey as a discrete algal assemblage.

***Puccinellia maritima-Spartina maritima* sub-community:** *Puccinellietum maritimae typicum*, phase with *Spartina maritima* Beeftink 1962. Here, *P. maritima* dominates with variable amounts of *Spartina maritima*, annual *Salicornia* spp., *Limonium vulgare*, *Suaeda maritima* and *Aster tripolium* var. *discoideus*. Stands of this sub-community are generally a few tens of square metres in extent.

Habitat

The *Puccinellietum maritimae* is the most widespread and extensive perennial community of the lower salt-marsh in Britain. It occurs both as a discontinuous pioneer zone and as a continuous sward in the zonation above the pioneer vegetation. It is also common on slumped creek-sides, in old pans and on disturbed sites in the upper marsh. Fragmentary stands of the association are found infrequently on very exposed maritime cliffs, for example on the Butt of Lewis, Outer Hebrides. (see also Praeger 1911).

The association occurs on a wide range of substrates including various clays and silts, highly calcareous sands

and soils of high organic content; more rarely, it is found on gravel and shingle. Its importance as a colonising community is very much increased on sandier substrates: it is the most frequent pioneer on the sandy marshes of western England and Wales and commoner, for example, on the north-west as against the south-east shore of The Wash (Anon. 1976). The pH is usually basic with most soils in the range 6.0–8.5 (Adam 1976, Bridges 1977, Gray & Scott 1977*a*). Sediments in pioneer and lower marsh zones are generally higher in calcium content and lower in organic matter than those higher up the marsh (Gray & Bunce 1972, Adam 1976). Soils are often intermittently waterlogged and poorly aerated and share a moderate to high submergence rate and salinity. Data on submergence are limited but suggest that the lower limit of the *Puccinellietum* may experience more than 350 submergences/year; Gray & Scott (1977*b*) recorded a mean rate for their Morecambe Bay samples with *Puccinellia maritima* of 220 submergences/year while on Scolt Head, Norfolk, Chapman's General Salt Marsh extended from 150 to 225 submergences/year (Chapman 1960*b*). Proctor (1980) measured salinities of 12–30 g l^{-1} for *Puccinellia maritima* in the Exe estuary, Devon, but levels well in excess of those of sea-water may develop in the higher marsh because of evaporation in the absence of submersion.

Grazing is of undoubted importance in the maintenance of the association though its effect is complex and there is evidence that the response of species varies between sites. Many marshes are heavily used for pasturing stock, most frequently sheep but also cattle and horses; wildfowl, rabbit, hare and vole grazing may also be intensive. Grazing affects the species composition of the sward. It may be important in maintaining the dominance of perennial grasses as against herbaceous dicotyledons (Gray 1972) or in controlling the balance between *Puccinellia maritima* and *Festuca rubra* (Gray & Scott 1977*b*): *P. maritima* responds to grazing by the production of small, prostrate, short-leaved and rapidly tillering forms (Gray & Scott 1977*a*, 1980). With intensive grazing *Limonium* spp. and *Halimione portulacoides* may be reduced in abundance (Boorman 1967, Ranwell 1968, Rojanavipart & Kay 1977). On silt and clay marshes heavy cattle-trampling can lead to widespread poaching.

Moderate grazing helps maintain a sward which can support considerable populations of wintering wildfowl. There is evidence of a preference for *Puccinellia maritima* as against rank swards, such as those of the *Juncetum gerardi*, in wigeon (Cadwalladr *et al*. 1972, Cadwalladr & Morley 1974) and the brent goose (Charman & Macey 1978). For brent, the *Puccinellietum* provides a valuable food source after *Zostera* and *Enteromorpha* and there is heavy use in January–March (Ranwell & Downing 1959; Charman 1975, 1977*b*, 1979; Charman & Macey 1978).

Some of the species in the association are resistant to oil spillage by virtue of their underground storage organs, e.g. *Plantago maritima*, *Armeria maritima* and *Triglochin maritima*, but *Puccinellia maritima* itself declines rapidly with repeated oiling (Baker 1979).

The particular environmental relationships of the sub-communities are as follows. The *Puccinellia-Glaux* sub-community occurs in a number of different habitats all of which are open to rapid disturbance: old turf-cuttings, former pans, creeks, old cart tracks. It is also found in situations where the boundary between salt-marsh and dune becomes blurred: where sand is blown on to the upper marsh, where dune lows are subject to tidal flooding (see Lambert & Davis 1940) and where salt-marsh/dune interfaces are subject to disturbance by trampling or car-parking. There are small stands on gravel and shingle on the upper marsh at some sites and, at others, large stands in the open areas behind sea walls.

The *Limonium-Armeria* sub-community is found at relatively high levels in the salt-marsh zonation. Frequently it does not form a continuous belt but occurs as a series of small discrete stands separated from each other by creek levees. The soil in these inter-creek basins is normally a heavy clay with a considerable quantity of organic matter (loss on ignition >30%) in the upper few centimetres of the profile. The development of creek levees restricts the drainage in the basins (the concave stage of marsh development after Beeftink 1966): water may be retained there after submergence (Perraton 1953) and the soils are often strongly gleyed. On many salt-marshes in south-east England such stands have the maximum pan density within the sites (Pethwick 1974). The pan edges are often marked by a narrow fringe of more vigorous vegetation in which *Triglochin maritima* is particularly prominent.

At some sites, where salt-marsh abuts onto dunes, there is an unbroken zone of this sub-community. Here the sediments are sands or alternating bands of sand and clay and pans and creeks are relatively few; such creeks as do occur lack pronounced levees. At the higher parts of such stands *Festuca rubra* and *Juncus gerardii* occur. This habitat seems to be that described for the *Plantagini-Limonietum* Westhoff & Segal 1961.

The *Plantago-Armeria* sub-community is also found at comparatively high levels. The form with tall *Plantago maritima* occurs above the *Limonium-Armeria* sub-community and the form with short *P. maritima* in shallow depressions throughout the upper *Puccinellietum* and sometimes in the higher *Juncetum gerardi* of grazed salt-marshes. Extensive stands are found in some re-vegetated turf-cuttings in Morecambe Bay.

The *Puccinellia*-turf fucoid sub-community is rare or absent from sandy salt-marshes and is especially characteristic of loch-head sites in west Scotland where shallow soils (20–30 cm deep) develop over rock or shingle. Such

soils tend to have a high organic content, to be reddish in colour and to contain coarse gravel throughout the profile. Although high salinities can be attained during drought (Gillham 1957*b*), *Festuca rubra* may occur even at the lowest levels attained by this sub-community, perhaps reflecting the influence of high regional rainfall. Small stands of the sub-community are also widespread among coastal rocks in the lower splash zone.

The *Puccinellia-Spartina maritima* sub-community is very local but it has been recorded from mid-marsh depressions and upper-marsh borrow pits with soft mud. Beeftink (1962) considered the vegetation characteristic of mud-flat/salt-marsh transitions.

Zonation and succession

Where the *Puccinellietum* is a pioneer community, as on sandier substrates, it appears to establish itself mainly by the rooting of vegetative fragments of *P. maritima* uprooted from existing swards by grazing stock and carried by tides (Ranwell 1961, Brereton 1971, Adam 1976, Gray & Scott 1977*a*). *P. maritima* can set abundant seed (Gray & Scott 1977*a*) but it has no special dispersal mechanism and, though caryopses can be washed away, seedling establishment in the pioneer zone seems uncommon.

Once established, the scattered plants produce numerous radiating stolons and accrete sediment into a series of hummocks (see Plate 3 in Ranwell 1972). Hummock size varies from shore to shore: some hummocks never exceed 50 cm in height but others are taller and attain a diameter of several metres. The hummock tops may carry the transitional *Puccinellia-Salicornia-Suaeda* community. Yapp & Johns (1917) postulated that the intervening hollows developed into pans but Pethwick (1974) showed that such a model could not account for the majority of upper-marsh pans.

At some sites a narrow zone of very scattered hummocks gives way quickly to a continuous sward of the *Puccinellia*-dominated sub-community. In other cases the hummocky topography persists much higher upshore (see the striking photographs in Yapp & Johns 1917) and eventually passes to fairly smooth swards of some *Puccinellietum* vegetation or, in the mid- and upper marsh, to *Juncetum gerardi* which is the usual high level vegetation of the grazed marshes of the west coast (Figure 8). On ungrazed west coast sites, the *Limonium-Armeria* sub-community may occur in the upper marsh.

In the south-east, the *Puccinellietum* is rarely a pioneer community. Its position in the zonation varies, the *Puccinellia*-dominated sub-community appearing either below or above the *Halimionetum portulacoidis*. In this region, the *Puccinellietum* can be found right up to the tidal limit, either as the *Puccinellia*-dominated sub-community, as around The Wash, or as the very characteristic high marsh *Limonium-Armeria* sub-community.

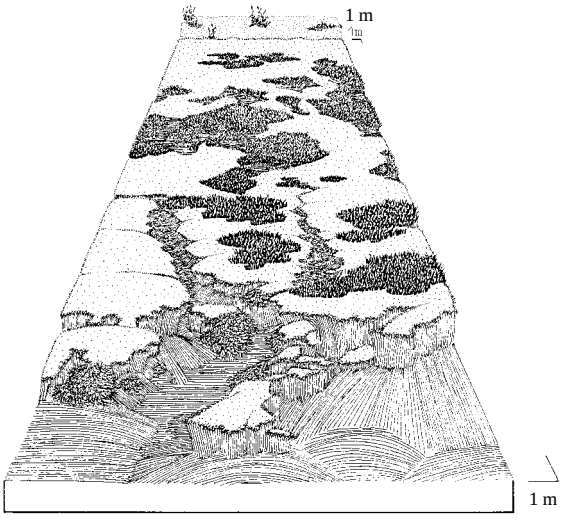
In the upper reaches of estuaries, where the soil salinity in the lower marsh is kept constantly low by freshwater dilution, an inversion of the normal zonation may be found with the *Puccinellietum* in upper marsh depressions where evaporation produces high salinities (Gillham 1957*a*, Adam 1976). Disturbance of upper marsh sites frequently results in the association appearing as a secondary pioneer, especially in the form of the *Puccinellia-Glaux* sub-community (cf. Beeftink 1962).

In the loch-head sites where the *Puccinellia*-turf fucoid sub-community is characteristic, it is frequently the lowest vegetation but it seems only rarely to be actively expanding. To seaward, there is usually a very low cliff or the vegetation cover is discontinuous with discrete patches on isolated rock or gravel plinths.

Distribution

The association is the most widespread community on British salt-marshes and probably no site lacks at least a fragmentary stand. The *Puccinellia*-dominated sub-community is the most widespread of the types, being frequent on all coasts except those of west Scotland and

Figure 8. Zonation on an eroding salt-marsh. The intact marsh carries various kinds of SM16 *Juncetum gerardi*, a ground of the *Armeria* variant of the *Festuca-Glaux* sub-community with patches of the *Juncus gerardii* sub-community. Running down below, on material slumped from the sides of the simple 'herring-bone' creeks, is a narrow zone of the SM13 *Puccinellietum maritimae*. The sequence terminates above in fragmentary SM24 *Atriplici-Elymetum pycnanthi*.



the northern Isles where it is largely replaced by the *Puccinellia*-turf fucoid sub-community. The *Plantago-Armeria* sub-community is also widespread, though local, and the *Puccinellia-Glaux* sub-community is commoner on the west coast. The *Limonium-Armeria* sub-community is widespread in the south-east but much less frequent on the west coast where it is confined to lightly grazed and ungrazed sites. *Spartina maritima* is declining throughout northern Europe and the *Puccinellia-S. maritima* sub-community is restricted to Essex (and perhaps north Kent?).

Affinities

The vegetation types within the *Puccinellietum maritimae* can be seen as a floristic transition between the open annual communities of the lower marsh dominated by *Salicornia* spp. and *Suaeda maritima* and the *Juncetum gerardi* swards of the mid- and high marsh. The association grades floristically to the former through the more species-poor forms of the *Puccinellia*-dominated sub-community and the transitional *Puccinellia-Salicornia-Suaeda* vegetation.

Floristic table SM13

	a	b	c	d	e	f	13
Puccinellia maritima	V (4–10)	V (2–10)	V (1–8)	III (2–7)	V (4–9)	V (9–10)	V (1–10)
Glaux maritima	II (1–7)	V (5–9)	I (2–5)	V (2–5)	V (3–6)		II (1–9)
Armeria maritima	II (1–7)	III (2–7)	IV (3–8)	V (3–8)	IV (2–8)	I (1–5)	II (1–8)
Plantago maritima	II (1–7)	III (2–5)	IV (3–9)	V (5–9)	V (4–7)		II (1–9)
Salicornia agg.	III (2–6)	III (2–6)	IV (2–8)	II (2–3)	II (2–4)	V (4–10)	II (2–10)
Algal mat	II (3–10)	II (5–8)	IV (3–9)	II (4–8)	IV (4–7)		II (3–10)
Triglochin maritima	II (1–8)	III (2–4)	V (2–8)	IV (2–7)	II (1–3)	II (1–6)	II (1–8)
Aster tripolium (rayed)	III (1–8)	II (2–6)	II (2–7)	IV (2–7)	II (2–3)		II (1–8)
Suaeda maritima	III (1–6)	I (1–3)	III (1–3)	I (2–3)		IV (1–10)	II (1–10)
Halimione portulacoides	II (1–5)	I (2)	IV (1–6)	I (2–4)		III (4–10)	II (1–10)
Limonium cf. *L. vulgare*	II (1–8)	I (3)	V (2–8)			V (1–10)	II (1–10)
Turf fucoids*	I (2–3)		I (3)		V (4–9)		I (2–9)
Spartina maritima						V (1–10)	I (1–10)
Aster tripolium var. *discoideus*	I (1–5)					IV (1–8)	I (1–8)
Spergularia media	II (1–5)	II (2–3)	III (1–4)	III (1–3)	II (2–4)	I (3–5)	II (1–5)
Spartina anglica	I (1–7)	I (3)	I (2)	I (1–2)		I (5)	I (1–7)
Festuca rubra	I (2–5)	II (2–5)	II (2–6)	III (2–6)	II (2–4)		I (2–6)
Agrostis stolonifera	I (3–5)	I (2–3)	I (3–4)	II (3–6)	I (3–4)		I (2–6)
Limonium humile	I (2–5)	I (1–3)	I (1–8)	I (1–3)		I (4)	I (1–8)
Cochlearia officinalis	I (1–3)	I (2)	I (1–4)		I (3)		I (1–4)
Juncus gerardii	I (2–3)		I (2–6)	II (2–6)	I (3–4)		I (2–6)
Bostrychia scorpioides	I (4–7)		I (3–8)	I (6)	I(3)	I (8)	I (3–8)
Arthrocnemum perenne	I (1–3)		I (1–4)			II (1–6)	I (1–6)
Aster tripolium	I (1–6)		II (1–5)	I (3–4)			I (1–6)
Cochlearia anglica	I (1–6)		I (1–4)	I (2–3)			I (1–6)
Atriplex prostrata	I (1–7)						I (1–7)

Number of samples	319	23	89	26	17	20	494
Mean number of species/sample	6 (1–13)	6 (3–12)	9 (3–14)	8 (5–11)	7 (5–12)	7 (4–10)	7 (1–14)
Mean vegetation height (cm)	11 (2–50)	6 (2–15)	11 (3–25)	6 (2–15)	5 (2–15)	no data	6 (2–50)
Mean total cover (%)	88 (20–100)	85 (45–100)	91 (50–100)	96 (90–100)	91 (75–100)	no data	90 (20–100)

* Includes *Ascophyllum nodosum* ecad *mackaii*, *Fucus vesiculosus* ecad *caespitosus* and ecad *volubilis* and *Pelvetia canaliculata*.

a Sub-community with *Puccinellia maritima* dominant

b *Glaux maritima* sub-community

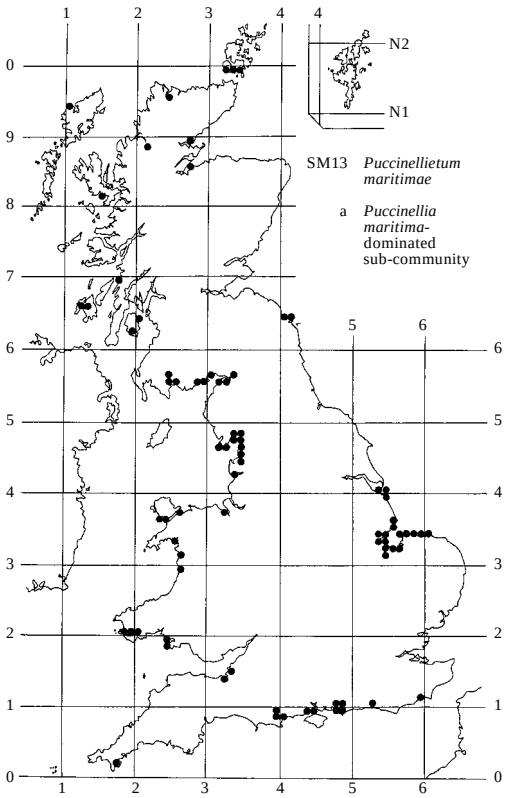
c *Limonium vulgare-Armeria maritima* sub-community

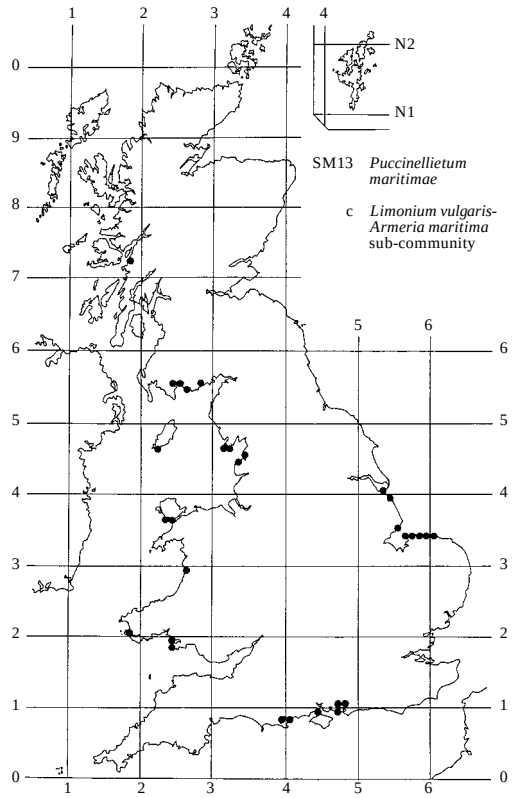
d *Plantago maritima-Armeria maritima* sub-community

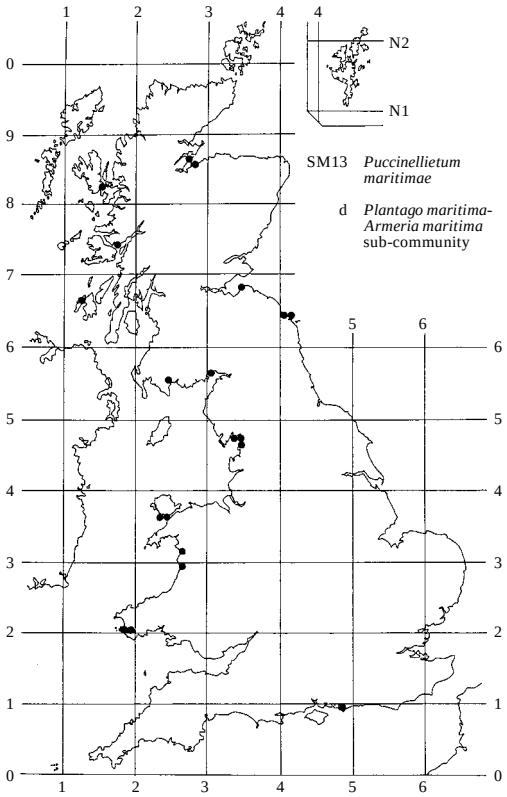
e *Puccinellia maritima*-turf fucoid sub-community

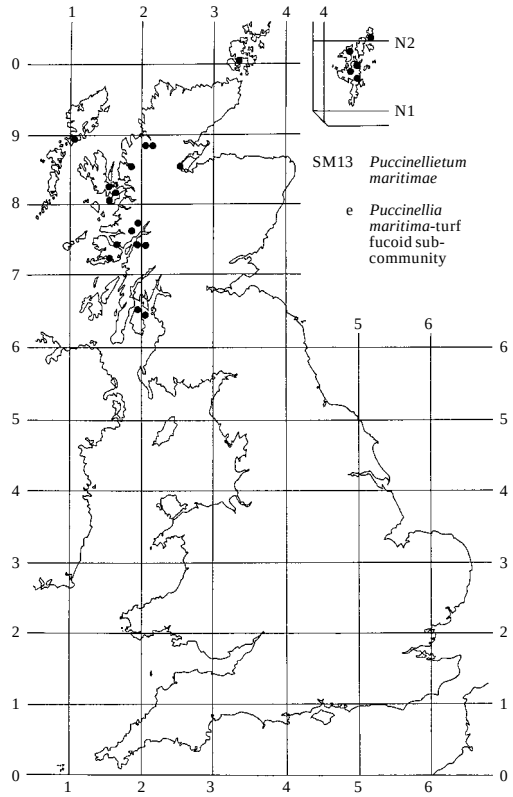
f *Puccinellia maritima-Spartina maritima* sub-community

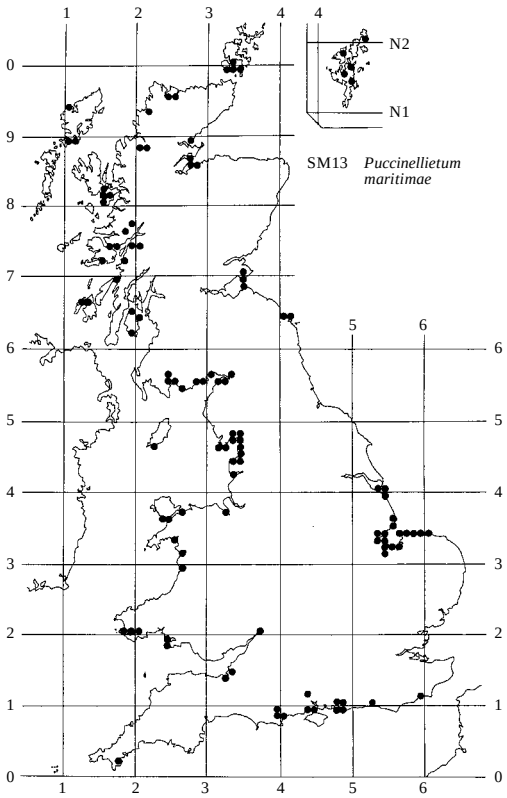
13 *Puccinellietum maritimae* (total)


N2
N1
SM13 *Puccinellietum maritimae*
a *Puccinellia maritima*-dominated sub-community


N2
N1
SM13 *Puccinellietum maritimae*
c *Limonium vulgaris-Armeria maritima* sub-community


N2
N1
SM13 *Puccinellietum maritimae*
d *Plantago maritima-Armeria maritima* sub-community


N2
N1
SM13 *Puccinellietum maritimae*
e *Puccinellia maritima*-turf fucoid sub-community


N2
N1
SM13 *Puccinellietum maritimae*

SM14

Halimione portulacoides salt-marsh community

Halimionetum portulacoidis (Kuhnholtz-Lordat 1927) Des Abbayes et Corillion 1949

Synonymy
Obionetum and *Halimionetum auct. angl.*

Constant species
Halimione portulacoides, *Puccinellia maritima*.

Rare species
Arthrocnemum perenne, *Frankenia laevis*, *Inula crithmoides*, *Limonium bellidifolium*, *Suaeda vera*.

Physiognomy
This is a closed, species-poor association in which *Halimione portulacoides* is constant and physiognomically conspicuous as a bushy canopy up to 50 cm high or as a virtually prostrate carpet. *Puccinellia maritima* is also constant and there is frequently a little *Suaeda maritima* and sparse records for a variety of species from both low and upper marsh. Epiphytic algae are often abundant on the lower stems of the *H. portulacoides* and at some sites small patches of fucoids are present beneath canopy gaps.

Sub-communities
Géhu & Delzenne (1975) allocated samples of *Halimione portulacoides* vegetation with the red alga *Bostrychia scorpioides* to the separate association *Bostrychio-Halimionetum portulacoidis* (Corillion 1953) R.Tx. 1963. Although *B. scorpioides* was recorded occasionally here, there is no substantial floristic reason for distinguishing samples containing this species as even a sub-community within the *Halimionetum*. The three following sub-communities are, however, quite distinct.

Sub-community with *Halimione portulacoides* dominant. In this most species-poor sub-community, *H. portulacoides* always has high cover values (usually >90%) and there is usually a sparse undercover of *Puccinellia maritima* and some *Suaeda maritima*. The *H. portulacoides* may be present as a low or tall even-topped canopy or as discrete hemispherical bushes 1–2 m diameter and up to 50 cm high. Though this last form is developed on sandy substrates, there is no floristic basis for distinguishing a Sandy *Obionetum* (*sensu* Chapman 1934) within this sub-community.

***Juncus maritimus* sub-community:** *Halimione-Juncus maritimus* nodum Adam 1976. Here *H. portulacoides* is somewhat reduced in cover and varying amounts of *J. maritimus* are present as scattered shoots emerging through the shrubby canopy or as small dense patches, presumably of clonal origin. *Puccinellia maritima* remains constant with low cover but here *Plantago maritima*, *Limonium vulgare* and *Triglochin maritima* are also frequent. *Elymus pycnanthus* is an uncommon but distinctive associate.

***Puccinellia maritima* sub-community:** *Puccinellio-Halimionetum portulacoidis* Sea Meadow Chapman 1934; *Puccinellietum maritimae typicum*, terminal phase with *H. portulacoides* Beeftink 1962. *H. portulacoides* and *P. maritima* are co-dominant in an intimate mixture with the shoots of the former making a diffuse open network (cf. mosaics with discrete patches of *Halimionetum* and *Puccinellietum*). *Suaeda maritima*, *Triglochin maritima*, *Plantago maritima* and *Limonium vulgare* are frequent and sometimes abundant and, at high levels on the marsh, *Festuca rubra* may be common.

Habitat
The association occurs on a variety of substrates including clays, sands, shingle and occasionally soils of high organic content (Chapman 1950, O'Reilly & Pantin 1957, Adam 1976). Most commonly, it is developed on silty clay of low organic content, with some free calcium carbonate and a pH in the range 7.0–8.0. It appears tolerant of a range of submersion regimes: at Scolt Head, Norfolk, the *Halimionetum* extends from about 100 to 400 submergences/year (Chapman 1950, 1960*a*; cf. O'Reilly & Pantin 1957). Proctor (1980) has shown that, in the Exe salt-marshes, Devon, *H. portulacoides*

tolerates chloride levels at 10–24 g l^{-1} (salinity 16–36 g l^{-1}). Within these rather wide limits, the association occurs in two distinct situations, as an extensive belt of variable position in the general zonation or as narrow ribbons on creek levees (the 'Great *Obione* Fringe' of Chapman 1934) and low ridges on the marsh surface (Proctor 1980). The occurrences may reflect a need in *H. portulacoides* for a well-drained aerobic soil environment, at least for seed germination (Chapman 1950). Creek levees offer such conditions and, even in intervening basins where soils may be strongly reduced a few centimetres below the surface, the shallow adventitious roots of *H. portulacoides* may avoid the more severe effects of waterlogging (see Figure 28 in Chapman 1960*b*). Alternatively, levee occurrences may reflect a preference for a good supply of soil nutrients, particularly nitrogen and phosphate.

The *Juncus maritimus* and *Puccinellia maritima* sub-communities occur throughout the habitat range of the association but the bushy form of the *H. portulacoides*-dominated sub-community is confined to sandy substrates where salt-marsh abuts dunes or, less frequently, on the lower marsh.

Halimionetum is generally absent from sheep-grazed marshes (e.g. Yapp & Johns 1917) except for those creek-sides which are inaccessible to the stock. It is, however, found on a number of cattle-grazed marshes, notably around The Wash, and it will tolerate a certain amount of rabbit grazing (Chapman 1950). Brent geese do not graze extensively on *H. portulacoides* when feeding on saltings (Charman & Macey 1978).

Zonation and succession

Where *Halimionetum* occurs within the marsh zonation, its position is variable. It can be either above or below the *Puccinellietum maritimae* and boundaries between the two associations can be marked by mosaics (see Corillion 1953). At some sites, *Halimionetum* may run right from the upper limit of the pioneer zone to the sea wall. Where it does extend far down the marsh there is sometimes an open mosaic of *H. portulacoides* and *Arthrocnemum perenne* at its lower limit.

The association can occur on creek levees whether or not there is a nearby inter-creek zone of *Halimionetum*. Where it occurs in both situations on the same marsh, the creek *Halimionetum* may be above or below the inter-creek zone. Usually the creek *Halimionetum* cuts across the boundaries of a number of marsh communities.

On the high marsh, *Halimionetum* in both situations may give way to a zone of *Atriplici-Elymetum pycnanthi*, sometimes with an intervening but patchy zone of *Artemisietum maritimae*. This zonation may indicate a successional sequence consequent upon sediment accretion.

The origin and successional status of the *Puccinellia maritima* sub-community is obscure. Its distinctive physiognomy may arise by invasion of the *H. portulacoides*-dominated sub-community by *P. maritima* when the canopy opens with ageing of the bushes or as a result of grazing or by invasion of *Puccinellietum* by *H. portulacoides*. Alternatively the co-dominants may simultaneously invade some other salt-marsh community. Only long-term observation can elucidate the process(es) involved here.

Other changes can occur within *Halimionetum* as a result of frost or human disturbance (Beeftink 1977*a*, *b*; Beeftink *et al*. 1978). Killing of *H. portulacoides* on creek levees by frost can result in the temporary replacement of the association by *Artemisietum maritimae* for 4–5 years. Disturbance in inter-creek basins produces a phase characterised by *Suaeda maritima* and *Aster tripolium*.

Distribution

The *Halimionetum* is most widespread and extensive in south-east England: it is estimated that the association covers 30% of the salt-marshes of The Wash (Anon. 1976). It reaches its northern limit in south Scotland and this may be related to the incidence of severe frosts rather than to any effect of low mean summer temperatures (Ranwell 1972, Beeftink 1977*a*, *b*; cf. Chapman 1950). Sensitivity to grazing restricts its occurrences on the west coast. There is evidence of a recent expansion of the community within Europe (Beeftink 1959, 1977*a*).

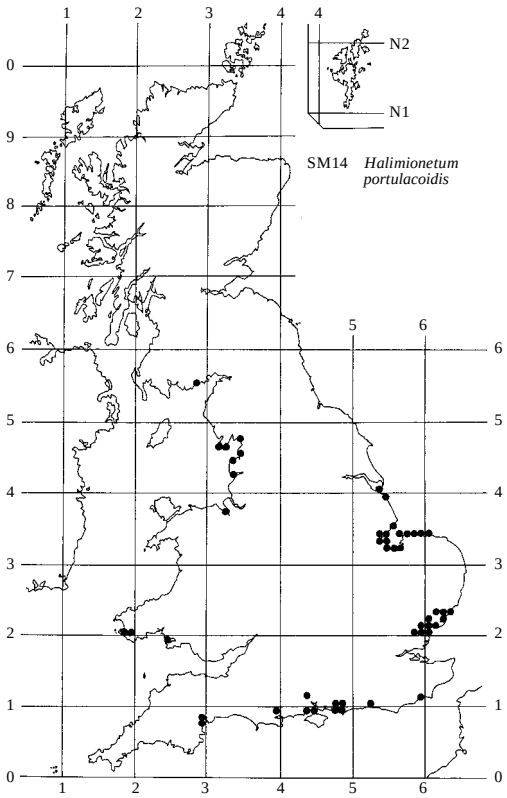
Affinities

Some authorities (e.g. Beeftink 1962) expand the *Halimionetum* to take in the *Artemisia maritima*-dominated vegetation of the high marsh and there may also be a case for considering some *Arthrocnemum perenne* stands as part of the association. Whatever its precise limits, the *Halimionetum* is a distinctive community of widespread occurrence on European coasts. It is usually placed alongside the *Puccinellietum maritimae* in the Asteretea but Géhu (1975) has erected an alliance Halimionion within the Arthrocnemetea to emphasise its affinities with the dwarf chenopod communities best developed around the Mediterranean.

Floristic table SM14

	a	b	c	14
Halimione portulacoides	V (7–10)	V (6–9)	V (5–9)	V (5–10)
Puccinellia maritima	IV (2–5)	IV (3–6)	V (2–8)	V (2–8)
Juncus maritimus		V (4–8)	I (2)	I (2–8)
Plantago maritima	I (1–5)	IV (2–5)	III (1–7)	II (1–7)
Limonium cf. *L. vulgare*	I (1–4)	IV (2–5)	III (1–7)	II (1–7)
Suaeda maritima	III (2–4)	I (2–3)	III (1–6)	III (1–6)
Triglochin maritima	I (1–4)	III (2–6)	III (1–6)	II (1–6)
Algal mat	I (5–8)	II (4–6)	I (3–8)	I (3–8)
Aster tripolium (rayed)	I (2–3)	II (2–3)	II (2–5)	I (2–5)
Salicornia agg.	I (1–5)	I (2–3)	III (2–5)	II (1–5)
Aster tripolium	I (1–3)	I (2–3)	II (1–4)	I (1–4)
Armeria maritima	I (5)	I (3)	I (2–4)	I (2–5)
Artemisia maritima	I (2)	I (2–5)	I (1–5)	I (1–5)
Arthrocnemum perenne	I (1–5)	I (1–2)	I (1–4)	I (1–5)
Spartina anglica	I (1–3)	I (2)	I (1–3)	I (1–3)
Spergularia media	I (1–5)	I (2)	I (1–4)	I (1–5)
Inula crithmoides	I (2–5)			I (2–5)
Elymus pycnanthus		II (1–6)		I (1–6)
Aster tripolium var. *discoideus*	I (1–3)		II (1–6)	I (1–6)
Number of samples	91	19	64	174
Mean number of species/sample	4 (1–10)	7 (4–11)	6 (4–10)	6 (1–10)
Mean vegetation height (cm)	24 (4–40)	46 (35–70)	25 (8–45)	27 (4–70)
Mean total cover (%)	97 (50–100)	95 (80–100)	97 (80–100)	97 (50–100)

a Sub-community with *Halimione portulacoides* dominant
b *Juncus maritimus* sub-community
c *Puccinellia maritima* sub-community
14 *Halimionetum portulacoidis* (total)


N2
N1
SM14 *Halimionetum portulacoidis*

SM15

Juncus maritimus–Triglochin maritima salt-marsh community

Synonymy

Juncetum maritimi auct. angl. p.p.; *Triglochin-Juncus maritimus* nodum Adam 1976.

Constant species

Juncus maritimus, *Plantago maritima*, *Triglochin maritima*.

Physiognomy

Tall tussocks of *Juncus maritimus* are always overwhelmingly dominant in this association and the associates are rather variable. However, *Triglochin maritima* and *Plantago maritima* are constant in usually small amounts in the understorey and various Puccinellion species, such as *Puccinellia maritima*, rayed *Aster tripolium*, *Armeria maritima* and *Glaux maritima*, occur frequently throughout. The association differs from the *Juncus maritimus* salt-marsh in the relative infrequency of *Agrostis stolonifera*, *Festuca rubra* and *Juncus gerardii*. Commonly the bases of the *J. maritimus* shoots support a variety of epiphytic algae, notably *Bostrychia scorpioides* and *Catenella repens*, and there may be an extensive algal mat, locally rich in dwarf free-living fucoids, on the substrate surface. Stands are often based upon discrete and sometimes large clones of *J. maritimus* but may also form a distinct zone within the marsh.

Sub-communities

Adam (1977) suggested that there are three centres of variation within the association around which sub-communities might be erected: stands which are very species-poor, sometimes pure *J. maritimus* in vigorous, tall and dense patches; stands in which *Halimione portulacoides* and *Limonium* cf. *vulgare* are conspicuous and fairly rich stands lacking these two species.

Habitat

J. maritimus is tolerant of a wide range of salinities and soil moisture conditions (Ranwell *et al*. 1964, Gillham 1957*b*) and the association occurs at all levels on salt-marshes and on a variety of substrates. Soil pH is generally around 7.0 but loss-on-ignition varies from 3% to more than 40%.

The most species-poor stands are found on the low marsh, usually on soft anaerobic mud (Gillham 1957*a*, Chater 1973, Adam 1976, 1977, Proctor 1980), though sometimes, as in Scottish sites, on shallow peaty soils over shingle (Gillham 1957*b*, Adam *et al*. 1977). The lowest stand for which accurate data are available experiences 220 submergences/year but many stands seem to occur at lower levels. Richer stands lacking *H. portulacoides* and *Limonium* cf. *vulgare* also occur at low levels, on western salt-marshes frequently along the foot of small erosion cliffs where there is perhaps water-seepage. Stands with these two species are found as a narrow zone in the upper parts of salt-marshes in south-east England (the *Juncetum maritimi* Chapman 1934).

The association occurs on both grazed and ungrazed salt-marshes but, even where there is grazing, stands tend to be avoided by stock.

Zonation and succession

There is a marked difference in the relative position of the association on salt-marshes in south-east England and those elsewhere but lack of submersion data makes it difficult to assess these variations in terms of absolute relationships to tidal levels. On the west and Channel coasts, the association generally occurs at relatively low levels in association with the *Spartinetum townsendii* or more usually within or at the upper limit of the *Puccinellietum maritimae*. In the south-east, a narrow belt of the association occurs normally between the *Puccinellietum maritimae*, *Limonium-Armeria* sub-community, and the *Atriplici-Elymetum pycnanthi* or the tall *Festuca rubra* sub-community of the *Juncetum gerardi*. The association grades smoothly into the *Puccinellietum* which effectively constitutes the understorey of the *Juncus-Triglochin* vegetation. On those few ungrazed western marshes where the *Puccinellietum maritimae*,

Limonium-Armeria sub-community occurs, the association occupies the position typical of south-east salt-marshes.

In at least one site, *Juncus maritimus* has been seen as a coloniser with *Spartina anglica*.

Distribution

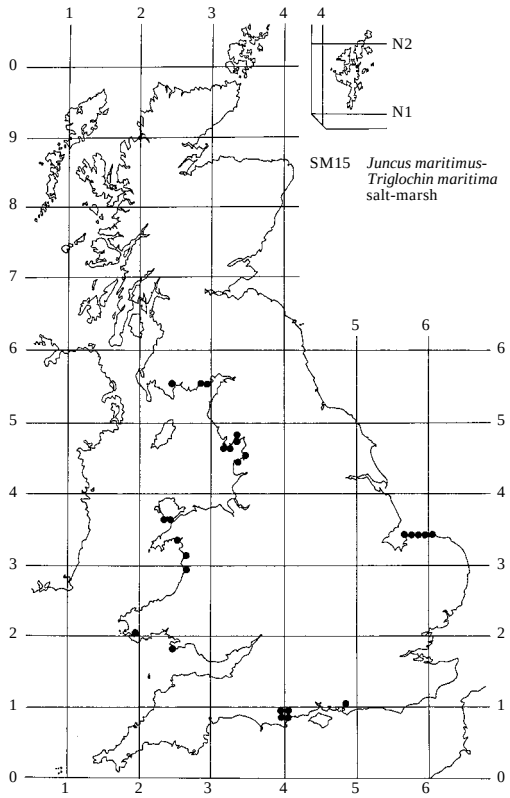
The association is the most widespread community dominated by *J. maritimus* in Great Britain. It is common on the west coast and is the major *J. maritimus* community in south-east England. One of the most extensive stands in the country is at Cefni Marsh, Anglesey where the association forms mosaics with *Scirpetum maritimi* over much of the marsh (Packham & Liddle 1970).

Affinities

The association can be seen as the northern extremity of a continuum of vegetation types in which *J. maritimus*, *Triglochin maritima*, *Limonium vulgare* and *Aster tripolium* are important components and which reaches down to the Mediterranean in the *Junco maritimi-Triglochinetum maritimi* Br.-Bl. 1931 (Braun-Blanquet & de Ramm 1957, Adam 1977). Such a range of vegetation types could be accommodated within the Puccinellion of the Asteretea which would also allow some weight to be given to the interesting low-level occurrences of *J. maritimus* vegetation.

Floristic table SM15

Juncus maritimus	V (5–10)
Triglochin maritima	IV (2–6)
Plantago maritima	IV (2–8)
Aster tripolium (rayed)	III (2–4)
Puccinellia maritima	III (2–7)
Armeria maritima	III (2–5)
Glaux maritima	III (2–5)
Algal mat	III (2–8)
Limonium cf. *L. vulgare*	II (1–6)
Cochlearia anglica	II (1–4)
Juncus gerardii	II (3–7)
Halimione portulacoides	II (1–6)
Festuca rubra	II (2–8)
Agrostis stolonifera	II (2–6)
Aster tripolium	I (1–5)
Cochlearia officinalis	I (2–3)
Salicornia agg.	I (2–5)
Suaeda maritima	I (2–3)
Spartina anglica	I (1–5)
Spergularia media	I (2–4)
Turf fucoids	I (3–6)
Phragmites australis	I (2–6)
Carex extensa	I (1–3)
Atriplex prostrata	I (1–3)
Limonium humile	I (1–3)
Oenanthe lachenalii	I (3–4)
Artemisia maritima	I (1–4)
Number of samples	63
Mean number of species/sample	10 (2–14)
Mean vegetation height (cm)	57 (25–100)
Mean total cover (%)	76 (70–100)


N2
N1
SM15 *Juncus maritimus-Triglochin maritima* salt-marsh

SM16

Festuca rubra salt-marsh community
Juncetum gerardi Warming 1906

Synonymy
Festucetum (*rubrae*) *auct. angl.*

Constant species
Festuca rubra, *Plantago maritima*, *Glaux maritima*.

Physiognomy
The closed grasslands of the *Juncetum gerardi* are normally dominated by mixtures of *Festuca rubra* and *Agrostis stolonifera* with a variety of herbaceous associates among which *Plantago maritima*, *Glaux maritima*, *Armeria maritima* and *Triglochin maritima* are generally the most frequent and abundant. *Juncus gerardii* itself is present in varying amounts: it is usually constant through all but the most anomalous of the *Juncetum* swards and in some cases is dominant or co-dominant. In certain sub-communities, there are frequent records for low-marsh species and an algal mat is often conspicuous over the substrate surface. In other sub-communities, a group of mesotrophic grassland and flush species are well-represented. The *Juncetum gerardi* is the community within which bryophytes reach their lowest limit on salt-marshes.

Sub-communities
As in the other major British salt-marsh association, the *Puccinellietum maritimae*, variation is virtually continuous, largely based on quantitative differences among relatively few species and frequently including a site-specific element reflecting local histories of marsh use. The following sub-communities should therefore be seen as foci of national variation with somewhat hazy boundaries.

***Puccinellia maritima* sub-community:** *Juncus gerardii-Puccinellia maritima* nodum Adam 1976; *Puccinellietum maritimae agrostidetosum* Beeftink 1962. This sub-community comprises generally short swards which are floristically transitional between the *Juncetum gerardi* and the *Puccinellietum maritimae*. *J. gerardi*, *Puccinellia maritima*, *Festuca rubra*, *Plantago maritima*, *Glaux maritima* and *Triglochin maritima* are constant and varying proportions of these species co-dominate. *Agrostis stolonifera*, *Armeria maritima* and rayed *Aster tripolium* are less frequent but each may be abundant in particular stands.

Sub-community with *Juncus gerardii* dominant: *Juncetum gerardi*, *J. gerardii* variant Beeftink 1962; (not *Juncetum gerardi juncetosum* Tyler 1969). *Juncus gerardii* always dominates in the tall swards of this sub-community, the stands of which are rarely extensive, 2–3 m diameter at most, and probably vegetatively expanding clones. Even on heavily-grazed marshes, *J. gerardii* remains largely untouched by stock and clumps remain tall and conspicuous though such clumps are often surrounded by a short cropped turf in which *J. gerardii* is still abundant: this perhaps indicates the existence of genotypes of *J. gerardii* of differing palatability. *Plantago maritima*, *Glaux maritima*, *Triglochin maritima* and rayed *Aster tripolium* are also constant though rarely of great abundance. *Festuca rubra* and *Agrostis stolonifera* are reduced in frequency compared with the association as a whole.

***Festuca rubra-Glaux maritima* sub-community:** *Festucetum rubrae* Yapp & Johns 1917; *Juncus gerardii-Glaux maritima-Agrostis stolonifera* Association Nordhagen 1923; *Festuca-Glaux*, *Festuca-Agrostis* and *Festuca-Armeria* noda Adam 1976; *Juncetum gerardi*, variant with *Festuca rubra* f. *littoralis* Beeftink 1962 *p.p.*; *Juncetum gerardi festucetosum* Tyler 1969 *p.p. Festuca rubra* and *Agrostis stolonifera* are usually co-dominant in the low swards of this sub-community. *Plantago maritima*, *Glaux maritima*, *Triglochin maritima* and *Armeria maritima* are also constant and may each be abundant. *Juncus gerardii* is somewhat variable in amount and even when abundant may be difficult to detect in close-cropped turf. This is the lowest vegetation in which bryophytes are typically encountered on salt-marshes: *Rhytidiadelphus squarrosus*, *Hypnum cupressiforme* and *Eurhynchium praelongum* are the most frequent species. Algae are uncommon.

Within the sub-community stands may be encountered in which either *A. stolonifera* or *F. rubra* are sparsely represented. In other cases, these two species are overwhelmingly co-dominant in short swards in which *J. gerardii* is very poorly represented (the *Agrostis stolonifera* variant). *J. gerardii* is also sparse in some stands where *F. rubra* and *Armeria maritima* are co-dominant in the absence of *A. stolonifera* (the *Armeria maritima* variant). There is good evidence to see these very distinct communities as extreme forms of *Juncetum gerardi* derived as a result of particular marsh management regimes (see below).

***Leontodon autumnalis* sub-community:** *Juncus gerardii-Trifolium repens-Leontodon autumnalis* Association Nordhagen 1923; *Juncetum gerardi leontodetosum* Raabe 1950; *Juncetum gerardi leontodetosum* and *odontitosum* Gillner 1960; *Carex distans-Plantago maritima* Association Ivimey-Cook & Proctor 1966 *p.p.*; *Juncetum gerardi festucetosum* Tyler 1969 *p.p.* This sub-community has much the same physiognomy as the last and here too *Festuca rubra, Agrostis stolonifera* and *Juncus gerardii* can all be well-represented in the short, smooth swards. *Plantago maritima* and *Glaux maritima* remain constant but here there are also frequent records for a variety of species characteristic of non-maritime vegetation. Among these, *Trifolium repens* is constant but *Potentilla anserina*, *Leontodon autumnalis* and *Carex flacca* can each be frequent and abundant. On cattle-grazed marshes, where the vegetation is normally not so shortly cropped as under sheep-grazing, a number of species flower and *L. autumnalis* may be particularly conspicuous. *Carex distans* may also be abundant in this sub-community but this species has different habitat preferences across its British range. It is uncommon on salt-marshes in the south-east but frequent in western England and in Wales; in Scotland, it again becomes rare on salt-marshes though it remains quite common among low coastal rocks (see Jermy & Tutin 1968).

Within the belts occupied by this sub-community there is sometimes a zonation of *T. repens*, *L. autumnalis*, *C. distans* and *P. anserina* in order of lowest occurrence but this is not universal and, indeed, all these species can occur occasionally in the lower marsh *Festuca-Glaux* sub-community. At the highest levels occupied by the *L. autumnalis* sub-community *Lolium perenne*, *Cynosurus cristatus*, *Bromus hordeaceus* ssp. *hordeaceus*, *Elymus repens* and *Poa pratensis* are sometimes found. It is possible that these species seed in from adjacent sea-banks where grassland mixtures have been sown. Another occasional species in the upper-marsh sites is *Trifolium fragiferum* which becomes restricted to coastal communities at the northern limits of its British range. It is rarely extensive, tending to occur in discrete patches often associated with freshwater seepage onto the upper marsh.

As with the *Festuca-Glaux* sub-community there are rather extreme forms of salt-marsh swards which are perhaps best seen in relation to a more central type of *Juncetum gerardi* vegetation. A *Trifolium repens* variant is very similar to the *L. autumnalis* sub-community except for its lower levels of *J. gerardii*.

Low turf very similar in floristics to this sub-community is of common occurrence on some sea cliffs. Here *F. rubra*, *Plantago maritima*, *Armeria maritima* and more rarely *Glaux maritima* are generally co-dominant but *J. gerardii*, *C. distans*, *T. repens* and *L. autumnalis* may all be conspicuous.

***Carex flacca* sub-community.** *Juncetum gerardi festuco-caricetosum nigrae* Tyler 1969; ? *Danthonia decumbens-Agrostis canina* community Tyler 1969; *Agrostis tenuis-Festuca ovina* community Tyler 1969 *p.p.* The floristics and physiognomy of this sub-community are generally similar to the last except that here *C. flacca* is much more frequent and sometimes co-dominant with the grasses and herbaceous halophytes. Bryophytes may also be more conspicuous: *Campylium polygamum*, *Amblystegium serpens*, *Grimmia maritima*, *Cratoneuron filicinum*, *Amblystegium riparium*, *Calliergon cuspidatum*, *Rhytidiadelphus squarrosus*, *Hypnum cupressiforme* and *Eurhynchium praelongum* all occur occasionally and each may be abundant in particular samples.

Sometimes the turf of this sub-community is broken by flushed gravelly patches and here *Blysmus rufus*, *Eleocharis uniglumis*, *E. palustris* and *E. quinqueflora* may be locally abundant.

Sub-community with tall *Festuca rubra* dominant: *Festucetum littoralis* Corillion 1953; Tall *Festuca rubra* nodum Adam 1976; *Juncetum gerardi*, variant with *Festuca rubra* f. *littoralis* Beeftink 1962 *p.p.*; includes *Festuca rubra-Agrostis stolonifera-Hordeum secalinum* associes Ranwell 1961; (not *Festucetum rubrae* Yapp & Johns 1917). The very distinctive springy mattresses of this sub-community are perhaps best seen as a physiognomic variant of the *Juncetum gerardi*. *F. rubra* is consistently dominant. It grows tall and dense and, after tidal inundation, presents a bedraggled appearance. Although all of the species frequent in the association as a whole occur here, most are reduced in frequency and rarely make a major contribution to the sward. *Plantago maritima* and *Agrostis stolonifera* are the most common associates. Some stands are distinctive in the presence of conspicuous amounts of *Halimione portulacoides*; others may have *Elymus pycnanthus* and, in Somerset and the upper Severn estuary, *Hordeum secalinum* occurs in this sub-community (Ranwell 1961, Owen 1972). Flowering appears to be rare in British stands

(cf. Gravesen & Vestegaard 1969 in Denmark). In winter, when the vegetation may remain flattened for long periods, seedlings of *Atriplex* spp. and *Cochlearia* spp. may appear in profusion on top of the matted grass.

Habitat

The *Juncetum gerardi* covers extensive areas of salt-marsh especially in the north and west of Britain where it is the predominant community of the mid- and upper marsh. It occurs on a range of substrates from marsh levels experiencing several hundred submergences/year to the upper tidal limit. It is usually grazed and provides swards that are valuable for commercial turf-cutting.

Regimes of salt-marsh grazing are very variable. The stock involved, the stocking rates, the pattern of use through the year may all vary from marsh to marsh and through time and all these factors might be expected to influence the appearance of the vegetation. Much of the site-specific variation within the *Juncetum gerardi* is probably related to the unique grazing history of every site.

The general effect of grazing is to maintain a fine short sward, preventing the overwhelming dominance of (a) particular species (Dahlbeck 1945, Gillner 1960, Beeftink 1977*a*). It is probably important in controlling the proportions of *Puccinellia maritima*, *Agrostis stolonifera* and *Festuca rubra* in the sward and thus influences the position and the nature of the boundary between the communities of the *Puccinellietum maritimae* and the *Juncetum gerardi* and the extent and composition of the transitional vegetation classified here as the *Puccinellia* sub-community (Ranwell 1968, Gray & Scott 1977*b*). If grazing pressure is generally low or if grazing ceases, *F. rubra* is particularly responsive, growing tall and rank, excluding most potential competitors and eventually producing the sort of tussocky, species-poor grassland that is characteristic of the tall *F. rubra* sub-community. Such vegetation is unpalatable to wildfowl (Cadwalladr *et al*. 1971, Cadwalladr & Morley 1974, Charman & Macey 1978) and to re-introduced sheep.

The preparation and cutting of 'sea-washed' turf is important at a number of salt-marsh sites (e.g. Morecambe Bay; see Gray 1972). The grass-dominated swards of the *Festuca-Glaux* sub-community (the *Agrostis stolonifera* variant) are most favoured and are prepared over a number of years by mowing during the growing season, the application of fertiliser and sometimes of selective herbicides. This produces a virtually pure turf of fine-leaved *F. rubra* and *A. stolonifera*. Cutting is now highly mechanised and involves the removal of shallow (*c*. 3.5 cm deep) turves often over considerable areas. Recolonisation of cuttings produces a diverse and irregular succession (see below) and may involve the development of the transitional *Puccinellia* sub-community.

There is a broad correlation between variation in the sub-communities of the *Juncetum gerardi* and the incidence of tidal submersion. The transitional *Puccinellia* sub-community usually extends furthest down-marsh and it may be subject to more than 250 submergences/year, though it can also occur in very slight hollows in the upper marsh. Where it extends down into the *Puccinellietum* it is found on knolls and creek levees. The *Festuca-Glaux* sub-community is also found in such situations though the lower limit of continuous swards experiences between 150 and 200 submergences/year. The *Leontodon* sub-community occurs at higher levels which are subject to up to 100–120 submergences/year. Where vegetation virtually identical to this sub-community occurs on sea cliffs, it is found in situations which receive very considerable amounts of sea-spray and its soils show some of the highest values of Na/organic matter encountered in that habitat. The *Carex flacca* sub-community is best developed at the the storm-tide level where there are usually only one or two flooding tides per annum and perhaps at extremes up to 25 submergences/year. Despite the frequent seepage of freshwater into sites occupied by this sub-community, the soil salinity during droughts may reach quite high values (Gillham 1957*b*).

Substrates on which the *Juncetum gerardi* occurs include clays, silts, sands, shingle and soils of high organic content. The *Puccinellia* sub-community spans the entire range of substrate variation. Other sub-communities are more restricted: the tall *Festuca rubra* sub-community tends to occur on clays, silts and sands while the *Festuca-Glaux* and *Leontodon* sub-communities are generally confined to sandier material with some occurrences on more organic soils. Although the *Juncus gerardii* sub-community occurs on various substrates, its occurrences in south-east England frequently indicate the presence of shingle below the top soil horizon and, in some cases, this vegetation can develop directly on shingle banks. The *Carex flacca* sub-community is most frequently found on soils with high organic content, at least in the upper part of the profile. The pH of the substrates on which the *Juncetum* occurs varies between 5.0 and 7.0, with finer material without organic enrichment being more basic.

A combined effect of tidal inundation and substrate type is mediated through soil permeability. The degree of waterlogging probably has some effect on the proportions of *F. rubra*, *A. stolonifera* and *Puccinellia maritima* in the vegetation. *F. rubra* may suffer competitively against *P. maritima* under waterlogged and more saline conditions and against *A. stolonifera* in waterlogged and less saline situations (Gray & Scott 1977*a*). On cliffs, the factor which favours the development of the *Leontodon* sub-community of the *Juncetum gerardi* rather than some form of *Festuca-Armeria* sward is probably the

retention of water in the heavy gleyed soils: both vegetation types receive similar amounts of salt-spray and both are grazed.

Among the grasses of the *Juncetum gerardi*, *A. stolonifera* seems more resistant to oil and refinery effluent spillage than either *F. rubra* or *P. maritima* and it may gain a competitive advantage in vegetation recovering from such pollution. *Armeria maritima*, *Plantago maritima* and *Triglochin maritima* are able to resist considerable amounts of spillage by virtue of their underground storage organs (Baker 1979).

Zonation and succession

In general, the *Juncetum gerardi* occupies a position above the *Puccinellietum maritimae* in the salt-marsh zonation but the extent of the *Juncetum* in the south-east differs strikingly from its contribution to salt-marshes elsewhere. In the south-east, the association is of very limited extent and occurs only at high levels in the marsh, most often forming a discontinuous zone in contact with the *Limonium-Armeria* sub-community of the *Puccinellietum*. In the north and west, the *Juncetum* is usually very extensive in both the mid- and upper-marsh. The exact reasons for this difference, and for the more seaward extension of particular species in the west, are unknown (Beeftink 1977*a*, *b*, Adam 1978) but the major factor controlling the relative positions of the two associations is the degee of submersion. In upper estuaries, where there is freshwater dilution, the positions of the *Juncetum* and *Puccinellietum* are reversed. The location and nature of the junction between the associations is also affected markedly by the extent and nature of the grazing.

Within the *Juncetum*, there is usually a zonation of the different sub-communities in relation to their tolerance of submersion. The detailed pattern varies from site to site and, though the *Festuca-Glaux* sub-community usually gives way to the *Leontodon* sub-community upmarsh, the relative depth of the zones is very variable (Figure 9). In some cases, there is a complex mosaic of the two communities over the mid-marsh. The *Leontodon* sub-community may, in turn, pass into the *Carex flacca* sub-community. Provided that the upper limit of the salt-marsh is not an artificial boundary, the topmost zone grades into non-maritime grassland or mire (e.g. Gillham 1957*b*). The tall *Festuca rubra* sub-community often forms part of zonations with the *Halimionetum*, sometimes occupying a position between this association and fragmentary stands of the *Artemisietum*.

The zonation of the sub-communities may represent a successional sequence in response to substrate accretion and the gradual raising of salt-marsh surfaces. Grazing too, can, be responsible for considerable temporal changes within the *Juncetum gerardi* (see above) and may shift the succession towards the development of other associations. Very heavy grazing, particularly by cattle and horses on clay and silt substrates, can lead to poaching and the appearance of *Puccinellietum maritimae* or to communities characteristic of disturbed saline sites such as the *Puccinellietum distantis* and the *Agrostis stolonifera-Alopecurus geniculatus* community.

Turf-cutting opens up areas for colonisation by a variety of species. In the early stages a variety of annuals and short-lived perennials predominate: *Spergularia marina*, *Juncus bufonius*, *Plantago coronopus* and *Sagina maritima*, for example, often with *Pottia heimii*. Diverse assemblages of such species have sometimes been classified within the Saginetea. *Puccinellia maritima* is frequently an early colonist and a closed *Puccinellietum maritimae* may develop. *P. maritima* may persist within a *Festuca rubra* sward to produce a patchwork of the transitional vegetation of the *Puccinellia* sub-community of the *Juncetum gerardi*. It is this pattern of recolonisation which helps make grazing and turf-cutting compatible activities on the same salt-marsh.

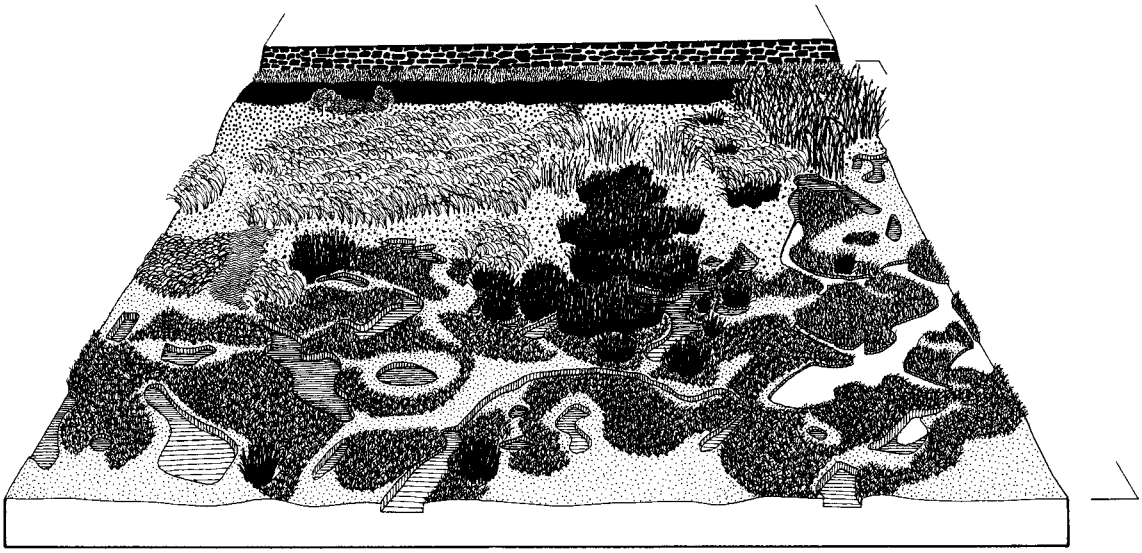
Distribution

The *Juncetum gerardi* is widespread except in the south-east where it is local and where the *J. gerardii*-dominated sub-community is the most frequent representative of the association. The *Festuca-Glaux* and *Leontodon* sub-communities are virtually ubiquitous in western Britain but very sparsely distributed in the south-east. In north Norfolk, for example, their only extensive occurrence is at Brancaster which, interestingly, is the only marsh in the area still subject to regular grazing. Both sub-communities have been reported from brackish reclaimed pastures and they may be more widespread in this habitat. Where the *Leontodon* sub-community occurs on sea cliffs it is chiefly northern with some isolated occurrences in Wales and Cornwall where its distribution may be related to localised flushing rather than a generally high precipitation. It is commonest in west Scotland, the Outer Isles, Orkney and Shetland. The grass-dominated swards of the *Festuca-Glaux* and *Leontodon* sub-communities have been encountered chiefly in those areas where sheep-grazing and turf-cutting are most intensive. The *Carex flacca* sub-community is widespread in the west but most frequent in west Scotland.

Affinities

The *Juncetum gerardi* is one of the most important communities on British salt-marshes but its internal diversity and its affinities have been little discussed. The view of the *Juncetum* adopted here is a broad one, roughly comparable to that of Tyler (1969*b*). A similar range of vegetation types to that included here occurs widely in northern Europe and numerical studies (Adam 1977) have emphasised the close relationship between the British and European communities.

Figure 9. Complex of upper marsh communities at Bolton-le-Sands, Morecambe Bay.
The bulk of the marsh vegetation comprises various kinds of SM16 *Juncetum gerardi*. In the foreground, as a mosaic around the largely dried-up pans, are the *Festuca-Glaux* and *Juncus gerardii* sub-communities, with a small patch of the tall *Festuca rubra* sub-community to the left. Above, these give way to the *Leontodon* sub-community. Scattered through the *Juncetum gerardi* are dense clumps of the SM18 *Juncus maritimus* salt-marsh. On the slope below the road, the *Juncetum* gives way to a narrow zone of the MG11 *Festuca-Agrostis-Potentilla* grassland with small stands of OV25 *Urtica-Cirsium* vegetation on rotting horse faeces. On the flushed ground below are small stands of the SM20 *Eleocharitetum uniglumis* and some larger areas of S21 *Scirpetum maritimi* and S20 *Scirpetum tabernaemontani*; from one of these, a small stand of MG13 *Agrostis-Alopecurus* grassland runs down the marsh towards a large pan. The flooded pans to the right have thick festoons of the SM2 *Ruppietum maritimae*.



Salt-marsh communities

SM16 *Juncetum gerardi*
Leontodon sub-community
Trifolium variant

SM16 *Juncetum gerardi*
Festuca-Glaux sub-community
Armeria variant

SM16 *Juncetum gerardi*
Juncus gerardii-dominated sub-community

SM16 *Juncetum gerardi*
Sub-community with tall *Festuca rubra* dominant

SM18 *Juncus maritimus* salt-marsh
Oenanthe sub-community

SM20 *Eleocharitetum uniglumis*

Swamps

S21 *Scirpetum maritimi*

S20 *Scirpetum tabernaemontani*

Mesotrophic grasslands

MG13 *Agrostis-Alopecurus* community

MG11 *Festuca-Agrostis-Potentilla* community
(with *Urtica* patches)

MG6 *Lolio-Cynosuretum*

The *Festuca-Glaux* sub-community can be regarded as the core of the British *Juncetum gerardi*. Floristic transitions from this sub-community to the *Puccinellietum maritimae* are obvious and the major difficulty is deciding where exactly to draw the line between the two associations. In other directions, floristic affinities are more diverse and contentious. Certain authorities would see some of the samples included here within the *Leontodon* sub-community as part of the Elymo-Rumicion crispi, emphasising the transitional nature of the vegetation (see the *Agrostidetum stoloniferae* sub-association of var. *salina* and *Trifolium fragiferum* Westhoff 1947 and *Ononis spinosa-Carex distans* Association Runge 1966 in Westhoff & den Held 1969; Géhu 1973*b*). An alternative treatment of the high level stands of the *Leontodon* sub-community with pasture grasses would be to place such vegetation in a maritime sub-community of the *Lolio-Cynosuretum cristati* (e.g. Raabe 1953; see also Gillner 1960).

Carex-rich upper marsh grasslands similar to those included here within the *Carex flacca* sub-community have been described from Scandinavia (Nordhagen 1923, Du Rietz & Du Rietz 1925, Almquist 1929, Gillner 1960, Tyler 1969*b*), Germany (Tüxen 1937) and The Netherlands (Westhoff 1947). Some would place these again within the Elymo-Rumicion crispi, while others see them as variants of inland mire types occasionally encountered in maritime or paramaritime situations (cf. the *Isolepsis setacea* variant of the *Schoeno-Juncetum serratuletosum* in Wheeler 1980*b* and the Caricion davallianae dune-slack communities of Westhoff & den Held 1969).

The *J. gerardii*-dominated sub-community bears some resemblance to communities of the Eleocharion. It should, however, be distinguished from the *Juncetum gerardi juncetosum* (Tyler 1969*b*) which possesses a distinctive suite of bryophytes not represented here.

The tall *Festuca rubra* sub-community is a somewhat diverse assemblage united by the overwhelming dominance of *F. rubra*. It could be divided on a strict floristic basis between the *Juncetum gerardi*, the *Halimionetum* and the *Atriplici-Elymetum pycnanthi*. Alternatively, the entire sub-community could be separated entirely from the *Juncetum* as part of the *Festucetum littoralis* Corillion 1953 (e.g. Géhu 1975, Géhu & Delzenne 1975).

Floristic table SM16

	a	b	c	d	e	f	16
Festuca rubra	IV (2–7)	III (2–7)	V (2–10)	V (5–10)	V (2–9)	V (4–8)	V (2–10)
Juncus gerardii	V (3–7)	V (6–10)	V (2–7)	I (2–3)	V (2–7)	V (3–6)	V (2–10)
Glaux maritima	V (2–8)	IV (2–7)	V (2–8)	II (2–6)	V (2–7)	IV (2–6)	IV (2–8)
Plantago maritima	V (3–8)	IV (2–6)	V (2–8)	IV (1–5)	IV (2–7)	V (2–6)	IV (2–8)
Agrostis stolonifera	III (2–9)	II (3–7)	IV (2–8)	III (2–8)	V (2–8)	V (3–8)	IV (2–9)
Triglochin maritima	V (1–7)	IV (2–5)	IV (1–6)	II (1–5)	III (1–6)	III (1–5)	III (1–7)
Armeria maritima	III (2–6)	III (2–5)	IV (2–8)	I (2–3)	III (2–5)	III (2–6)	III (2–8)
Aster tripolium (rayed)	III (1–5)	IV (1–4)	III (1–5)	II (2–6)	I (1–4)	I (3)	II (1–6)
Puccinellia maritima	V (2–9)	I (3–6)	I (2–6)	II (2–5)			I (2–9)
Algal mat	II (3–8)	II (3–8)	I (4–8)	I (3)	I (4–5)		I (3–8)
Spergularia media	II (1–4)	I (2)	I (2–3)	II (1–4)	I (2–3)		I (1–4)
Aster tripolium	II (2–4)	I (3)	I (1–3)	I (1–4)			I (1–4)
Salicornia agg.	II (2–5)	I (2)	I (1–3)		I (2)		I (1–5)
Atriplex prostrata	I (3)	II (2–3)	I (1–3)	II (1–4)	I (2–3)	I (2)	I (1–4)
Cochlearia anglica	I (2–4)	II (2–3)	I (2–3)		I (2)		I (2–4)
Halimione portulacoides	I (2–4)	II (2–3)	I (1–2)	II (1–8)			I (1–8)
Limonium cf. *L. vulgare*	I (2–6)	II (2–4)	I (1–8)	II (1–5)	I (2)		I (1–8)
Trifolium repens		I (2–4)	I (2–5)	I (2–4)	IV (2–7)	V (1–7)	II (1–7)
Leontodon autumnalis		I (2)	I (2–5)	I (2–4)	III (1–6)	V (2–5)	II (1–6)
Carex flacca	I (3)				I (2–6)	IV (1–7)	I (1–7)
Carex distans		I (2)	I (1–3)	I (2–3)	III (1–7)	II (1–5)	I (1–7)
Potentilla anserina			I (2)	I (3–6)	II (2–8)	III (3–7)	I (2–8)
Holcus lanatus				I (3–6)	I (2–5)	I (2–6)	I (2–6)
Lotus corniculatus			I (4)	I (2–4)	I (2–5)	I (2–6)	I (2–6)
Cerastium fontanum			I (2)	I (2)	I (2–3)	II (2–3)	I (2–3)
Sagina procumbens			I (2–4)		I (2–5)	II (2–5)	I (2–5)
Eurhynchium praelongum			I (3–4)		I (2–7)	I (3–6)	I (2–7)
Rhytidiadelphus squarrosus			I (3)		I (3–5)	I (3–8)	I (3–8)
Hypnum cupressiforme			I (2)		I (2–3)	I (4–6)	I (2–6)
Anthoxanthum odoratum				I (3)	I (3)	I (2–5)	I (2–5)
Plantago lanceolata				I (2)	I (2–3)	I (1–3)	I (1–3)

Floristic table SM16 (*cont.*)

	a	b	c	d	e	f	16
Cynosurus cristatus					I (2–3)	I (5–6)	I (2–6)
Ranunculus acris					I (2)	I (1–4)	I (1–4)
Number of samples	34	49	150	85	149	46	513
Mean number of species/sample	9 (6–13)	8 (3–12)	9 (5–16)	7 (3–12)	11 (7–18)	16 (9–31)	10 (3–31)
Mean vegetation height (cm)	7 (2–25)	26 (2–40)	11 (2–75)	26 (10–60)	10 (2–50)	10 (2–60)	14 (2–75)
Mean total cover (%)	95 (70–100)	96 (50–100)	96 (50–100)	99 (80–100)	100 (90–100)	100 (90–100)	98 (50–100)

a *Puccinellia maritima* sub-community
b Sub-community with *Juncus gerardii* dominant
c *Festuca rubra-Glaux maritima* sub-community
d Sub-community with tall *Festuca rubra* dominant
e *Leontodon autumnalis* sub-community
f *Carex flacca* sub-community
16 *Juncetum gerardi* (total)

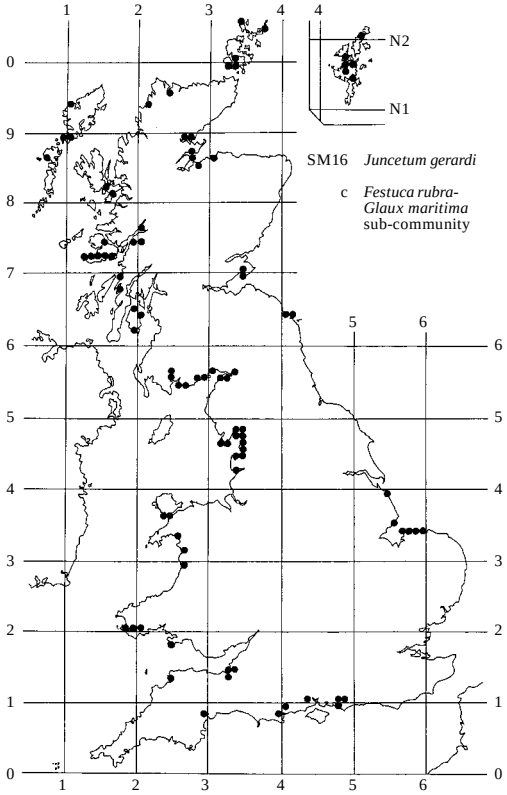
SM16 sub-communities

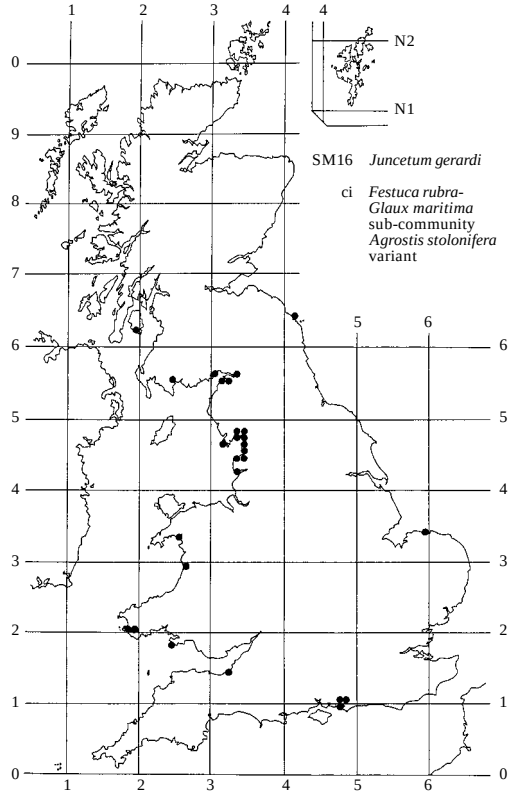
	c	ci	cii	e	ei
Festuca rubra	V (2–10)	V (5–10)	V (5–10)	V (2–9)	V (4–9)
Juncus gerardii	V (2–7)	I (2)	I (1)	V (2–7)	I (3–4)
Glaux maritima	V (2–8)	IV (2–7)	V (3–7)	V (2–7)	IV (2–7)
Plantago maritima	V (2–8)	IV (1–8)	V (2–7)	IV (2–7)	IV (2–5)
Agrostis stolonifera	IV (2–8)	V (3–8)		V (2–8)	V (4–8)
Triglochin maritima	IV (1–6)	III (2–5)	IV (1–7)	III (1–6)	II (2–4)
Armeria maritima	IV (2–8)	IV (2–8)	V (2–8)	III (2–5)	III (2–5)
Aster tripolium (rayed)	III (1–5)	II (1–4)	III (2–7)	I (1–4)	I (2)
Puccinellia maritima	I (2–6)	I (2–6)	I (2–5)		
Algal mat	I (4–8)	I (3–6)	II (3–7)	I (4–5)	
Spergularia media	I (2–3)	II (1–3)	II (2–3)	I (2–3)	I (1)
Aster tripolium	I (1–3)	I (3)	I (2–5)		
Salicornia agg.	I (1–3)	I (2–3)	II (2–3)	I (2)	
Atriplex prostrata	I (1–3)	I (1–2)	I (1–2)	I (2–3)	I (2–3)
Cochlearia anglica	I (2–3)	I (2)	I (2–3)	I (2)	I (2)
Halimione portulacoides	I (1–2)	I (4)	I (1–2)		
Limonium cf. *L. vulgare*	I (1–8)	I (1–2)	I (1–2)	I (2)	
Suaeda maritima	I (1–3)	I (2)	II (1–4)	I (2)	I (1)
Trifolium repens	I (2–5)			IV (2–7)	V (2–8)
Leontodon autumnalis	I (2–5)	I (2–5)		III (1–6)	II (2–5)
Carex flacca				I (2–6)	I (5)
Carex distans	I (1–3)			III (1–7)	I (2–4)
Potentilla anserina	I (2)	I (5)		II (2–8)	I (2–6)
Holcus lanatus				I (2–5)	I (2–3)
Lotus corniculatus	I (4)			I (2–5)	I (3–4)
Cerastium fontanum	I (2)			I (2–3)	I (2–3)
Sagina procumbens	I (2–4)	I (4)		I (2–5)	I (2)
Eurhynchium praelongum	I (3–4)	I (4)		I (2–7)	I (3)
Rhytidiadelphus squarrosus	I (3)			I (3–5)	I (3–4)
Hypnum cupressiforme	I (2)			I (2–3)	
Anthoxanthum odoratum				I (3)	

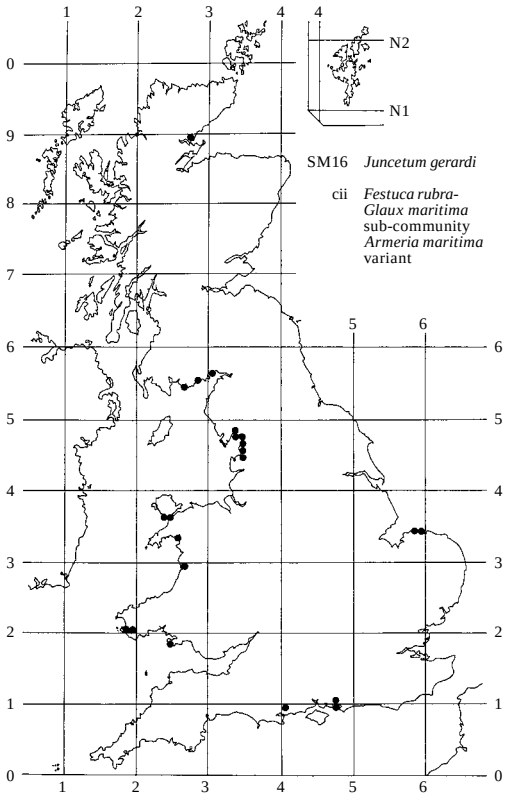
SM16 sub-communities (*cont.*)

	c	ci	cii	e	ei
Plantago lanceolata				I (2–3)	
Cynosurus cristatus				I (2–3)	
Ranunculus acris				I (2)	
Number of samples	150	68	51	149	30
Mean number of species/sample	9 (5–16)	6 (2–12)	7 (4–12)	11 (7–18)	9 (5–13)
Mean vegetation height (cm)	11 (2–75)	5 (2–20)	5 (2–15)	10 (2–50)	7 (2–25)
Mean total cover (%)	96 (50–100)	98 (80–100)	96 (80–100)	100 (90–100)	99 (85–100)

c *Festuca rubra-Glaux maritima* sub-community
ci *Agrostis stolonifera* variant
cii *Armeria maritima* variant
e *Leontodon autumnalis* sub-community
ei *Trifolium repens* variant


N2
N1
SM16 *Juncetum gerardi*
c *Festuca rubra-Glaux maritima* sub-community


N2
N1
SM16 *Juncetum gerardi*
ci *Festuca rubra-Glaux maritima* sub-community *Agrostis stolonifera* variant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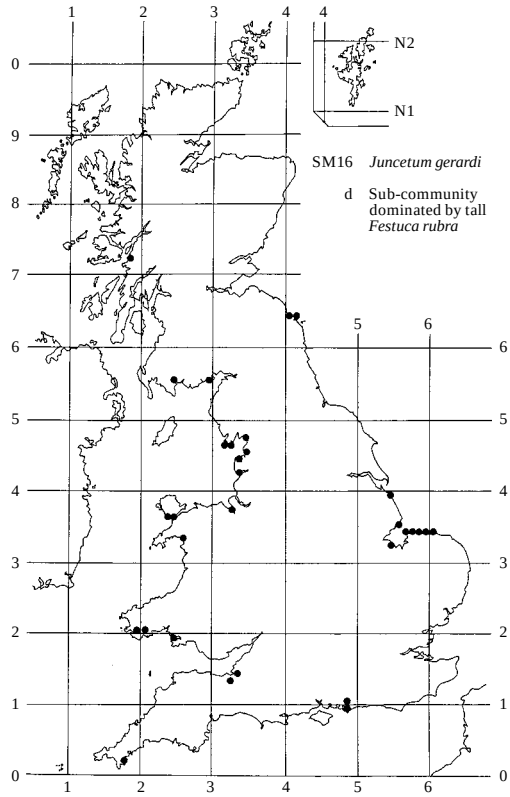
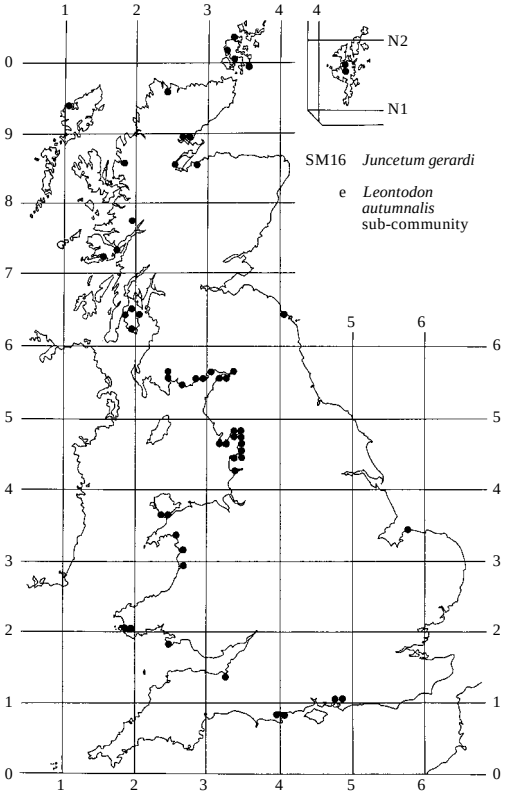
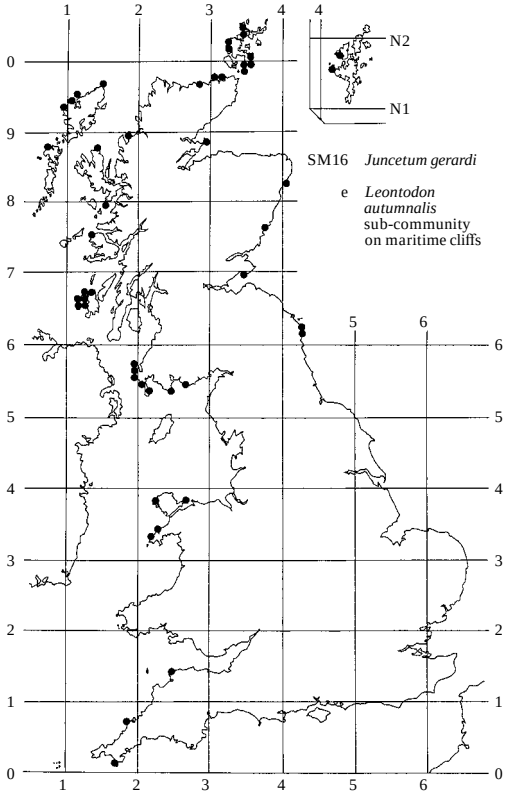
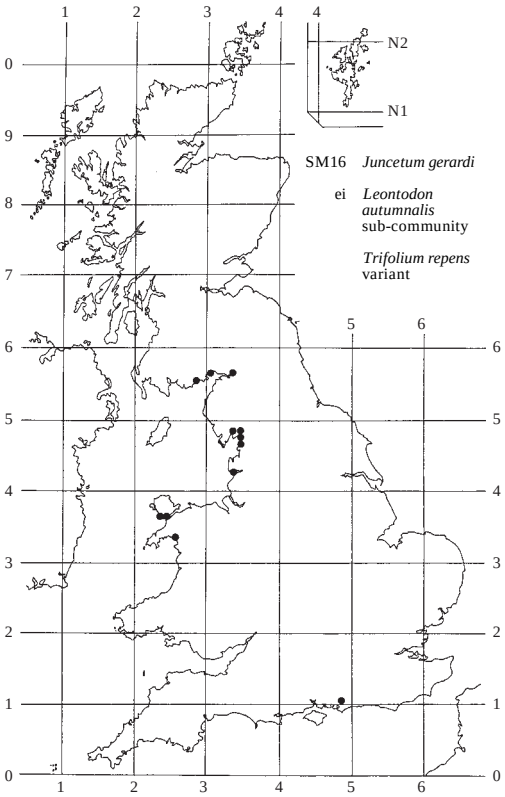
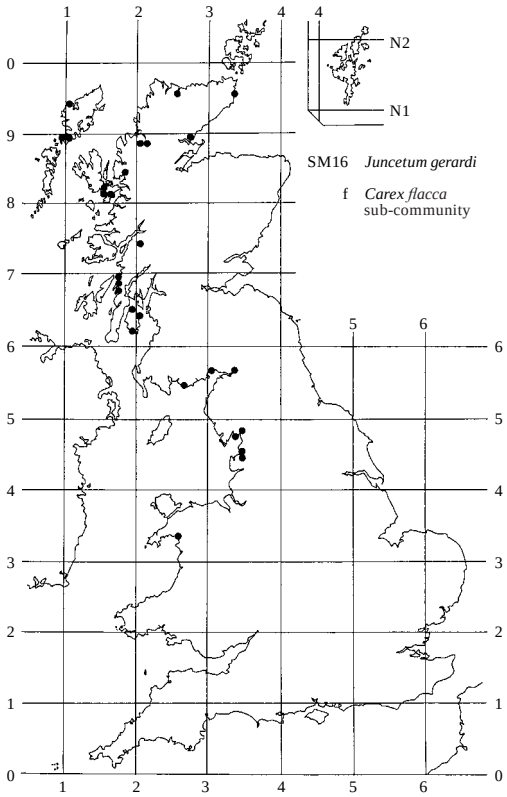
cii *Festuca rubra-Glaux maritima* sub-community *Armeria maritima* variant

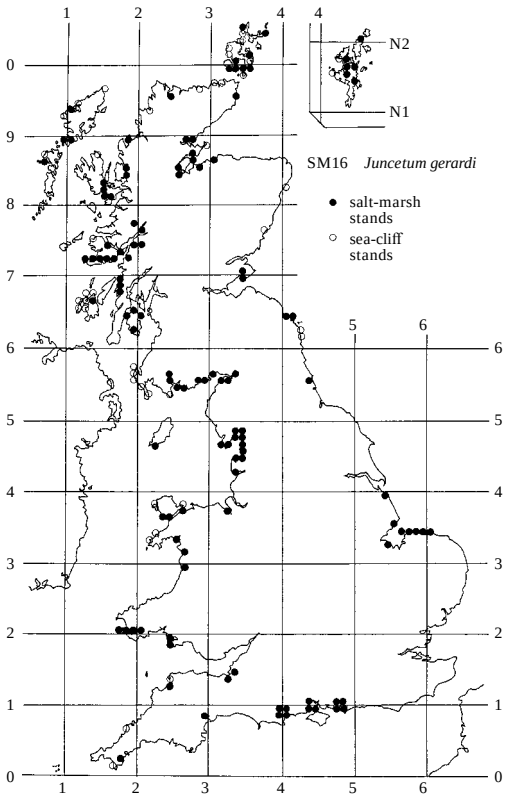

N2
N1
SM16 *Juncetum gerardi*
d Sub-community dominated by tall *Festuca rubra*


N2
N1
SM16 *Juncetum gerardi*
e *Leontodon autumnalis* sub-community


N2
N1
SM16 *Juncetum gerardi*
e *Leontodon autumnalis* sub-community on maritime cliffs


N2
N1
SM16 *Juncetum gerardi*
ei *Leontodon autumnalis* sub-community
Trifolium repens variant


N2
N1
SM16 *Juncetum gerardi*
f *Carex flacca* sub-community


N2
N1
SM16 *Juncetum gerardi*
salt-marsh stands
sea-cliff stands

SM17

Artemisia maritima salt-marsh community

Artemisietum maritimae Hocquette 1927

Synonymy

Festucetum littoralis artemisietosum Ghestem 1972; includes *Halimionetum portulacoidis*, terminal phase with *Artemisia maritima* Beeftink 1962.

Constant species

Artemisia maritima, *Festuca rubra*, *Halimione portulacoides*, *Plantago maritima*.

Rare species

Limonium binervosum, *L. humile*, *Suaeda vera*.

Physiognomy

This is a species-poor community of somewhat variable physiognomy. Stands are generally small and fragmentary but they range from rank grassy patches dominated by *Festuca rubra* with prominent *Artemisia maritima* to open bushy vegetation with *A. maritima* over low *Halimione portulacoides*. There is usually a little *Plantago maritima*; *Limonium* cf. *vulgare* and *Puccinellia maritima* are also frequent.

Habitat

The *Artemisietum maritimae* is an upper-marsh community occurring on a variety of substrates, though often in association with tidal litter and inwashed shell fragments. Its most usual habitat is on creek levees where it forms small patches on the usually heavy clay soils which frequently show organic enrichment in the upper part of the profile. It is also found on ridges and mounds on the upper marsh and sometimes forms a fringe along the foot of sea walls or around stands of *Atriplici-Elymetum pycnanthi*. Where such zones occur at the marsh/dune interface the substrate is often a coarse sand.

Most occurrences are on ungrazed marshes but this may be a reflection of the predominantly south-eastern distribution of the association.

Zonation and succession

The association is normally found as a patchy zone between the *Halimionetum* and *Atriplici-Elymetum pycnanthi*. Junctions with the former may be marked by an intermediate zone with abundant *Festuca rubra*. This zonation may reflect a succession related to increase in marsh height with sediment accretion.

Distribution

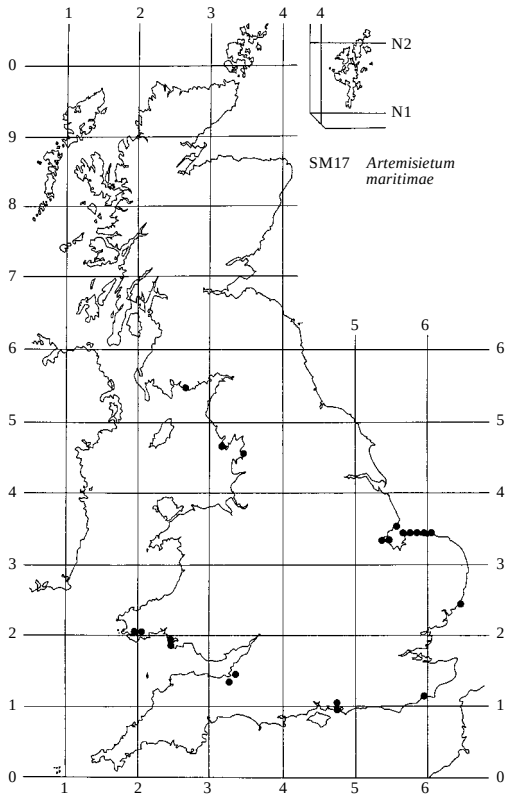
The *Artemisietum* is widespread in East Anglia and along the south coast and it extends north into Scotland. West coast occurrences are scattered and restricted mainly to ungrazed marshes.

Affinities

Traditionally, an *Artemisia maritima* community has not been distinguished in British accounts of salt-marsh vegetation (e.g. Chapman 1934, Tansley 1939) and some Continental authorities regard the community as a subdivision of the *Halimionetum* or *Festucetum littoralis*. Nonetheless, though British stands are generally fragmentary and united mainly by the prominence of *Artemisia maritima*, the major associates represent a distinctive assemblage of species. Furthermore, Continental stands of this vegetation are frequently far more extensive and floristically distinct than those in Britain. A British *Artemisietum* could thus be sensibly seen as a somewhat impoverished extension of an association which occupies a noteworthy floristic transition between a number of Puccinellion and Armerion communities.

Floristic table SM17

Artemisia maritima	V (3–9)
Festuca rubra	V (2–9)
Halimione portulacoides	IV (1–8)
Plantago maritima	IV (1–5)
Limonium cf. *L. vulgare*	III (2–6)
Puccinellia maritima	III (2–7)
Armeria maritima	II (2–4)
Glaux maritima	II (1–4)
Triglochin maritima	II (2–5)
Aster tripolium (rayed)	II (2–4)
Aster tripolium	I (1–3)
Cochlearia anglica	I (1–3)
Juncus gerardii	I (3–5)
Agrostis stolonifera	I (2–5)
Atriplex prostrata	I (2–3)
Elymus pycnanthus	I (2–4)
Suaeda vera	I (1–3)
Spergularia media	I (1–4)
Plantago coronopus	I (2–5)
Cochlearia officinalis	I (2)
Elymus repens	I (2–3)
Juncus maritimus	I (3–5)
Suaeda maritima	I (2–4)
Salicornia agg.	I (2)
Parapholis strigosa	I (2–4)
Hordeum marinum	I (3–4)
Number of samples	42
Mean number of species/sample	7 (2–12)
Mean vegetation height (cm)	19 (7–35)
Mean total cover (%)	98 (50–100)



SM18
Juncus maritimus salt-marsh community

Synonymy
Juncetum maritimi auct. angl. p.p., includes *Juncus maritimus-Oenanthe lachenalii* ass. R.Tx. 1937

Constant species
Agrostis stolonifera, *Festuca rubra*, *Glaux maritima*, *Juncus gerardii*, *J. maritimus*.

Physiognomy
The association is dominated by tall dense clumps of *Juncus maritimus* with an understorey of *Agrostis stolonifera*, *Festuca rubra*, *Glaux maritima* and *Juncus gerardii*. There is a rich subsidiary flora in which mesotrophic grassland species (notably *Leontodon autumnalis* and *Trifolium repens*) and weed species (for example, *Atriplex hastata*, *Elymus repens* and *Rumex crispus*) are conspicuous. Bryophytes may be locally abundant with patches of *Calliergon cuspidatum*, *Amblystegium riparium*, *A. serpens* and *Eurhynchium praelongum*. Stands of the association may be based on individual clones of *J. maritimus*, in some cases up to 15 m in diameter, or occur as an extensive zone.

Sub-communities

***Plantago maritima* sub-community:** *Juncetum maritimi* Yapp & Johns 1917; *Festuca rubra-Juncus maritimus* nodum Adam 1976. *Plantago maritima* and *Triglochin maritima* attain constancy in the often luxuriant vegetation of this sub-community and there are frequent records for *Leontodon autumnalis*, rayed *Aster tripolium* and *Armeria maritima*. It sometimes occupies extensive areas, notably at Ynys Hir in the Dovey estuary, Dyfed.

***Oenanthe lachenalii* sub-community:** *Juncus maritimus-Oenanthe lachenalii* ass. R.Tx. 1937; *Oenanthe lachenalii-Juncus maritimus* nodum Adam 1976. *Triglochin maritima*, *Leontodon autumnalis* and *Oenanthe lachenalii* are constant here, the last giving a particularly distinctive appearance to the vegetation in the flowering season, though it is rarely present in abundance. Individual stands, even those in close proximity, may have singular characteristics and different weed species, germinating in trapped drift litter, are especially variable. Some stands have abundant *Cirsium arvense*, others *Atriplex hastata*, *Sonchus arvensis* or *Urtica dioica*.

***Festuca arundinacea* sub-community:** *Festuca arundinacea-Juncus maritimus* nodum Adam 1976. *Oenanthe lachenalii*, remains constant in this sub-community but salt-marsh species like *Glaux maritima*, *Juncus gerardii*, *Plantago maritima* and *Triglochin maritima* are less frequent. However, the most obvious feature here is the constancy of *Festuca arundinacea*, the large tussocks of which may be co-dominant with the *Juncus maritimus*, and of *Leontodon autumnalis*, *Potentilla anserina* and *Trifolium repens* in the understorey. Other mesotrophic grassland species such as *Holcus lanatus*, *Lotus corniculatus*, *Ranunculus acris* and *Vicia cracca* are also frequent.

Habitat
The association is predominantly an upper-marsh community but the sub-communities differ in their tolerance of tidal submersion. The lowest recorded site for the *Festuca arundinacea* sub-community experienced 25 submergences/year while the *Oenanthe* sub-community seems to be able to tolerate at least 150 submergences/year. As the *Plantago* sub-community is normally found seaward of the *Oenanthe* sub-community, its tolerance is presumably even greater.

The association occurs on a variety of substrates but the pH is generally around 7.0 (cf. Bridges 1977 who recorded values down to 5.1). There is normally an appreciable accumulation of organic matter in the top 10–20 cm of the soil and superficial litter trapping may be considerable. This material provides a suitable substrate for colonisation by weed species.

Although the association is common on grazed marshes, *Juncus maritimus* is itself unpalatable and its dense tall growth confers protection on the associated

species. Yapp & Johns (1917) and Tansley (1939) suggested that the luxuriance of vegetation within *J. maritimus* stands may also be due to the higher and more constant humidity levels attained there. Extensive spread of the association on grazed marshes reduces their agricultural value but eradication has been attempted on only a small local scale. Mowing, draining, the use of herbicides and physical removal of *J. maritimus* have all been attempted. Packham & Liddle (1970) have reported some success in control on Cefni Marsh, Anglesey, by cutting close to the ground in early summer.

Oenanthe lachenalii is remarkably resistant to oil and refinery effluent spillage (Baker 1979). Even after repeated oiling, plants respond simply by producing new shoots.

Zonation and succession

At a few sites, there is a zonation within single extensive stands of the association from the *Plantago* sub-community through the *Oenanthe* sub-community to the *Festuca* sub-community. More generally, isolated stands of each of the sub-communities occur within other communities, the *Oenanthe* and *Plantago* sub-communities usually within the *Juncetum gerardi*, though the *Plantago* sub-community may also extend down-marsh into the upper part of the *Puccinellietum maritimae*. Unlike these two sub-communities where stands are sharply defined the *Festuca* sub-community often has rather diffuse boundaries with its neighbouring communities on the upper marsh.

Juncus maritimus can be an aggressive invader. Packham & Liddle (1970) reported the transformation of an area of *Puccinellietum maritimae* within the space of 20 years. It has been conventional in British accounts to regard *Juncus maritimus* salt-marsh, if not as the true climax of succession, then at least as a very stable stage in upper marsh development which can be considered for most purposes as the climax. The association is clearly important on those marshes where it occurs but it is probably better to see it as part of a seral sequence parallel to that involving the *Juncetum gerardi*.

Distribution

The association is widespread on the west coast as far north as Arran but very local in south-east England, though it may occur there on derelict reclaimed land. In Norfolk, the association is replaced by the *Juncus maritimus-Triglochin maritima* salt-marsh.

Affinities

The classification of *Juncus maritimus* vegetation poses a number of problems (Adam 1977). *J. maritimus* occurs widely in British salt-marshes but those vegetation types in which it is dominant or co-dominant are nonetheless distinct. Two of these are best considered as sub-communities of other well-defined associations: the *Halimionetum portulacoidis* and the *Atriplici-Elymetum pycnanthi*. A further community forms the distinctive, partly low-marsh, *Juncus maritimus-Triglochin maritima* association.

The three remaining types are those grouped here as the *Juncus maritimus* salt-marsh. The *Juncetum maritimi* of British authors has not been taken up in Continental studies but, although this partly reflects a different approach to classification, it is probably also an indication of the less important role which *J. maritimus* plays outside Great Britain. An alternative approach to these three types of *J. maritimus* salt-marsh would be to consider them as variants of the *Juncetum gerardi* (see Braun-Blanquet & Tüxen 1952, Ivimey-Cook & Proctor 1966, Moore *et al*. 1970 and Moore & O'Reilly 1977 in Ireland). However, although the two associations share a considerable number of species, the *Juncus maritimus* salt-marsh is distinct in containing conspicuous weed species and also in its striking physiognomy. The representation of ruderals has led some workers to place *J. maritimus* vegetation in various taxa of the Elymo-Rumicion crispi (e.g. Westhoff & den Held 1969).

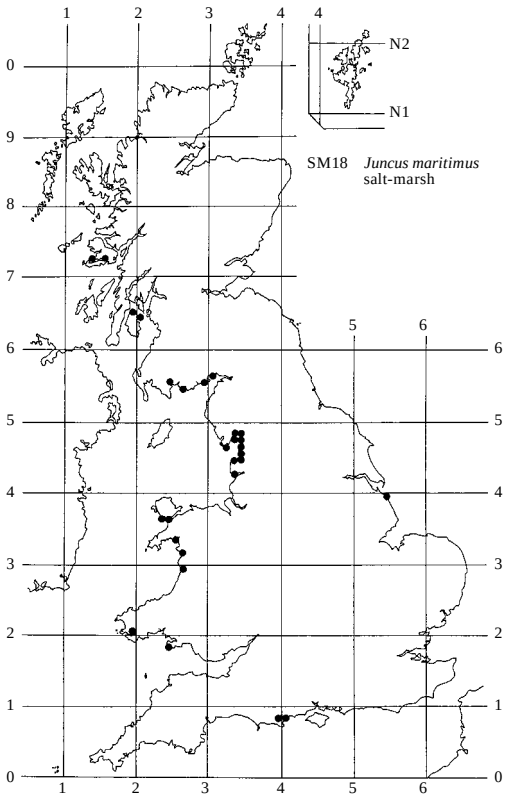
There is no single well-described phytosociological equivalent of the association diagnosed here. Tüxen (1937) reported a *Juncus maritimus-Oenanthe lachenalii* association from north Germany and similar communities have been encountered from other sites in that region (Libbert 1940, Voderberg 1955, Passarge 1964), from The Netherlands (Westhoff & den Held 1969) and from north Spain (Tüxen & Oberdorfer 1958, Bellot 1966). These have not been fully described or related to British *J. maritimus* vegetation but it may eventually be sensible to incorporate them into a single association.

The general floristic similarities to the *Juncetum gerardi* suggest that the *Juncus maritimus* salt-marsh is best placed within the Armerion maritimae of the Asteretea.

Floristic table SM18

	a	b	c	18
Juncus maritimus	V (7–9)	V (2–9)	V (5–8)	V (2–9)
Agrostis stolonifera	V (3–8)	V (3–8)	V (4–7)	V (3–8)
Festuca rubra	V (1–8)	V (3–8)	V (5–7)	V (1–8)
Glaux maritima	IV (2–7)	IV (2–6)	III (2–4)	IV (2–7)
Juncus gerardii	IV (3–5)	IV (2–6)	III (3–5)	IV (2–6)
Triglochin maritima	IV (2–5)	IV (2–5)	II (2–3)	III (2–5)
Plantago maritima	V (2–6)	III (2–4)	II (2–3)	III (2–6)
Oenanthe lachenalii	I (1–3)	V (2–5)	V (2–5)	III (1–5)
Leontodon autumnalis	III (2–4)	IV (2–5)	IV (1–4)	II (1–5)
Festuca arundinacea	I (2)	I (2–3)	V (3–7)	II (2–7)
Potentilla anserina	I (3–5)	II (2–7)	IV (2–7)	II (2–7)
Trifolium repens	II (2–6)	III (3–8)	IV (3–5)	III (2–8)
Aster tripolium (rayed)	III (2–4)	II (2–3)	I (2)	II (2–4)
Armeria maritima	III (2–5)	I (2–4)	I (2–3)	II (2–5)
Algal mat	II (4–8)	I (4–5)		I (4–8)
Atriplex prostrata	II (1–5)	III (2–5)	II (2–3)	II (1–5)
Elymus repens	I (4)	II (2–6)	III (3–6)	II (2–6)
Carex distans	I (2–3)	II (2–5)	III (1–4)	II (1–5)
Lotus corniculatus	I (4)	I (2–4)	III (3–5)	I (2–5)
Eurhynchium praelongum	I (3–5)	II (3–6)	III (3–7)	II (3–7)
Carex extensa	II (3–4)	I (1–4)	I (3)	I (1–4)
Poa pratensis	I (3–5)	II (2–5)	I (2–4)	I (2–5)
Rumex crispus	I (1–3)	II (2–3)	I (1–3)	I (1–3)
Samolus valerandi	I (3)	I (2–4)	II (2–4)	I (2–4)
Cirsium arvense		I (2–7)	II (2–3)	I (2–7)
Holcus lanatus		I (2–7)	II (2–7)	I (2–7)
Ranunculus acris		I (2–3)	II (2–4)	I (2–4)
Vicia cracca		I (2–4)	II (1–6)	I (1–6)
Carex otrubae		I (2–4)	I (2–4)	I (2–4)
Cochlearia officinalis	II (2–4)	II (2–3)	II (1–3)	II (1–4)
Amblystegium serpens	I (3–5)	I (3)	I (3–5)	I (3–5)
Galium palustre	I (3)	I (2–4)	I (3)	I (2–4)
Lychnis flos-cuculi	I (3)	I (2–3)	I (3)	I (2–3)
Sonchus arvensis	I (3)	I (2–3)	I (2–5)	I (2–5)
Number of samples	51	71	33	155
Mean number of species/sample	11 (5–20)	13 (7–25)	15 (8–32)	13 (5–32)
Mean vegetation height (cm)	51 (5–100)	49 (30–100)	53 (30–100)	50 (5–100)
Mean total cover (%)	98 (85–100)	99 (70–100)	99 (95–100)	98 (70–100)

a *Plantago maritima* sub-community
b *Oenanthe lachenalii* sub-community
c *Festuca arundinacea* sub-community
18 *Juncus maritimus* salt-marsh (total)


N2
N1
SM18 *Juncus maritimus* salt-marsh

SM19

Blysmus rufus salt-marsh community

Blysmetum rufi (G. E. & G. Du Rietz 1925) Gillner 1960

Synonymy

Juncus gerardii-Carex extensa Association Birks 1973 *p.p.*

Constant species

Blysmus rufus, Agrostis stolonifera, Glaux maritima, Juncus gerardii, Triglochin maritima.

Rare species

Blysmus rufus.

Physiognomy

The *Blysmetum rufi* is a species-poor association, generally dominated by *Blysmus rufus* but often with abundant *Agrostis stolonifera*, *Glaux maritima* and *Juncus gerardii*. *Triglochin maritima*, *Festuca rubra*, *Plantago maritima* and *Carex extensa* are all frequent but rarely present in quantity. Some stands may have an extensive algal mat and certain bryophytes may be abundant: *Amblystegium riparium*, *A. serpens*, *Calliergon cuspidatum*, *Campylium stellatum*, *C. polygamum*, *Drepanocladus aduncus* and *Cratoneuron filicinum*. Cover may be somewhat open, especially on gravelly or rocky substrates, and stands are usually small (10–20 m^2), though at a number of Scottish sites the association covers hundreds of square metres.

Habitat

The association occurs on a variety of substrates but sites are often either poorly-drained or subject to flushing by brackish or fresh-water. The characteristic situation is in small depressions in the upper marsh. In some cases, the *Blysmetum* may develop in old upper-marsh pans, especially where these have a shingle base, and it is sometimes present along path edges (Gillner 1960, Tyler 1969*b*, Beeftink 1977*a*). In west Scotland, small stands are widespread within rocky flushes in the salt-marsh/mire transition on raised beaches and also among coastal rocks (Gillham 1957*b*, Birks 1973, Adam *et al.* 1977). The majority of occurrences are on grazed salt-marshes, although *B. rufus* itself does not appear to be much eaten.

Zonation and succession

Although *B. rufus* sometimes occurs as scattered shoots within the *Juncetum gerardi* (notably at Caerlaverock NNR, Dumfries & Galloway; Martin 1977), stands of the *Blysmetum* are usually rather sharply defined from the *Juncetum gerardi* which is the usual surrounding vegetation. Freshwater flushing over gravel sometimes allows the association to develop at fairly low levels in the marsh but it is unlikely that the *Blysmetum* plays any role in succession.

Distribution

B. rufus is one of the very few species constituting a northern element in the British salt-marsh flora (Ratcliffe 1977) and the association is locally distributed along the west coast from mid-Wales northwards, being commonest in west Scotland. Its generally small stands render it vulnerable to local extinction following habitat disturbance but, though there is some evidence for the loss of *B. rufus* in the southern part of its range (Perring & Walters 1962, Martin 1977, Ratcliffe 1977), there is nothing to suggest a large-scale contraction in distribution.

Affinities

The *Blysmetum rufi* is not discussed in the early descriptions of British salt-marshes which were mainly concerned with communities in south-east England. It has, however, been referred to in more recent accounts from northern and western Britain (Gillham 1957*b*, Greenwood 1972, Birks 1973, Adam *et al.* 1977) and the association is widely described on the Continent, where it is especially widespread in southern Scandinavia.

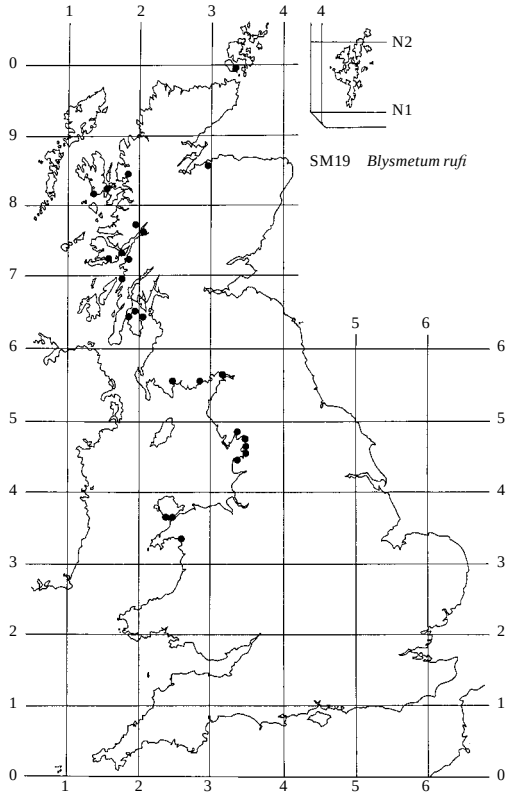
The *Blysmetum* shows clear affinities with the *Juncetum gerardi* and some accounts of the community

regard it as part of that association (e.g. Birks 1973) or as a closely-related association within the Armerion maritimae (e.g. Beeftink 1965, 1977*a*). An alternative treatment is to place the association alongside the *Eleocharitetum uniglumis*, which is similar in its physiognomy and its habitat to the *Blysmetum*, and which is itself the centre of a separate alliance, the Eleocharion uniglumis (Siira 1970, Tyler *et al*. 1971).

There are some ecological similarities between the *Blysmetum* of the Scottish raised-beach flushes and certain of the Caricion davallianae communities *sensu* Wheeler (1980*b*).

Floristic table SM19

Blysmus rufus	V (3–9)
Agrostis stolonifera	V (2–7)
Glaux maritima	V (2–7)
Juncus gerardii	V (2–6)
Triglochin maritima	IV (1–5)
Festuca rubra	III (2–6)
Plantago maritima	III (2–5)
Carex extensa	III (2–5)
Aster tripolium (rayed)	II (2–3)
Armeria maritima	II (2–5)
Algal mat	II (3–7)
Trifolium repens	II (2–5)
Juncus articulatus	II (1–6)
Eleocharis uniglumis	II (4–9)
Alopecurus geniculatus	I (3–5)
Potentilla anserina	I (2–3)
Leontodon autumnalis	I (2–3)
Eleocharis quinqueflora	I (5)
Triglochin palustris	I (2–3)
Amblystegium riparium	I (3–4)
Amblystegium serpens	I (2–4)
Carex nigra	I (3–4)
Calliergon cuspidatum	I (3–7)
Cochlearia anglica	I (2)
Campylium polygamum	I (2–5)
Oenanthe lachenalii	I (3)
Puccinellia maritima	I (1–4)
Carex lepidocarpa	I (2–3)
Campylium stellatum	I (3–5)
Number of samples	23
Mean number of species/sample	10 (5–17)
Mean vegetation height (cm)	17 (6–25)
Mean total cover (%)	90 (50–100)



SM20

Eleocharis uniglumis salt-marsh community

Eleocharitetum uniglumis Nordhagen 1923

Constant species
Eleocharis uniglumis, *Agrostis stolonifera*.

Physiognomy
Although *Eleocharis uniglumis* is a widespread minor constituent of a variety of damp transitional communities along the upper marsh fringes (Birks 1973, Adam 1976), it is here dominant in a species-poor association, similar in floristics and appearance to the *Blysmetum rufi*. There is often an extensive undercarpet of *Agrostis stolonifera* and *Juncus gerardii*, *Glaux maritima*, *Festuca rubra*, *Triglochin maritima*, *Potentilla anserina* and *Alopecurus geniculatus* all occur frequently and may be abundant in particular stands. As in the *Blysmetum*, cover is variable and algae and bryophytes may form a patchy carpet over the substrate surface.

Habitat
In Britain, the *Eleocharitetum* occurs most frequently in depressions in the upper marsh. Some of the most extensive stands occur in brackish marshes by the River Gilpin, Cumbria. Rarely, it occurs in what is a widespread habitat in Scandinavia, as a fringe of emergent vegetation, as around the brackish and atidal Loch an Amadain in Skye.

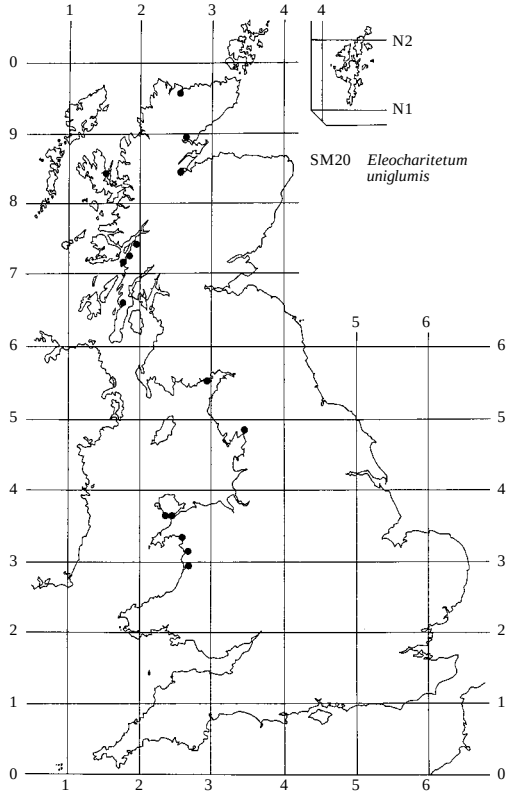
Zonation and succession
The *Eleocharitetum* occurs patchily within other upper-marsh associations such as the *Juncetum gerardi* and it does not play a major role in salt-marsh succession.

Distribution
The association is a rare community on British salt-marshes occurring locally along the west coast from the Dovey estuary northwards.

Affinities
British vegetation dominated by *E. uniglumis* is clearly closely related to that described from Scandinavia (Gillner 1960, Tyler 1969*b*, Siira 1970) although the emergent stands in Britain lack the aquatic species characteristic of the *Eleocharetum* of, for example, the Baltic. Siira (1970) and Tyler *et al*. (1971) assign the association to the alliance Eleocharion uniglumis, and a sensible treatment of both the *Eleocharitetum* and the *Blysmetum rufi* would be to regard them as constituting, in this alliance, the brackish end of variation within the Asteretea.

Floristic table SM20

Eleocharis uniglumis	V (5–10)
Agrostis stolonifera	V (3–7)
Glaux maritima	III (2–5)
Juncus gerardii	III (3–6)
Festuca rubra	II (2–7)
Triglochin maritima	II (2–5)
Alopecurus geniculatus	II (2–6)
Potentilla anserina	II (2–7)
Aster tripolium (rayed)	I (2–3)
Plantago maritima	I (4)
Armeria maritima	I (2–3)
Algal mat	I (8)
Carex extensa	I (3)
Trifolium repens	I (3–6)
Leontodon autumnalis	I (2–3)
Juncus articulatus	I (3–6)
Eleocharis quinqueflora	I (2–3)
Triglochin palustris	I (2)
Amblystegium riparium	I (3)
Carex nigra	I (2–4)
Hydrocotyle vulgaris	I (3–8)
Atriplex prostrata	I (2–3)
Samolus valerandi	I (3–4)
Carex distans	I (3–4)
Galium palustre	I (3–4)
Oenanthe lachenalii	I (1–4)
Scirpus maritimus	I (2–3)
Number of samples	17
Mean number of species/sample	8 (4–22)
Mean vegetation height (cm)	22 (10–45)
Mean total cover (%)	90 (60–100)



SM21
Suaeda vera–Limonium binervosum salt-marsh community

Synonymy
Suaedeto-Limonietum Chapman 1934 *p.p.*; *Halimioneto-Limonietum* Chapman 1934 *p.p.*; ? *Suaedetum fruticosae* Tansley 1939 *p.p.*; *Suaedeto-Limonietum binervosi* Adam 1976; *Halimiono-Frankenietum laevis* Adam 1976 *emend.*; Norfolk *Frankenia laevis* stands Brightmore 1979.

Constant species
Armeria maritima, *Halimione portulacoides*, *Limonium binervosum*, *Puccinellia maritima*, *Suaeda vera*.

Rare species
Frankenia laevis, *Limonium bellidifolium*, *L. binervosum*, *Suaeda vera*.

Physiognomy
The rather open vegetation of this community is generally dominated by scattered bushes of *Suaeda vera* and *Halimione portulacoides* up to 40 cm high with a patchy cover of herbaceous halophytes between. Among the constants, *Puccinellia maritima* and *Limonium binervosum* are usually most abundant with smaller amounts of *Armeria maritima*. *Suaeda maritima* is fairly frequent throughout.

Sub-communities

Typical sub-community: *Suaedeto-Limonietum binervosi* Adam 1976. *Festuca rubra*, *Plantago maritima* and *Artemisia maritima* are frequent in this sub-community, the first sometimes in abundance. There are occasional records for a variety of species characteristic of disturbed places on the upper marsh and of strandlines.

***Frankenia laevis* sub-community:** *Halimiono-Frankenietum laevis* Adam 1976 *emend*. *Frankenia laevis* and *Limonium bellidifolium* are constant in this sub-community which is more species-poor than the above.

Habitat
The community is characteristic of salt-marsh/dune interfaces, spit laterals, eroded dunes and some sand-dune lows where there is a base of shingle covered with varying amounts of blown sand and inwashed silt (Chapman 1934, 1960*b*, Tansley 1939).

The sub-communities differ in their tolerance of tidal inundation. The Typical sub-community is most frequently encountered at or above the tidal limit where there is inundation only during severe storms. The *Frankenia* sub-community extends further down-marsh and at its lower limit there may be a thick layer of heavy clay over the shingle base. During the summer, high soil salinities may be experienced with a salt crust forming on the soil surface (see also Brightmore 1979).

Grazing, especially by rabbits, is, or has been, of considerable importance in the maintenance of this community. Heavy grazing of low *Suaeda vera* and *Halimione portulacoides* helps to maintain an open cover but reduction of grazing or resumed grazing of taller bushes of these species (Brightmore 1979) may allow the development of a closed or more erect canopy which can shade out *Frankenia laevis* from the *Frankenia* sub-community.

Zonation and succession
In general the community occupies a stable position at the uppermost end of the salt-marsh zonation but reduction of grazing may lead eventually to the development of the *Elymo-Suaedetum verae*, especially at lower levels.

Distribution
The community is endemic to Great Britain and is restricted to the north Norfolk coast. *Frankenia laevis*, *Limonium bellidifolium*, *L. binervosum* and *Suaeda vera* are all members of the Mediterranean element in the British flora (Matthews 1955) but, though of restricted

occurrence, they are not, apart from *L. bellidifolium*, confined to north Norfolk and their distributions overlap elsewhere. Neither is the distinctive salt-marsh/sand-dune interface habitat restricted to that area. Yet there is no evidence to suggest that this particular species assemblage has ever had a more widespread distribution (Adam 1978). Both *Frankenia laevis* and *Suaeda vera* are conspicuous members of other communities in a similar habitat.

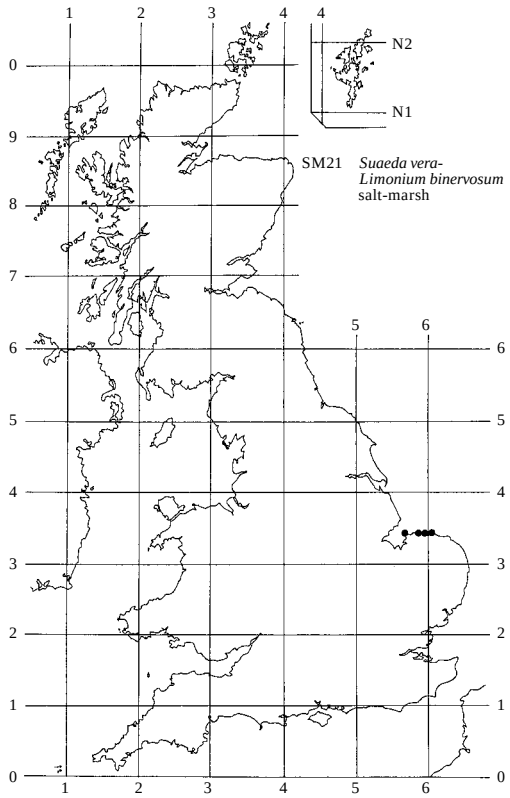
Affinities

Together with the *Limonio vulgaris-Frankenietum laevis*, this community represents vegetation which has floristic affinities with the Puccinellion communities yet which stands alongside the Armerion communities in its high position on the salt-marsh. Géhu & Géhu-Franck (1975) erected a new taxon, the Frankenio-Armerion, for similar vegetation described from France and suggested that this might be regarded as a sub-alliance within the Armerion.

Floristic table SM21

	a	b	21
Suaeda vera	V (1–4)	V (1–7)	V (1–7)
Puccinellia maritima	V (3–7)	V (2–6)	V (2–7)
Armeria maritima	V (2–7)	IV (2–5)	IV (1–7)
Halimione portulacoides	V (1–6)	IV (2–7)	IV (1–7)
Limonium binervosum	V (2–7)	IV (1–5)	IV (1–7)
Suaeda maritima	II (3)	III (2–6)	II (2–6)
Artemisia maritima	III (1–4)		I (1–4)
Festuca rubra	III (5–6)	I (3)	II (3–6)
Plantago maritima	III (2–4)	I (2–3)	II (2–4)
Elymus pycnanthus	II (1–2)		I (1–2)
Limonium cf. *L. vulgare*	II (2–5)		I (2–5)
Sagina maritima	II (2–3)	I (2)	I (2–3)
Spergularia marina	II (2–3)	I (2)	I (2–3)
Glaux maritima	I (3)		I (3)
Spergularia media	I (2)	I (1)	I (1–2)
Frankenia laevis		V (2–5)	III (2–5)
Limonium bellidifolium	II (1–4)	IV (1–6)	III (1–6)
Cochlearia anglica	I (2–3)	II (2)	I (2–3)
Cochlearia danica	I (2–3)	II (3)	I (2–3)
Salicornia agg.	I (3)	II (2–3)	I (2–3)
Cochlearia officinalis		I (1–2)	I (1–2)
Number of samples	11	14	25
Mean number of species/sample	10 (5–13)	8 (5–12)	8 (5–13)
Mean vegetation height (cm)	15 (4–40)	18 (3–40)	17 (3–40)
Mean total cover (%)	63 (20–90)	53 (20–80)	57 (20–90)

a Typical sub-community
b *Frankenia laevis* sub-community
21 *Suaeda vera-Limonium binervosum* salt-marsh (total)


N2
N1
SM21 *Suaeda vera-Limonium binervosum* salt-marsh

SM22

Halimione portulacoides-Frankenia laevis salt-marsh community

Limonio vulgaris-Frankenietum laevis Géhu & Géhu-Franck 1975

Synonymy

Halimiono-Frankenietum laevis Adam 1976 *p.p*; Sussex *Frankenia laevis* stands Brightmore 1979.

Constant species

Armeria maritima, Frankenia laevis, Halimione portulacoides.

Rare species

Frankenia laevis, Inula crithmoides, Arthrocnemum perenne.

Physiognomy

This community has a short uneven open sward dominated by *Halimione portulacoides* and *Frankenia laevis* with scattered plants of *Armeria maritima* and *Puccinellia maritima*. *Festuca rubra, Limonium vulgare,* annual *Salicornia* spp. and *Spergularia media* are frequent at low cover values and at some sites *Inula crithmoides* is conspicuous.

Habitat

The community generally occurs on mixtures of silt, sand and shingle at salt-marsh/sand-dune interfaces. Similar vegetation but lacking *H. portulacoides* has been recorded from Chalk undercliffs and rubble (Brightmore 1979).

Distribution

The community is confined to the south coast of Sussex where the best stands are developed at East Head, Chichester Harbour. *Frankenia laevis* has recently been reported from Anglesey (Roberts 1975) where it has become well established (after original planting?) among *Festuca rubra, Armeria maritima* and *Puccinellia maritima* to produce vegetation rather similar to this community.

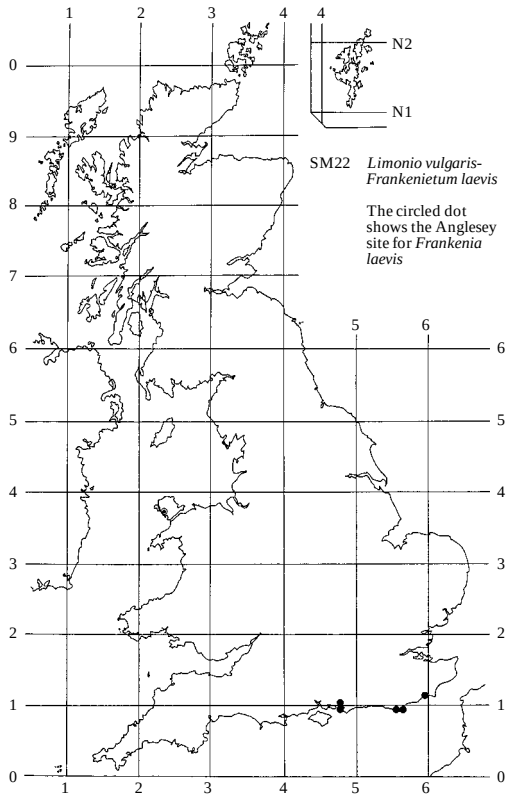
Affinities

The community is distinguished from the *Suaeda vera-Limonium binervosum* salt-marsh by the absence here of *S. vera* and the replacement of *Limonium bellidifolium* and *L. binervosum* by *L. vulgare*. Géhu & Géhu-Franck (1975) and Géhu & Delzenne (1975) regard the Sussex stands as representing a species-poor parallel to the *Frankenio-Limonietum lychnidifolii* of north-west France and have provisionally assigned them (and the Anglesey vegetation) to the *Limonio vulgaris-Frankenietum laevis*. This association and the *Suaeda vera-Limonium binervosum* community could be placed together in the Frankenio-Armerion.

Floristic table SM22

Frankenia laevis	V (3–8)
Halimione portulacoides	IV (3–9)
Puccinellia maritima	IV (2–5)
Armeria maritima	III (2–4)
Spergularia media	III (1–2)
Festuca rubra	II (3–5)
Salicornia agg.	II (1–3)
Elymus farctus	II (3–4)
Limonium vulgare	II (1–5)
Parapholis strigosa	II (1–4)
Suaeda maritima	I (1–2)
Arthrocnemum perenne	I (1–2)
Plantago maritima	I (1–2)
Plantago coronopus	I (1–5)
Number of samples	18
Mean number of species/sample	8 (6–13)
Mean vegetation height (cm)*	3 (2–5)
Mean total cover (%)	86 (80–100)

* Data of four samples only.


N2
N1
SM22 *Limonio vulgaris-Frankenietum laevis*
The circled dot shows the Anglesey site for *Frankenia laevis*

SM23

Spergularia marina-Puccinellia distans salt-marsh community

Puccinellietum distantis Feekes (1934) 1945

Synonymy
Sperguletum marinae Tyler 1969.

Constant species
Spergularia marina, Puccinellia distans, P. maritima.

Physiognomy
The *Puccinellietum distantis* is a generally open association of scattered but often abundant individuals of *Spergularia marina, Puccinellia distans* and *P. maritima* with rather variable amounts of *Agrostis stolonifera* and sparse records for a variety of salt-marsh species (especially in coastal sites) and ruderal glycophytes. An algal mat is sometimes conspicuous in coastal stands but bryophytes are always rare.

Sub-communities
Sampling of coastal stands of the association has been insufficient to detect the existence of well-defined sub-communities but individual stands bear some resemblance to the *Puccinellietum distantis polygonetosum* R.Tx. 1956 *emend*. Beeftink 1962 (with *Polygonum aviculare*) and the *Puccinellietum distantis pholiuretosum* (with *Parapholis strigosa*) described from The Netherlands (Beeftink 1962, 1965, 1977*a*). Lee (1977) encountered inland stands similar to the 'initial' (with *Atriplex hastata*) and 'degraded' (without *A. hastata* and *Spergularia marina*) sub-associations recognised on Polish coastal marshes (Piotrowski 1974) and to the *Puccinellietum distantis juncetosum* Westhoff 1947 (with *Juncus ambiguus* Guss.) described from the Netherlands (Beeftink 1962). Lee's (1977) *asteretosum* is probably best considered in relation to the *Aster tripolium* communities of salt-marshes and brackish habitats. Further sampling is necessary to establish the validity of these sub-divisions in Britain.

Habitat
The association is characteristic of disturbed situations with soils of variable but generally high salinity. On coastal marshes, it is found in dried-up pans in the upper marsh, in old turf-cuttings, along paths and (particularly in The Wash) in cattle-poached areas. It also occurs on and behind sea walls.

Inland, *Puccinellietum distantis* has been described (Lee 1977) from both natural brine springs and marshes, where it is best developed on the most saline, cattle-poached soils, and from the artificial habitats associated with the salt and alkali industries. Disturbance helps maintain and extend the association, especially through the establishment of the prolifically-seeding annual *Spergularia marina*. Lee found this species best able to tolerate the most saline conditions, though it appeared to suffer from competition with *Puccinellia distans* on soils of lower salinity. Differential response of these two species formed the basis of small-scale mosaics over uneven spoil and soil surfaces.

In these inland sites, the so-called 'initial' sub-association (after Piotrowski 1974) persisted provided soil salinity remained high. The 'degraded' sub-association, dominated by *P. distans*, was characteristic of drier soils and the *juncetosum* of wetter soils, both of lower salinity.

Zonation and succession
Mosaics of the various sub-communities appear to develop in relation to differences in soil salinity levels and the height of the water-table. In coastal sites, the association is usually rather sharply marked off from the surrounding vegetation, often *Juncetum gerardi* or *Puccinellietum maritimae*, though in some cases there may be a more gradual transition to a *Puccinellietum maritimae* with large amounts of *Puccinellia distans* (e.g. the upper reaches of the tidal Nene; Adam & Akeroyd 1978).

The association is maintained by continued disturbance. If this ceases, then a closed sward of the surrounding vegetation is likely to extend into the *Puccinellietum distantis*.

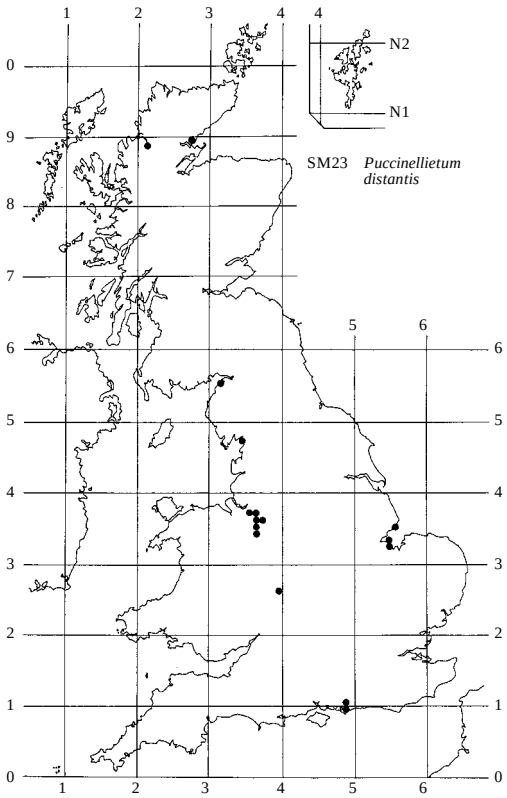
Distribution
Fragmentary stands occur on coastal marshes throughout the country. Inland, the association is confined to areas with percolation of saline waters or accumulation of salt and alkali waste. The most extensive sites are in Cheshire, though some of these have been lost by reclamation (Lee 1975, 1977).

Affinities
The British stands are typical of the *Puccinellietum distantis* widely described from Europe. The association is most closely related to the *Puccinellietum maritimae* but its distinctive ephemeral nature has led some authorities to place it in a separate alliance, the Puccinellion distantis, within the Asteretea.

Floristic table SM23

	a	b
Spergularia marina	V (4–8)	V (2–9)
Puccinellia maritima	V (1–7)	IV (4–5)
Puccinellia distans	II (1–6)	IV (2–8)
Agrostis stolonifera	II (4–6)	IV (2–7)
Salicornia agg.	III (2–7)	
Suaeda maritima	III (2–5)	
Glaux maritima	II (2–5)	I (1)
Algal mat	II (5–8)	
Parapholis strigosa	II (4–8)	
Halimione portulacoides	II (1–3)	
Atriplex prostrata	II (1–5)	I (2–3)
Triglochin maritima	II (2–3)	I (1)
Plantago maritima	II (2–4)	
Elymus pycnanthus	II (1–4)	
Aster tripolium (rayed)	I (3–4)	I (1–9)
Alopecurus geniculatus	I (2–5)	I (2–3)
Juncus bufonius	I (3–4)	I (2–9)
Polygonum aviculare	I (3–4)	
Festuca rubra	I (3–4)	
Spergularia media	I (3–8)	
Number of samples	13	180
Mean number of species/sample	7 (2–11)	6 (3–8)*
Mean vegetation height (cm)	6 (3–15)	no data
Mean total cover (%)	70 (50–90)	71 (30–100)*

* Means of 25 samples only.
a Coastal stands
b Inland stands (Lee 1977)


N2
N1
SM23 *Puccinellietum distantis*

SM24

Elymus pycnanthus salt-marsh community

Atriplici-Elymetum pycnanthi Beeftink & Westhoff 1962

Synonymy

Agropyretum pungentis Perraton 1953; includes *Agropyron pungens-Juncus maritimus* nodum Adam 1976.

Constant species

Elymus pycnanthus.

Physiognomy

The association is invariably dominated by the stiff clumps of *Elymus pycnanthus* and this may be the sole species. Usually, however, there are a few associates though these are somewhat varied and individual stands may be rendered distinctive by the abundance of (a) particular species. Sometimes there is a patchy or extensive understorey of *Halimione portulacoides, Artemisia maritima* and/or *Puccinellia maritima*. In other cases, *Atriplex prostrata* and/or *Festuca rubra* may be conspicuous. *Juncus maritimus* is sometimes abundant though stands with this species are not worthy of distinction as a subcommunity (cf. Adam 1976, 1977). Other stands have a prominent umbelliferous element with *Conium maculatum*, *Foeniculum vulgare* and *Smyrnium olusatrum* and, more locally, *Petroselinum segetum* and *Sison amomum*.

Habitat

The *Atriplici-Elymetum* is an upper-marsh community occurring on a variety of substrates including organically-enriched clay, sand (where *Festuca rubra* is often abundant) and shingle. Substrates are generally well-drained and there is often considerable free calcium carbonate derived from inwashed shell fragments. The pH is generally above 7.0. The association also occurs on older, partly decayed drift litter, where *Atriplex prostrata* flourishes, but in many stands there is little litter except at the seaward edge.

The association may be confined to a narrow strip around the tidal limit or form extensive stands in the upper marsh; occasionally it forms mosaics with other communities. It may extend down the marsh on creek levees and reach above the tidal limit, sometimes covering unmown sea walls where unbellifer-rich stands are characteristic.

Most stands occur on ungrazed or cattle-grazed marshes. Where sheep are admitted to sites with established stands, these are avoided by stock (Cadwalladr & Morley 1973) but the rarity of the association on marshes with a long tradition of sheep-grazing suggests that establishment may not be possible under such a management regime.

Zonation and succession

The association often terminates the zonation at the upper limit of British salt-marshes. A common pattern, seen on many Essex salt-marshes and around the Exe in Devon (Proctor 1980), runs from *Spartinetum townsendii* or *Asteretum tripolii* through *Halimionetum portulacoidis* to the *Atriplici-Elymetum*. The largest stands of the association appear to have developed from the *Halimionetum*.

On creek levees, the association may develop from the *Artemisietum maritimae* or, more locally, the *Spartinetum townsendii*. On high-level drift, there is sometimes a succession from the *Atriplex* strand-lines to the association. In sites inundated by only very exceptional storms, the association may be invaded by shrubs and trees but succession to woodland is likely to be prevented by the occasional subjection to saline waters.

Distribution

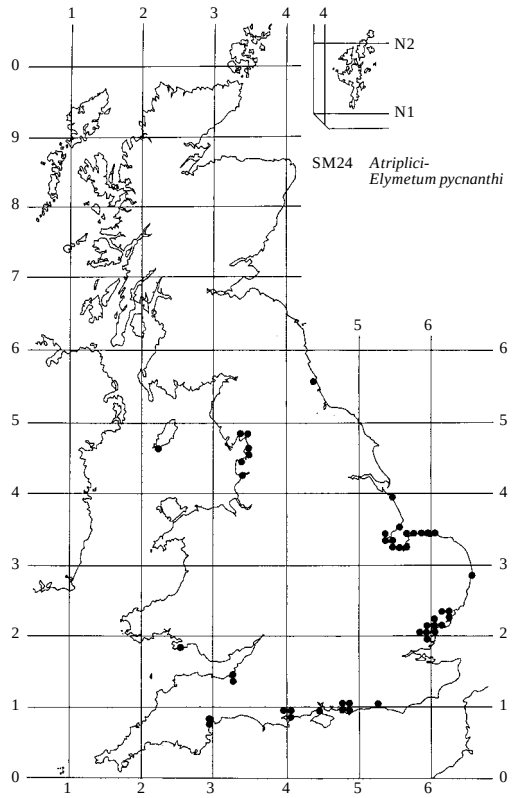
The association is most abundant in south-east England and stands on the west coast are local and small. *Elymus pycnanthus* reaches its northern limit in Britain at the Solway.

Affinities

Westhoff & den Held (1969) emphasise the nitrophilous character of the *Atriplici-Elymetum* by assigning it to the Angelicion litoralis in the Artemisietea but the similarities here are weaker than those between the association and other clearly maritime communities of the upper marsh and strand-line. A better solution is to place the association with the *Elymo pycnanthi-Suaedetum verae* in the Elymion pycnanthi of the Elymetea (Géhu & Géhu 1969).

Floristic table SM24

Elymus pycnanthus	V (2–10)
Halimione portulacoides	III (1–8)
Festuca rubra	III (1–9)
Atriplex prostrata	II (1–5)
Glaux maritima	II (1–5)
Puccinellia maritima	I (2–7)
Juncus maritimus	I (2–8)
Agrostis stolonifera	I (3–8)
Artemisia maritima	I (2–7)
Suaeda vera	I (1–7)
Juncus gerardii	I (2–5)
Limonium cf. *L. vulgare*	I (1–5)
Plantago maritima	I (1–5)
Armeria maritima	I (1–4)
Beta maritima	I (1–3)
Atriplex littoralis	I (1–3)
Sonchus arvensis	I (2–3)
Parapholis strigosa	I (2–4)
Potentilla anserina	I (2–3)
Aster tripolium var. *discoideus*	I (1–3)
Aster tripolium (rayed)	I (1–3)
Galium aparine	I (2–3)
Phragmites australis	I (2–6)
Ammophila arenaria	I (1–6)
Hypnum cupressiforme var. *lacunosum*	I (4–6)
Number of samples	110
Mean number of species/sample	6 (1–16)
Mean vegetation height (cm)	61 (30–100)
Mean total cover (%)	98 (75–100)



SM25

Suaeda vera drift-line community

Elymo pycnanthi-Suaedetum verae (Arènes 1933) Géhu 1975

Synonymy
Suaedetum fruticosae Tansley 1939 *p.p.*; *Agropyro-Suaedetum fruticosae* Adam 1976; *Halimiono-Suaedetum fruticosae* Adam 1976.

Constant species
Halimione portulacoides, *Suaeda vera*.

Rare species
Arthrocnemum perenne, *Suaeda vera*.

Physiognomy
The *Elymo pycnanthi-Suaedetum verae* is of variable appearance. The two association constants are sometimes co-dominant as a more or less closed shrubby cover; in other cases they occur as scattered bushes in a grassy ground. The *S. vera* shoots provide a niche for a varied flora of epiphytic lichens (Ellis 1960).

Sub-communities

***Elymus pycnanthus* sub-community:** *Elymo pycnanthi-Suaedetum verae typicum* Géhu & Delzenne 1975; *Agropyro-Suaedetum fruticosae* Adam 1976. Here the cover of *H. portulacoides* is low and the vegetation is dominated by complementary proportions of *S. vera* bushes and stiff clumps of *Elymus pycnanthus* with usually a little *Festuca rubra*. The upper edge of stands may be marked in spring by a narrow band of winter annuals such as *Cochlearia danica*, *Myosotis ramosissima*, *Sagina maritima* and *Valerianella locusta* germinating on drift debris.

***Halimione portulacoides* sub-community:** *Elymo pycnanthi-Suaedetum verae halimionetosum* Géhu & Delzenne 1975; *Halimiono-Suaedetum fruticosae* Adam 1976. *S. vera* and *H. portulacoides* are co-dominant as a shrubby canopy of variable height over a ground of scattered *Puccinellia maritima* and *Limonium* cf. *vulgare*, often with a little *Aster tripolium*, annual *Salicornia* spp., *Spergularia media* and *Suaeda maritima*. The sub-community provides an occasional high-level context for *Bostrychia scorpioides* and *Pelvetia canaliculata*.

Habitat
The association is most characteristic of drift-lines at salt-marsh/shingle interfaces with a tendency for the *Halimione* sub-community to be associated with superficial smears of sticky yellow-brown clay. The *Elymus* sub-community often runs down-marsh on ridges of drier silt and shorter-growing stands of the *Halimione* sub-community can tolerate up to about 120 submergences/year.

Zonation and succession
The association marks a particular type of transition from the upper marsh to other maritime communities and the driftline stands are probably stable in time.

The low-level stands of the *Halimione* sub-community overlap the habitat of the *Frankenia laevis* sub-community of the *Suaeda vera-Limonium binervosum* salt-marsh and at some sites in north Norfolk there is a mosaic of the two communities. The balance between them could be controlled by rabbit-grazing. Chapman (1960*b*) suggested that *Limonium bellidifolium* declined on Hut Marsh, Scolt Head Island, Norfolk because of the increased vigour of *H. portulacoides* following the reduction there of rabbit-grazing.

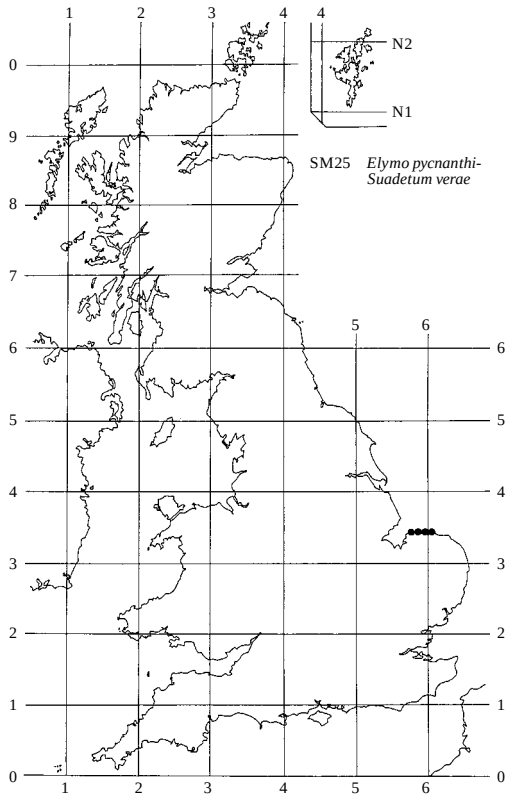
Distribution
The association occurs in north Norfolk and Essex.

Affinities
Vegetation similar to the British stands of the *Elymo-Suaedetum* has been described from western France (Corillion 1953, Vanden Berghen 1965*a*, Géhu & Géhu 1969, Géhu 1972, 1975). Géhu (1975) and Géhu & Delzenne (1975) have emphasised the Mediterranean affinities of *Suaeda vera* by assigning the association to the Halimionion in the Arthrocnemetea fruticosae. An alternative view would be to stress the drift-line character of the vegetation and place the association with the *Atriplici-Elymetum pycnanthi* in the Elymion pycnanthi.

Floristic table SM25

	a	b	25
Suaeda vera	V (1–8)	V (3–8)	V (1–8)
Halimione portulacoides	V (2–4)	V (6–9)	V (2–9)
Elymus pycnanthus	V (4–10)		IV (4–10)
Festuca rubra	III (2–5)		II (2–5)
Artemisia maritima	II (1–2)		I (1–2)
Cochlearia anglica	II (1–3)	I (1)	I (1–3)
Cochlearia danica	II (1–3)		I (1–3)
Glaux maritima	II (2–3)		I (2–3)
Plantago maritima	II (1–5)		I (1–5)
Atriplex littoralis	I (2)		I (2)
Puccinellia maritima	I (2)	V (1–7)	III (1–7)
Limonium cf. *L. vulgare*	I (1–4)	V (2–3)	II (1–4)
Suaeda maritima	I (2–3)	III (2–3)	II (2–3)
Aster tripolium	I (2)	III (1–2)	I (1–2)
Bostrychia scorpioides		III (2–5)	I (2–5)
Salicornia agg.		III (3)	I (3)
Spergularia media		III (3–4)	I (3–4)
Arthrocnemum perenne		II (1–2)	I (1–2)
Cochlearia officinalis		II (2–3)	I (2–3)
Pelvetia canaliculata		II (4)	I (4)
Triglochin maritima		II (2–3)	I (2–3)
Algal mat		I (5)	I (5)
Number of samples	13	7	20
Mean number of species/sample	6 (4–8)	8 (5–11)	7 (4–11)
Mean vegetation height (cm)	70 (50–100)	43 (20–73)	61 (20–100)
Mean total cover (%)	95 (70–100)	84 (50–100)	91 (50–100)

a *Elymus pycnanthus* sub-community
b *Halimione portulacoides* sub-community
25 *Elymo pycnanthi-Suaedetum verae* salt-marsh (total)


N2
N1
SM25 Elymo pycnanthi-Suadetum verae

SM26
Inula crithmoides on salt-marshes

Inula crithmoides is a maritime perennial largely confined to southern England and Wales: it is recorded from Essex round to Anglesey with an isolated station in south-west Scotland (Perring & Walters 1962). Although it occurs in maritime cliff communities throughout its range, occurrences in salt-marsh vegetation are restricted to south-east England from Essex to Hampshire.

Here it is an occasional in various associations but it is sometimes encountered in abundance, usually with *Halimione portulacoides* as a co-dominant. In the few available samples there is a distinction between stands where *Puccinellia maritima*, annual *Salicornia* spp. and *Limonium* cf. *vulgare* are constant in generally small amounts and those which have abundant *Elymus pycnanthus*. The former occur on low-marsh sites with coarse sand; the latter on moderately organic soils with much drift litter on the upper marsh.

Ranwell (1972; Ranwell & Boorman 1977) has correlated the distribution of *I. crithmoides* on salt-marshes with the occurrence of lime-rich freshwater influence and the presence of Chalk bedrock near the surface. Though this may be true, it is difficult to see the ecological significance of the observation: most salt-marshes are alkaline to some degree and *I. crithmoides* may be climatically restricted to salt-marshes which are coincidentally particularly base-rich.

Within its limited range on salt-marshes, *I. crithmoides* tends to be more confined to high-marsh occurrences with *Elymus pycnanthus* in Essex (see Rose 1964, Rose & Géhu 1964).

The most obvious affinities of the *I. crithmoides* salt-marsh vegetation are with the *Halimionetum portulacoidis*. Vanden Berghen (1965*a*) has suggested that, along the Biscay coast of France, *I. crithmoides* and *Arthrocnemum perenne* characterise a southern variant of the *Halimionetum*. Stands with abundant *Elymus pycnanthus* will perhaps find a place within the *Atriplici-Elymetum pycnanthi* but could also be seen as the northern limit of the Mediterranean association *Elymo pycnanthi-Inuletum crithmoidis* Br.-Bl. 1952 (Molinier & Tallon 1974).

The rather striking difference in distribution between salt-marsh and maritime cliff communities with *I. crithmoides* points to the possibility of there being distinct ecotypes of the species in Great Britain.

Floristic table SM26

	a	b	26
Inula crithmoides	V (4–7)	IV (5–9)	V (4–9)
Halimione portulacoides	V (5–9)	IV (3–8)	V (3–9)
Puccinellia maritima	V (2–4)		III (2–4)
Salicornia agg.	V (3–5)		III (3–5)
Limonium cf. *L. vulgare*	V (2–5)		III (2–5)
Plantago maritima	III (3)		II (3)
Armeria maritima	III (3–7)		II (3–7)
Suaeda maritima	III (2–4)	I (3)	III (2–4)
Arthrocnemum perenne	II (3–5)		II (3–5)
Algal mat	II (5)		II (5)
Spergularia media	II (2)		II (2)
Spartina anglica	I (2)		I (2)
Festuca rubra	I (2)		I (2)
Aster tripolium (rayed)	I (4)		I (4)
Elymus pycnanthus		IV (5–9)	III (5–9)
Bostrychia scorpioides		II (4)	I (4)
Number of samples	6	4	10
Mean number of species/sample	8 (3–10)	4 (3–5)	6 (3–10)
Mean vegetation height (cm)	26 (8–50)	50 (35–60)	36 (8–60)
Mean total cover (%)	93 (80–100)	100	96 (80–100)

a Stands with *Puccinellia maritima*, *Salicornia* agg. and *Limonium* cf. *L. vulgare*
b Stands with *Elymus pycnanthus*
26 *Inula crithmoides* stands

SM27

Ephemeral salt-marsh vegetation with *Sagina maritima*

Saginion maritimae Westhoff, van Leeuwen & Adriani 1962

Small stands of ephemeral vegetation with an often open cover of annuals and short-lived perennials occur patchily on British salt-marshes. Recurrent assemblages are rare and there seems to be a large element of chance in the floristic composition, early arrivals frequently pre-empting the niche. Such vegetation may include *Sagina maritima*, *S. nodosa* and *Plantago coronopus*, more rarely *Bupleurum tenuissimum* (to the south-east) and *Centaurium littorale* (to the north) and provide a salt-marsh context for ephemerals such as *Cochlearia danica* and *Desmazeria marina* which also occur in other maritime habitats.

Breaks in the turf of mid- and upper-marsh communities provide the most usual habitat for such species and they are especially characteristic of old turf-cuttings where they form part of the sequence of recolonising vegetation giving way to mixtures of *Festuca rubra*, *Agrostis stolonifera*, *Puccinellia maritima* and *Potentilla anserina*, which come to approximate to the *Puccinellietum maritimae*, the *Juncetum gerardi* or the *Festuca-Agrostis-Potentilla* mesotrophic grassland. Such ephemerals also occur in disturbed situations around reclamation banks (e.g. Gray 1977, 1979, Adam & Akeroyd 1978).

This kind of vegetation is the nearest equivalent in Britain to similarly diverse assemblages on Continental salt-marshes which have been assigned to the Saginion alliance in the Saginetea maritimae Westhoff, van Leeuwen & Adriani 1962 (e.g. Beeftink 1962, 1965, 1975, 1977*a*; Tüxen & Westhoff 1963; Westhodd & den Held 1969). There, too, the vegetation is characteristic of upper-marsh situations, being especially associated with salt-marsh/sand-dune transitions where there is a contact between more and less maritime sediments of low soil moisture content but fluctuating salinity.

SM28

Elymus repens salt-marsh community

Elymetum repentis maritimum Nordhagen 1940

Synonymy

Elymetum repentis maritimum, *Elymus repens*, *Potentilla anserina-Elymus repens-Vicia* and *Elymus repens-Potentilla anserina* soziations ? Nordhagen 1940.

Constant species

Agrostis stolonifera, *Atriplex prostrata*, *Elymus repens*, *Festuca rubra*.

Rare species

Allium scorodoprasum, *Hordeum marinum*.

Physiognomy

The *Elymetum repentis* has a closed grassy sward up to about 1 m tall, generally dominated by *Elymus repens* with usually smaller amounts of *Festuca rubra* and *Agrostis stolonifera* and, beneath, scattered plants of *Atriplex prostrata* and an open ground cover of *Potentilla anserina*. *Oenanthe lachenalii*, *Sonchus arvensis*, *Rumex crispus* and *Cirsium arvense* are occasional and often give a scruffy appearance to the vegetation and tussocks of *Juncus gerardii* or *Festuca arundinacea* may be locally prominent. The community is generally richer and more varied than the *Atriplici-Elymetum* with a wide range of occasionals of low frequency, some characteristic of other disturbed upper-marsh vegetation of strand-lines and reclamation banks, others more typical of rank inland grasslands. *Allium scorodoprasum* has been recorded in vegetation of this kind on the north Solway coast and *Hordeum marinum* from Somerset. Bryophytes occur occasionally with *Eurhynchium praelongum*, *Amblystegium riparium*, *Funaria hygrometrica*, *Pottia heimii* and *Bryum* spp.

Habitat

The community is characteristic of similar situations to those occupied by the *Atriplici-Elymetum*: upper-marsh areas where there is often a combination of disturbance, drift-litter deposition and some freshwater influence. It is, however, less consistently confined to well-drained sites, occasionally growing on heavy waterlogged clays. At Cefni salt-marsh in Anglesey, it occupies the areas marked as 'drift' on the map of Packham & Liddle (1970). The community also occurs on the recently-excavated material thrown on to the banks of drainage channels while, on some brackish marshes, such as those at the tidal limit in estuaries (as in the Lune in Lancashire), it may form extensive stands.

Zonation and succession

Like the *Atriplici-Elymetum*, this community is often part of the vegetation which terminates the salt-marsh vegetation at its upper limit and in such situations it may occur in clear zonations or confused mosaics with such communities as the *Juncetum gerardi*, the *Juncus maritimus* salt-marsh, the *Potentillo-Festucetum arundinaceae*, the *Festuca rubra-Agrostis stolonifera-Potentilla anserina* grassland and various of the vegetation types in which Cyperaceae or tall swamp helophytes predominate in brackish pools and ditches.

Distribution

The community can be seen as the north-western equivalent of the *Atriplici-Elymetum*, being especially frequent around the Irish Sea coast. It is probably more widespread in eastern Scotland than the map suggests.

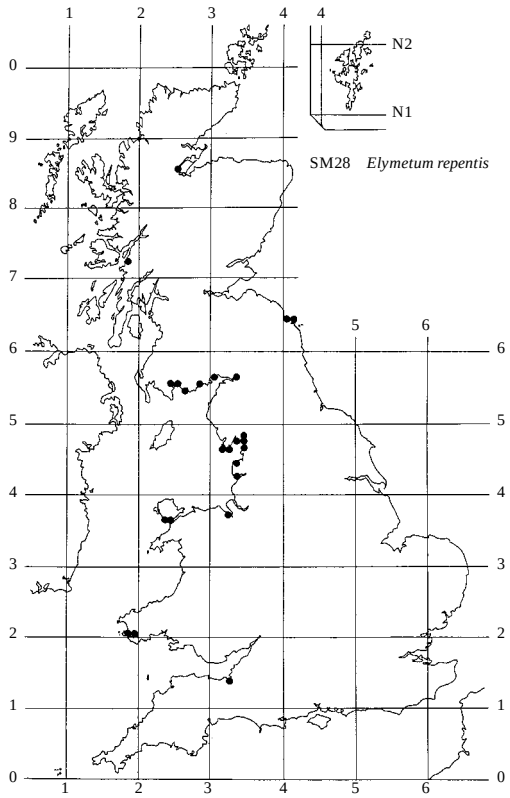
Affinities

Although there are clear floristic similarities between this community and *Elymus repens* vegetation of foredunes and shingle strand-lines, salt-marsh *Elymetum repentis* is sufficiently distinct to be considered as a separate vegetation type. *Elymus repens* growing on salt-marshes is morphologically distinct and may represent a separate ecotype.

As defined here, the community is synonymous with the vegetation described by Nordhagen (1940) which is frequent in Scandinavia and northern Germany (see also Störmer 1938, Tüxen 1950, Gillner 1960, Tyler 1969*b*). Authors differ as to whether the community is best placed in a narrowly-defined Elymo-Rumicion crispi (Nordhagen 1940), in that alliance as expanded by Tüxen (1950) or alongside the *Atriplici-Elymetum* in the Elymion pungentis (Géhu & Géhu 1969).

Floristic table SM28

Elymus repens	V (4–10)
Festuca rubra	V (3–8)
Agrostis stolonifera	IV (3–8)
Atriplex prostrata	IV (2–6)
Potentilla anserina	III (2–8)
Oenanthe lachenalii	II (1–4)
Sonchus arvensis	II (2–6)
Rumex crispus	II (1–5)
Festuca arundinacea	II (1–9)
Cirsium arvense	II (1–4)
Juncus gerardii	II (2–6)
Vicia cracca	I (2–5)
Matricaria maritima	I (1–4)
Carex otrubae	I (1–6)
Cochlearia officinalis	I (2–4)
Glaux maritima	I (2–4)
Atriplex littoralis	I (2–5)
Galium aparine	I (1–4)
Aster tripolium (rayed)	I (2–4)
Oenanthe crocata	I (1–5)
Triglochin maritima	I (2)
Cochlearia anglica	I (2–4)
Eurhynchium praelongum	I (2–5)
Lotus corniculatus	I (3–4)
Poa pratensis	I (3–4)
Melilotus altissima	I (2–5)
Deschampsia cespitosa	I (3–5)
Leontodon autumnalis	I (1–2)
Urtica dioica	I (3–5)
Lolium perenne	I (2–3)
Plantago maritima	I (2)
Arrhenatherum elatius	I (2–7)
Stellaria media	I (2–6)
Cirsium vulgare	I (1–2)
Scirpus maritimus	I (4)
Puccinellia maritima	I (3)
Beta vulgaris ssp. *maritima*	I (2–5)
Holcus lanatus	I (2–4)
Taraxacum sp.	I (2–3)
Trifolium repens	I (2–4)
Plantago lanceolata	I (1–2)
Algal mat	I (4–6)
Anthriscus sylvestris	I (1–4)
Aster tripolium	I (2–3)
Torilis japonica	I (2)
Odontites verna	I (2–3)
Alopecurus geniculatus	I (2–6)
Eleocharis uniglumis	I (4)
Rumex conglomeratus	I (2–3)
Dactylis glomerata	I (3)
Medicago lupulina	I (2–3)
Silene vulgaris ssp. *maritima*	I (1–4)
Centaurea nigra	I (2–3)
Heracleum sphondylium	I (1–2)
Apium graveolens	I (2)
Calystegia sepium	I (4–6)
Number of samples	62
Number of species/sample	9 (2–27)
Vegetation height (cm)	66 (30–120)
Total cover (%)	99 (70–100)


N2
N1
SM28 *Elymetum repentis*

The Marine Habitat Classification for Britain and Ireland. Version 04.05

Sublittoral Sediment Section

This document is an extract from:

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SS Sublittoral sediment

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt), Reduced/low (0.5-30ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Strong, Moderately strong, Weak, Very weak
Substratum:	Boulders, cobbles and pebbles, gravels, sands, muds, mixed sediments.
Zone:	Infralittoral, Circalittoral
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m, 30-50 m, 50-100 m

Previous code

SS	97.06

Biotope description

Sediment habitats in the sublittoral near shore zone (i.e. covering the infralittoral and circalittoral zones), typically extending from the extreme lower shore down to the edge of the bathyal zone (200m). Sediment ranges from boulders and cobbles, through pebbles and shingle, coarse sands, sands, fine sands, muds, and mixed sediments. Those communities found in or on sediment are described within this broad habitat type.

Situation

No situation data available.

Temporal variation

No temporal data available.

SS.SCS Sublittoral coarse sediment (unstable cobbles and pebbles, gravels and coarse sands)

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Strong, Moderately strong, Weak, Very weak
Substratum:	Cobbles and pebbles, gravels and coarse sands.
Zone:	Infralittoral, Circalittoral
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m

Previous code

IGS in part	97.06
CGS in part	97.06

Biotope description

Coarse sediments including coarse sand, gravel, pebbles, shingle and cobbles which are often unstable due to tidal currents and/or wave action. These habitats are generally found on the open coast or in tide-swept channels of marine inlets. They typically have a low silt content and a lack of a significant seaweed component. They are characterised by a robust fauna including venerid bivalves.

Situation

No situation data available.

Temporal variation

No temporal data available.

SS.SCS.SCSVS Sublittoral coarse sediment in variable salinity (estuaries)

Habitat classification

Salinity:	Variable (18-35ppt), Reduced (18-30ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Strong, Moderately strong, Weak, Very weak
Substratum:	Pebbles and gravel with a minor sand fraction
Zone:	Infralittoral, Circalittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

part of IGS.EstGS	97.06

Biotope description

Clean gravels that occur in the upper reaches of marine inlets, especially estuaries, where water movement is sufficiently strong to remove the silt content of the sediment. The habitat typically lacks a significant seaweed component and is characterised by a sparse but very robust brackish-water tolerant fauna.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Carcinus maenas	●●●	Rare	33	
Pomatoschistus	●●●	Occasional	67	

SS.SCS.ICS Infralittoral coarse sediment

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Strong, Moderately strong, Weak, Very weak
Substratum:	Sand with gravel, pebbles and/or shingle
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

part IGS.FaG	97.06

Biotope description

Moderately exposed habitats with coarse sand, gravelly sand, shingle and gravel in the infralittoral, are subject to disturbance by tidal steams and wave action. Such habitats found on the open coast or in tide-swept marine inlets are characterised by a robust fauna of infaunal polychaetes such as *Chaetozone setosa* and *Lanice conchilega*, cumacean crustacea such as *Iphinoe trispinosa* and *Diastylis bradyi*, and venerid bivalves.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
NEMERTEA	••	Common	3	17
NEMATODA	••	Present	1	22
Eteone longa	••	Present	3	10
Anaitides maculata	••	Present	4	12
Glycera lapidum	••	Common	6	25
Nephtys cirrosa	••	Present	6	16
Nephtys hombergii	••	Present	2	10
Scoloplos armiger	••	Abundant	4	19
Spio martinensis	••	Frequent	5	19
Spiophanes bombyx	••	Frequent	3	66
Magelona mirabilis	•	Frequent	1	19
Chaetozone setosa	•••	Abundant	10	144
Mediomastus fragilis	••	Present	1	21
Lanice conchilega	•••••	Abundant	54	
Lanice conchilega	•••	Common	8	62
Iphinoe trispinosa	••	Frequent	5	18
Diastylis bradyi	••	Common	11	54
Pagurus bernhardus	•••	Occasional	8	
Liocarcinus depurator	••	Occasional	3	
Carcinus maenas	••	Occasional	3	
Nucula nitidosa	••	Frequent	2	19
Ensis ensis	••	Abundant	2	14
Abra alba	••	Present	1	68
Asterias rubens	••	Occasional	5	
Echinocardium cordatum	••	Occasional	1	
Pomatoschistus minutus	••	Frequent	4	
Chorda filum	••	Occasional	1	

SS.SCS.ICS.SSh Sparse fauna on highly mobile sublittoral shingle (cobbles and pebbles)

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Shingle and/or pebbles
Zone:	Infralittoral
Depth band:	5-10 m, 10-20 m, 20-30 m, 30-50 m

Previous code

None

Biotope description

Sublittoral clean shingle and pebble habitats with a lack of conspicuous fauna. Unstable, rounded pebbles and stones (as opposed to sub-angular cobbles, which are often found lying on or embedded in other sediment) that are strongly affected by tidal steams and/or wave action can support few animals and are consequently faunally impoverished. The species composition of this biotope may be highly variable seasonally and is likely to comprise of low numbers of robust polychaetes or bivalves with occasional epibiota including echinoderms and crustacea such as *Liocarcinus* spp. and *Pagurus* spp. In more settled periods there may be colonisation by anemones such as *Urticina felina* and small populations of hydroids and Bryozoa.

Situation

This biotope is found in marine inlets with very strong tidal currents as well as in very wave exposed open coast environments.

Temporal variation

The faunal composition of this biotope is likely to be highly variable as a result of seasonal changes in wave and tidal energy.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Chaetopterus variopedatus	●●●●●	Rare	100	
Spisula elliptica	●●●●●	Present	100	4

SS.SCS.ICS.HchrEdw *Halcampa chrysanthellum* and *Edwardsia timida* on sublittoral clean stone gravel

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Extremely sheltered
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Clean stone gravel with pebbles
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

IGS.HalEdw	97.06

Biotope description

Periodically (seasonally?) disturbed sublittoral stone gravel with small pebbles characterised by the presence of the anemones *Halcampa chrysanthellum* and *Edwardsia timida*. Associated species are often typical of a hydroid/bryozoan turf with polychaetes such as *Pomatoceros* spp. encrusting larger pebbles and low numbers of syllid and phyllodocid polychaetes living interstitially. In some areas this biotope may also contain opportunistic red seaweeds and infauna such as *Sabella pavonina*. It should be noted that this habitat may show considerable variation in community composition and it is possible that it is a sub-biotope of other gravel biotopes.

Situation

This biotope tends to occur at the entrance to marine inlets where tidal currents are moderately strong.

Temporal variation

The faunal composition and species richness of this biotope may vary seasonally as a result of disturbance from increased wave or tidal action.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Eudendrium	••	Rare	1	
Nemertesia antennina	••	Rare	1	
Obelia	••	Occasional	2	
Obelia geniculata	••	Present	2	
Alcyonium digitatum	••	Occasional	1	
Cerianthus lloydii	••	Occasional	2	
Urticina felina	••	Occasional	2	
Sagartia elegans	•••	Occasional	6	
Halcampa chrysanthellum	••••	Rare	11	
Edwardsia claparedii	••	Present	2	
Edwardsia timida	••••	Frequent	18	
Eupolymnia nebulosa	••	Present	1	
Lanice conchilega	•••	Occasional	4	
Sabella pavonina	••	Rare	1	
Pomatoceros triqueter	•••	Frequent	6	
Pagurus bernhardus	•••	Rare	4	
Carcinus maenas	••	Occasional	2	
Gibbula cineraria	••	Present	1	
Pecten maximus	••	Rare	1	
BRYOZOA	••	Occasional	2	
Alcyonidium diaphanum	•••	Occasional	5	
Crossaster papposus	••	Present	1	
Asterias rubens	•••	Occasional	6	
Amphipholis squamata	••	Present	1	
Clavelina lepadiformis	••	Rare	1	
Pholis gunnellus	••	Frequent	3	
Dilsea carnosa	••	Present	1	
Chondrus crispus	••	Present	1	
Cryptopleura ramosa	••	Present	1	
Nitophyllum punctatum	••	Present	1	
Polysiphonia stricta	••	Present	1	
Desmarestia aculeata	••	Present	1	
Chorda filum	••	Present	1	
Laminaria saccharina	••	Present	1	

SS.SCS.ICS.MoeVen *Moerella* spp. with venerid bivalves in infralittoral gravelly sand

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak
Substratum:	Medium to coarse sand and gravelly sand
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

part of IGS.Sell	97.06

Biotope description

Infralittoral medium to coarse sand and gravelly sand which is subject to moderately strong water movement from tidal streams may be characterised by *Moerella* spp. with the polychaete *Glycera lapidum* (agg.) and venerid bivalves. Typical species include *Moerella pygmaea* or *M. donacina* with other robust bivalves such as *Dosinia lupinus*, *Timoclea ovata*, *Goodallia triangularis* and *Chamelea gallina*. Other infauna include nephtyd and spionid polychaetes and amphipod crustacea. Another important component of this biotope in some areas is the bivalve *Spisula solida* (see K hne & Rachnor 1996) which may be common or abundant. In conjunction with FfabMag this biotope may form part of the 'Shallow *Venus* Community', the 'Boreal Off-shore Sand Association' and the '*Goniadella-Spisula* association' of previous workers (see Petersen 1918; Jones 1951; Thorson 1957; Salzwedel, Rachor & Gerdes 1985). Epifaunal communities may be reduced in this biotope when compared to FfabMag; both types may have surface sand waves which may be indicative of the presence of venerid bivalves (Warwick & Davies 1977). This hypothesis, however, requires testing. Remote grab sampling is likely to under-estimate venerid bivalves and other deep-burrowing and more dispersed species such as *Paphia*, *Ensis* and *Spatangus*. In southern areas of the UK and the North Sea, in slightly siltier sand and shelly sand, SCS.MoeVen may give way to the other *Spisula* biotope SSA.SsubNhom. Together these two biotopes replace the old biotope IGS.Sell.

Situation

This biotope is found on the exposed open coast and in estuaries with moderately strong tidal currents.

Temporal variation

No temporal data available.

Similar biotopes

SCS.MedLumVen	Similar biotope found in deeper water than MoeVen (generally greater than 15-20m), with increased importance of *Mediomastus fragilis* and *Lumbrineris* spp.
SSA.FfabMag	More stable than MoeVen, where reduced exposure and/or tidal currents result in a muddy sandy bottom. The community is dominated by *Fabulina fabula* and *Magelona mirabilis*.
SCS.Glap	In areas where the sediment is subject to continual disturbance by wave action MoeVen grades into Glap, which is more impoverished and lacks the venerid bivalve communities.
LSA.Po.Ang	On exposed lower shore sand MoeVen may give way to Po.Ang

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Anemonia viridis	••	Occasional	1	
NEMERTEA	••••	Common	5	39
NEMATODA	•••	Frequent	5	64
Pisione remota	••	Common	9	147
Glycera lapidum	••••	Common	7	84
Streptosyllis websteri	••	Present	1	30
Nephtys cirrosa	•••	Present	3	23
Aonides paucibranchiata	••	Frequent	1	42
Spio filicornis	•••	Present	4	39
Spiophanes bombyx	••	Present	1	8
Lanice conchilega	•••	Occasional	10	
Bathyporeia pelagica	••	Frequent	1	21
Apseudes latreillii	••	Common	6	708
Pagurus bernhardus	•••	Occasional	16	
Liocarcinus depurator	••	Occasional	6	
Carcinus maenas	••	Occasional	2	
Goodallia triangularis	••	Frequent	1	33
Spisula solida	••	Common	1	31
Moerella donacina	•••	Abundant	11	108
Moerella pygmaea	•••	Frequent	8	55
Dosinia lupinus	••	Present	2	18
Chamelea gallina	••	Present	1	10
Timoclea ovata	••	Common	2	23
Echinocyamus pusillus	•••	Present	5	60
Callionymus lyra	••	Occasional	1	
Pomatoschistus minutus	••••	Frequent	32	
Gracilaria gracilis	•••	Frequent	9	
Chondrus crispus	••	Occasional	1	
Polyides rotundus	••	Occasional	1	
Laminaria saccharina	••	Occasional	1	
Ulva	••	Frequent	4	

SS.SCS.ICS.HeloMsim

Hesionura elongata and *Microphthalmus similis* with other interstitial polychaetes in infralittoral mobile coarse sand

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Medium to very coarse sand
Zone:	Infralittoral
Depth band:	5-10 m, 10-20 m

Previous code

None

Biotope description

On infralittoral sandbanks and sandwaves and other areas of mobile medium-coarse sand, populations of interstitial polychaetes may be found. These habitats consist of loosely packed grains of sand forming waves up to several metres high often with gravel, or occasionally silt, in the troughs of the waves. This biotope is commonly found both inshore along the east coast of the UK e.g. around the Race Bank, Docking Shoal and Inner Dowsing banks (IECS, 1995; IECS, 1999), and in the Southern Bight of the North Sea and off the Belgian coast (Degraer *et al*. 1999; Vanosmael *et al*. 1982). These habitats support interstitial communities living in the spaces between the grains of sand, in particular hesionurid polychaetes such as *Hesionura elongata* and *Microphthalmus similis*, along with protodrilid polychaetes such as *Protodrilus* spp. and *Protodriloides* spp. Other important species may include Turbellaria spp. and larger deposit feeding polychaetes such as *Travisia forbesii*. An important feature of this biotope which is not reflected in much of the available data is the importance of the meiofaunal population which may exceed the macrofaunal population both in terms of abundance and biomass (Willems *et al*. 1982).

Situation

This biotope is commonly found both in shore adjacent to the coast, and further away from the coast.

Temporal variation

No temporal data available.

Similar biotopes

SSA.IMoSa	More mobile and found on finer sediments than HeloMsim. More faunally impoverished as a result of this mobility.
SSA.NcirBat	NcirBat is found in finer sediments with a higher proportion of amphipod and isopod crustaceans
SCS.Glap	Glap has a gravel fraction and is more faunally impoverished
SCS.Pkef	Pkef has a more varied sediment composition with a higher fine sand or silt fraction and high prevalence of *Protodorvillea kefersteini*

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
TURBELLARIA	●●●	Common	59	140
NEMERTEA	●	Common	4	11
Hesionura elongata	●●	Common	4	115
Glycera lapidum	●●	Present	3	6
Microphthalmus	●	Frequent	2	34
Microphthalmus similis	●●	Frequent	6	73
Nephtys cirrosa	●●	Present	3	3
Travisia forbesii	●	Common	5	18
Protodrilus	●●	Frequent	4	19
Protodriloidae	●	Common	2	6
Spisula elliptica	●	Present	1	2

SS.SCS.ICS.Glap *Glycera lapidum* in impoverished infralittoral mobile gravel and sand

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	Strong, Moderately strong
Substratum:	Medium to coarse sand with some gravel
Zone:	Infralittoral
Depth band:	5-10 m, 10-20 m

Previous code

part of IMS.SpiSpi	97.06

Biotope description

In infralittoral mixed slightly gravelly sands on exposed open coasts impoverished communities characterised by the polychaete *Glycera lapidum* (agg.) may be found. *Glycera lapidum* is a species complex and as such some variability in identification may be found in the literature. It is also quite widespread and may occur in a variety of coarser sediments and is often present in other SCS biotopes. However, it is rarely considered a characteristic species and where this is the case it is normally due to the exclusion of other species. Consequently it is considered that habitats containing this biotope may be subject to continual or periodic sediment disturbance from wave action, which prevents the establishment of a more stable community. Other taxa include spionid polychaetes such as *Spio martinensis* and *Spiophanes bombyx, Nephtys* spp. and in some areas the bivalve *Spisula elliptica*. It is possible that SCS.Glap it is not a true biotope, rather an impoverished, transitional community, which in more settled conditions develops into other more stable communities.

Situation

In many cases e.g. along the East Yorkshire coast this biotope is found in shallow inshore areas facing directly into the prevailing wind and subject to considerable wave action.

Temporal variation

Due to the variability in sediment regime at these habitats there may be high seasonal or spatial variability within this community.

Similar biotopes

SSA.IMoSa	Glap may a coarser extension of the mobile sand biotope IMoSa
SCS.MoeVen	The current biotope may be an impoverished/sub-climactic version of MoeVen
SCS.GlapThyAmy	The offshore biotope (GlapThyAmy) is also characterised by *Glycera lapidum* but it is not known at this stage whether Glap is a shallow extension of this much deeper biotope.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
NEMERTEA	●●●	Present	8	21
Glycera lapidum	●●●●●	Present	51	36
Nephtys cirrosa	●●●	Present	7	7
Nephtys longosetosa	●●	Present	1	2
Spio martinensis	●●●●	Present	21	11
Spiophanes bombyx	●●	Present	3	12
Ophelia	●●	Present	2	3
Gastrosaccus spinifer	●	Present	1	2

SS.SCS.ICS.CumCset — Cumaceans and *Chaetozone setosa* in infralittoral gravelly sand

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Moderately strong
Substratum:	Medium to very fine sand with gravel and pebbles
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m

Previous code

None

Biotope description

In shallow medium-fine sands with gravel, on moderately exposed open coasts, communities dominated by cumacean crustaceans such as *Iphinoe trispinosa* and *Diastylis bradyi* along with the cirratulid polychaete *Chaetozone setosa* (agg.) may occur. *Chaetozone setosa* is a species complex so it is likely that some variability in nomenclature will be found in the literature. Other important taxa may include the polychaetes *Anaitides* spp., *Lanice conchilega*, *Eteone longa* and *Scoloplos armiger*. This community may be subject to periodical sedimentary disturbance, such that a sub-climactic community may develop with opportunistic taxa such as *C. setosa* and *S. armiger* often dominating the community (Allen 2000).

Situation

This biotope may be found in areas with moderate currents and wave action often facing into the prevailing wind and along the Holderness coast of the North Sea. It is possible that this biotope has developed due to chronic sedimentary disturbance in areas where the biotopes AalbNuc or FfabMag would normally develop as these biotopes are often found in more sheltered areas adjacent to CumCset.

Temporal variation

The importance of the cumacean crustaceans in this biotope is unusual, and their numbers are likely to fluctuate over time; at times of increased disturbance it is likely that C. setosa will become more dominant.

Similar biotopes

SCS.Glap	In more exposed areas CumCset may grade into Glap as fewer species are able to tolerate the more frequent sediment disturbance
SSA.AalbNuc	In areas of weaker current and/or wave action the sediment becomes more stable and CumCset may grade into AalbNuc
SSA.FfabMag	In areas of weaker current and / or wave action as sediment stability increases CumCset may grade into FfabMag.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Eteone longa	●●●●	Present	3	17
Anaitides maculata	●●●●	Common	4	25
Nephtys hombergii	●●●	Common	2	18
Scoloplos armiger	●●●●	Abundant	3	32
Spio martinensis	●●●	Frequent	3	33
Chaetozone setosa	●●●●●	Abundant	22	324
Lanice conchilega	●●●●	Common	4	22
Iphinoe trispinosa	●●●●●	Frequent	35	151
Diastylis bradyi	●●●●	Common	8	39
Nucula nitidosa	●●●	Frequent	2	37
Ensis ensis	●●●●	Present	3	23
Mya arenaria	●●	Present	1	22

SS.SCS.ICS.SLan

Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Strong, Moderately strong, Weak, Very weak
Substratum:	Medium to very fine gravelly sand
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

IGS.FaS.Lcon	97.06

Biotope description

Dense beds of *Lanice conchilega* occur in coarse to medium fine gravelly sand in the shallow sublittoral, where there are strong tidal streams or wave action. Several other species of polychaete also occur as infauna e.g. *Spiophanes bombyx*, *Scoloplos armiger*, *Chaetozone setosa* and *Magelona mirabilis*. Lanice beds are found in a wide range of habitats including muddier mixed sediment. The dense *Lanice* biotope (LGS.Lan) on certain lower shores may be a littoral extension of the current biotope. The presence of *L. conchilega* in high numbersmay, over time, stabilise the sediment to the extent where a more diverse community may develop (Wood, 1987). Possibly as a result of this, there is a high level of variation with regard the infauna found in SCS.SLan. It is likely that a number of sub-biotopes may subsequently be identified for this biotope. Offshore from the Wash and the North Norfolk coast *Lanice* beds are often found intermixed with *Sabellaria spinulosa* beds in muddier mixed sediment, particularly in the channels between the shallow sandbanks, which are so prevalent in this area (IECS, 1995; NRA, 1995). It is possible that the presence of *Lanice* has stabilised the habitat sufficiently to allow the deposition of finer material, which has subsequently assisted the development of *S. spinulosa*. It may be more accurate to define SLan as an epibiotic biotope which overlays a variety of infaunal biotopes (e.g. NcirBat in finer sands and AalbNuc or FfabMag in slightly muddier areas).

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Eteone longa	●●●	Present	1	22
Anaitides maculata	●●	Present	1	17
Eumida bahusiensis	●●	Common	1	33
Nephtys	●●	Abundant	1	46
Nephtys cirrosa	●●	Common	3	33
Scoloplos armiger	●●●●	Abundant	4	35
Spiophanes bombyx	●●●●	Common	20	301
Magelona mirabilis	●●●	Frequent	3	81
Chaetozone setosa	●●●	Abundant	7	176
Arenicola marina	●●	Frequent	1	
Lanice conchilega	●●●●●	Abundant	34	261
Lanice conchilega	●●●●●	Abundant	63	
Bathyporeia pelagica	●●	Frequent	1	30
Diastylis bradyi	●●	Frequent	1	
Pagurus bernhardus	●●●	Occasional	2	318
Liocarcinus depurator	●●	Occasional	1	71
Carcinus maenas	●●	Occasional	6	
Ensis	●	Frequent	3	
Abra alba	●●●	Common	3	
Asterias rubens	●●●	Occasional	5	
Echinocardium cordatum	●●	Occasional	2	
Pomatoschistus minutus	●●	Frequent	1	
Chorda filum	●●	Frequent	1	

SS.SCS.CCS Circalittoral coarse sediment

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Coarse sand and gravel with a minor finer sand fraction
Zone:	Infralittoral - lower, Circalittoral
Depth band:	10-20 m, 20-30 m, 30-50 m

Previous code

part of CGS	97.06

Biotope description

Tide-swept circalittoral coarse sands, gravel and shingle generally in depths of over 15-20m. This habitat may be found in tidal channels of marine inlets, along exposed coasts and offshore. This habitat, as with shallower coarse sediments, may be characterised by robust infaunal polychaetes, mobile crustacea and bivalves. Certain species of sea cucumber (e.g. *Neopentadactyla*) may also be prevalent in these areas along with the lancelet *Branchiostoma lanceolatum*.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Nemertesia antennina	••	Occasional	2	
Cerianthus lloydii	••	Occasional	2	
NEMERTEA	••••	Common	11	36
NEMATODA	••	Present	3	14
Pholoe synophthalmica	••	Present	3	8
Hesionura elongata	••	Present	1	9
Glycera lapidum	•••	Frequent	9	30
Nereis longissima	••	Present	2	6
Lumbrineris gracilis	••	Common	2	44
Protodorvillea kefersteini	••••	Present	12	36
Scoloplos armiger	••	Present	2	7
Minuspio cirrifera	••	Present	4	8
Spiophanes bombyx	••	Frequent	2	15
Chaetopterus variopedatus	••	Occasional	2	
Caulleriella zetlandica	••	Present	5	15
Mediomastus fragilis	•••	Present	4	61
Notomastus latericeus	••	Present	1	7
Owenia fusiformis	••	Present	1	9
Sabellaria spinulosa	••	Present	2	5
Terebellidae	••	Present	1	6
Lanice conchilega	••	Present	1	9
Lanice conchilega	••	Occasional	6	
Pomatoceros triqueter	••	Frequent	10	
Ampelisca spinipes	•••	Frequent	5	28
Pagurus bernhardus	••	Occasional	4	
Pecten maximus	••	Occasional	4	
Abra alba	••	Frequent	1	28
Asterias rubens	•••	Occasional	10	
Ophiura albida	••	Frequent	5	
Echinus esculentus	••	Occasional	3	
Echinocyamus pusillus	••	Common	3	37
Neopentadactyla mixta	•••	Frequent	29	

SS.SCS.CCS.PomB *Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	Strong, Moderately strong
Substratum:	Cobbles and pebbles with sand
Zone:	Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m, 30-50 m
Other features:	Mobile substrata

Previous code

ECR.PomByC	97.06

Biotope description

This biotope is characterised by a few ubiquitous robust and/or fast growing ephemeral species which are able to colonise pebbles and unstable cobbles and slates which are regularly moved by wave and tidal action. The main cover organisms tend to be restricted to calcareous tube worms such as *Pomatoceros triqueter (*or *P. lamarcki),* small barnacles including *Balanus crenatus* and *Balanus balanus*, and a few bryozoan and coralline algal crusts. Scour action from the mobile substratum prevents colonisation by more delicate species. Occasionally in tide-swept conditions tufts of hydroids such as *Sertularia argentea* and *Hydrallmania falcata* are present. This biotope often grades into SMX.FluHyd which is characterised by large amounts of the above hydroids on stones also covered in *Pomatoceros* and barnacles. The main difference here is that SMX.FluHyd, seems to develop on more stable, consolidated cobbles and pebbles or larger stones set in sediment in moderate tides. These stones may be disturbed in the winter and therefore long-lived and fragile species are not found.

Situation

This biotope is found on exposed open coasts as well as at the entrance to marine inlets.

Temporal variation

No temporal data available.

Similar biotopes

FIR.CC.Mo	A similar shallow water biotope occurring on cobbles at the base of surge gullies
SMX.FluHyd	As substratum stability increases (larger rocks and less turbulent wave action) more species are able to colonise the sea bed. FluHyd, FluCoAs.SmAs and ByErSp.DysAct in that order, represent the progression from PomB to more stable mixed substrata although still with a high proportion of scour- and sand-tolerant species.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Lanice conchilega	••	Occasional	1	
Pomatoceros	•	Common	4	
Pomatoceros triqueter	••••	Frequent	61	
Balanus balanus	••	Occasional	2	
Balanus crenatus	••	Frequent	3	
Bryozoa indet crusts	••	Frequent	5	
Asterias rubens	•••	Occasional	6	
Echinus esculentus	•••	Occasional	7	

SS.SCS.CCS.MedLumVen *Mediomastus fragilis, Lumbrineris* spp. and venerid bivalves in circalittoral coarse sand or gravel

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Gravel with coarse to medium sand
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m, 30-50 m, 50-100 m

Previous code

part of CGS.Ven	97.06

Biotope description

Circalittoral gravels, coarse to medium sands, and shell gravels, sometimes with a small amount of silt and generally in relatively deep water (generally over 15-20m), may be characterised by polychaetes such as *Mediomastus fragilis*, *Lumbrineris* spp., *Glycera lapidum* with the pea urchin *Echinocyamus pusillus*. Other taxa may include Nemertea spp., *Protodorvillea kefersteini, Owenia fusiformis, Spiophanes bombyx* and *Amphipholis squamata* along with amphipods such as *Ampelisca spinipes*. This biotope may also be characterised by the presence of conspicuous venerid bivalves, particularly *Timoclea ovata*. Other robust bivalve species such as *Moerella* spp., *Glycymeris glycymeris* and *Astarte sulcata* may also be found in this biotope. *Spatangus purpureus* may be present especially where the interstices of the gravel are filled by finer particles, in which case, *Gari tellinella* may also be prevalent (Glemarec 1973). Venerid bivalves are often under-sampled in benthic grab surveys and as such may not be conspicuous in many infaunal datasets. Such communities in gravelly sediments may be relatively species-rich and they may also contain epifauna such as *Hydroides norvegicus* and *Pomatoceros lamarcki*. In sand wave areas this biotope may also contain elements of the FfabMag biotope, particularly *Magelona* species. This biotope has previously been described as the 'Deep *Venus* Community' and the 'Boreal Off-Shore Gravel Association' by other workers (Ford 1923; Jones 1950) and may also be part of the Venus community described by Thorson (1957) and in the infralittoral etage described by Glemarec (1973). SCS.MedLumVen may be quite variable over time and in fact may be closer to a biotope complex in which a number of biotopes or sub-biotopes may yet be defined. For example, Ford (1923) describes a 'Series A' and a 'Series B' characterised by *Echinocardium cordatum-Chamelea gallina* and *Spatangus purpurea-Clausinella fasciata*. Furthermore, mosaics of cobble and lag gravel often contain ridges of coarse gravelly sand and these localised patches are also characterised by robust veneriid and similar bivalves including *Arcopagia crassa, Laevicardium crassum* and others including *Glycymeris glycymeris* (E.I.S. Rees pers. comm.. 2002). This high porosity fine gravel or coarse sand may be a separate biotope.

Situation

This biotope and variants of it make up a significant proportion of the offshore Irish Sea benthos (Mackie, Oliver & Rees 1995).

Temporal variation

MedLumVen may be quite variable over time.

Similar biotopes

SCS.MoeVen	MoeVen is the shallow water variant of the current biotope
SCS.Pkef	Pkef is more impoverished and less diverse than MedLumVen. It is possible that Pkef is a disturbed or transitional variant of MedLumVen resulting from dredging activities or storm events.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
ACTINIARIA	••	Common	2	182
NEMERTEA	••••	Common	5	55
Glycera lapidum	••••	Common	5	47
Sphaerosyllis	••	Present	1	21
Lumbrineris gracilis	••••	Common	10	98
Protodorvillea kefersteini	••••	Present	3	42
Poecilochaetus serpens	•••	Present	1	18
Spiophanes bombyx	•••	Frequent	4	27
Mediomastus fragilis	••••	Frequent	11	130
Owenia fusiformis	••••	Present	4	21
Lanice conchilega	••••	Occasional	29	
Pista cristata	••	Abundant	1	25
Ampelisca spinipes	•••	Frequent	2	21
Pagurus bernhardus	••••	Frequent	35	
Pecten maximus	•••	Occasional	7	
Abra alba	••	Common	2	54
Timoclea ovata	•••	Common	2	30
Corbula gibba	•••	Frequent	2	27
Cochlodesma praetenue	••	Common	2	21
Asterias rubens	••••	Occasional	29	
Amphipholis squamata	•••	Abundant	3	67
Echinocyamus pusillus	••••	Common	13	63

SS.SCS.CCS.Pkef *Protodorvillea kefersteini* and other polychaetes in impoverished circalittoral mixed gravelly sand

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Not known
Substratum:	Medium to coarse sand with some gravel or shell, and a fine sand or mud fraction
Zone:	Infralittoral
Depth band:	10-20 m, 20-30 m

Previous code

None

Biotope description

In coarse gravelly or shelly sand sometimes with a slight mud content, along open coasts in depths of 10 to 30m, and in shallower offshore areas, an impoverished community characterised by *Protodorvillea kefersteini* may be found. This biotope has a number of other species associated with it including Nemertea spp., *Caulleriella zetlandica*, *Minuspio cirrifera*, *Glycera lapidum*, *Ampelisca spinipes* and numerous other polychaete species all occurring at low abundances. The polychaete *Sabellaria spinulosa* is also found in low numbers in this biotope

Situation

This biotope has been reported in the North Sea along the Norfolk/Lincolnshire coast located in and around marine aggregate dredging areas (IECS, 1999).

Temporal variation

This biotope may be quite variable both spatially and temporally in terms community structure and also sediment type which is often borderline between the SCS complex and the SMX complex.

Similar biotopes

SCS.MedLumVen	MedLumVen is more diverse than the current biotope and it is possible that Pkef is a disturbed or transitional variant of the MedLumVen due to dredging activities or storm events.
SBR.SspiMx	As for MedLumVen.
SCS.HeloPkef	A deep water variant of Pkef
SMX.PoVen	PoVen is an offshore version of Pkef.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
NEMERTEA	••••	Common	14	23
NEMATODA	••	Present	2	11
Pholoe synophthalmica	•••	Present	5	12
Hesionura elongata	••	Present	2	8
Glycera lapidum	•••	Present	6	11
Exogone verugera	••	Frequent	6	17
Nereis longissima	•••	Present	3	9
Protodorvillea kefersteini	••••	Present	17	33
Scoloplos armiger	••	Present	2	10
Minuspio cirrifera	•••	Present	7	15
Caulleriella zetlandica	••••	Present	12	26
Notomastus latericeus	••	Frequent	1	7
Sabellaria spinulosa	•••	Present	3	6
Terebellidae	••	Present	2	7
Ampelisca spinifer	•••	Present	7	37
BRACHYURA	••	Present	2	6

SS.SCS.CCS.Nmix *Neopentadactyla mixta* in circalittoral shell gravel or coarse sand

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Clean shell and stone gravel; very coarse sand with a finer sand fraction
Zone:	Infralittoral - lower, Circalittoral
Depth band:	10-20 m, 20-30 m, 30-50 m

Previous code

CGS.NeoBv	96.7
CGS.Ven.Neo	97.06

Biotope description

Sublittoral plains of clean, shell, maerl and / or stone gravels or sometimes coarse sands, with frequent *Neopentadactyla mixta*. *Pecten maximus* may occur occasionally along with *Lanice conchilega*. Other epifaunal species may include *Ophiura albida*, *Pagurus* spp. and *Callionymus* spp. These sediments may be thrown into dunes by wave action or tidal streams. Widespread species such as *Cerianthus lloydii* and *Chaetopterus variopedatus* are present in many examples of this biotope. Scarcely recorded species such as *Molgula oculata*, *Ophiopsila annulosa* and *Amphiura securigera* may also be found. *O. annulosa* only occurs in records from the south-west of the British Isles. It should be noted that *Neopentadactyla* may exhibit periodicity in its projection out of, and retraction into, the sediment (Picton 1993).This biotope may be an epibiotic overlay of the biotope MedLumVen.

Situation

This biotope may occur adjacent to maerl beds and to some extent in the lower infralittoral where some seaweeds may occur in low abundances.

Temporal variation

No temporal data available.

Similar biotopes

SMP.Pcal	Nmix may occur in circalittoral dead maerl plains, often adjacent to maerl beds

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Nemertesia antennina	••	Occasional	2	
Cerianthus lloydii	••	Occasional	2	
Adamsia carciniopados	••	Rare	1	
Chaetopterus variopedatus	••	Occasional	2	
Lanice conchilega	••	Occasional	5	
Pagurus bernhardus	••	Occasional	3	
Pecten maximus	•••	Occasional	5	
Asterias rubens	•••	Occasional	5	
Ophiura albida	••	Frequent	8	
Echinus esculentus	••	Occasional	1	
Neopentadactyla mixta	•••••	Frequent	50	
Callionymus lyra	••	Occasional	3	
Callionymus reticulatus	•	Occasional	1	

SS.SCS.CCS.Blan *Branchiostoma lanceolatum* in circalittoral coarse sand with shell gravel

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	Not known
Substratum:	Medium to coarse sand with some gravel or shell gravel
Zone:	Circalittoral
Depth band:	20-30 m, 30-50 m, 50-100 m

Previous code

CGS.Ven.Bra	97.06

Biotope description

Gravel and coarse sand with shell gravel often contains communities of robust venerid bivalves (SCS.MedLumVen). Shallower examples, such as the biotope presented here, may support a significant population of *Branchiostoma lanceolatum*. Other conspicuous infauna may include *Echinocyamus pusillus, Glycera lapidum, Polygordius, Pisione remota* and *Arcopagia crassa* (in the south of UK). Sessile epifauna are typically a minor component of this community. This biotope has been described from a limited number of records and as such may need revising when further data become available. This biotope is related to the 'Boreal Offshore Gravel Association' and 'Deep *Venus* Community' described by other workers (Ford 1923; Jones 1951), and may also be closely allied (the same?) as the '*Venus fasciata*' community of Cabioch (Glemarec 1973). This biotope may be an epibiotic overlay of the biotope SCS.MoeVen or SCS.MedLumVen.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
NEMATODA	••••	Present	1	7
Pisione remota	•••••	Frequent	18	60
Hesionura elongata	••••	Present	3	20
Glycera lapidum	•••••	Common	20	70
Aglaophamus malmgreni	•••••	Present	5	17
Paradoneis lyra	••••	Present	1	7
Aonides paucibranchiata	••••	Present	1	7
Laonice bahusiensis	••••	Present	1	10
Polygordius	•••••	Frequent	13	53
Echinocyamus pusillus	•••••	Abundant	25	170
Branchiostoma lanceolatum	•••••	Abundant	10	37

SS.SCS.OCS Offshore circalittoral coarse sediment

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Gravel and coarse sand.
Zone:	Circalittoral
Depth band:	20-30 m, 30-50 m, 50-100 m

Previous code

part of COS	97.06

Biotope description

Offshore (deep) circalittoral habitats with coarse sands and gravel or shell. This habitat may cover large areas of the offshore continental shelf although there is relatively little quantitative data available. Such habitats are quite diverse compared to shallower versions of this habitat and generally characterised by robust infaunal polychaete and bivalve species. Animal communities in this habitat are closely related to offshore mixed sediments and in some areas settlement of *Modiolus modiolus* larvae may occur and consequently these habitats may occasionally have large numbers of juvenile *M. Modiolus*. In areas where the mussels reach maturity their byssus threads bind the sediment together, increasing stability and allowing an increased deposition of silt leading to the development of the biotope SBR.ModMx.

Situation

No situation data available.

Temporal variation

No temporal data available.

SS.SCS.OCS.GlapThyAmy *Glycera lapidum, Thyasira* spp. and *Amythasides macroglossus* in offshore gravelly sand

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Not known
Tidal streams:	Not known
Substratum:	Coarse sands and gravel, stone or shell, and occasionally silt.
Zone:	Circalittoral

Previous code

None

Biotope description

Offshore (deep) circalittoral habitats with coarse sands and gravel, stone or shell and occasionally a little silt (<5%) may be characterised by the polychaetes *Glycera lapidum* and *Amythasides macroglossus* with the bivalve *Thyasira* spp. (particularly *Thyasira succisa*). Other taxa include polychaetes such as *Exogone verugera*, *Notomastus latericeus*, *Spiophanes kroyeri*,*Aphelochaeta marioni* (*Tharyx marioni*) and *Lumbrineris gracilis* and occasional numbers of the bivalve *Timoclea ovata*. This biotope bears some resemblance to the shallow SCS.Glap and also to the circalittoral and offshore venerid biotopes (SCS.MedLumVen and SMX.PoVen) but differs by the range of polychaete and bivalve fauna present. This biotope is notable for the presence of the rarely recorded ampharetid polychaete *Amythasides macroglossus* and also for the small ear file clam *Limatula subauriculata* which is common in some examples of this biotope.

Situation

No situation data available.

Temporal variation

No temporal data available.

SS.SCS.OCS.HeloPkef *Hesionura elongata* and *Protodorvillea kefersteini* in offshore coarse sand

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Not known
Tidal streams:	Not known
Substratum:	Coarse sand.
Zone:	Circalittoral

Previous code

None

Biotope description

Offshore (deep) circalittoral habitats with coarse sand may support populations of the interstitial polychaete *Hesionura elongata* with *Protodorvillea kefersteini*. Other notable species include the phyllodocid polychaete *Protomystides limbata* and the bivalve *Moerella pygmaea*. This biotope was reported in the offshore northern North Sea by Eleftheriou and Basford (1989). Relatively little data exists for this biotope.

Situation

No situation data available.

Temporal variation

No situation data available.

Similar biotopes

SCS.HeloMsim	HeloPkef occurs at greater depths than the shallow sandbank biotope and can be distinguished by the relative importance of the polychaete *Microphthalmus similis* in HeloMsim
SCS.Pkef	HeloPkef is possibly a deep water variant of this biotope and can be distinguished through the increased importance of the polychaete *Hesionura elongata*.
SCS.MoeVen	HeloPkef is possibly a deep water variant of this biotope where the dominance of *Moerella pygmaea* is reduced and replaced by and increase in importance of the polychaetes *Hesionura elongata* and *Protodorvillea kefersteini*.

SS.SSA Sublittoral sands and muddy sands

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt), Reduced (18-30ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Medium to fine sands and muddy sands.
Zone:	Infralittoral, Circalittoral
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m, 30-50 m

Previous code

Part of IGS	97.06
IMS in part	97.06
CMS in part	97.06

Biotope description

Clean medium to fine sands or non-cohesive slightly muddy sands on open coasts, offshore or in estuaries and marine inlets. Such habitats are often subject to a degree of wave action or tidal currents which restrict the silt and clay content to less than 15%. This habitat is characterised by a range of taxa including polychaetes, bivalve molluscs and amphipod crustacea.

Situation

No situation data available.

Temporal variation

No temporal data available.

SS.SSA.SSaLS Sublittoral sand in low or reduced salinity (lagoons)

Habitat classification

Salinity:	Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Ultra sheltered
Tidal streams:	Very weak
Substratum:	Medium to fine sand with a minor silt fraction
Zone:	Infralittoral
Depth band:	0-5 m

Previous code

None

Biotope description

Shallow sand and muddy sand in areas of low or reduced, although relatively stable salinity (may vary annually), with largely ephemeral faunal communities. The species are often similar to that found in SMuLS and are characterised by *Arenicola marina* with other species, including mysids, tubificoid and enchytraeid oligochaetes, *Corophium volutator*, *Hediste diversicolor*, *Pygospio elegans*, *Hydrobia ulvae* and *Cerastoderma glaucum*, which commonly occur in lagoons. Filamentous green algae such as *Chaetomorpha linum* may also be present. In some examples of this biotope the polychaete *Fabricia sabella* may be super-abundant and the isopod *Sphaeroma hookeri* common.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Capitella capitata	••••	Abundant	70	20104
Arenicola marina	•••	Abundant	42	
Tubificoides benedii	••••	Present	20	938
Mysidae	•••	Frequent	30	
Corophium volutator	••	Rare	2	
Chironomida	••••	Present	10	258
Gasterosteus aculeatus	••	Rare	5	
Pomatoschistus	••	Rare	5	
Fucus vesiculosus	••	Occasional	7	
Chaetomorpha linum	••	Frequent	7	

SS.SSA.SSaVS Sublittoral sand in variable salinity (estuaries)

Habitat classification

Salinity:	Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Medium to very fine sand
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

IGS.EstGS	97.06

Biotope description

Clean sands that occur in the upper reaches of marine inlets, especially estuaries, where water movement is moderately strong, allowing the sedimentation of sand but not the finer silt fraction. The habitat typically lacks a significant seaweed component and is characterised by brackish-water tolerant fauna, particularly amphipods, polychaetes and mysid shrimps.

Situation

No situation data available.

Temporal variation

No temporal data avaialble.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Nephtys cirrosa	••	Common	17	9
Capitella capitata	••	Frequent	13	8
Neomysis integer	••	Frequent	13	6
Gammarus salinus	•	Present	5	3
Eurydice pulchra	••	Present	27	4

SS.SSA.SSaVS.MoSaVS Infralittoral mobile sand in variable salinity (estuaries)

Habitat classification

Salinity:	Variable (18-35ppt), Reduced (18-30ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Medium to fine sand
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

IGS.MobRS	97.06

Biotope description

Very mobile sand in areas of strong tidal currents and variable salinity. No stable community is able to develop within this extremely mobile and abrasive habitat. The fauna encountered in this habitat consists of epifaunal crustaceans or relatively low numbers of robust species, such as the isopod *Eurydice pulchra* or *Mesopodopsis slabberi*. The polychaete *Capitella capitata* may occur frequently in some areas. Other taxa such as the polychaetes *Eteone* spp. and *Arenicola marina*, the mysid *Neomysis integer* and the amphipods *Bathyporeia* spp. and *Haustorius arenarius* may also be washed in from adjacent communities. This biotope is found in tidal channels of estuaries and areas where water movement keeps silt and mud in suspension, and excludes even the more robust infauna. If oligochaetes, polychaetes and bivalves are present in any numbers within this habitat type then care must be taken to avoid the inclusion of juvenile or spat recruitment counts which may mask the presence of this biotope. This is particularly relevant as sampling usually occurs at slack water periods when settlement takes place

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SSA.NintGam	MoSaVS bears some similarity with NintGam although the latter is found further up the estuary at the transition between brackish and fresh water. The freshwater community present in NintGam will not be present here.
SSA.IMoSa	A similar biotope that occurs in fully saline conditions, it can be distinguished from MoSaVS by the absence of species tolerant to reduced salinities.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Capitella capitata	••	Frequent	24	15
Mesopodopsis slabberi	••	Present	11	3
Haustorius arenarius	•	Present	2	1
Eurydice pulchra	•••	Present	59	8

SS.SSA.SSaVS.NcirMac *Nephtys cirrosa* and *Macoma balthica* in variable salinity infralittoral mobile sand

Habitat classification

Salinity:	Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak
Substratum:	Medium to very fine sand
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Surface veneer of mud may be present at slack water

Previous code

Ncir	97.06

Biotope description

Mobile sand in variable salinity conditions where tidal currents create an unstable shifting habitat. Characteristic species include the polychaetes *Nephtys cirrosa* and *Scoloplos armiger* along with amphipods of the genus *Bathyporeia* and *Haustorius arenarius*. The bivalve *Macoma balthica* may occur in more stable examples of this biotope, although not in the abundances found in the NhomMac. The biotope contains relatively few species, each typically in low to moderate abundance. It is found in tidal channels with moderate tidal streams. Care should be taken in identification of this biotope due to the presence juveniles and species washed in during slack water.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SSA.MoSaVS	As wave exposure and /or current strength decreases and the finer sand and silt fractions begin to sediment out of the water column, the sediment habitat is less mobile and MoSaVS grades into NcirMac
SSA.NcirBat	The current biotope is a reduced salinity version of NcirBat, distinguished from this by the absence of species not tolerant of reduced salinities, in particular the polychaete *Chaetozone setosa*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Nephtys cirrosa	••••	Common	59	22
Scoloplos armiger	••	Abundant	6	5
Capitella capitata	••	Present	2	4
Bathyporeia pelagica	•	Frequent	2	9
Bathyporeia pilosa	••	Frequent	13	90
Haustorius arenarius	••	Frequent	4	14
Macoma balthica	••	Frequent	5	7

SS.SSA.SSaVS.NintGam *Neomysis integer* and *Gammarus* spp. in fluctuating low salinity infralittoral mobile sand

Habitat classification

Salinity:	Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Very sheltered
Tidal streams:	Strong
Substratum:	Fine to very fine muddy sand
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m
Other features:	Surface veneer of mud may be present at slack water

Previous code

IGS.NeoGam	97.06

Biotope description

Upper estuary mobile fine muddy sands with very low fluctuating salinity characterised by the mysid shrimp *Neomysis integer* (see Arndt 1991) and amphipods of the genus *Gammarus* spp. This habitat has a rather sparse infauna and species such as *N. integer* will most likely be found on the sediment surface or just above it whilst *Gammarus* may be under loose weed, stones or other detritus on the sediment surface. The harsh physicochemical regime imposed by such environmental conditions in the upper estuary leads to a relatively impoverished community but high densities of the mobile, salinity-tolerant, crustaceans can occur. The biotope is found in the transitional zone between freshwater and brackish environments, relying on the decreased freshwater input during the summer for penetration of the brackish species up-stream. As such this biotope may also contain elements of freshwater communities.

Situation

It may be found in conjunction with SMuVS.LhofTtub, although it lacks appreciable numbers of oligochaetes.

Temporal variation

Numbers of *Neomysis* may to fluctuate on a seasonal basis due high over wintering mortality (Gameson 1982) and the location of this biotope within the estuary may also shift upstream or downstream on a seasonal or yearly basis related in part to the freshwater flow into the estuary as has been noted in the Humber (Allen *et al*. 2003).

Similar biotopes

SSA.MoSaVS	NintGam bears some similarity with MoSaVS, although the latter is found further down the estuary in higher salinities. The freshwater community present in NintGam is not present in MoSaVS.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Neomysis integer	●●●●●	Frequent	82	33
Gammarus salinus	●●●●	Present	17	14

SS.SSA.IFiSa Infralittoral fine sand

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Strong, Moderately strong, Weak, Very weak
Substratum:	Medium to very fine sand
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

IGS.FaS	97.06

Biotope description

Clean sands which occur in shallow water, either on the open coast or in tide-swept channels of marine inlets. The habitat typically lacks a significant seaweed component and is characterised by robust fauna, particularly amphipods (*Bathyporeia*) and robust polychaetes including *Nephtys cirrosa* and *Lanice conchilega*.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hydrallmania falcata	●●●	Occasional	10	
Sertularia cupressina	●●	Present	4	
Urticina felina	●●	Rare	4	
Nephtys cirrosa	●●●	Common	31	20
Scoloplos armiger	●●	Present	2	24
Spio filicornis	●●	Frequent	2	41
Spiophanes bombyx	●●	Present	4	51
Magelona mirabilis	●●	Frequent	9	17
Chaetozone setosa	●●	Common	4	20
Lanice conchilega	●●●	Occasional	13	
Balanus crenatus	●●	Occasional	2	
Bathyporeia elegans	●●	Frequent	11	154
Bathyporeia guilliamsoniana	●●	Frequent	4	112
Pagurus bernhardus	●●●●	Rare	23	
Cancer pagurus	●●	Present	1	
Liocarcinus depurator	●●	Rare	4	
Carcinus maenas	●●	Rare	3	
Alcyonidium diaphanum	●●	Occasional	4	
Asterias rubens	●●	Occasional	5	
Laminaria saccharina	●●	Rare	1	

SS.SSA.IFiSa.IMoSa Infralittoral mobile clean sand with sparse fauna

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Strong, Moderately strong, Very weak
Substratum:	Medium to fine sand
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

IGS.Mob	97.06

Biotope description

Medium to fine sandy sediment in shallow water, often formed into dunes, on exposed or tide-swept coasts often contains very little infauna due to the mobility of the substratum. Some opportunistic populations of infaunal amphipods may occur, particularly in less mobile examples in conjunction with low numbers of mysids such as *Gastrosaccus spinifer*, the polychaete *Nephtys cirrosa* and the isopod *Eurydice pulchra*. Sand eels *Ammodytes* sp. may occasionally be observed in association with this biotope (and others). This biotope is more mobile than SSA.NcirBat and may be closely related to LSa.BarSa on the shore. Common epifaunal species such as *Pagurus bernhardus*, *Liocarcinus depurator*, *Carcinus maenas* and *Asterias rubens* may be encountered and are the most conspicuous species present.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SSA.MoSaVS	MoSaVS occurs in reduced salinities but differs in that the sparse fauna of IMoSa are not tolerant of reduced salinities.
SSA.NcirBat	Where sediment disturbance decreases in less exposed or weaker tidal currents, IMoSa may grade into NcirBat with an increase in species richness as the environment becomes more stable.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Nephtys	•	Present	4	3
Nephtys cirrosa	•	Present	11	2
Gastrosaccus spinifer	•	Present	13	2
Pontocrates arenarius	•	Present	17	4
Urothoe brevicornis	•	Present	15	2
Bathyporeia elegans	•	Present	1	1
Eurydice pulchra	•	Present	6	2
Pagurus bernhardus	•••••	Present	41	
Liocarcinus depurator	••	Rare	4	
Ammodytes	••	Frequent	3	
Ammodytes tobianus	••••	Present	46	
Pleuronectes platessa	••	Present	6	

SS.SSA.IFiSa.ScupHyd *Sertularia cupressina* and *Hydrallmania falcata* on tide-swept sublittoral sand with cobbles or pebbles.

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Medium to fine sand with pebbles and cobbles
Zone:	Infralittoral, Circalittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Sand scour

Previous code

IGS.Scup	96.7
IGS.ScupHyd	97.06

Biotope description

Shallow sands with cobbles and pebbles, exposed to strong tidal streams, with conspicuous colonies of hydroids, particularly *Hydrallmania falcata* and to a lesser extent *Sertularia cupressina* and *S. argentea*. These hydroids are tolerant to periodic submergence and scour by sand. Both diving and dredge surveys will easily record this biotope. *Flustra foliacea*, *Balanus crenatus* and *Alcyonidium diaphanum* may also occur on the more stable cobbles and pebbles, with *Urticina felina* and occasional *Lanice conchilega* present in the sand. Infaunal components of the other biotopes in the SSA or SCS complex may occur in this biotope as may elements of the 'Venus' associations; indeed, this biotope may be at one extreme of the spectrum of such associations (E.I.S. Rees pers. comm. 1997) and this biotope may be best considered an epibiotic overlay.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMX.FluHyd	The less scoured biotope FluHyd occurs in deeper water where there is less sand and a higher proportion of stones and cobbles.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hydrallmania falcata	••••	Occasional	18	
Sertularia argentea	••	Occasional	3	
Sertularia cupressina	•••	Present	12	
Urticina felina	•••	Rare	8	
Lanice conchilega	••••	Occasional	11	
Sabella pavonina	••	Rare	1	
Balanus crenatus	•••	Rare	4	
Pagurus bernhardus	••••	Rare	12	
Liocarcinus depurator	••	Rare	1	
Carcinus maenas	•••	Present	5	
Mytilus edulis	••	Present	1	
Alcyonidium diaphanum	•••	Occasional	6	
Flustra foliacea	••	Rare	2	
Asterias rubens	•••	Occasional	5	

SS.SSA.IFiSa.NcirBat *Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Weak, Very weak
Substratum:	Medium to very fine sand
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m

Previous code

IGS.NcirBat	97.06

Biotope description

Well-sorted medium and fine sands characterised by *Nephtys cirrosa* and *Bathyporeia* spp. (and sometimes *Pontocrates* spp.) which occur in the shallow sublittoral to at least 30 m depth. This biotope occurs in sediments subject to physical disturbance, as a result of wave action (and occasionally strong tidal streams). The magelonid polychaete *Magelona mirabilis* may be frequent in this biotope in more sheltered, less tideswept areas whilst in coarser sediments the opportunistic polychaete *Chaetozone setosa* may be commonly found. The faunal diversity of this biotope is considerably reduced compared to less disturbed biotopes (such as FfabMag) and for the most part consists of the more actively-swimming amphipods. Sand eels *Ammodytes* sp. may occasionally be observed in association with this biotope (and others) and spionid polychaetes such as *Spio filicornis* and *S. martinensis* may also be present. Occasional *Lanice conchilega* may be visible at the sediment surface.

Situation

No situation data available.

Temporal variation

Stochastic recruitment events in the *Nephtys cirrosa* populations may be very important to the population size of other polychaetes present and may therefore create a degree of variation in community composition (Bamber 1994).

Similar biotopes

SSA.NcirMac	The current biotope is very similar to NcirMac, which occurs in reduced/variable salinities with additional reduced salinity fauna.
LSA.AmSco.Pon	AmSco.Pon is closely allied to NcirBat but occurs in the intertidal zone
LSA.Po	Po is closely allied to NcirBat but occurs in the intertidal zone
SSA.IMoSa	As sediment disturbance increases NcirBat may grade into IMoSa with only the most robust species able to tolerate the mobile sand environment
SSA.FfabMag	As sediment disturbance decreases and the finer silt fraction can begin to sediment out of the water column NcirBat may grade into the muddy sand biotope FfabMag.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
POLYCHAETA	••	Present	4	
Nephtys cirrosa	•••••	Common	43	40
Nephtys hombergii	••	Present	1	4
Scoloplos armiger	••	Present	1	4
Spio filicornis	••	Frequent	1	14
Spio martinensis	••	Present	1	23
Spiophanes bombyx	••	Present	2	7
Magelona mirabilis	••••	Frequent	15	38
Chaetozone setosa	•••	Common	5	16
Lanice conchilega	•••	Occasional	57	
Pontocrates arenarius	••	Frequent	2	16
Bathyporeia elegans	•••	Frequent	14	140
Bathyporeia guilliamsoniana	••	Frequent	5	18
Crangon crangon	••	Rare	5	
Pagurus bernhardus	••	Occasional	8	
Liocarcinus depurator	••	Occasional	8	
Fabulina fabula	••	Present	1	5
Echinocardium cordatum	••	Present	4	
Ammodytes tobianus	••	Rare	8	
Pomatoschistus	••	Occasional	8	

SS.SSA.IFiSa.TbAmPo Semi-permanent tube-building amphipods and polychaetes in sublittoral sand

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	Weak, Very weak
Substratum:	Medium to very fine muddy sand
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

Part of IMU.TubeAP 97.06

Biotope description

Sublittoral marine sand in moderately exposed or sheltered inlets and voes in shallow water may support large populations of semi-permanent tube-building amphipods and polychaetes. Typically dominated by *Corophium crassicorne* with other tube building amphipods such as *Ampelisca* spp. also common. Other taxa include typical shallow sand fauna such as *Spiophanes bombyx*, *Urothoe elegans*, *Bathyporeia* spp. along with various polychaetes including *Exogone hebes* and *Lanice conchilega*. *Polydora ciliata* may also be abundant in some areas. At the sediment surface, Arenicola marina worm casts may be visible and occasional seaweeds such as *Laminaria saccharina* may be present. As many of the sites featuring this biotope are situated near to fish farms it is possible that it may have developed as the result of moderate nutrient enrichment. The distribution of this biotope is poorly known and like the muddier SMU.AmpPlon, to which it is related, appears to have a patchy distribution.

Situation

No situation data available.

Temporal variation

It is possible that this biotope is a temporal or spatial variant of other more stable biotopes resulting from localised changes to sediment stability and organic status.

Similar biotopes

SMU.AmpPlon	AmpPlon occurs on muddier sediment than TbAmPo and can be distinguished by the importance of *Photis longicaudata* in the muddier biotope.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
NEMERTEA	••••	Common	2	82
POLYCHAETA	•••	Common	15	
Anaitides mucosa	•••	Present	1	142
Exogone hebes	•••	Common	4	487
Scoloplos armiger	•••	Present	1	118
Polydora ciliata	••	Abundant	3	318
Pygospio elegans	•••	Frequent	2	238
Spio filicornis	•••	Frequent	3	188
Spiophanes bombyx	•••••	Present	5	253
Capitomastus minimus	•••	Present	2	307
Arenicola marina	•••••	Occasional	19	
Lanice conchilega	•••	Frequent	6	
Urothoe elegans	••••	Present	3	286
Urothoe marina	•••	Common	3	293
Phoxocephalus holbolli	•••	Frequent	2	242
Ampelisca brevicornis	•••	Common	2	291
Bathyporeia elegans	••	Common	1	475
Bathyporeia guilliamsoniana	••	Common	2	558
Corophium crassicorne	•••••	Common	48	3469
Pagurus bernhardus	•••	Occasional	6	
Liocarcinus depurator	•••	Rare	3	
Ensis	••	Present	3	
Ensis arcuatus	••	Common	2	
Cochlodesma praetenue	••••	Present	3	256
Asterias rubens	••	Occasional	1	
Echinocardium cordatum	••	Occasional	1	
Pleuronectidae	••	Occasional	4	
Nitophyllum punctatum	••	Occasional	1	
Polysiphonia	••	Rare	1	
Polysiphonia elongata	••	Occasional	1	
Eudesme virescens	••	Occasional	2	
Desmarestia aculeata	••	Occasional	1	
Desmarestia viridis	•••	Occasional	4	
Chorda filum	•••	Frequent	9	
Laminaria saccharina	••••	Occasional	12	
Ulva	••	Occasional	1	

SS.SSA.IMuSa Infralittoral muddy sand

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Fine to very fine sand with a silt fraction
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

Part of IMS.FaMS 97.06

Biotope description

Non-cohesive muddy sand (with 5% to 20% silt/clay) in the infralittoral zone, extending from the extreme lower shore down to more stable circalittoral zone at about 15-20 m. The habitat supports a variety of animal-dominated communities, particularly polychaetes (*Magelona mirabilis*, *Spiophanes bombyx* and *Chaetozone setosa*), bivalves (*Fabulina fibula* and *Chamelea gallina*) and the urchin *Echinocardium cordatum*.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Nephtys	••••	Common	7	32
Nephtys cirrosa	••	Common	2	15
Nephtys hombergii	•••	Present	2	12
Scoloplos armiger	••	Present	1	13
Spio	••	Frequent	1	16
Spiophanes bombyx	••••	Common	13	152
Magelona mirabilis	•••••	Common	16	223
Cirratulidae	••	Common	2	33
Chaetozone setosa	•••••	Common	11	97
Arenicola marina	•••	Frequent	12	
Lanice conchilega	•••	Occasional	14	
Bathyporeia	••	Frequent	2	63
Diastylis bradyi	••	Present	1	6
Pagurus bernhardus	•••	Occasional	11	
Liocarcinus depurator	••	Occasional	4	
Nucula nitidosa	•••	Frequent	3	63
Ensis	•••	Frequent	8	
Phaxas pellucidus	••	Common	2	29
Fabulina fabula	•••••	Common	14	138
Abra alba	••	Present	1	16
Abra prismatica	••	Present	1	9
Chamelea gallina	•••	Common	5	39
Asterias rubens	•••	Occasional	5	
Echinocardium cordatum	••••	Frequent	22	
Pomatoschistus	••	Occasional	1	
Pleuronectidae	••	Frequent	2	
Diatoms - film	••	Common	3	

SS.SSA.IMuSa.EcorEns *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Medium to fine sand; slightly muddy sand
Zone:	Infralittoral
Height band:	Lower shore
Depth band:	5-10 m, 10-20 m, 20-30 m

Previous code

IGS.EcorEsil	96.7
IMS.EcorEns	97.06

Biotope description

Sheltered lower shore and shallow sublittoral sediments of sand or muddy fine sand in fully marine conditions, support populations of the urchin *Echinocardium cordatum* and the razor shell *Ensis siliqua* or *Ensis ensis*. Other notable taxa within this biotope include occasional *Lanice conchilega*, *Pagurus* and *Liocarcinus* spp. and *Asterias rubens*. This biotope has primarily been recorded by epifaunal dive, video or trawl surveys where the presence of relatively conspicuous taxa such as E. cordatum and Ensis spp. have been recorded as characteristic of the community. However, these species, particularly *E. cordatum* have a wide distribution and are not necessarily the best choice for a characteristic taxa (Thorson, 1957). Furthermore, detailed quantitative infaunal data for this biotope is often rather scarce, possibly as a result of survey method as remote grab sampling is likely to under-estimate deep-burrowing species such as *Ensis* sp. (Warwick & Davis 1977). Consequently, it may be better to treat this biotope as an epibiotic overlay which is likely to overlap a number of other biotopes such as FfabMag, NcirBat and AalbNuc with infaunal components of these biotopes occurring within EcorEns. The precise nature of this infaunal community will be related to the nature of the substratum, in particular the quantity of silt/clay present. Infaunal species may include the polychaetes *Spiophanes bombyx*, *Magelona mirabilis*, *Nephtys cirrosa* and *Chaetozone setosa* and the amphipod *Bathyporeia* spp. This biotope is currently broadly defined and needs further consideration as to whether it should be placed at biotope or biotope complex level. AreISa is another biotope based primarily on epibiotic data. It is likely that this biotope and EcorEns form a wider epibiotic sand /muddy sand community with EcorEns biased towards sandier areas and SSA.AreISa towards slightly muddier areas.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMP.Zmar	In some areas the seagrass *Zostera marina* may occur in low densites in this biotope but does not form distinct beds as in Zmar.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Eteone longa	••	Abundant	1	42
Glycera tridactyla	••	Present	2	16
Nephtys cirrosa	•••	Common	8	52
Spiophanes bombyx	••••	Common	37	228
Magelona filiformis	••	Present	2	63
Magelona mirabilis	•••	Common	10	425
Chaetozone setosa	•••	Present	6	63
Arenicola marina	••	Occasional	2	
Lanice conchilega	••••	Occasional	14	
Bathyporeia elegans	••	Common	3	62
Bathyporeia pelagica	••	Common	5	114
Siphonoecetes kroyeranus	••	Present	1	21
Iphinoe trispinosa	•••	Frequent	3	24
Pagurus bernhardus	••••	Occasional	9	
Corystes cassivelaunus	••	Rare	2	
Liocarcinus depurator	••	Occasional	2	
Polinices pulchellus	••	Rare	1	
Hinia reticulata	••	Frequent	2	
Tellimya ferruginosa	••	Present	1	20
Ensis	•••	Frequent	10	
Ensis ensis	•	Super-abundant	2	38
Ensis siliqua	••	Frequent	2	
Angulus tenuis	••	Present	1	45
Chamelea gallina	••	Present	2	13
Astropecten irregularis	••	Occasional	1	
Asterias rubens	•••	Occasional	7	
Echinocardium cordatum	•••••	Frequent	34	
Echinocardium cordatum	•••	Present	1	19
Pomatoschistus	••	Occasional	2	
Pleuronectidae	••	Frequent	2	

SS.SSA.IMuSa.FfabMag *Fabulina fabula* and *Magelona mirabilis* with venerid bivalves and amphipods in infralittoral compacted fine muddy sand

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Medium to very fine sand with some silt
Zone:	Infralittoral
Depth band:	5-10 m, 10-20 m, 20-30 m

Previous code

IGS.FabMag	97.06

Biotope description

In stable, fine, compacted sands and slightly muddy sands in the infralittoral and littoral fringe, communities occur that are dominated by venerid bivalves such as *Chamelea gallina*. This biotope may be characterised by a prevalence of *Fabulina fabula* and *Magelona mirabilis* or other species of *Magelona (*e.g. *M. filiformis)*. Other taxa, including the amphipod *Bathyporeia* spp. and polychaetes such as *Chaetozone setosa*, *Spiophanes bombyx* and *Nephtys* spp. are also commonly recorded. In some areas the bivalve *Spisula elliptica* may also occur in this biotope in low numbers. The community is relatively stable in its species composition, however, numbers of *Magelona* and *F. Fabulina* tend to fluctuate. Around the Scilly Isles numbers of *F. fabulina* in this biotope are uncommonly low whilst these taxa are often found in higher abundances in muddier communities (presumably due to the higher organic content). Consequently it may be better to revise this biotope on the basis of less ubiquitous taxa such as key amphipod species (E.I.S. Rees pers. comm. 2002) although more data is required to test this. FfabMag and MoeVen are collectively considered to be the 'shallow *Venus* community' or 'boreal off-shore sand association' of previous workers (see Petersen 1918; Jones 1950; Thorson 1957). These communities have been shown to correlate well with particular levels of current induced 'bed-stress' (Warwick & Uncles 1980). The 'Arctic *Venus* Community' and 'Mediterranean *Venus* Community' described to the north and south of the UK (Thorson 1957) probably occur in the same habitat and appears to be the same biotope described as the *Ophelia borealis* community in northern France and the central North Sea (K nitzer *et al.* 1992). Sites with this biotope may undergo transitions in community composition. The epibiotic biotopes EcorEns and AreISa may also overlay this biotope in some areas.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SSA.AalbNuc	FfabMag forms part of a continuum of communities found along the depth and sand/silt gradients with an increase in silt/clay leading to the development of AalbNuc in deeper water.
SSA.NcirBat	As sediment disturbance increases and the finer silt fraction is unable to sediment out of the water column FfabMag may grade into the sandy biotope NcirBat.
SCS.MoeVen	MoeVen is found in slightly coarser sediments. FfabMag differs from MoeVen because of the prevalence of the brittle-shelled *F. fabula* over the more robust *Moerella* and *Spisula*, and because it occurs in generally finer, more compact sands.
SMU.NhomMac	In very shallow water with a greater mud fraction this biotope may give way to the sandy mud biotope NhomMac.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
POLYCHAETA	••	Occasional	8	
Nephtys	••••	Common	6	34
Nephtys cirrosa	••	Common	1	12
Nephtys hombergii	•••	Present	1	14
Spio	•••	Frequent	1	18
Spiophanes bombyx	•••••	Common	15	148
Magelona mirabilis	•••••	Common	22	211
Cirratulidae	•••	Common	2	37
Chaetozone setosa	•••••	Common	13	102
Lanice conchilega	•••	Frequent	19	
Bathyporeia	••	Frequent	2	70
Pagurus bernhardus	••	Occasional	4	
Liocarcinus depurator	•••	Rare	13	
Nucula nitidosa	•••	Frequent	3	70
Ensis	••	Frequent	8	
Phaxas pellucidus	•••	Common	2	33
Fabulina fabula	•••••	Common	17	141
Abra alba	••	Present	1	17
Chamelea gallina	•••	Common	3	41
Asterias rubens	••	Rare	3	
Echinocardium cordatum	••••	Frequent	34	
Pomatoschistus minutus	••	Frequent	4	
Pleuronectidae	•		2	

SS.SSA.IMuSa.AreISa *Arenicola marina* in infralittoral fine sand or muddy sand

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Fine to very fine sand and muddy sand
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

None

Biotope description

In shallow fine sand or non-cohesive muddy sand in fully marine conditions (or occasionally in variable salinity) a community characterised by the polychaete *Arenicola marina* may occur. This biotope appears quite faunally sparse. Those other taxa present however, include scavenging crustacea such as *Pagurus bernhardus* and *Liocarcinus depurator,* terebellid polychaetes such as *Lanice conchilega* and the burrowing anemone *Cerianthus lloydii*. Occasional *Sabella pavonina* and frequent *Ensis* spp. may also be observed in some areas. The majority of records for this biotope are derived from epifaunal surveys and consequently there is little information available for the associated infaunal species. It is possible that this biotope, like EcorEns (to which it is broadly similar) is an epibiotic overlay on other biotopes from the SSA complex.

Situation

No situation data available.

Temporal variation

At certain times of the year a diatom film may be present on the sediment surface.

Similar biotopes

LSA.MacAre	AreISa is likely to be a shallow water extension of the littoral *Arenicola* biotope MacAre

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*	
Hydractinia echinata	••	Occasional	1		
Cerianthus lloydii	••	Frequent	2		
Capitella capitata	••••	Common	91		112
Arenicola marina	••••	Abundant	9		9
Arenicola marina	•••••	Common	55		
Terebellidae	••	Occasional	1		
Lanice conchilega	•••	Occasional	5		
Sabella pavonina	••	Occasional	1		
Pagurus bernhardus	••••	Occasional	10		
Liocarcinus depurator	••	Occasional	2		
Carcinus maenas	••	Occasional	2		
Ensis	••	Frequent	1		
Diatoms - film	••	Common	9		

SS.SSA.IMuSa.SsubNhom *Spisula subtruncata* and *Nephtys hombergii* in shallow muddy sand

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak
Substratum:	Muddy sand occasionally with surface shell fragments.
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m

Previous code

part of IGS.Sell	97.6

Biotope description

In shallow non-cohesive muddy sands, in fully marine conditions, a community characterised by the bivalve *Spisula subtruncata* and the polychaete *Nephtys hombergii* may occur. The sediments in which this community is found may vary with regard silt content but they generally have less than 20% silt/clay and in some areas may contain a degree of shell debris. This biotope falls somewhere between SSA.FfabMag and SSA.AalbNuc with regard sediment type (i.e. somewhat muddier than SSA.FfabMag and less muddy than SSA.AalbNuc) and may have species in common with both. As a result, other important species in this community include *Abra alba*, *Fabulina fabula* spp. and *Mysella bidentata* spp. In addition, *Diastylis rathkei/typical*, *Philine aperta* (in muddier sediments), *Ampelisca* spp., *Ophiura albida*, *Phaxas pellucidus* and occasionally *Bathyporeia* spp, may also be important, although this is not clear from the data available. In areas of slightly coarser, less muddy sediment *S. solida* or *S. elliptica* may appear occasionally in this biotope. Abundances of *Spisula subtruncata* in this biotope are often very high and distinguish it from other closely related biotopes. Extensive areas of this community to the north east of the Dogger Bank were recorded in the 1950s, but these seem to have declined since then (Kroncke 1990). More information is required with regard the status of this biotope.

Situation

No situation data available.

Temporal variation

In some areas this biotope may be a temporal variant or sub-biotope of SSA.FfabMag and SSA.AalbNuc rather than an established biotope in itself. For example SSA.SsubNhom has been recorded in Red Wharf Bay and Conwy Bay where it appears to be short term variant of other more established biotopes (e.g. SSA.AalbNuc) and appears to have only intermittent occurrence in single age cohort patches possibly due to predation in some areas (e.g. Red Wharf Bay) by the common Scoter *Melanitta nigra* (E.I.S. Rees pers. comm. 2002).

Similar biotopes

SCS.MoeVen	SsubNhom is found on slightly siltier and/or shelly sand and can be distinguished by the dominance of *S. subtruncata*.
SSA.FfabMag	SsubNhom is muddier than FfabMag and can be distinguished by the dominance of *Spisula*
SSA.AalbNuc	SsubNhom is less muddy than AalbNuc and can be distinguished by the dominance of *Spisula*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Harmothoe lunulata	••••	Common	1	31
Pholoe inornata	••••	Common	2	43
Sthenelais limicola	•••••	Abundant	4	31
Eteone longa	••••	Present	2	6
Glycera tridactyla	•••••	Common	4	24
Nephtys hombergii	•••••	Common	7	69
Spiophanes bombyx	•••••	Frequent	5	60
Magelona alleni	••••	Frequent	4	20
Cirratulidae	••••	Present	1	6
Chaetozone setosa	••••	Common	6	44
Owenia fusiformis	••••	Common	2	23
Lagis koreni	•••	Common	2	645
Pariambus typicus	•••	Frequent	1	33
Nucula nitidosa	•••	Common	2	82
Mysella bidentata	•••••	Frequent	5	184
Mactra stultorum	••••	Common	2	31
Spisula subtruncata	•••••	Common	9	189
Fabulina fabula	•••••	Common	6	31
Abra alba	•••••	Common	13	1629
Dosinia lupinus	••••	Common	1	10
Chamelea gallina	••••	Present	2	9
Amphiura brachiata	•••••	Abundant	4	141
Ophiura ophiura	•••	Abundant	1	11

SS.SSA.CFiSa Circalittoral fine sand

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Weak, Very weak
Substratum:	Clean fine sands
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m, 30-50 m

Previous code

part of CGS	97.06

Biotope description

Clean fine sands with less than 5% silt/clay in deeper water, either on the open coast or in tide-swept channels of marine inlets in depths of over 15-20m. The habitat may also extend offshore and is characterised by a wide range of echinoderms (in some areas including the pea urchin *Echinocyamus pusillus*), polychaetes and bivalves. This habitat is generally more stable than shallower, infralittoral sands and consequently supports a more diverse community.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Virgularia mirabilis	••	Occasional		
Cerianthus lloydii	•••	Frequent		
Nephtys	••	Common		
Spiophanes bombyx	••	Frequent		
Chaetozone setosa	••	Common		
Lanice conchilega	•••	Occasional		
Pagurus bernhardus	•••	Occasional		
Nucula nitidosa	••	Frequent		
Pecten maximus	••	Occasional		
Abra alba	••	Common		
Asterias rubens	•••	Occasional		
Amphiura filiformis	•••	Abundant		
Ophiura albida	•••	Frequent		
Ophiura ophiura	••	Frequent		

SS.SSA.CFiSa.EpusOborApri *Echinocyamus pusillus, Ophelia borealis* and *Abra prismatica* in circalittoral fine sand

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Not known
Tidal streams:	Not known
Substratum:	Medium to fine sand.
Zone:	Circalittoral

Previous code

None

Biotope description

Circalittoral and offshore medium to fine sand (from 40m to 140m) characterised by the pea urchin *Echinocyamus pusillus*, the polychaete *Ophelia borealis* and the bivalve *Abra prismatica*. Other species may include the polychaetes *Spiophanes bombyx*, *Pholoe* sp., *Exogone* spp., *Sphaerosyllis bulbosa*, *Goniada maculata*, *Chaetozone setosa*, *Owenia fusiformis*, *Glycera lapidum*, *Lumbrineris latreilli* and *Aricidea cerrutii* and the bivalves *Thracia phaseolina* and *Moerella pygmaea* and to a lesser extent *Spisula elliptica and Timoclea ovata*. This biotope has been found in the central and northern North Sea.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SCS.MedLumVen	This biotope is similar to MedLumVen but it occurs in finer sediments with a lower proportion of venerid bivalves.

SS.SSA.CFiSa.ApriBatPo *Abra prismatica, Bathyporeia elegans* and polychaetes in circalittoral fine sand

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Not known
Tidal streams:	Not known
Substratum:	Medium to fine sands.
Zone:	Circalittoral

Previous code

None

Biotope description

In circalittoral and offshore medium to fine sands between 25m and 100m a community characterised by the bivalve *Abra prismatica*, the amphipod *Bathyporeia elegans* and polychaetes such as *Scoloplos armiger*, *Spiophanes bombyx*, *Aonides paucibranchiata*, *Chaetozone setosa*, *Ophelia borealis* and *Nephtys longosetosa* may be found. Crustacea such as the cumacean *Eudorellopsis deformis* and the opheliid polychaetes such as *Ophelia borealis*, *Travisia forbesii* or *Ophelina neglecta* are often present in this biotope and the brittlestar *Amphiura filiformis* may also be common at some sites. This biotope has been reported in the central and northern North Sea (Basford and Eleftheriou, 1989; K nitzer *et al*., 1992).

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SSA.EpusOborApri	EpusOborApri is generally found in somewhat finer sand than ApriBatPo.
SMU.AfilMysAnit	As the mud fraction of the sediment increases ApriBatPo may grade into the sandy mud biotope AfilMysAnit
SMU.AfilNten	As the mud fraction of the sediment increases ApriBatPo may grade into the sandy mud biotope AfilNten

SS.SSA.CMuSa Circalittoral muddy sand

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Fine to very fine sand with a fine silt fraction
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m, 30-50 m

Previous code

part of CMS	97.06

Biotope description

Circalittoral non-cohesive muddy sands with the silt content of the substratum typically ranging from 5% to 20%. This habitat is generally found in water depths of over 15-20m and supports animal-dominated communities characterised by a wide variety of polychaetes, bivalves such as *Abra alba* and *Nucula nitidosa*, and echinoderms such as *Amphiura* spp and *Ophiura* spp., and *Astropecten irregularis*. These circalittoral habitats tend to be more stable than their infralittoral counterparts and as such support a richer infaunal community.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Cerianthus lloydii	●●●	Frequent	1	22
Metridium senile	●●	Rare	5	
Sagartiogeton undatus	●●	Occasional	1	
NEMERTEA	●●●	Present	2	
Sthenelais limicola	●●●	Present	1	6
Goniada maculata	●●●	Present	2	9
Nephtys	●●●●	Common	5	54
Nephtys hombergii	●●●	Common	2	14
Scoloplos armiger	●●●●	Present	3	19
Prionospio fallax	●●●	Present	1	6
Spiophanes bombyx	●●●●	Frequent	6	48
Chaetozone setosa	●●●●	Common	6	81
Scalibregma inflatum	●●●	Present	2	30
Owenia fusiformis	●●●	Present	2	13
Terebellidae	●●	Occasional	1	
Lanice conchilega	●●●	Present	2	14
Lanice conchilega	●●●	Occasional	4	
Bathyporeia tenuipes	●●●	Present	1	21
Pagurus bernhardus	●●●●	Occasional	8	
Macropodia rostrata	●●	Rare	2	
Corystes cassivelaunus	●●	Occasional	2	
Corystes cassivelaunus	●●●	Present	1	5
Liocarcinus depurator	●●	Rare	2	
Philine aperta	●●	Occasional	2	
Nucula nitidosa	●●●●●	Frequent	11	118
Solenidae	●●	Super-abundant	2	52
Fabulina fabula	●●●●	Common	7	86
Gari fervensis	●●●	Present	1	7
Abra alba	●●●●●	Abundant	12	495
Abra prismatica	●●●	Frequent	2	22
Chamelea gallina	●●●	Present	1	9
Astropecten irregularis	●●●	Occasional	6	
Asterias rubens	●●●●	Occasional	14	
Amphiura brachiata	●●●●	Common	18	
Ophiura albida	●●●	Abundant	1	40
Ophiura albida	●●	Occasional	2	
Ophiura ophiura	●●●	Occasional	6	
Echinocardium cordatum	●●●	Rare	5	
Labidoplax digitata	●●	Occasional	1	
Pomatoschistus minutus	●●	Occasional	3	

SS.SSA.CMuSa.AalbNuc *Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Fine muddy sands occasionally with small gravel content
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m, 30-50 m

Previous code

CMS.AbrNucCor	97.06

Biotope description

Non-cohesive muddy sands or slightly shelly/gravelly muddy sand characterised by the bivalves *Abra alba* and *Nucula nitidosa*. Other important taxa include *Nephtys* spp., *Chaetozone setosa* and *Spiophanes bombyx* with *Fabulina fabula* also common in many areas. The echinoderms *Ophiura albida* and *Asterias rubens* may also be present. The epibiotic biotope EcorEns may overlap this biotope. This biotope is part of the *Abra* community defined by Thorson (1957) and the infralittoral etage described by Glemarec (1973).

Situation

No situation data available.

Temporal variation

Numbers of adult *Abra alba* can exceed 1000 m- in favourable conditions (Francesch & Lopez-Jamar 1991) although, as a result of variable recruitment and adult mortality, numbers can vary widely. Consequently the relative density of the characterising species in this biotope is known to vary from year to year (Molander 1962) and *Nucula nitidosa* can, in some cases, be at least if not more prevalent than *Abra alba* (Salzwedel, Rachor & Gerdes 1985). Some areas (e.g. in Liverpool Bay and other areas of the Irish Sea for which long term data is available) are known to display a succession of biotopes with LkorPpel, SsubNhom and AalbNuc becoming the prevalent biotope from one year to the next (Rees et al, 1992; Rees and Walker, 1983). It may be that these biotopes are merely different aspects of the same community with small changes in environmental conditions and/or recruitment, enough to push the community from one form to the next.

Similar biotopes

SMU.AfilMysAnit	In muddier sediments AalbNuc may grade into AfilMysAnit
SMU.BlyrAchi	At greater depths and in muddier sediments AalbNuc may grade into BlyrAchi
SMU.LkorPpel	In muddier sediments AalbNuc may grade into LkorPpel
SSA.FfabMag	The two biotopes may be separated by the relative dominance of *Abra alba* and *Nucula* spp. in AalbNuc and the increased proportion of amphipods such as *Bathyporeia* spp.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Echiurus echiurus		Present		
Goniada maculata	●●●	Present	1	9
Nephtys	●●●●●	Common	5	55
Nephtys hombergii				
Scoloplos armiger	●●●●	Present	2	20
Spiophanes bombyx	●●●●	Frequent	6	47
Chaetozone setosa	●●●●	Common	6	78
Scalibregma inflatum	●●●	Present	1	31
Owenia fusiformis	●●●	Present	1	13
Lanice conchilega	●●●●	Occasional	39	
Lanice conchilega	●●●	Present	1	14
Nucula nitidosa	●●●●●	Frequent	16	122
Solenidae	●●	Super-abundant	3	53
Fabulina fabula	●●●●	Common	10	87
Abra alba	●●●●●	Abundant	21	513
Abra prismatica	●●●	Frequent	2	22
Asterias rubens	●●●●	Occasional	41	
Ophiura albida	●●●●	Rare	20	
Ophiura albida	●●●	Abundant	2	41

SS.SSA.CMuSa.AbraAirr *Amphiura brachiata* with *Astropecten irregularis* and other echinoderms in circalittoral muddy sand

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Weak, Very weak
Substratum:	fine to very fine muddy sand
Zone:	Circalittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

None

Biotope description

In shallow, circalittoral non-cohesive muddy sand (typically less than 20% silt/clay) abundant populations of the brittlestar *Amphiura brachiata* may occur with other echinoderms such as *Astropecten irregularis*, *Asterias rubens*, *Ophiura ophiura* and *Echinocardium cordatum*. Other infaunal species typically include *Mysella bidentata*, *Lanice conchilega* and *Magelona filiformis*. This biotope is likely to form part of the non-cohesive/cohesive muddy sand communities, which make up the 'off-shore muddy sand association' described by other workers (Jones 1951; Mackie 1990). It is possible that in some areas this biotope forms an epifaunal overlay which may cover a range of biotopes in years of good recruitment but does not develop into a settled or established community.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Corymorpha nutans	••	Occasional	2	13
Cerianthus lloydii	•••	Frequent	1	
Sagartiogeton undatus	••	Occasional	5	
Peachia cylindrica	••	Occasional	2	
NEMERTEA	•••	Present	1	
Pholoe inornata	•••	Present	2	18
Nephtys hombergii	•••	Present	1	11
Magelona alleni	•••	Present	3	25
Magelona filiformis	•••	Frequent	5	403
Arenicola marina	••	Occasional	2	
Owenia fusiformis	•••	Present	3	14
Melinna palmata	•••	Present	2	10
Terebellidae	••	Frequent	1	
Lanice conchilega	•••	Frequent	3	
Myxicola infundibulum	••	Rare	1	
Ampelisca brevicornis	•••	Present	2	10
Pagurus bernhardus	••••	Occasional	9	
Corystes cassivelaunus	••	Occasional	1	
Cancer pagurus	••	Rare	1	
Liocarcinus depurator	••	Rare	1	
Mysella bidentata	•••	Common	30	768
Ensis arcuatus	••	Frequent	1	
Abra nitida	•••	Present	2	28
Cochlodesma praetenue	•••	Present	3	18
Astropecten irregularis	••••	Frequent	6	
Asterias rubens	••••	Frequent	8	
Amphiura brachiata	••••	Super-abundant	36	95
Amphiura brachiata	•••••	Abundant	26	
Amphiura filiformis	•••	Present	1	66
Ophiura ophiura	•••	Occasional	6	
Echinocardium cordatum	•••	Present	4	26
Echinocardium cordatum	•••	Occasional	4	
Labidoplax digitata	•••	Occasional	3	
Pomatoschistus minutus	••	Occasional	3	
Pleuronectidae	••	Occasional	1	

SS.SSA.OSa Offshore circalittoral sand

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Not known
Tidal streams:	Not known
Substratum:	Fine sands and muddy sands.
Zone:	Circalittoral

Previous code

part of COS	97.06

Biotope description

Offshore (deep) circalittoral habitats with fine sands or non-cohesive muddy sands. Very little data is available on these habitats however they are likely to be more stable than their shallower counterparts and characterised by a diverse range of polychaetes, amphipods, bivalves and echinoderms.

Situation

No situation data available.

Temporal variation

No temporal data available.

SS.SSA.OSa.MalEdef

Maldanid polychaetes and *Eudorellopsis deformis* in offshore circalittoral sand or muddy sand

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Not known
Tidal streams:	Not known
Substratum:	Sand and muddy sand.
Zone:	Circalittoral

Previous code

None

Biotope description

In deep offshore sand or non-cohesive muddy sand dense populations of maldanid polychaetes such as *Maldane sarsi* and the cumacean *Eudorellopsis deformis* may be found. Accompanying these species are abundant ophiuroids including *Amphiura filiformis*, polychaetes such as Terebellidae sp., *Chaetozone setosa*, *Levinsenia gracilis*, *Scoloplos armiger*, the amphipod *Harpinia antennaria* and the bivalves *Nuculoma tenuis* and *Parvicardium minimum*. This biotope is similar to the *Maldane sarsi-Ophiura sarsi* community defined by Glemarec (1973).

Situation

No situation data available.

Temporal variation

No temporal data available.

SS.SSA.OSa.OfusAfil *Owenia fusiformis* and *Amphiura filiformis* in offshore circalittoral sand or muddy sand

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Not known
Tidal streams:	Not known
Substratum:	Slightly muddy sand.
Zone:	Circalittoral

Previous code

part of CMS.AfilEcor 97.06

Biotope description

Areas of slightly muddy sand (generally <20% mud) in offshore waters may be characterised by high numbers of the tube building polychaete *Owenia fusiformis* often with the brittlestar *Amphiura filiformis*. Whilst *O. fusiformis* is also found in other circalittoral or offshore biotopes it usually occurs in lower abundances than in SSA.OfusAfil. Other species found in this community are the polychaetes *Goniada maculata*, *Pholoe inornata*, *Diplocirrus glaucus*, *Chaetozone setosa* and *Spiophanes kroyeri* with occasional bivalves such as *Timoclea ovata* and *Thyasira equalis*. The sea cucumber *Labidoplax buski* and the cumacean *Eudorella truncatula* are also commonly often found in this biotope.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SSA.MalEdef	Maldanid polychaetes may also occur in the current biotope but never in the same abundance as in MalEdef.

SS.SMU Sublittoral cohesive mud and sandy mud communities

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt), Reduced (18-30ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered, Ultra sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Mud and sandy mud.
Zone:	Infralittoral, Circalittoral
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m

Previous code

IMU in part	97.06
CMU in part	97.06
part of IMS	97.06

Biotope description

Sublittoral mud and cohesive sandy mud extending from the extreme lower shore to offshore, circalittoral habitats. This biotope is predominantly found in sheltered harbours, sealochs, bays, marine inlets and estuaries and stable deeper/offshore areas where the reduced influence of wave action and/or tidal streams allow fine sediments to settle. Such habitats are often by dominated by polychaetes and echinoderms, in particular brittlestars such as Amphiura spp. Seapens such as Virgularia mirabilis and burrowing megafauna including Nephrops norvegicus are common in deeper muds. Estuarine muds tend to be characterised by infaunal polychaetes and oligochaetes.

Situation

No situation data available.

Temporal variation

No temporal data available.

SS.SMU.SMuLS Sublittoral mud in low or reduced salinity (lagoons)

Habitat classification

Salinity:	Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Extremely sheltered, Ultra sheltered
Tidal streams:	Weak, Very weak
Substratum:	Mud and sandy mud
Zone:	Sublittoral fringe, Infralittoral
Depth band:	0-5 m

Previous code

None

Biotope description

Shallow, typically anoxic, muddy and sandy mud sediments in areas of low or reduced, although stable, salinity (may vary annually) with largely ephemeral faunal communities. Characterised by *Arenicola marina* and blue-green algae with other species, including mysids, *Carcinus maenas* and *Corophium volutator* which commonly occur in lagoons. Important infaunal species may include *Hediste diversicolor*, *Heterochaeta costata* and chironomids; however infaunal records for this biotope are limited.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hediste diversicolor	••••	Abundant	44	1050
Pygospio elegans	•••	Present	3	13
Arenicola marina	•••	Frequent	45	
Heterochaeta costata	••••	Abundant	34	1767
Mysidae	••	Frequent	13	
Corophium volutator	••	Frequent	8	
Crangon crangon	••	Occasional	8	
Carcinus maenas	••	Occasional	8	
Chironomida	••••	Common	15	1770
Hydrobia ulvae	••	Common	1	297
Hydrobia ulvae	••	Occasional	3	
Ruppia	••	Occasional	4	

SS.SMU.SMuVS Sublittoral mud in variable salinity (estuaries)

Habitat classification

Salinity:	Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Mud and sandy mud
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m

Previous code

IMU.EstMu	97.06

Biotope description

Shallow sublittoral muds, extending from the extreme lower shore into the subtidal in variable salinity (estuarine) conditions. Such habitats typically support communities characterised by oligochaetes, and polychaetes such as *Aphelochaeta marioni*. In lowered salinity conditions the sediments may include a proportion of coarser material, where the silt content is sufficient to yield a similar community to that found in purer muds.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
POLYCHAETA	••	Present	71	
Nephtys hombergii	•••	Common	18	52
Scoloplos armiger	••	Present	1	17
Polydora ciliata	••	Common	2	434
Pygospio elegans	••	Present	2	22
Streblospio shrubsolii	••	Frequent	4	90
Aphelochaeta marioni	•••	Common	17	2423
Capitella capitata	••	Frequent	9	58
Melinna palmata	••	Common	1	135
Tubificoides benedii	•••	Frequent	6	228
Tubificoides pseudogaster	••	Common	3	301
Tubificoides swirencoides	••	Common	3	392
Corophium volutator	••	Frequent	2	70
Carcinus maenas	••	Rare	7	
Crepidula fornicata	••	Present	7	
Cardiidae	••	Present	18	
Macoma balthica	•	Present	1	3

SS.SMU.SMuVS.PolCvol *Polydora ciliata* and *Corophium volutator* in variable salinity infralittoral firm mud or clay

Habitat classification

Salinity:	Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Weak
Substratum:	Hard clay, relict peat, mud with fine sand fraction
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m

Previous code

IMU.PolVS	97.06

Biotope description

Variable salinity clay and firm mud characterised by a turf of the polychaete *Polydora ciliata* along with the amphipod *Corophium volutator*. Other important taxa include the polychaetes *Pygospio elegans*, *Hediste diversicolor*, *Streblospio shrubsolii* and the oligochaete *Tubificoides benedii*. *P. ciliata* also occurs in high densities elsewhere (see MCR.Pol) and may be a specific feature of the Humber Estuary in these conditions. This biotope occurs only in very firm mud and clay and possibly submerged relict saltmarsh with a high detrital content. It is characterised, and can be separated from other biotopes, by a combination of the sediment characteristics and the very high density of *Polydora ciliata*. In some areas, such as the Humber estuary, cyclical behaviour with regard its characteristic taxa has been reported with either *P. ciliata* or *C. volutator* increasing in dominance at the expense of the other (Gameson 1982). It is possible that changes in water quality or the sediment regime may be responsible for this.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMU.AphTubi	These two biotopes are similar in characteristics but can be distinguished on the relative abundances of the characterising species *Polydora ciliata*, *Corophium volutator* and *Aphelochaeta marioni*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Eteone longa	●●●	Common	2	32
Hediste diversicolor	●●●●	Common	5	84
Polydora ciliata	●●●●●	Abundant	43	6407
Tharyx	●●	Common	2	877
Pygospio elegans	●●●●	Frequent	9	152
Streblospio shrubsolii	●●●	Common	6	642
Tubificoides benedii	●●●●	Frequent	4	616
Tubificoides pseudogaster	●●	Abundant	2	2850
Gammarus salinus	●●	Common	1	6
Corophium volutator	●●●●	Common	21	556
Hydrobia ulvae	●●	Common	1	332

SS.SMU.SMuVS.AphTubi *Aphelochaeta marioni* and *Tubificoides* spp. in variable salinity infralittoral mud

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong, Weak
Substratum:	Cohesive mud and sandy mud, possibly with shell debris and stones
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m

Previous code

IMU.PhoSco	96.7
IMU.AphTub	97.06

Biotope description

Variable salinity cohesive muddy sediment (sometimes with some coarser material) dominated by the polychaete *Aphelochaeta marioni* (or other *Aphelochaeta* species e.g. *A. amplivasatus*) and the oligochaete *Tubificoides* spp. These taxa are generally accompanied by *Nephtys hombergii* whilst the polychaetes *Capitella capitata* and *Melinna palmata* may also occur in high numbers in some areas. Other members of the cirratulid polychaete group e.g. *Caulleriella zetlandica.* and *Tharyx* spp. may also occur in high numbers, sometimes replacing *A. marioni* as the dominant polychaete. However, there is still inconsistency in the identification of the cirratulid group which is further compounded by fragmentation during sample processing. This biotope is very common in stable muddy environments and may extend from reduced salinity to fully marine conditions.

Situation

This biotope may also be found in conjunction with MacAbr.

Temporal variation

No temporal data available.

Similar biotopes

SMU.NhomTubi	The current biotope may be more diverse version of NhomTubi and can be distinguished by the abundance of *A. marioni*, terebellids and the stability of the sediment in AphTubi, together with the importance of associated species such as *Diastylis rathkei typica* in NhomTubi
SMX.CreMed	It may be separated from CreMed by the relative abundances of the slipper limpet *Crepidula fornicata* in addition to *A. marioni*.
SMX.AphPol	In areas of mixed sediment *A. marioni* may also occur in high numbers. In this case it may be difficult to separate AphTubi from AphPol requiring classification on sediment characteristics and associated species in addition to the abundance of *A. marioni*.
SMU.MelMagThy	Where AphTub occurs in polyhaline waters it may grade into the biotope MelMagThy as the salinity increases e.g. in the Fal estuary (Allen *et al*. 2002).

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
POLYCHAETA	••	Present	71	
Exogone naidina	••	Frequent	2	239
Nephtys	••	Common	1	30
Nephtys hombergii	••••	Common	9	56
Scoloplos armiger	••	Present	1	20
Polydora ciliata	••	Common	1	38
Tharyx	••	Abundant	9	1328
Pygospio elegans	••	Present	1	23
Streblospio shrubsolii	••	Frequent	2	63
Caulleriella zetlandica	••	Common	2	492
Aphelochaeta marioni	••••	Abundant	33	5185
Capitella capitata	•••	Frequent	2	80
Mediomastus fragilis	••	Frequent	1	192
Melinna palmata	••	Common	2	250
Ampharete	••	Common	1	16
Tubificoides benedii	•••	Frequent	4	301
Tubificoides pseudogaster	••	Common	3	186
Tubificoides swirencoides	•••	Common	7	841
Carcinus maenas	•	Rare	4	
Crepidula fornicata	•	Present	7	
Cardiidae	•	Present	18	
Cerastoderma edule	••	Present	1	17
Abra nitida	••	Common	1	19
Phoronis muelleri	••	Frequent	1	267

SS.SMU.SMuVS.NhomTubi *Nephtys hombergii* and *Tubificoides* spp. in variable salinity infralittoral soft mud

Habitat classification

Salinity:	Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Mud; sandy mud
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m

Previous code

IMU.NhomTub	97.06

Biotope description

Variable salinity soft infralittoral mud and sandy mud characterised by the polychaete *Nephtys hombergii* and oligochaetes of the genus *Tubificoides*. Other characterising species that may be present are the polychaetes *Streblospio shrubsolii* and *Aphelochaeta marioni*, and the cumacean *Diastylis rathkei typica*.

Situation

The biotope is found in areas of silt deposition in soft and sandy muds but may not form a stable habitat. It may be found adjacent to AphTubi, separated by the abundance of *Aphelochaeta marioni* and its more cohesive sediments

Temporal variation

No temporal data available.

Similar biotopes

SMU.AphTubi	This biotope may be an impoverished version of AphTubi and can be distinguished by the abundance of *A. marioni*, terebellids and the stability of the sediment in AphTubi, together with the importance of associated species such as *Diastylis rathkei typica* in NhomTubi and species such as *Caulleriella zetlandica* in AphTubi.
SMU.MoMu	The more mobile muds (MoMu) may contain a reduced element of this biotope in which case only sediment description will distinguish the two biotopes.
SMU.NhomMac	This biotope may also be allied with NhomMac which is found in more marine conditions and can be distinguished by the abundance of *Macoma balthica* and weaker tidal streams.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Nephtys hombergii	●●●●●	Common	44	112
Scoloplos armiger	●●	Abundant	1	35
Streblospio shrubsolii	●●●	Common	8	92
Aphelochaeta marioni	●●●	Frequent	5	65
Tubificoides	●●	Common	7	243
Tubificoides amplivasatus	●●●	Common	20	271
Tubificoides benedii	●●	Frequent	2	74
Diastylis rathkei typica	●●●	Common	8	48
Hydrobia ulvae	●●	Frequent	2	17

SS.SMU.SMuVS.MoMu Infralittoral fluid mobile mud

Habitat classification

Salinity:	Variable (18-35ppt), Reduced/low (0.5-30ppt)
Wave exposure:	Sheltered, Extremely sheltered
Tidal streams:	Moderately strong, Weak
Substratum:	Fluid mud
Zone:	Infralittoral
Depth band:	0-5 m
Other features:	Found only on slack water

Previous code

IMU.MobMud	97.06

Biotope description

Fluid mobile mud suspended and deposited on each tide. In areas with very high quantities of suspended particulate material in the water column it may become deposited around slack water when tidal currents fall. This can form fluid mud layers up to several metres thick (Warwick & Uncles 1980) becoming a transient habitat in its own right. Species present within this biotope will be those washed in from other communities such as *Nephtys hombergii* or *Capitella capitata*. This biotope may be under-recorded due to sampling problems, and also where sediment descriptions are absent from field data.

Situation

It may be found adjacent to; OlVS, NhomTubi and to some extent AphTubi.

Temporal variation

No temporal data available.

Similar biotopes

SMU.OlVS	The more mobile muds (MoMu) may contain a reduced element of OlVS in which case only sediment description will distinguish the two biotopes.
SMU.CapTubi	The more mobile muds (MoMu) may contain a reduced element of CapTubi in which case only sediment description will distinguish the two biotopes.
SMU.NhomTubi	The more mobile muds (MoMu) may contain a reduced element of NhomTubi in which case only sediment description will distinguish the two biotopes.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Capitella capitata	●●●	Present	0	
OLIGOCHAETA	●●●	Present	0	

SS.SMU.SMuVS.CapTubi *Capitella capitata* and *Tubificoides* spp. in reduced salinity infralittoral muddy sediment

Habitat classification

Salinity:	Variable (18-35ppt), Reduced (18-30ppt)
Wave exposure:	Moderately exposed, Sheltered, Extremely sheltered
Tidal streams:	Strong, Moderately strong, Very weak
Substratum:	Cohesive muddy sediment, sandy mud
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Possible organic enrichment or physical disturbance

Previous code

IMU.CapTub	97.06

Biotope description

Reduced or variable salinity muddy sediment characterised by the *Capitella capitata* species complex with a relatively low species richness. Large numbers of the oligochaetes *Tubificoides* spp. may be found in conjunction with *C. capitata*, along with other species such as *Marenzellaria* sp, *Macoma balthica*, *Arenicola marina* and *Eteone longa*. In some estuaries this biotope may also include high numbers of the polychaete *Ophryotrocha*. This biotope usually has a moderate organic content, and is found away from tidal channels in estuaries. The presence of dense *Capitella* has classically been associated with organically enriched and physically disturbed habitats in the marine environment (Warren 1977; Pearson & Rosenberg 1978) and areas of higher organic loads in estuaries will typically fall into the biotope Cap. Where Capitella is less abundant and accompanied by other typical estuarine species the dominance of Capitella may be associated with other natural factors including the occurrence of a competitive refuge for *C. capitata* in the reduced-salinity environment (Wolff 1973).

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMU.OlVS	OlVS can be separated from CapTubi by a swap in the dominant species from *C. capitata* to *Tubificoides* spp. and OlVS frequently occurs in lower salinity.
SMU.MoMu	MoMu may contain a similar suite of species to CapTubi although in lower abundance. Only a description of the sediment consistency in the field would allow positive classification
SMU.Cap	Cap tends to occur in fully marine conditions or in estuarine areas of high organic enrichment and can be distinguished by the reduced species richness as compared to CapTubi.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
NEMATODA	••	Present	1	2
Eteone longa	••	Common	2	6
Neanthes virens	•		1	5
Marenzelleria	••	Common	7	79
Pygospio elegans	••	Present	1	5
Capitella capitata	•••••	Frequent	60	119
Arenicola marina	••	Present	3	6
OLIGOCHAETA	•••	Frequent	3	129
Tubificoides benedii	••	Frequent	10	84
Corophium volutator	••	Present	1	8
Macoma balthica	•••	Present	4	4

SS.SMU.SMuVS.OlVS Oligochaetes in variable or reduced salinity infralittoral muddy sediment

Habitat classification

Salinity:	Variable (18-35ppt), Reduced (18-30ppt)
Wave exposure:	Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong, Weak
Substratum:	Cohesive muddy sediment, sandy mud
Zone:	Infralittoral
Depth band:	0-5 m
Other features:	Possibly affected by a high biochemical oxygen demand

Previous code

IMU.Tub

Biotope description

Reduced or variable salinity muddy and sandy mud sediments characterised by oligochaetes, particularly of the genus *Tubificoides* or from the group Enchytraeidae. The abundance of the oligochaetes may vary by several orders of magnitude but very few other species will be present. Organic loading and poor water-exchange within the sediment lead to anoxic conditions which may explain the low species richness within this biotope.

Situation

This biotope is found towards the edges of tidal channels in estuaries where current velocities allow deposition of silt and the establishment of an infaunal community. The biotope may occur downstream of SMU.LhofTtub, differentiated by the absence of the freshwater species, and adjacent to more mobile and sandier biotopes in the tidal channels.

Temporal variation

No temporal data available.

Similar biotopes

SMU.LhofTtub	LhofTtub is similar to OlVS however the latter lacks the freshwater element
SMU.CapTubi	CapTubi can be separated from OlVS by the presence of the polychaete *Capitella capitata*.
SMU.MoMu	More mobile muds, which occur in areas with an extremely high suspended particulate component to the water column, MoMu, may contain a very similar suite of species to OlVS and can only positively be separated by a description of the sediment characteristics in the field.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
OLIGOCHAETA	••••	Frequent	84	245
Tubificoides pseudogaster	•	Present	2	40
Diptera larva	••	Abundant	11	61

SS.SMU.SMuVS.LhofTtub *Limnodrilus hoffmeisteri, Tubifex tubifex* and *Gammarus* spp. in low salinity infralittoral muddy sediment

Habitat classification

Salinity:	Low (<18ppt)
Wave exposure:	Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Cohesive muddy sediment
Zone:	Infralittoral
Depth band:	0-5 m
Other features:	Very low, fluctuating salinity; possibly with a high biochemical oxygen demand

Previous code

IMU.LimTtub	97.06

Biotope description

Upper estuary muddy sediments with very low fluctuating salinity, characterised by the oligochaetes *Limnodrilus hoffmeisteri* and *Tubifex tubifex*. Other taxa may include *Marenzelleria wireni*, *Gammarus zaddachi*, *Paranais litoralis* and *Heterochaeta costata*. The biotope contains elements of both freshwater and brackish communities.

Situation

This biotope is found in the transitional zone between the freshwater and brackish environments where tidal currents are sufficiently reduced to allow the deposition of fine silt and the establishment of an infaunal community. It may be found adjacent to NeoGam away from the stronger tidal streams.

Temporal variation

The position of this biotope in the estuary may vary seasonally depending on freshwater input (Gameson, 1982).

Similar biotopes

SMU.OlVS	LhofTtub is similar to OlVS however the latter lacks the freshwater element.
SSA.NintGam	NintGam may be found in conjunction with LhofTtub, although it lacks appreciable numbers of oligochaetes.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Marenzelleria wireni	••	Present	3	21
Limnodrilus hoffmeisteri	••••	Common	78	1011
Tubifex tubifex	•••	Present	19	91

SS.SMU.ISaMu Infralittoral sandy mud

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Mud with a fine to very fine sand fraction
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

part of IMS.FaMS	97.06

Biotope description

Infralittoral, cohesive sandy mud, typically with over 20% silt/clay, in depths of less than 15-20m. This habitat is generally found in sheltered bays or marine inlets and along sheltered areas of open coast. Typical species include a rich variety of polychaetes including *Melinna palmate*, tube building amphipods (*Ampelisca* spp.) and deposit feeding bivalves such as *Macoma balthica* and *Mysella bidentata*. Sea pens such as *Virgularia mirabilis* and brittlestars such as *Amphiura* spp. may be present but not in the same abundances as found in deeper circalittoral waters.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hydractinia echinata	••	Occasional	4	
Cerianthus lloydii	••	Occasional	3	
Metridium senile	••	Rare	2	
Sagartiogeton undatus	••••	Occasional	21	
NEMERTEA	••	Common	2	53
NEMATODA	•••	Frequent	4	563
Nephtys hombergii	••••	Common	20	42
Scoloplos armiger	••	Abundant	3	60
Magelona filiformis	••	Common	2	133
Chaetozone gibber	••	Abundant	2	476
Capitella capitata	••	Abundant	5	695
Arenicola marina	•	Occasional	2	
Euclymene oerstedii	••	Abundant	1	64
Melinna palmata	••	Abundant	5	808
Terebellidae	••	Occasional	4	
Myxicola infundibulum	••	Occasional	2	
Ampelisca brevicornis	••	Frequent	1	78
Ampelisca tenuicornis	••	Frequent	1	130
Pagurus bernhardus	•••	Occasional	7	
Liocarcinus depurator	••	Occasional	3	
Carcinus maenas	•••	Occasional	16	
Nucula nitidosa	•••	Frequent	8	48
Thyasira flexuosa	•••	Frequent	2	40
Mysella bidentata	••	Frequent	2	134
Macoma balthica	••	Frequent	7	15
Abra alba	•••	Common	8	74
Asterias rubens	••	Occasional	3	
Ascidiella aspersa	•••	Frequent	6	
Pomatoschistus	••	Occasional	3	

SS.SMU.ISaMu.NhomMac *Nephtys hombergii* and *Macoma balthica* in infralittoral sandy mud

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Extremely sheltered
Tidal streams:	Weak
Substratum:	Sandy mud
Zone:	Infralittoral
Depth band:	5-10 m, 10-20 m
Other features:	Organically enriched

Previous code

IMS.AbrLag	96.7
IMS.MacAbr	97.06

Biotope description

Near-shore shallow sandy muds and muds, and sometimes mixed sediments, may be characterised by the presence of the polychaete *Nephtys hombergii* and the bivalve *Macoma balthica*. *Abra alba*, and *Nucula nitidosa* may also be important although they may not necessarily occur simultaneously or in high numbers. Other taxa include *Spiophanes bombyx*, *Lagis koreni*, and *Echinocardium cordatum.* In some areas *Scoloplos armiger* and *Crangon crangon* may also be present. The community appears to be quite stable (Dewarumez *et al.* 1992) and the substratum is typically rich in organic content. This community has been included in the 'Boreal Offshore Muddy Sand Association' of Jones (1950) and is also described by several other authors (Petersen 1918; Cabioch & Gla‡on 1975). A similar community may occur in deep water in the Baltic (Thorson 1957). This biotope may occur in slightly reduced salinity estuarine conditions where *Mya* sp. may become a significant member of the community (Thorson 1957).

Situation

The community may occur in small patches or swathes in shallow waters parallel to the shore (Jones 1950; Cabioch & Gla‡on 1975) or in shallow nearshore depressions or trenches where finer material collects e.g. off the Suffolk coast (IECS 1991). This biotope is known to occur in patches between Denmark and the western English Channel.

Temporal variation

Sites with SMU.NhomMac may develop into *Amphiura* biotopes with time (E.I.S. Rees pers. comm. 1996)

Similar biotopes

SSA.AalbNuc	In deeper, less muddy areas NhomMac may grade into AalbNuc and it is possible that this biotope is part of the *Abra* dominated muddy sand biotopes.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Nephtys cirrosa				
Nephtys hombergii	●●●●●	Common	37	57
Spiophanes bombyx	●●	Present	3	11
Magelona mirabilis	●	Present	1	4
Lagis koreni	●●	Present	3	9
Nucula nitidosa	●●●	Frequent	18	109
Macoma balthica	●●●●	Frequent	20	41
Abra alba	●●●	Present	6	13
Ophiura ophiura	●●	Present	2	9
Echinocardium cordatum	●●	Present	3	16

SS.SMU.ISaMu.SundAasp *Sagartiogeton undatus* and *Ascidiella aspersa* on infralittoral sandy mud

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	sandy mud
Zone:	Infralittoral, Circalittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

None

Biotope description

Sheltered sublittoral mud or sandy mud in shallow water with relatively few conspicuous species may be characterised by the anemone *Sagartiogeton undatus* in low numbers and the tunicate *Ascidiella aspersa*. Other taxa may include *Carcinus maenas*, *Pagurus bernhardus* and terebellid polychaetes. The burrowing anemones *Cerianthus lloydii* may also be found occasionally. The status of this biotope is uncertain at present as it is not known whether it is an impoverished, disturbed or epifaunal variant of other sheltered, shallow mud biotopes such as PhiVir or if the areas in which it has been recorded have been incompletely surveyed.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hydractinia echinata	••	Occasional	3	
Cerianthus lloydii	••	Occasional	3	
Metridium senile	••	Rare	2	
Sagartiogeton undatus	••••	Occasional	24	
Terebellidae	•••	Occasional	4	
Myxicola infundibulum	••	Occasional	2	
Pagurus bernhardus	•••	Occasional	6	
Liocarcinus depurator	••	Occasional	3	
Carcinus maenas	••••	Occasional	18	
Buccinum undatum	••	Rare	1	
Asterias rubens	•••	Occasional	3	
Ascidiella aspersa	•••	Frequent	7	
Gobius niger	••	Occasional	1	
Pomatoschistus	••	Occasional	3	
Pomatoschistus minutus	••	Occasional	1	

SS.SMU.ISaMu.MysAbr *Mysella bidentata* and *Abra* spp. in infralittoral sandy mud

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very sheltered
Tidal streams:	Very weak
Substratum:	Muddy sands and sandy muds
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

None

Biotope description

Cohesive sandy mud, sometimes with a small quantity of shell in shallow water may contain the bivalves *Mysella bidentata* and *Abra* spp. (typically *A. alba* and *A. nitida*). Other characteristic taxa may include *Scoloplos armiger*, *Mya* sp., and *Thyasira flexuosa*. Tube building amphipods are also characteristic of this biotope in particular *Ampelisca* spp. and Aoridae such as *Microprotopus maculatus*.

Situation

This biotope is generally found in sheltered marine inlets or sealochs such as Strangford Lough.

Temporal variation

No temporal data available.

Similar biotopes

SMU.AmpPlon	MysAbr is similar to AmpPlon but differs in the variety and abundance of amphipods and is found in muddier sediments in sheltered sealochs such as Strangford Lough. It is possible that these two biotopes are actually part of a wider biotope which contains more than one entity depending on its geographic location and prevailing environmental conditions

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
NEMATODA	●●●●●	Frequent	15	2246
Nephtys hombergii	●●	Common	2	32
Nephtys kersivalensis	●●	Common	1	8
Scoloplos armiger	●●●●	Super-abundant	10	215
Cirratulidae	●●●	Common	2	73
Capitella capitata	●●	Frequent	1	654
Mediomastus fragilis	●●	Frequent	1	66
Arenicola marina	●●	Present	1	
Melinna palmata	●●	Common	1	5
Dexamine thea	●●●	Frequent	1	21
Ampelisca brevicornis	●●●	Common	6	173
Ampelisca tenuicornis	●●●	Frequent	2	86
Microprotopus maculatus	●●	Frequent	2	31
Aoridae	●●●	Frequent	1	45
Pariambus typicus	●●●	Present	1	88
Thyasira flexuosa	●●●●	Present	2	84
Mysella bidentata	●●●●●	Frequent	9	548
Abra alba	●●●●	Common	11	216
Abra nitida	●●●	Common	2	20
Mya	●●●●	Common	3	15
Zostera marina	●●●●	Present	99	

SS.SMU.ISaMu.MelMagThy *Melinna palmata* with *Magelona* spp. and *Thyasira* spp. in infralittoral sandy mud

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered
Tidal streams:	Moderately strong
Substratum:	Sandy mud
Zone:	Infralittoral
Depth band:	5-10 m, 10-20 m

Previous code

part of IMS.SpiSpi	97.06

Biotope description

In infralittoral cohesive sandy mud, in sheltered marine inlets, and occasionally variable salinity environments, dense populations of the polychaete *Melinna palmata* may occur, often with high numbers of *Magelona* spp. and the bivalve *Thyasira flexuosa*. Other important taxa may include *Chaetozone gibber*, *Nephtys hombergii*, *Galathowenia oculata*, *Euclymene oerstedii*, *Ampelisca tenuicornis*, *Ampharete lindstroemi*, *Abra alba*, and *Phoronis* sp. In addition the polychaete *Aphelochaeta* spp. and the gastropod *Turritella communis* may be common or abundant in some areas. At the sediment surface visible taxa may include occasional *Virgularia mirabilis*, and mobile epifauna such as *Pagurus bernhardus*. This biotope is characteristic in many southern UK marine inlets and in some areas e.g. Plymouth Sound during high levels of recruitment when *M. palmata* often occurs in abundances between 500 to 1000 per m2 moderate numbers of the species often 'overspill' into adjacent biotopes (Allen *et al*. 2001).

Situation

In many areas this biotope is found on or near the boundary between euryhaline and polyhaline waters and in such areas moderately high numbers of *Aphelochaeta* spp. are often recorded.

Temporal variation

Numbers of *M. palmata* tend to vary considerably from year to year presumably due to recruitment and/or adult mortality.

Similar biotopes

SSA.AalbNuc	The current biotope displays some similarity to AalbNuc but is found in shallower water, muddier sediments and often in estuarine influenced areas.
SMU.AphTubi	In some areas the current biotope may resemble a more diverse, marine version of AphTubi and it is possible that MelMagThy occupies an intermediate position between AphTubi and AalbNuc.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hydractinia echinata	●●●	Occasional	8	
Virgularia mirabilis	●●●	Occasional	20	
Cerianthus lloydii	●●●	Occasional	8	
NEMERTEA	●●●●●	Common	4	111
NEMATODA	●●●●	Frequent	1	74
Nephtys hombergii	●●●●	Common	3	44
Spio filicornis	●●●●	Frequent	2	29
Magelona alleni	●●●●	Frequent	2	68
Magelona filiformis	●●●●	Common	7	453
Chaetozone gibber	●●●●	Abundant	10	1615
Tharyx	●●●	Common	1	278
Aphelochaeta marioni	●●●	Common	1	312
Notomastus latericeus	●●●●	Occasional	1	41
Euclymene oerstedii	●●●●	Abundant	3	211
Galathowenia oculata	●●●●	Common	3	215
Melinna palmata	●●●●●	Abundant	19	2739
Ampharete lindstroemi	●●●●	Frequent	3	77
Myxicola infundibulum	●●●	Frequent	12	
Harpinia antennaria	●●●●	Frequent	2	52
Ampelisca tenuicornis	●●●●	Common	2	374
Pagurus bernhardus	●●●●	Occasional	23	
Carcinus maenas	●●●	Rare	4	
Turritella communis	●●●	Common	1	77
Nucula nitidosa	●●●●	Present	2	29
Thyasira flexuosa	●●●●●	Frequent	3	68
Thyasira flexuosa	●●●	Present	5	
Mysella bidentata	●●●	Present	5	
Phaxas pellucidus	●●●●	Present	1	30
Abra alba	●●●●	Common	2	67
Mya truncata	●●●	Present	10	
Corbula gibba	●●●●	Present	1	19
Phoronis	●●●●	Common	2	78
Amphiura filiformis	●●●	Present	5	

SS.SMU.ISaMu.AmpPlon *Ampelisca* spp., *Photis longicaudata* and other tube-building amphipods and polychaetes in infralittoral sandy mud

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Not known
Tidal streams:	Not known
Substratum:	Sandy muds.
Zone:	Infralittoral

Previous code

part of IMU.TubeAP 97.06

Biotope description

Sublittoral stable cohesive sandy muds occurring over a wide depth range may support large populations of semi-permanent tube-building amphipods and polychaetes. In particular large numbers of the amphipods *Ampelisca* spp. and *Photis longicaudata* may be present along with polychaetes such as *Lagis koreni*. Other important taxa may include bivalves such as *Nucula nitidosa, Chamelea gallina, Abra alba* and *Mysella bidentata* and the echinoderms *Echinocardium cordatum* and *Amphiura brachiata*. In some areas polychaetes such as *Spiophanes bombyx* and *Polydora ciliata* may also be conspicuously numerous. This community is poorly known, appearing to occur in restricted patches. In some areas it is possible that AmpPlon may develop as a result of moderate organic enrichment. A similar community in mud has also been reported in the Baltic which is characterised by large populations of amphipods such as *Ampelisca* spp., *Corophium* spp. and *Haploops tubicola* (see Petersen 1918; Thorson 1957) and it is not known if SMU.AmpPlon is a UK variant of this biotope.

Situation

No situation data available.

Temporal variation

In some areas of the Irish Sea this biotope is reported to be a temporal variant of AalbNuc, SsubNhom and LkorPpel. Some researchers consider these biotopes to be part of a wider muddy sand community which varies temporally depending on changes in sediment deposition and recruitment as was reported in areas of Red Wharf Bay off the Welsh coast (E.I.S. Rees pers. comm. 2002)

Similar biotopes

SMU.MysAbr	Similar to AmpPlon but differs in the variety and abundance of amphipods and is found in muddier sediments in sheltered sealochs such as Strangford Lough. It is possible that these two biotopes are actually part of a wider biotope which contains more than one entity depending on its geographic location and prevailing environmental conditions.

SS.SMU.ISaMu.Cap *Capitella capitata* in enriched sublittoral muddy sediments

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt), Low (<18ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong, Weak
Substratum:	Muddy sediment
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

IMU.Cap	97.06

Biotope description

The polychaete *Capitella capitata* (agg.) a widely-occurring, opportunist species complex that is particularly associated with organically enriched and polluted sediments (Warren 1977; Pearson & Rosenberg 1978) where it may be superabundant. In very polluted/disturbed areas only *Capitella*, Nematodes and occasional *Malacoceros fuliginosus* may be found whilst in slightly less enriched areas and estuaries species such as *Tubificoides*, *Cirriformia tentaculata*, *Pygospio elegans* and *Polydora ciliata* may also be found. In some areas e.g. the Tees estuary, high numbers of the polychaete *Ophryotrocha* may also be present. Cap may become established as a result of anthropogenic activities such as fish farming and sewerage effluent but may also occur with natural enrichment as a result of, for example, coastal bird roosts. This biotope may also occur to some extent in the intertidal and in estuaries.

Situation

This biotope typically occurs in marine inlets, embayments or estuaries where organic enrichment allows *C. capitata* to out compete other taxa, although the species may also occur in enriched muddy coastal sediments and also offshore where there is a high organic input from adjacent oil drilling platforms (CapThy & CapThy.Odub).

Temporal variation

No temporal data available.

Similar biotopes

SMU.CapTubi	Cap tends to occur in fully marine conditions or in estuarine areas of high organic enrichment and can be distinguished by the reduced species richness as compared to CapTubi.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
NEMATODA	●●●	Frequent	2	201
Malacoceros fuliginosus	●●●●	Common	7	506
Polydora ciliata	●●●	Present	2	329
Capitella capitata	●●●●●	Abundant	83	5155
OLIGOCHAETA	●●●	Common	1	109
Tubificoides benedii	●●	Frequent	3	316

SS.SMU.IFiMu Infralittoral fine mud

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Mud (occasionally with shells or stones)
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

IMU.MarMu	97.06

Biotope description

Shallow sublittoral muds, extending from the extreme lower shore to about 15-20 m depth in fully marine or near marine conditions, predominantly in extremely sheltered areas with very weak tidal currents. Such habitats are found in sealochs and some rias and harbours. Populations of the lugworm *Arenicola marina* may be dense, with anemones, the opisthobranch *Philine aperta* and synaptid holothurians also characteristic in some areas. The extent of the oxidised layer may be shallow with some areas being periodically or permanently anoxic. In these areas bacterial mats may develop on the sediment surface. Infaunal records for this biotope complex are limited encompassing only one biotope. They are therefore not representative of the full suit of infaunal species found in this biotope.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Hydractinia echinata	••	Occasional	2	
Cerianthus lloydii	••	Occasional	2	
Ophiodromus flexuosus	•••	Present	4	3
Hediste diversicolor	••	Frequent	2	49
Polydora ciliata	••	Present	1	2
Caulleriella caputesocis	••••	Frequent	15	20
Aphelochaeta marioni	•••	Present	4	4
Arenicola marina	•••	Frequent	12	
Pagurus bernhardus	•••	Occasional	7	
Liocarcinus depurator	••	Rare	3	
Carcinus maenas	••••	Occasional	25	
Hydrobia ulvae	••••	Frequent	20	29
Philine aperta	••	Frequent	6	
Cerastoderma edule	•••••	Common	33	31
Abra nitida	••••	Common	22	38
Asterias rubens	•••	Occasional	6	
Beggiatoa	••	Present	16	
Diatoms - film	••	Present	4	
Laminaria saccharina	••	Present	2	

SS.SMU.IFiMu.CerAnit *Cerastoderma edule* with *Abra nitida* in infralittoral mud

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very sheltered
Tidal streams:	Weak
Substratum:	Mud and gravelly mud
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m

Previous code

None

Biotope description

Sheltered shallow sublittoral muds and gravelly muds in marine embayments, inlets or harbours may contain populations of the edible cockle *Cerastoderma edule* with *Abra nitida*. Other taxa may include the gastropod *Hydrobia ulvae*, cirraltulid polychaetes such as *Caulleriella* spp. and other polychaetes including *Hediste diversicolor* and *Aphelochaeta marioni*. Available data for this biotope are limited to parts of Southampton Water, Chichester Harbour and also in the Wash. The species list given here may therefore be far from complete. It is not known at this stage whether this biotope is a sublittoral extension of intertidal cockle beds (e.g. LSA.CerPo) or whether it exists independently of intertidal populations of *C. edule*.

Situation

No situation data available.

Temporal variation

No situation data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Ophiodromus flexuosus	●●●	Present	4	3
Hediste diversicolor	●●	Frequent	2	49
Polydora ciliata	●●	Present	1	2
Caulleriella caputesocis	●●●●	Frequent	15	20
Aphelochaeta marioni	●●●	Present	4	4
Hydrobia ulvae	●●●●	Frequent	20	29
Cerastoderma edule	●●●●●	Common	33	31
Abra nitida	●●●●	Common	22	38

SS.SMU.IFiMu.Are *Arenicola marina* in infralittoral mud

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Mud
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m

Previous code

LMU.Are in part	96.7
IMU.AreSyn	97.06

Biotope description

In very shallow, extremely sheltered, very soft muds *Arenicola marina* may form very conspicuous mounds and casts. This biotope may also contain synaptid holothurians such as *Labidoplax media* and *Leptosynapta bergensis* or *L. inhaerens*. However these species may be under recorded (possibly due to periodicity in feeding) and are not considered characteristic of this biotope. Other conspicuous fauna may include *Carcinus maenas*, *Asterias rubens* and *Pagurus bernhardus* whilst the scallop *Pecten maximus* and the turret shell *Turritella communis* may also be present in some areas.

Situation

This biotope typically occurs in waters shallower than about 5 m in sheltered basins of sealochs and lagoons that may be partially separated from the open sea by tidal narrows or rapids.

Temporal variation

Sediment surfaces may become covered by a diatom film at certain times of the year

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Arenicola marina	●●●●●	Common	34	
Terebellidae	●●	Present	1	
Pagurus bernhardus	●●●	Present	5	
Liocarcinus depurator	●●●	Present	3	
Carcinus maenas	●●●●●	Frequent	27	
Turritella communis	●●	Present	2	
Chlamys	●●	Present	1	
Pecten maximus	●●	Present	2	
Asterias rubens	●●●●	Rare	6	
Gobiidae	●●	Present	2	
Diatoms - film	●●●	Present	5	
Laminaria saccharina	●●●	Present	3	

SS.SMU.IFiMu.PhiVir *Philine aperta* and *Virgularia mirabilis* in soft stable infralittoral mud

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Mud occasionally with small stones
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

IMU.PhiVir	97.06

Biotope description

Physically very stable muds, occasionally with small stones, with a high proportion of fine material (typically greater than 80 %) may contain the opisthobranch *Philine aperta* and the seapen *Virgularia mirabilis*. These muds typically occur in shallow water down to about 12-15 m where significant seasonal variation in temperature is presumed to occur. This habitat is restricted to the most sheltered basins in, for example, sealochs. Although most records suggest full salinity conditions are prevalent, some sites may be subject to variable salinity. *Philine aperta* is the most characteristic species of this habitat, occurring in high densities at many sites, whilst *Virgularia mirabilis*, a species found more widely in muddy sediments, appears to reach its highest densities in this shallow mud but may not be present in all examples of this biotope. Other conspicuous species found in this shallow muddy habitat include *Cerianthus lloydii*, *Pagurus bernhardus*, *Sagartiogeton* spp. and *Hydractinia echinata*. Burrowing crustacean megafauna, characteristic of deeper mud, are rare or absent from this shallow sediment although *Nephrops norvegicus* may sometimes be recorded. This biotope has been primarily recorded on the basis of its epifauna and a few conspicuous infauna. Little data exists on the infaunal component of this biotope but it may include *Nephtys* spp., spionid polychaetes, *Ampelisca* spp. and the bivalves *Nucula* spp., *Thyasira flexuosa*, *Mysella bidentata* and *Abra* spp. In the south of Great Britain, the polychaete *Sternaspis scutata* is also characteristic of this biotope. This polychaete is rare in Great Britain (Sanderson 1996). Indeed, this southern variant of the biotope is very restricted in the UK to Portland Harbour but is known to occur further south in the Gulf of Gascony and the Mediterranean (Glemarec 1973; Dauvin *et al*. 1994).

Situation

No situation data available.

Temporal variation

It is possible that this biotope is a temporal variant of other SMU biotopes. The key species, *Philine aperta*, may be highly variable from year to year The sediment may also be covered by a diatom film at certain times of the year

Similar biotopes

SMU.SpnMeg	SpnMeg is similar to PhiVir, but occurs deeper, is more stable, and is characterised by burrowing megafauna and the sea pen *Pennatula phosphorea*
SMU.BlyrAchi	PhiVir displays some resemblance to BriAchi, but the latter is characterised by a high abundance of ophiuroid species particularly *Amphiura* spp.
SMU.MysAbr	PhiVir may be closely allied to MysAbr, possibly sharing some of the infaunal elements of this biotope. However MysAbr is found on sandier sediments
SMU.SundAasp	SundAasp appears to be an impoverished (disturbed?) version of PhiVir lacking in *P. aperta* and *V. mirabilis*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hydractinia echinata	●●●	Occasional	4	
Virgularia mirabilis	●●●	Frequent	8	
Cerianthus lloydii	●●●	Frequent	7	
Sagartiogeton laceratus	●●	Occasional	1	
Sagartiogeton undatus	●●	Frequent	2	
Terebellidae	●●	Occasional	2	
Pagurus bernhardus	●●●●	Frequent	11	
Liocarcinus depurator	●●●	Occasional	3	
Carcinus maenas	●●●	Occasional	5	
Philine aperta	●●●●●	Common	30	
Aequipecten opercularis	●●	Rare	2	
Asterias rubens	●●●	Occasional	5	
Amphiura filiformis	●●	Frequent	1	
Ascidiella aspersa	●●	Occasional	2	
Pomatoschistus	●●	Occasional	2	
Laminaria saccharina	●●	Rare	1	

SS.SMU.IFiMu.Ocn *Ocnus planci* aggregations on sheltered sublittoral muddy sediment

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Stones or shells on muddy sediment
Zone:	Infralittoral, Circalittoral
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m

Previous code

SCR.Ocn	96.7
IMU.Ocn	97.06

Biotope description

Dense aggregations of *Ocnus planci [?brunneus]* on various substrata, typically muddy but occasionally with stones or shells, in sheltered conditions such as sealochs. *Philine aperta* also characterises this biotope but is present in lower abundances than in PhiVir. Other associated species vary but are typical of very sheltered muddy habitats and include the ophiuroids *Ophiura* spp. and *Ophiothrix fragilis*. *Melanella alba*, which parasitises holothurians, has been found in large numbers at one site.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Alcyonium digitatum	••	Rare	1	
Myxicola infundibulum	••	Rare	1	
Liocarcinus depurator	••	Occasional	4	
Buccinum undatum	••	Present	2	
Philine aperta	•••	Frequent	20	
Aequipecten opercularis	••	Rare	1	
Mya truncata	••	Occasional	3	
Asterias rubens	•••	Occasional	7	
Ophiothrix fragilis	••	Frequent	4	
Ophiocomina nigra	••	Occasional	3	
Ophiura albida	••	Rare	1	
Ophiura ophiura	••	Frequent	7	
Ocnus lacteus	••	Frequent	27	
Ocnus planci	•••	Abundant	19	

SS.SMU.IFiMu.Beg *Beggiatoa* spp. on anoxic sublittoral mud

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Mud
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Anoxic

Previous code

CMU.Beg	97.06

Biotope description

Sublittoral soft anoxic mud, often in areas with poor water exchange with the open sea, can have a conspicuous bacterial mat covering of *Beggiatoa* spp. The anoxia may be a result of natural conditions of poor water exchange in some sealochs (and many Scandinavian fjords) or artificially under fish farm cages from nutrient enrichment. The fauna is normally impoverished at such sites, with few elements of the infaunal communities present in other muddy biotopes. Scavenging species such as *Asterias rubens* and *Carcinus maenas* are typically present where the habitat is not too anoxic along with occasional *Arenicola marina* but in extreme conditions of anoxia little survives other than the *Beggiatoa*. The polychaete *Ophiodromus flexuosus* occurs in high densities at the interface between oxygenated and deoxygenated sediments (in Norwegian fjords).

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
POLYCHAETA	•		2	
Carcinus maenas	•••	Present	18	
Asterias rubens	••	Occasional	1	
Beggiatoa	•••••	Present	75	

SS.SMU.CSaMu Circalittoral sandy mud

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Mud with a significant fine to very fine sand fraction
Zone:	Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m, 30-50 m, 50-100 m

Previous code

part of CMS	97.06

Biotope description

Circalittoral, cohesive sandy mud, typically with over 20% silt/clay, generally in water depths of over 10m, with weak or very weak tidal streams. This habitat is generally found in deeper areas of bays and marine inlets or offshore from less wave exposed coasts. Sea pens such as *Virgularia mirabilis* and brittlestars such as *Amphiura* spp. are particularly characteristic of this habitat whilst infaunal species include the tube building polychaetes *Lagis koreni* and *Owenia fusiformis*, and deposit feeding bivalves such as *Mysella bidentata* and *Abra* spp.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Kirchenpaueria pinnata	••	Occasional	1	
Nemertesia ramosa	••	Occasional	1	
Virgularia mirabilis	••••	Occasional	12	
Cerianthus lloydii	•••	Occasional	9	
NEMERTEA	•••	Common	4	71
Thysanocardia procera	••	Common	2	60
Pholoe inornata	••	Frequent	2	82
Nephtys incisa	•••	Present	3	48
Lumbrineris gracilis	••	Common	1	32
Chaetopterus variopedatus	••	Occasional	1	
Cirratulidae	••	Abundant	2	275
Diplocirrus glaucus	•••	Present	2	59
Scalibregma inflatum	••	Common	1	60
Owenia fusiformis	•••	Common	2	48
Lagis koreni	•••	Common	3	192
Melinna palmata	••	Present	2	47
Terebellidae	••	Occasional	1	
Lanice conchilega	••	Occasional	3	
Pomatoceros triqueter	••	Occasional	1	
Pariambus typicus	••	Frequent	2	136
Pagurus bernhardus	•••	Occasional	8	
Pagurus prideaux	••	Rare	2	
Liocarcinus depurator	•••	Occasional	4	
Turritella communis	••	Occasional	2	
Aporrhais pespelecani	••	Rare	1	
Nuculoma tenuis	••	Frequent	1	26
Pecten maximus	•••	Occasional	7	
Mysella bidentata	••••	Common	19	1011
Phaxas pellucidus	••	Common	1	123
Abra alba	••	Common	1	96
Abra nitida	•••	Abundant	6	398
Phoronis	•••	Common	5	139
Asterias rubens	••••	Occasional	8	
OPHIUROIDEA	••	Abundant	2	104
Amphiura filiformis	••	Frequent	2	
Amphiura filiformis	••••	Super-abundant	18	440
Ophiura albida	•••	Frequent	6	
Ophiura ophiura	•••	Frequent	4	
Echinus esculentus	••	Occasional	2	

SS.SMU.CSaMu.AfilMysAnit *Amphiura filiformis*, *Mysella bidentata* and *Abra nitida* in circalittoral sandy mud

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Weak, Very weak
Substratum:	Sandy mud
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m

Previous code

part of CMS.AfilEcor	96.7
part of IMS.SpiSpi	97.06
part of CMS.AfilEcor	97.06

Biotope description

Cohesive sandy mud off wave exposed coasts with weak tidal streams can be characterised by super-abundant *Amphiura filiformis* with *Mysella bidentata* and *Abra nitida*. This community occurs in muddy sands in moderately deep water (Hiscock 1984; Picton *et al.* 1994) and may be related to the 'off-shore muddy sand association' described by other workers (Jones 1951; Thorson 1957; Mackie 1990) and is part of the infralittoral etage described by Glemarec. This community is also characterised by the sipunculid *Thysanocardia procera* and the polychaetes *Nephtys incisa*, *Phoronis* sp. and *Pholoe* sp., with cirratulids also common in some areas. Other taxa such as *Nephtys hombergii*, *Echinocardium cordatum*, *Nucula nitidosa*, *Callianassa subterranea* and *Eudorella truncatula* may also occur in offshore examples of this biotope (e.g. K nitzer *et al.* 1992).

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SSA.AalbNuc	In sandier sediments AfilMysAnit may grade into AalbNuc
SSA.FfabMag	In shallower sandy sediments AfilMysAnit may grade into FfabMag
SMU.AfilNten	AfilNten may be distinguished from AfilMysAnit by the abundance of the characterising species *Nuculoma tenuis* in AfilNten and by the importance of other characterising species such as *Thysanocardia procera* and *Nephtys incise* in AfilMysAnit. AfilNten is also generally found in deeper water.
SMU.ThyNten	ThyNten may be distinguished from AfilMysAnit by the abundance of the characterising species *Thyasira flexuosa* and by the decreased abundance of *Amphiura filiformis* in ThyNten. ThyNten is generally found in deeper waters.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Tubularia indivisa	••	Rare	2	
Sagartiogeton undatus	••	Rare	2	
NEMERTEA	•••	Present	1	47
Thysanocardia procera	••••	Present	4	129
Phascolion strombus strombus	••	Rare	2	
POLYCHAETA	•••	Abundant	14	
Aphrodita aculeata	••	Rare	2	
Pholoe inornata	••••	Frequent	3	157
Nephtys hombergii	••	Frequent	1	
Nephtys incisa	••••	Present	5	97
Levinsenia gracilis	•••	Present	2	83
Tharyx	••	Frequent	1	
Tharyx	•••	Common	2	240
Cirratulidae	•••	Super-abundant	4	600
Chaetozone setosa	••	Frequent	1	
Diplocirrus glaucus	•••	Present	2	107
Pectinariidae	•••	Occasional	6	
Lagis koreni	•••	Present	1	62
Melinna palmata	•••	Present	3	85
Lanice conchilega	•••	Rare	5	
Pariambus typicus	•••	Common	2	260
Pagurus bernhardus	••••	Occasional	11	
Turritella communis	•••	Rare	5	
Mysella bidentata	•••••	Abundant	22	1635
Abra nitida	••••	Super-abundant	11	838
Corbula gibba	••	Present	1	49
Phoronis	••••	Abundant	2	121
OPHIUROIDEA	•••	Abundant	7	252
Amphiura chiajei	•••	Common	12	
Amphiura filiformis	•••••	Super-abundant	19	760
Amphiura filiformis	•••	Abundant	12	
Ophiura ophiura	••••	Rare	6	

SS.SMU.CSaMu.ThyNten *Thyasira* spp. and *Nuculoma tenuis* in circalittoral sandy mud

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	Very weak
Substratum:	Mud occasionally with scattered shells or gravel
Zone:	Circalittoral
Depth band:	20-30 m, 30-50 m, 50-100 m

Previous code

None

Biotope description

Circalittoral cohesive sandy muds with small quantities of gravel, off sheltered or moderately exposed coasts may support populations characterised by *Thyasira* spp. and in particular *Thyasira flexuosa*. Other characteristic taxa may include *Nuculoma tenuis*, *Goniada maculate* and in some areas *Rhodine gracilior*. *Mysella bidentata*, *Abra alba*, *Harpinia antennaria* and *Amphiura filiformis* may be abundant in some examples of this biotope. Whilst moderately diverse, animal abundances are often low and it is possible that the biotope is the result of sedimentary disturbance e.g. from trawling and is possibly an impoverished version of AfilNten. Collectively the biotopes ThyNten, AfilMysAnit, AfilNten and OfusAfil, may form the *Amphiura* dominated components of the 'off-shore muddy sand association' described by other workers (Jones 1951; Thorson 1957; Mackie 1990) and the infralittoral etage described by Glemarec (1973).

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMU.AfilNten	The current biotope may be distinguished from AfilNten by the differing abundances of the characterising species *Amphiura filiformis* and *Thyasira flexuosa* in the two biotopes.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Virgularia mirabilis	••	Present	1	5
NEMERTEA	••••	Present	7	30
Pholoe inornata	••	Present	1	24
Glycera rouxii	••	Present	2	6
Goniada maculata	••••	Present	5	10
Nephtys	•••	Present	2	8
Lumbrineris hibernica	••	Present	3	12
Paraonidae	••	Present	2	6
Spiophanes bombyx	••	Present	1	8
Spiophanes kroyeri	••	Present	1	4
Chaetozone setosa	•••	Present	2	8
Diplocirrus glaucus	•••	Present	2	10
Rhodine gracilior	•••	Common	4	20
Scalibregma inflatum	••	Common	1	91
Galathowenia oculata	••	Present	3	11
Owenia fusiformis	••	Common	2	9
Anobothrus gracilis	••	Present	1	5
Terebellides stroemi	••	Present	3	8
Harpinia antennaria	•••	Frequent	3	16
Cylichna cylindracea	•••	Present	2	7
Nuculoma tenuis	•••	Frequent	4	14
Lucinoma borealis	•••	Present	2	4
Thyasira	•	Common	1	80
Thyasira flexuosa	••••	Frequent	12	65
Thyasira flexuosa	•••••	Occasional	50	
Mysella bidentata	•••	Frequent	3	31
Phaxas pellucidus	••	Present	1	6
Abra alba	•••	Present	3	12
Abra alba	•••••	Present	25	
Mya arenaria	•••••	Present	25	
Amphiura filiformis	•••	Abundant	3	15

SS.SMU.CSaMu.AfilNten *Amphiura filiformis* and *Nuculoma tenuis* in circalittoral and offshore sandy mud

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Very weak
Substratum:	Sandy mud
Zone:	Circalittoral
Depth band:	50-100 m

Previous code

part of AfilEcor	97.06

Biotope description

In cohesive and non-cohesive sandy mud, off moderately exposed coasts in deep water dense populations of *Amphiura filiformis* with the bivalve *Nuculoma tenuis* may occur. This biotope together with AfilMysAnit, ThyNten and OfusAfil may be part of the *Amphiura filiformis* dominated infralittoral etage described by Glemarec (1973) and part of the 'off-shore muddy sand association' described by other workers (Jones 1951; Mackie 1990). Other species characteristic of this biotope may include the echinoderms *Ophiura albida* and *Echinocardium flavescens* and the bivalve *Mysella bidentata*. *Phaxas pellucidus*, *Owenia fusiformis* and *Virgularia mirabilis* may also be present. At the sediment surface the hydroid *Sertularia argentea* may be present although only at very low abundances. Variations of this biotope exist in the northern North Sea (see below) and it is possible that more than one entity exists for this biotope.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMU.AfilMysAnit	AfilNten may be distinguished from AfilMysAnit by the abundance of the characterising species *Nuculoma tenuis* in AfilNten and by the importance of other characterising species such as *Thysanocardia procera* and *Nephtys incise* in AfilMysAnit. AfilNten is also generally found at greater depths and may be a deeper water extension of AfilMysAnit.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hydrallmania falcata	●●●	Rare	8	
Sertularia argentea	●●●●	Rare	26	
Obelia longissima	●●●●●	Rare	57	
Virgularia mirabilis	●●●	Abundant	3	32
Diplocirrus glaucus	●●●●	Present	2	35
Ophelina acuminata	●●●	Common	2	39
Scalibregma inflatum	●●●	Present	2	54
Owenia fusiformis	●●●	Common	3	162
Lagis koreni	●●●	Common	2	24
Cylichna cylindracea	●●●	Common	2	31
Antalis entalis	●●●	Frequent	2	41
Nuculoma tenuis	●●●●●	Common	15	160
Mysella bidentata	●●●●	Common	9	239
Phaxas pellucidus	●●●●	Frequent	3	33
Abra nitida	●●●	Present	2	64
Cellaria fistulosa	●●●	Rare	8	
Amphiura filiformis	●●●●●	Super-abundant	22	461
Ophiura albida	●●●●●	Super-abundant	12	234
Echinocardium flavescens	●●●●	Abundant	10	118

SS.SMU.CSaMu.VirOphPmax *Virgularia mirabilis* and *Ophiura* spp. with *Pecten maximus* on circalittoral sandy or shelly mud

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Weak, Very weak
Substratum:	Sandy mud; shelly and gravelly mud
Zone:	Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m

Previous code

CMS.VirOph	97.06

Biotope description

Circalittoral fine sandy mud may contain *Virgularia mirabilis* and *Ophiura* spp. A variety of species may occur, and species composition at a particular site may relate, to some extent, to the proportions of the major sediment size fractions. Several species are common to most sites including *Virgularia mirabilis* which is present in moderate numbers, *Ophiura albida* and *Ophiura ophiura* which are often quite common, and *Pecten maximus* which is usually only present in low numbers. *Virgularia mirabilis* is usually accompanied by occasional *Cerianthus lloydii*, *Liocarcinus depurator* and *Pagurus bernhardus*. *Amphiura chiajei* and *Amphiura filiformis* may occur in some examples of this biotope. Polychaetes and bivalves are generally the main components of the infauna, although the nemerteans, *Edwardsia claparedii*, *Phoronis muelleri* and *Labidoplax buski* may also be widespread. Of the polychaetes *Goniada maculata*, *Nephtys incisa*, *Minuspio cirrifera*, *Chaetozone setosa*, *Notomastus latericeus* and *Owenia fusiformis* are often the most widespread species whilst *Myrtea spinifera*, *Lucinoma borealis*, *Mysella bidentata*, *Abra alba* and *Corbula gibba* are typical bivalves in this biotope. This biotope is primarily identified on the basis of its epifauna and may be an epibiotic overlay over other closely related biotopes such as SpnMeg, AfilMysAnit and AfilNten.

Situation

Such sediments are very common in sealochs, often occurring shallower than the finest mud or in somewhat more exposed parts of the lochs.

Temporal variation

No temporal data available.

Similar biotopes

SMU.SpnMeg	SpnMeg is found on finer muddier sediment and may be characterised by frequent *Nephrops norvegicus* and other megafaunal species.
SMU.VirOphPmax.HAs	VirOphPmax.HAs Greater quantities of stones and shells on the surface give rise to more sessile epibenthic species and distinguish this sub biotope.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Virgularia mirabilis	●●●●●	Frequent	24	
Cerianthus lloydii	●●●●	Occasional	11	
Chaetopterus variopedatus	●●	Occasional	1	
Arenicola marina	●●	Occasional	2	
Terebellidae	●●	Occasional	1	
Lanice conchilega	●●	Occasional	2	
Pagurus bernhardus	●●●	Occasional	7	
Liocarcinus depurator	●●●●	Occasional	6	
Turritella communis	●●	Occasional	3	
Pecten maximus	●●●●	Occasional	6	
Asterias rubens	●●●●	Occasional	11	
Amphiura chiajei	●●	Common	1	
Amphiura filiformis	●●	Common	2	
Ophiura albida	●●●	Frequent	5	
Ophiura ophiura	●●●	Frequent	4	
Echinus esculentus	●●	Rare	1	

SS.SMU.CSaMu.VirOphPmax.HAs *Virgularia mirabilis* and *Ophiura* spp. with *Pecten maximus*, hydroids and ascidians on circalittoral sandy or shelly mud with stones

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Gravely mud; shelly mud; sandy mud with stones or shells
Zone:	Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m, 30-50 m

Previous code

CMS.VirOph.HAs	97.06

Biotope description

Circalittoral fine sandy mud with shell gravel and notable quantities of shells or small stones scattered over the sediment surface. These sediments, like SMU.VirOphPmax, may contain *Virgularia mirabilis, Pecten maximus* and *Ophiura* spp. but shells and small stones scattered over the sediment surface provided sufficient stable substrata for a variety of sessile epifaunal species to occur. Of these the hydroids *Kirchenpaueria pinnata, Nemertesia antennina* and *Nemertesia ramosa* are most common with solitary ascidians such as *Corella parallelogramma* and *Ascidia mentula* also present. The anemone *Cerianthus lloydii* is often found in the sediment together with occasional *Lanice conchilega*. The serpulids *Protula tubularia, Serpula vermicularis* and *Pomatoceros triqueter* and the barnacles *Balanus balanus* and *Balanus crenatus* are also often present on pebbles and shells. *Munida rugosa* are occasionally found under larger stones. All these species are typical of more rocky habitats in such sheltered conditions. As with SMU.VirOphPmax this biotope is primarily identified on the basis of its epifauna and may be an epibiotic overlay over other closely related biotopes such as AfilMysAnit and AfilNten.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMU.SpnMeg	SpnMeg is found on finer muddier sediment and may be characterised by frequent *Nephrops norvegicus* and other megafaunal species.
SMU.PhiVir	VirOphPmax.HAs occurs in more mixed sediments and often slightly deeper water
SMU.VirOphPmax	Greater quantities of stones and shells on the surface give rise to more sessile epibenthic species and distinguish this sub biotope from VirOphPmax.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Halecium halecinum	••	Occasional	1	
Kirchenpaueria pinnata	•••	Occasional	2	
Nemertesia antennina	••	Occasional	2	
Nemertesia ramosa	•••	Occasional	2	
Virgularia mirabilis	••••	Occasional	7	
Cerianthus lloydii	••••	Occasional	7	
Chaetopterus variopedatus	••	Occasional	1	
Lanice conchilega	•••	Occasional	3	
Pomatoceros triqueter	•••	Occasional	3	
Serpula vermicularis	••	Occasional		
Protula tubularia	••	Occasional	1	
Balanus balanus	••	Occasional		
Balanus crenatus	••	Occasional	1	
Pagurus bernhardus	•••	Occasional	6	
Pagurus prideaux	•••	Rare	2	
Munida rugosa	••	Occasional	1	
Inachus dorsettensis	••	Rare	1	
Liocarcinus depurator	•••	Occasional	2	
Turritella communis	••	Occasional	1	
Aporrhais pespelecani	••	Rare	1	
Buccinum undatum	••	Occasional	1	
Pecten maximus	••••	Occasional	8	
Crossaster papposus	••	Rare	1	
Asterias rubens	••••	Occasional	6	
Ophiura albida	•••	Frequent	5	
Ophiura ophiura	••	Occasional	2	
Echinus esculentus	•••	Occasional	4	
Corella parallelogramma	••	Occasional	1	
Ascidia mentula	•••	Occasional		

SS.SMU.CSaMu.LkorPpel *Lagis koreni* and *Phaxas pellucidus* in circalittoral sandy mud

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Strong, Moderately strong, Weak, Very weak
Substratum:	Sandy mud
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m, 30-50 m, 50-100 m

Previous code

None

Biotope description

In stable circalittoral sandy mud dense populations of the tube building polychaete *Lagis koreni* may occur. Other species found in this habitat typically include bivalves such as *Phaxas pellucidus*, *Mysella bidentata* and *Abra alba* and polychaetes such as *Mediomastus fragilis*, *Spiophanes bombyx*, *Owenia fusiformis* and *Scalibregma inflatum*. At the sediment surface easily visible fauna include *Lagis koreni* and *Ophiura ophiura*. *Lagis koreni* is an important source of food for commercially important demersal fish, especially dab and plaice (Macer, 1967; Lockwood, 1980 and Basimi & Grove, 1985).

Situation

No situation data available.

Temporal variation

In some areas e.g. Liverpool Bay, AalbNuc and LkorPpel have exhibited cyclical behaviour with the community periodically switching from one biotope to another - possibly in relation to dredge spoil disposal (Rees *et al.* 1992) along with other environmental and biological factors. Both *Lagis koreni* and *Phaxas pellucidus*, are capable of tolerating sudden increases in the deposition of sediment and often dominate such areas following such an event. Indeed it is likely that the two biotopes are merely different aspects of the same community as *Lagis koreni* is often recorded with high densities of *Abra alba* (Eagle 1975; Rees and Walker 1983). Densities of mature populations of *L. koreni* may exceed 1000m-2 (Eagle, 1975) but the abundance of the species often fluctuates considerably from year to year, presumably due to variations in mortality and recruitment.

Similar biotopes

SSA.AalbNuc	The current biotope is closely related to AalbNuc but tends to occur in muddier substratum

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Cerianthus lloydii	••	Rare	2	
NEMERTEA	•••••	Abundant	5	214
Nereiphylla lutea	••••	Abundant	2	86
Lumbrineris gracilis	••••	Common	2	115
Prionospio ehlersi	•••	Common	1	149
Spio	••••	Frequent	2	70
Spiophanes bombyx	•••••	Common	7	636
Chaetopterus variopedatus	••	Rare	1	
Chaetozone	••••	Common	1	52
Mediomastus fragilis	•••••	Frequent	5	312
Scalibregma inflatum	•••••	Common	3	174
Owenia fusiformis	•••••	Common	3	95
Amphictene auricoma	•••	Common	1	323
Lagis koreni	••••	Present	22	
Lagis koreni	•••••	Abundant	8	882
Lanice conchilega	••	Frequent	8	
Pariambus typicus	•••••	Frequent	2	94
Pseudocuma longicornis	•••	Frequent	1	84
Pagurus bernhardus	••	Frequent	4	
Macropodia rostrata	••	Rare	1	
Corystes cassivelaunus	••	Rare	1	
Liocarcinus depurator	••	Rare	1	
Buccinum undatum	••	Occasional	3	
Nucula nitidosa	••••	Frequent	1	44
Mysella bidentata	•••••	Common	6	1225
Phaxas pellucidus	•••••	Abundant	6	639
Abra alba	•••••	Common	4	441
Phoronis	••••	Common	2	114
Asterias rubens	•••	Occasional	6	
OPHIUROIDEA	••••	Abundant	2	175
Amphiura filiformis	•••	Abundant	1	120
Ophiura albida	••	Common	6	
Ophiura ophiura	•••	Common	20	
Psammechinus miliaris	••	Rare	1	
Echinocardium cordatum	••	Frequent	4	
Callionymus lyra	••	Rare	2	
Pomatoschistus	•••	Frequent	13	
Pleuronectidae	••	Rare	3	

SS.SMU.CFiMu Circalittoral fine mud

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Mud
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m, 30-50 m

Previous code

CMU	97.06

Biotope description

Sublittoral muds, occurring below moderate depths of 15-20 m, either on the open coast or in marine inlets such as sealochs. The seapens *Virgularia mirabilis* and *Pennatula phosphorea* are characteristic of this biotope complex together with the burrowing anemone *Cerianthus lloydii* and the ophiuroid *Amphiura* spp. The relatively stable conditions often lead to the establishment of communities of burrowing megafaunal species, such as *Nephrops norvegicus*.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*	
Funiculina quadrangularis	••	Frequent	2		
Virgularia mirabilis	••••	Frequent	17		
Pennatula phosphorea	•••	Frequent	6		
Cerianthus lloydii	••••	Occasional	10		
Nephtys hystricis	•••	Present	43		95
Chaetozone setosa	•••	Present	21		81
Terebellidae	••	Occasional	2		
Nephrops norvegicus	••••	Frequent	20		
Pagurus bernhardus	•••	Occasional	5		
Munida rugosa	••	Occasional	1		
Liocarcinus depurator	•••	Occasional	6		
Turritella communis	••	Frequent	2		
Mysella bidentata	••	Present	3		45
Abra alba	••	Present	7		57
Asterias rubens	•••	Occasional	7		
Amphiura chiajei	•••	Present	23		51
Amphiura chiajei	••	Common	3		
Amphiura filiformis	••	Common	3		

SS.SMU.CFiMu.SpnMeg Seapens and burrowing megafauna in circalittoral fine mud

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Mud
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m, 30-50 m

Previous code

CMU.SpNep	96.7
CMU.SpMeg	97.06

Biotope description

Plains of fine mud at depths greater than about 15 m may be heavily bioturbated by burrowing megafauna; burrows and mounds may form a prominent feature of the sediment surface with conspicuous populations of seapens, typically *Virgularia mirabilis* and *Pennatula phosphorea*. The burrowing crustacea present typically include *Nephrops norvegicus*, which is frequently recorded from surface observations although grab sampling may fail to sample this species. Indeed, some forms of sampling may also fail to indicate seapens as characterising species. This biotope also seems to occur in deep offshore waters in the North Sea, where densities of *Nephrops norvegicus* may reach 68 per 10 m-2 (see Dyer *et al.* 1982, 1983), and the Irish Sea. The burrowing anemone *Cerianthus lloydii* and the ubiquitous epibenthic scavengers *Asterias rubens*, *Pagurus bernhardus* and *Liocarcinus depurator* are present in low numbers in this biotope whilst the brittlestars *Ophiura albida* and *Ophiura ophiura* are sometimes present, but are much more common in slightly coarser sediments. Low numbers of the anemone *Pachycerianthus multiplicatus* may also be found, and this species, which is scarce in the UK, appears to be restricted to this habitat (Plaza & Sanderson 1997). The infauna may contain significant populations of the polychaetes *Pholoe* spp., *Glycera* spp., *Nephtys* spp., spionids, *Pectinaria belgica* and *Terebellides stroemi*, the bivalves *Nucula sulcata*, *Corbula gibba* and *Thyasira flexuosa*, and the echinoderm *Brissopsis lyrifera*.

Situation

These soft mud habitats occur extensively throughout the more sheltered basins of sealochs and voes and are present in quite shallow depths (as little as 15 m) in these areas probably because they are very sheltered from wave action.

Temporal variation

No temporal data available.

Similar biotopes

SMU.PhiVir	PhiVir is superficially similar to SpnMeg but is found in shallower, less thermally stable waters and lacks the large burrowing species and the sea pen *Pennatula phosphorea*.
SMU.SpnMeg.Fun	In the deeper fjordic lochs which are protected by an entrance sill, the tall seapen *Funiculina quadrangularis* may also be present and distinguishes SpnMeg.Fun from SpnMeg.
SMU.BlyrAchi	SpnMeg is closely allied to BriAchi and may show strong similarities in infaunal species composition. However, epifaunally they differ in the abundance of characterising species such as *Pennatula phosphorea* and *Amphiura* spp.
SMU.MegMax	MegMax is found in similar habitats but has reduced numbers of seapens and a wider range of megafauna.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hydractinia echinata	••	Occasional	1	
Virgularia mirabilis	••••	Frequent	20	
Pennatula phosphorea	•••	Frequent	6	
Cerianthus lloydii	••••	Occasional	13	
Chaetopterus variopedatus	••	Occasional	2	
Nephrops norvegicus	••••	Frequent	18	
Pagurus bernhardus	•••	Occasional	5	
Liocarcinus depurator	•••	Occasional	8	
Turritella communis	••	Frequent	3	
Asterias rubens	••••	Occasional	8	
Amphiura chiajei	••	Common	2	

SS.SMU.CFiMu.SpnMeg.Fun Seapens, including *Funiculina quadrangularis*, and burrowing megafauna in undisturbed circalittoral fine mud

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Mud
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m, 30-50 m
Other features:	Burrows

Previous code

CMU.SpMeg.Fun	97.06

Biotope description

Deep muds, especially in sealochs, support forests of the nationally scarce *Funiculina quadrangularis*, in addition to populations of the seapens *Virgularia mirabilis* and *Pennatula phosphorea*. The sediment is usually extensively burrowed by crustaceans, the most common of which is *Nephrops norvegicus*, but *Calocaris macandreae* and *Callianassa subterranea* may also be present (the latter is likely to be under-recorded by grab sampling because it is deep burrowing). The burrowing anemone *Cerianthus lloydii* is present in low numbers in this biotope and the rare anemone *Pachycerianthus multiplicatus* may also be found occasionally. *Amphiura* spp. are also often present in high densities.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMU.SpnMeg	This biotope is distinguished from SpnMeg by the presence of the nationally scarce seapen *Funiculina quadrangularis*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Funiculina quadrangularis	●●●●●	Frequent	23	
Virgularia mirabilis	●●●●	Occasional	10	
Pennatula phosphorea	●●●●	Frequent	14	
Cerianthus lloydii	●●●●	Occasional	8	
Terebellidae	●●	Occasional	1	
Nephrops norvegicus	●●●●	Frequent	13	
Pagurus bernhardus	●●●	Occasional	3	
Munida rugosa	●●●	Occasional	2	
Liocarcinus depurator	●●●	Occasional	3	
Turritella communis	●●	Frequent	3	
Aequipecten opercularis	●●	Occasional	1	
Asterias rubens	●●●	Occasional	6	
Amphiura filiformis	●●	Abundant	3	

SS.SMU.CFiMu.MegMax Burrowing megafauna and *Maxmuelleria lankesteri* in circalittoral mud

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Mud
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m, 30-50 m, 50-100 m

Previous code

None

Biotope description

In circalittoral stable mud distinctive populations of megafauna may be found. These typically include *Nephrops norvegicus*, *Calocaris macandreae* and *Callianassa subterranea*. Large mounds formed by the echiuran *Maxmuelleria lankesteri* are also frequent in this biotope. The seapen *Virgularia mirabilis* may occur occasionally in this biotope but not in the same abundance as SpnMeg to which MegMax is closely allied. Infaunal species may include *Nephtys hystricis*, *Chaetozone setosa*, *Amphiura chiajei* and *Abra alba*.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMU.SpnMeg	MegMax is found in similar habitats but has reduced numbers of seapens and a wider range of megafauna. It is unclear from the data examined which environmental factors separate these two biotopes although MegMax often occurs in slightly deeper water than SpnMeg.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Virgularia mirabilis	●●●	Occasional	6	
Cerianthus lloydii	●●●	Rare	4	
Maxmuelleria lankesteri	●●●	Frequent	13	
Ophiodromus flexuosus	●	Present	1	18
Nephtys hystricis	●●●	Present	43	95
Chaetozone setosa	●●●	Present	21	81
Nephrops norvegicus	●●●●	Frequent	24	
Calocaris macandreae	●●●	Frequent	15	
Jaxea nocturna	●	Present	1	
Callianassa subterranea	●●●	Present	6	
Pagurus bernhardus	●●●	Present	4	
Liocarcinus depurator	●●●	Present	4	
Carcinus maenas	●●	Present	1	
Buccinum undatum	●●	Present	2	
Mysella bidentata	●●	Present	3	45
Abra alba	●●	Present	7	57
Corbula gibba	●	Present	2	11
Asterias rubens	●●	Rare	2	
Amphiura chiajei	●●●	Present	23	51
Amphiura chiajei	●●	Frequent	2	
Lesueurigobius friesii	●●	Present	2	
Pomatoschistus minutus	●●	Present	2	

SS.SMU.CFiMu.BlyrAchi *Brissopsis lyrifera* and *Amphiura chiajei* in circalittoral mud

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Weak, Very weak
Substratum:	Silty mud
Zone:	Circalittoral
Depth band:	20-30 m, 30-50 m, 50-100 m

Previous code

CMU.BriAchi	97.06

Biotope description

Mud in deep offshore, or shallower stable nearshore, waters can be characterised by the urchin *Brissopsis lyrifera* and the brittle star *Amphiura chiajei*. Where intense benthic dredge fishing activity occurs, populations of the indicator species, *Brissopsis lyrifera* may be depressed, although broken tests may still remain (E.I.S. Rees pers. comm. 1997; M. Costello pers. comm. 1997). Low numbers of the seapen *Virgularia mirabilis* may be found in many examples of this biotope. In addition, in certain areas of the UK such as the northern Irish Sea, this community may also contain *Nephrops norvegicus* and can consequently be the focus for fishing activity (Mackie, Oliver & Rees 1995). Infaunal species in this community are similar to those found in SpnMeg and include the polychaetes *Nephtys hystricis*, *Pectinaria belgica*, *Glycera* spp. and *Lagis koreni* and the bivalves *Myrtea spinifera* and *Nucula sulcata*. This community is the 'Boreal Offshore Mud Association' and '*Brissopsis - Chiajei*' communities described by other workers (Petersen 1918; Jones 1950).

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMU.SpnMeg	SpnMeg is closely allied to BriAchi and may show strong similarities in infaunal species composition. However, epifaunally they differ in the abundance of characterising species such as *Pennatula phosphorea* and *Amphiura* spp.
SMU.AfilMysAnit	This community is similar to AfilMysAnit but tends to occur in deeper and siltier muds. Transitional communities between the two may contain large numbers of *Turritella communis*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Virgularia mirabilis	●●●	Occasional	3	
Nephtys hystricis	●●	Present	1	
Pectinaria belgica	●●●	Present	2	
Amphiura chiajei	●●●●●	Abundant	56	
Amphiura filiformis	●●●●●	Abundant	27	
Ophiura ophiura	●●●	Occasional	3	
Brissopsis lyrifera	●●	Present	2	

SS.SMU.OMu Offshore circalittoral mud

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Not known
Tidal streams:	Weak, Very weak
Substratum:	Mud and sandy mud.
Zone:	Circalittoral
Depth band:	50-100 m

Previous code

part of COS	97.06

Biotope description

In mud and cohesive sandy mud in the offshore circalittoral zone, typically below 50-70 m, a variety of faunal communities may develop, depending upon the level of silt/clay and organic matter in the sediment. Communities are typically dominated by polychaetes but often with high numbers of bivalves such as *Thyasira* spp., echinoderms and foraminifera.

Situation

No situation data available.

Temporal variation

No temporal data available.

SS.SMU.OMu.AfalPova *Ampharete falcata* turf with *Parvicardium ovale* on cohesive muddy sediment near margins of deep stratified seas

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Not known
Tidal streams:	Weak
Substratum:	Cohesive sandy mud
Zone:	Circalittoral
Depth band:	50-100 m

Previous code

COS.AmpPar	97.06

Biotope description

Dense stands of *Ampharete falcata* tubes which protrude from muddy sediments, appearing as a turf or meadow in localised areas. These areas seem to occur on a crucial point on a depositional gradient between areas of tide-swept mobile sands and quiescent stratifying muds. Dense populations of the small bivalve *Parvicardium ovale* occur in the superficial sediment. Other infauna in this diverse biotope includes *Lumbrineris scopa*, *Levinsenia* sp., *Prionospio steenstrupi*, *Diplocirrus glaucus* and *Praxillella affinis* although a wide variety of other infaunal species may also be found. Both the brittlestars *Amphiura filiformis* and *Amphiura chiajei* may be present together with *Nephrops norvegicus* in higher abundance than the BlyrAchi or AfilEcor biotopes. Substantial populations of mobile epifauna such as *Pandalus montagui* and smaller fish also occur, together with those that can cling to the tubes, such as *Macropodia* spp. A similar turf of worm tubes formed by the maldanid polychaete *Melinna cristata* has been recorded from Northumberland (Buchanan 1963). Nephrops trawling may severely damage this biotope and it is possible that such activity has destroyed examples of this biotope in the Irish Sea (E.I.S. Rees pers. comm. 2002).

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMU.AfilNten	This biotope is closely linked to SMU.AfilNten, which also may support *A. falcata* in some areas of the Irish Sea.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Scalibregma inflatum		Abundant		
Amphictene auricoma		Common		
Lagis koreni		Abundant		
Ampharete falcata		Super-abundant		
Pandalus montagui				
Crangon crangon				
Nephrops norvegicus				
Macropodia linaresi				
Goneplax rhomboides		Common		
Nuculoma tenuis		Common		
Mysella bidentata		Common		
Parvicardium ovale		Super-abundant		
Abra nitida		Abundant		
Amphiura chiajei		Super-abundant		
Amphiura filiformis		Abundant		
Brissopsis lyrifera		Abundant		
Agonus cataphractus				
Liparis liparis				

SS.SMU.OMu.ForThy Foraminiferans and *Thyasira* sp. in deep circalittoral fine mud

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Not known
Tidal streams:	Very weak
Substratum:	Soft mud
Zone:	Circalittoral
Depth band:	50-100 m

Previous code

COS.ForThy	97.06

Biotope description

In deep water and soft muds of Boreal and Arctic areas, a community dominated by foraminiferans and the bivalve *Thyasira* sp. (e.g. *T. croulinensis and T. pygmaea*) may occur (Thorson 1957; K nitzer *et al.* 1992). Foraminiferans such as *Saccammina*, *Psammosphaera*, *Haplophragmoides*, *Crithionina* and *Astorhiza* are important components of this community with dead tests numbering thousands per m2 (see Stephen 1923; McIntyre 1961) and sometimes visible from benthic photography (Mackie, Oliver & Rees 1995). It is likely that a community dominated by *Astorhiza* in fine sands in the Irish Sea may be another distinct biotope (E.I.S. Rees pers. comm. 2002). Polychaetes, e.g. *Paraonis gracilis*, *Myriochele heeri*, *Spiophanes kroyeri*, *Tharyx* sp., *Lumbrineris tetraura*, are also important components of this biotope. These communities appear to have no equivalent on the continental plateau further south (Glemarec 1973) but are known from the edge of the Celtic Deep in the Irish Sea (Mackie, Oliver & Rees 1995). The benthos in these offshore areas has been shown to be principally Foraminifera and similar, rich communities may exist in Scottish sealochs (McIntyre 1961). Communities from yet deeper (northern) waters at the extremes of the North Sea may be reminiscent, although dissimilar to ForThy (see Pearson *et al.* 1996) reflecting a higher proportion of silt/clay. A fully Arctic version of this biotope has also been described (Thorson 1934, 1957) although it should be noted that Jones (1950) considered this Boreal foraminiferan community to be part of a 'Boreal Deep Mud Association'.

Situation

This community typically occurs in water deeper than 100 m in the northern North Sea (K nitzer *et al.* 1992) and have been referred to as 'Foraminifera communities' by other workers (e.g. Stephen 1923; Thorson 1957; McIntyre 1961).

Temporal variation

No temporal data available.

Similar biotopes

SMU.BlyrAchi	In shallower water a *Brissopsis*-dominated community (BlyrAchi) may develop
SMU.ThyNten	ThyNten is similar to this biotope in terms of high numbers of *Thyasira* spp. but lacks the foraminiferan component and is generally found at shallower depths.

Characterising species

	% Frequency	Abundance (SACFOR)	%Contribution to similarity	Abundance (nos / m^2)
Foraminifera				
Exogone verugera				
Nephtys				
Aricidea catherinae				
Minuspio cirrifera				
Thyasira				
Thyasira flexuosa				
Amphiura				

SS.SMU.OMu.StyPse *Styela gelatinosa, Pseudamussium septemradiatum* and solitary ascidians on sheltered deep circalittoral muddy sediment

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very sheltered
Tidal streams:	Weak
Substratum:	Mud with terrigenous debris
Zone:	Circalittoral
Depth band:	50-100 m

Previous code

COS.Sty	97.06

Biotope description

This biotope is known only from deep water in Loch Goil (Clyde sealochs) in fine mud at 65 m with terrigenous debris. Large numbers of solitary ascidians, including *Styela gelatinosa*, *Ascidia conchilega*, *Corella parallelogramma* and *Ascidiella* spp., are characteristic of this biotope together with the bivalve *Pseudamussium septemradiatum*. Terebellid worms, the bivalve *Abra alba* and the polychaete *Glycera tridactyla* may also occur. It is possibly an ice age relict biotope.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Glycera tridactyla	●●●●●	Present		
Terebellidae	●●●●●	Frequent		
Pseudamussium septemradiatum	●●●●●	Common		
Abra alba	●●●●●	Occasional		
Paracucumaria hyndmani	●●●●●	Rare		
Corella parallelogramma	●●●●●	Frequent		
Ascidiella aspersa	●●●●●	Frequent		
Ascidiella scabra	●●●●●	Abundant		
Styela gelatinosa	●●●●●	Frequent		

SS.SMU.OMu.CapThy *Capitella capitata* and *Thyasira* spp. in organically-enriched offshore circalittoral mud and sandy mud

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Not known
Tidal streams:	Not known
Substratum:	Mud and sandy mud.
Zone:	Circalittoral

Previous code

None

Biotope description

In circalittoral and deep offshore mud and sandy mud adjacent to oil or gas platforms, organic enrichment from drill cuttings leads to the development of communities dominated by the *Capitella capitata*, an opportunist especially associated with organically enriched and polluted sediments as described for Cap (Warren 1977; Pearson & Rosenberg 1978). The bivalves *Thyasira flexuosa* or *T. sarsi* may also be found in moderate numbers at some sites. Other taxa may be present in low numbers in areas of less severe enrichment including *Pholoe inornata*, *Lagis koreni*, *Philine scabra*, *Anaitides groenlandica*, *Mediomastus fragilis* and *Paramphinome jeffreysii*.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMU.Cap	CapThy is closely related Cap although the latter is found in shallower depths.
SMU.CapThy.Odub	CapThy.Odub is found in sandier sediment and in slightly less polluted areas but is slightly less diverse

SS.SMU.OMu.CapThy.Odub *Capitella capitata, Thyasira* spp. and *Ophryotrocha dubia* in organically-enriched offshore circalittoral sandy mud

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Not known
Tidal streams:	Not known
Substratum:	Sandy mud.
Zone:	Circalittoral

Previous code

None

Biotope description

In deep offshore sandy mud adjacent to oil or gas platforms, organic enrichment from drill cuttings leads to the development of communities dominated by the pollution tolerant opportunist *Capitella capitata* and the polychaete *Ophryotrocha dubia* (or other species of *Ophryotrocha*). These species are generally found in extremely high abundances and accompanied by *Thyasira* spp., *Raricirrus beryli*, *Paramphinome jeffreysii* and *Chaetozone setosa*. Other taxa including *Exogone verugera*, *Pholoe inornata* and *Idasola simpsoni* may also be present.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMU.CapThy	CapThy is found in muddier sediment, in slightly more polluted areas and is slightly more diverse.

SS.SMU.OMu.LevHet *Levinsenia gracilis* and *Heteromastus filifirmis* in offshore circalittoral mud and sandy mud

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Not known
Tidal streams:	Not known
Substratum:	Mud and sandy mud.
Zone:	Circalittoral

Previous code

None

Biotope description

In deep offshore mud and sandy mud a community characterised by the polychaetes *Levinsenia gracilis* and *Heteromastus filiformis* may occur. Other important taxa may include *Paramphinome jeffreysii*, *Nephtys hystricis* and *N. incisa*, *Spiophanes kroyeri*, *Orbinia norvegica*, *Terebellides stroemi*, *Thyasira gouldi* and *T. equalis*. Burrowing megafauna such as *Calocaris macandreae* may also be found in this biotope. This biotope has been found in the central and northern North Sea. A similar community, dominated by *L. gracilis* but accompanied by *Glycera* spp. (particularly *Glycera rouxii*) and *Monticellina dorsobranchialis*, has also been reported from the Irish Sea. This Irish community also contains *Calocaris macandreae*, *Mediomastus fragilis*, *Tubificoides amplivasatus*, *Nephtys incisa*, *Ancistrosyllis groenlandica*, *Nucula sulcata*, *Litocorsa stremma* and *Minuspio* sp. and it is not known at present whether this represents a separate biotope or whether it is a geographic variant of a wider *Levinsenia* biotope.

Situation

This biotope has been found in the central and northern North Sea and may also occur in the Irish Sea

Temporal variation

No temporal data available.

SS.SMU.OMu.PjefThyAfil *Paramphinome jeffreysii, Thyasira* spp. and *Amphiura filiformis* in offshore circalittoral sandy mud

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Not known
Tidal streams:	Not known
Substratum:	Sandy mud.
Zone:	Circalittoral

Previous code

None

Biotope description

Deep, offshore cohesive sandy mud communities characterised by the polychaete *Paramphinome jeffreysii*, bivalves such as *Thyasira equalis* and *T. gouldi* and the brittlestar *Amphiura filiformis*. Other taxa may include Laonice cirrata, the sea cucumber Labidoplax buski and the polychaetes *Goniada maculata*, *Spiophanes kroyeri* and *Aricidea catherinae*. *Amphiura chiajei* may be occasional in this biotope as may *Philine scabra*, *Levinsenia gracilis* and *Pholoe inornata*. This biotope along with SMU.ThyNten, SMU.AfilMysAnit, SMU.AfilNten and SSA.OfusAfil, may comprise the *Amphiura* dominated components of the 'off-shore muddy sand association' (Jones 1951; Mackie 1990) and the infralittoral etage described by Glemarec (1973).

Situation

No situation data available.

Temporal variation

No temporal data available.

SS.SMU.OMu.MyrPo *Myrtea spinifera* and polychaetes in offshore circalittoral sandy mud

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Not known
Tidal streams:	Not known
Substratum:	Sandy mud.
Zone:	Circalittoral

Previous code

None

Biotope description

Deep, offshore habitats with cohesive sandy mud (>20% mud) may support communities characterised by infaunal polychaetes and the bivalve *Myrtea spinifera*. Polychaetes typically include *Chaetozone setosa*, *Paramphinome jeffreysii*, *Levinsenia gracilis*, *Aricidea catherinae* and *Prionospio malmgreni*. The bivalves *Thyasira* spp. and *Abra nitida* may also be found as may seapens, such as *Pennatula phosphorea*. Some examples of the biotope AfilNten contain *Myrtea spinifera* (Mackie 1990) in lower numbers but these habitats are generally sandier than those in MyrPo.

Situation

This biotope has been recorded in the northern North Sea but may also exist in the Irish Sea.

Temporal variation

No temporal data available.

SS.SMX Sublittoral mixed sediment

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt), Reduced (18-30ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered, Ultra sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Mixed sediments.
Zone:	Infralittoral, Circalittoral
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m, 30-50 m

Previous code

IMX in part	97.06
CMX in part	97.06

Biotope description

Sublittoral mixed (heterogeneous) sediments found from the extreme low water mark to deep offshore circalittoral habitats. These habitats incorporate a range of sediments including heterogeneous muddy gravelly sands and also mosaics of cobbles and pebbles embedded in or lying upon sand, gravel or mud. There is a degree of confusion with regard nomenclature within this complex as many habitats could be defined as containing mixed sediments, in part depending on the scale of the survey and the sampling method employed. The BGS trigon can be used to define truly mixed or heterogeneous sites with surficial sediments which are a mixture of mud, gravel and sand. However, another 'form' of mixed sediment includes mosaic habitats such as superficial waves or ribbons of sand on a gravel bed or areas of lag deposits with cobbles/pebbles embedded in sand or mud and these are less well defined and may overlap into other habitat or biotope complexes. These habitats may support a wide range of infauna and epibiota including polychaetes, bivalves, echinoderms, anemones, hydroids and Bryozoa. Mixed sediments with biogenic reefs or macrophyte dominated communities are classified separately in the SBR and SMP habitat complexes respectively.

Situation

No situation data available.

Temporal variation

No temporal data available.

SS.SMX.SMxLS Sublittoral mixed sediment in low or reduced salinity (lagoons)

Habitat classification

Salinity:	Low (<18ppt)
Wave exposure:	Ultra sheltered
Tidal streams:	Weak
Substratum:	Muddy mixed sediment
Zone:	Sublittoral fringe, Infralittoral
Depth band:	0-5 m

Previous code

None

Biotope description

Shallow, muddy mixed sediments in areas of low or reduced, although stable, salinity (may vary annually) with largely ephemeral faunal communities. Characterised infaunally by oligochaetes, including *Heterochaeta costata* and members of the Enchytraeidae, polychaetes such as *Hediste diversicolor*, *Polydora ciliata* and *Pygospio elegans*,and bivalves such as *Mya arenaria* and the lagoon cockle *Cerastoderma glaucum*. These bivalve species may also form conspicuious members of the epifauna together with more ubiquitous species like the common goby *Pomatoschistus microps*.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hediste diversicolor	●●●●●	Frequent	31	
Hediste diversicolor	●●●●	Super-abundant	25	1110
Polydora ciliata	●●●	Abundant	3	440
Pygospio elegans	●●●	Common	5	555
Alkmaria romijni	●●	Rare	2	
Heterochaeta costata	●●●●	Frequent	17	
Heterochaeta costata	●●●●	Abundant	20	1730
Enchytraeidae	●●●●	Abundant	34	2075
Neomysis integer	●●	Rare	2	
Corophium volutator	●●●	Present	1	3910
Sphaeroma hookeri	●●	Occasional	2	
Palaemonetes varians	●●	Occasional	3	
Chironomida	●●●●	Occasional	16	
Hydrobia ulvae	●●	Rare	1	
Hydrobia ulvae	●●●	Common	4	255
Cerastoderma glaucum	●●	Common	6	
Cerastoderma glaucum	●●●	Common	3	65
Mya arenaria	●●●	Super-abundant	6	720
Mya arenaria	●●●	Rare	4	
Pomatoschistus microps	●●●	Common	14	
Cladophora	●●	Rare	1	

SS.SMX.SMxVS Sublittoral mixed sediment in variable salinity (estuaries)

Habitat classification

Salinity:	Variable (18-35ppt), Reduced/low (0.5-30ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Muddy gravelly mixed sediment with stones and shells
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m

Previous code

IMX.EstMx	97.06

Biotope description

Shallow sublittoral mixed sediments in estuarine conditions, often with surface shells or stones, enabling the development of diverse epifaunal communities, e.g. *Crepidula fornicata* (IMX.CreAph), as well as infaunal communities. This biotope complex is therefore often quite species rich, compared with purer sediments.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Lepidonotus squamatus	●●●	Present	1	14
Eteone longa	●●●	Present	1	9
Exogone naidina	●●●	Frequent	2	169
Sphaerosyllis	●●	Frequent	2	106
Nephtys hombergii	●●●●	Common	6	34
Scoloplos armiger	●●●	Common	2	19
Polydora ciliata	●●●	Abundant	5	131
Caulleriella zetlandica	●●	Common	3	131
Aphelochaeta marioni	●●●●	Common	22	955
Capitella capitata	●●●	Frequent	1	49
Mediomastus fragilis	●●●●	Frequent	6	220
Melinna palmata	●●●	Common	2	49
Tubificoides	●●	Frequent	1	64
Tubificoides benedii	●●●	Common	3	136
Tubificoides swirencoides	●●	Common	1	358
CIRRIPEDIA	●●	Common	7	
Carcinus maenas	●●	Occasional	7	
Crepidula fornicata	●●●●	Frequent	58	
Crepidula fornicata	●●●●	Abundant	5	136
Cardiidae	●●	Present	20	
Abra alba	●●	Common	1	23
Abra nitida	●●	Common	1	31

SS.SMX.SMxVS.AphPol *Aphelochaeta* spp. and *Polydora* spp. in variable salinity infralittoral mixed sediment

Habitat classification

Salinity:	Variable (18-35ppt), Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong, Weak
Substratum:	Sandy gravelly muddy mixed sediment
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m

Previous code

IMX.PolMtru	97.06

Biotope description

In sheltered muddy mixed sediments in estuaries or marine inlets with variable or reduced/low salinity communities characterised by *Aphelochaeta marioni* and *Polydora ciliata* may be present. Other important taxa may include the polychaetes *Nephtys hombergii*, *Caulleriella zetlandica* and *Melinna palmata*, tubificid oligochaetes and bivalves such as *Abra nitida*. Conspicuous epifauna may include members of the bivalve family Cardiidae (cockles) and the slipper limpet *Crepidula fornicata*. This biotope is often found in polyhaline waters.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMU.AphTubi	In areas of mixed sediment, where *A. marioni* occurs in high numbers, it may be difficult to separate AphTubi from AphPol, requiring classification on sediment characteristics and associated species in addition to the abundance of *A. marioni*.
SMU.PolCvol	PolCvol is similar to AphPol but occurs in muddier estuarine conditions.
SMX.CreMed	CreMed may be distinguished from AphPol by the abundance of *C. fornicata* and its sediment characteristics. AphPol may also be found in reduced salinity conditions.
SMU.MelMagThy	As salinity increases AphPol may grade into MelMagThy with those species characteristic of the latter increasing in abundance.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
POLYCHAETA	•		4	
Harmothoe	•••	Common	2	15
Eteone longa	•••	Frequent	2	14
Hediste diversicolor	•••	Present	1	19
Nephtys hombergii	••••	Common	8	30
Scoloplos armiger	••	Present	1	8
Polydora ciliata	••••	Abundant	10	238
Pygospio elegans	••	Frequent	1	17
Streblospio shrubsolii	••	Present	2	56
Caulleriella zetlandica	•••	Common	5	180
Aphelochaeta marioni	•••••	Common	33	975
Capitella capitata	•••	Occasional	1	13
Mediomastus fragilis	•••	Present	2	84
Melinna palmata	••	Common	4	43
Ampharete	••	Common	1	19
Lanice conchilega	••	Frequent	1	11
Tubifex	••	Frequent	2	72
Tubificoides	•••	Frequent	3	111
CIRRIPEDIA	••	Common	14	
Carcinus maenas	•	Present	3	
Crepidula fornicata	•••	Present	27	
Cardiidae	•••	Present	50	
Cerastoderma edule	•••	Present	1	26
Abra nitida	•••	Common	3	62

SS.SMX.SMxVS.CreMed *Crepidula fornicata* and *Mediomastus fragilis* in variable salinity infralittoral mixed sediment

Habitat classification

Salinity:	Variable (18-35ppt)
Wave exposure:	Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Mixed muddy sediment
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

IMX.CreAph	97.06

Biotope description

Variable salinity mixed sediment characterised by the slipper limpet *Crepidula fornicata* and the polychaetes *Mediomastus fragilis* and *Aphelochaeta marioni*. Other numerically important taxa include the oligochaetes *Tubificoides benedii*, syllids such as *Exogone naidina* and *Sphaerosyllis*, and *Nephtys hombergii*. *Lepidonotus squamatus* and *Scoloplos armiger* may also be common. Shell debris and cobbles are colonised by the ascidians *Ascidiella aspersa*, *Ascidiella scabra*, *Molgula* sp. and *Dendrodoa grossularia* (the ascidians may not be recorded adequately by remote infaunal survey techniques).

Situation

This biotope occurs in the lower estuary where currents allow a stable environment to develop. It is associated with oyster beds and relict oyster beds, (Ost) in southern England and Wales. It may be found adjacent to or in conjunction with AphTubi and AphPol. It may be associated with VsenAsquAps and possibly form a component of SundAasp.

Temporal variation

No temporal data available.

Similar biotopes

SMX.CreAsAn	CreAsAn is found in more exposed marine areas with a lower silt content and in fully marine conditions
SMU.AphTubi	CreMed It may be separated from AphTubi by the relative abundances of the slipper limpet *Crepidula fornicata* in addition to *A. marioni*.
SMX.AphPol	CreMed may be distinguished from AphPol by the abundance of *C. fornicata* and its sediment characteristics

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
HYDROZOA	••	Present	5	
Harmothoe impar	•••	Common	2	18
Lepidonotus squamatus	••••	Common	2	21
Exogone naidina	••••	Frequent	4	288
Sphaerosyllis	••••	Frequent	4	183
Nephtys	•••	Common	2	29
Nephtys hombergii	••••	Common	3	36
Scoloplos armiger	••••	Abundant	2	28
Polydora ciliata	••	Common	2	53
Tharyx killariensis	••	Frequent	1	89
Caulleriella zetlandica	••	Frequent	1	95
Cirriformia tentaculata	••	Common	1	37
Aphelochaeta marioni	••••	Common	11	940
Capitella capitata	•••	Frequent	1	75
Mediomastus fragilis	••••	Common	8	320
Melinna palmata	•••	Common	1	54
Tubificoides benedii	••••	Common	7	219
Tubificoides pseudogaster	••	Frequent	1	91
Tubificoides swirencoides	••	Common	2	588
Carcinus maenas	••	Occasional	7	
Carcinus maenas	•••	Abundant	1	12
Crepidula fornicata	•••••	Common	85	
Crepidula fornicata	•••••	Abundant	11	234
Abra alba	••	Common	1	33

SS.SMX.IMx Infralittoral mixed sediment

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Mixed sediment
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m

Previous code

IMX.FaMx	97.06

Biotope description

Shallow mixed (heterogeneous) sediments in fully marine or near fully marine conditions, supporting various animal-dominated communities, with relatively low proportions of seaweeds. This habitat may include well mixed muddy gravelly sands or very poorly sorted mosaics of shell, cobbles and pebbles embedded in mud, sand or gravel. Due to the quite variable nature of the sediment type, a widely variable array of communities may be found, including those characterised by bivalves (SMX.VsenAsquAps, SMX.CreAsAn, and SMX.Ost), polychaetes (SMX.SpavSpAn) and file shells (SMX.Lim). This has resulted in many species being described as characteristic of this biotope complex all contributing only a small percentage to the overall similarity (see below). This biotope complex may also include a newly proposed *Chaetopterus* biotope (Rees pers com.) recently found in the eastern English Channel. This biotope is characterised by an undescribed *Chaetopterus* sp. and small *Lanice conchilega*. Further sampling is need in order to assess and fully characterise this potential biotope. As a result, the *Chaetopterus* biotope has not been included in this revision. Infaunal data for this biotope complex are limited to that described in the biotope SMX.VsenAsquAps and so are not representative of the infaunal component of the whole biotope complex.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Esperiopsis fucorum	••	Occasional	2	
Hydrallmania falcata	••	Occasional	2	
Alcyonium digitatum	••	Occasional	3	
Cerianthus lloydii	••	Occasional	2	
Urticina felina	•••	Occasional	5	
NEMERTEA	•••••	Common	3	288
NEMATODA	••••	Frequent	2	57
Anaitides mucosa	••••	Common	1	78
Syllidia armata	••••	Common	3	731
Sphaerosyllis hystrix	•••	Frequent	1	39
Caulleriella alata	•••	Common	2	120
Chaetozone gibber	•••	Common	3	582
Aphelochaeta marioni	••••	Common	4	2002
Mediomastus fragilis	•••••	Common	5	675
Notomastus latericeus	••••	Frequent	1	85
Melinna palmata	••••	Abundant	3	1210
Amphicteis gunneri	•••	Abundant	2	276
Lanice conchilega	••	Occasional	3	
Sabella pavonina	••	Common	7	
Pomatoceros lamarcki	•••	Common	2	178
Pomatoceros triqueter	••	Occasional	1	
Tubificoides benedii	••••	Common	2	500
Tubificoides swirencoides	•••	Common	2	385
Metaphoxus pectinatus	•••	Common	1	102
Abludomelita gladiosa	•••	Frequent	1	153
Gammarella fucicola	••••	Frequent	2	578
Maera grossimana	••••	Common	3	228
Corophium sextonae	••••	Common	3	961
Janira maculosa	••••	Frequent	1	260
Apseudes latreillii	•••••	Common	7	2520
Paguridae	••	Occasional	3	
Pagurus bernhardus	••	Occasional	3	
Hyas araneus	••	Occasional	1	
Cancer pagurus	••	Rare	1	
Necora puber	••	Occasional	1	
Carcinus maenas	••	Occasional	1	
Calliostoma zizyphinum	••	Rare	1	
Calyptraea chinensis	•••••	Common	5	351
Crepidula fornicata	•••	Common	20	
Buccinum undatum	•••	Occasional	5	
Limaria hians	••	Abundant	2	
Ostrea edulis	•	Occasional	1	
Tellimya ferruginosa	••••	Frequent	2	73
Venerupis senegalensis	•••••	Abundant	2	56
Asterias rubens	••	Occasional	3	
Ophiothrix fragilis	••	Occasional	2	
Ascidiella aspersa	••	Frequent	2	
Styela clava	••	Occasional	3	

SS.SMX.IMx.CreAsAn *Crepidula fornicata* with ascidians and anemones on infralittoral coarse mixed sediment

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Moderately strong
Substratum:	Medium-coarse sands with gravel, shell, pebbles and cobbles
Zone:	Circalittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

part of CreAph	97.06

Biotope description

Medium-coarse sands with gravel, shells, pebbles and cobbles on moderately exposed coasts may support populations of the slipper limpet *Crepidula fornicata* with ascidians and anemones. *C. fornicata* is common in this biotope though not as abundant as in the muddier estuarine biotope CreMed to which this is related. Anemones such as *Urticina felina* and *Alcyonium digitatum* and ascidians such as *Styela clava* are typically found in this biotope. Bryozoans such as *Flustra foliacea* are also found along with polychaetes such as *Lanice conchilega*. Little information is available with regard the infauna of this biotope but given the nature of the sediment the infaunal communities are liable to resemble those in biotopes from the SCS habitat complex. As with FluHyd this biotope could be considered a superficial or epibiotic overlay but more data is required to support this.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMX.CreMed	CreMed is found in less exposed marine areas, in particular estuaries, with a lower silt content and variable salinity.
SMX.FluHyd	FluHyd is found in deeper water in slightly more exposed areas with a higher proportion of cobbles and pebbles and in slightly stronger currents

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
HYDROZOA	••	Present	1	
Alcyonium digitatum	••	Occasional	3	
Anemonia viridis	••	Occasional	1	
Urticina felina	•••	Occasional	5	
Lanice conchilega	••	Occasional	3	
Pomatoceros	••	Occasional	1	
Paguridae	•••	Frequent	8	
Maja squinado	••	Rare	2	
Calliostoma zizyphinum	••	Occasional	2	
Crepidula fornicata	•••••	Common	47	
Buccinum undatum	••	Occasional	1	
Ostrea edulis	••	Rare	1	
Flustra foliacea	••	Frequent	3	
Styela clava	•••	Occasional	6	
Pomatoschistus	••	Occasional	1	
Foliose red algae	••	Present	1	

SS.SMX.IMx.SpavSpAn *Sabella pavonina* with sponges and anemones on infralittoral mixed sediment

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Strong, Moderately strong
Substratum:	Muddy gravelly sand with pebbles
Zone:	Circalittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

None

Biotope description

Muddy gravelly sand with pebbles off shallow, sheltered or moderately exposed coasts or embayments may support dense populations of the peacock worm *Sabella pavonina*. This community may also support populations of sponges such as *Esperiopsis fucorum*, *Haliclona oculata* and *Halichondria panicea* and anemones such as *Sagartia elegans*, *Cerianthus lloydii* and *Urticina felina*. Hydroids such as *Hydrallmania falcata* and the encrusting polychaete *Pomatoceros triqueter* are also important. This biotope may have an extremely diverse epifaunal community. Less is known about its infaunal component, although it is likely to include polychaetes such as Nephtys spp., *Harmothoe* spp., *Glycera* spp., syllid and cirratulid polychaetes, bivalves such as *Abra* spp., Aoridae amphipods and brittlestars such as *Amphipholis squamata*.

Situation

No sitautaion data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Halichondria panicea	●●●	Common	3	
Esperiopsis fucorum	●●●	Occasional	2	
Haliclona oculata	●●●	Occasional	2	
Hydrallmania falcata	●●●●	Occasional	4	
Cerianthus lloydii	●●●	Occasional	2	
Urticina felina	●●●	Occasional	1	
Sagartia elegans	●●●	Occasional	4	
Lanice conchilega	●●●	Occasional	3	
Sabella pavonina	●●●●●	Abundant	36	
Pomatoceros triqueter	●●●	Occasional	3	
Pagurus bernhardus	●●●	Frequent	5	
Hyas araneus	●●●	Occasional	2	
Liocarcinus depurator	●●●	Occasional	3	
Carcinus maenas	●●●●	Occasional	5	
Buccinum undatum	●●●	Occasional	2	
Alcyonidium diaphanum	●●●	Occasional	2	
Asterias rubens	●●●●	Occasional	6	
Ophiothrix fragilis	●●	Occasional	2	
Diplosoma spongiforme	●●●	Occasional	1	
Ascidiella scabra	●●●	Occasional	2	
Dendrodoa grossularia	●●●	Occasional	1	

SS.SMX.IMx.VsenAsquAps *Venerupis senegalensis, Amphipholis squamata* and *Apseudes latreilli* in infralittoral mixed sediment

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong, Weak
Substratum:	Muddy sandy gravel and pebbles
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m

Previous code

IMX.VsenMtru	97.06

Biotope description

Sheltered muddy sandy gravel and pebbles in marine inlets, estuaries or embayments with variable salinity or fully marine conditions, support large populations of the pullet carpet shell *Venerupis senegalensis* with the brittlestar *Amphipholis squamata* and the tanaid *Apseudes latreilli*. This biotope may be found at a range of depths from 5m to 30m although populations of *V. senegalensis* may also be found on the low shore. Other common species within this biotope include the gastropod *Calyptraea chinensis*, a range of amphipod crustacea such as *Corophium sextonae* and *Maera grossimana* and polychaetes such as *Mediomastus fragilis, Melinna palmata, Aphelochaeta marioni, Syllids* and tubificid oligochaetes. Many of the available records for this biotope are from southern inlets and estuaries such as Plymouth Sound and Milford Haven but *V. senegalensis* has a much wider distribution and it should be noted that northern versions of this biotope may a have a much lower species diversity than reported here.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
NEMERTEA	●●●●●	Common	3	288
NEMATODA	●●●●	Frequent	2	57
Anaitides mucosa	●●●●	Common	1	78
Syllidia armata	●●●●	Common	3	731
Sphaerosyllis hystrix	●●●	Frequent	1	39
Caulleriella alata	●●●	Common	2	120
Chaetozone gibber	●●●	Common	3	582
Aphelochaeta marioni	●●●●	Common	4	2002
Mediomastus fragilis	●●●●●	Common	5	675
Notomastus latericeus	●●●●	Frequent	1	85
Melinna palmata	●●●●	Abundant	3	1210
Amphicteis gunneri	●●●	Abundant	2	276
Pomatoceros lamarcki	●●●	Common	2	178
Tubificoides benedii	●●●●	Common	2	500
Tubificoides swirencoides	●●●	Common	2	385
Metaphoxus pectinatus	●●●	Common	1	102
Abludomelita gladiosa	●●●	Frequent	1	153
Gammarella fucicola	●●●●	Frequent	2	578
Maera grossimana	●●●●	Common	3	228
Corophium sextonae	●●●●	Common	3	961
Janira maculosa	●●●●	Frequent	1	260
Apseudes latreillii	●●●●●	Common	7	2520
Calyptraea chinensis	●●●●●	Common	5	351
Tellimya ferruginosa	●●●●	Frequent	2	73
Venerupis senegalensis	●●●●●	Abundant	2	56
Amphipholis squamata	●●●●●	Super-abundant	4	377

SS.SMX.IMx.Lim *Limaria hians* beds in tide-swept sublittoral muddy mixed sediment

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Mixed muddy sandy gravel
Zone:	Infralittoral - lower, Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m
Other features:	Consolidated bed formed from byssus-bound debris

Previous code

IMX.Lim	97.06

Biotope description

Mixed muddy gravel and sand often in tide-swept narrows in the entrances or sills of sealochs with beds or 'nests' of *Limaria hians*. The *Limaria* form woven 'nests' or galleries from byssus and fragments of seaweeds so that the animals themselves cannot be seen from above the seabed. *Modiolus modiolus* sometimes occur at the same sites lying over the top of the *Limaria* bed. Other fauna associated with this biotope include echinoderms (*Ophiothrix fragilis*, *Ophiocomina nigra* and *Asterias rubens*), *Buccinum undatum*, mobile crustaceans (e.g. *Pagurus bernhardus*), *Alcyonium digitatum* and hydroids such as *Plumularia setacea*, *Kirchenpaueria pinnata* and *Nemertesia* spp. Sometimes red seaweeds such as *Phycodrys rubens* occur if the beds are in shallow enough water.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SCS.Nmix	Lim is found in muddier, more sheltered conditions in similar depths
SMP.Lgla	Lim is sometimes found amongst maerl gravels but is deeper than Lgla

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Kirchenpaueria pinnata	●●●	Occasional		
Nemertesia antennina	●●	Frequent		
Nemertesia ramosa	●●	Frequent		
Alcyonium digitatum	●●●●	Rare		5
Pomatoceros triqueter	●●	Occasional		1
Pagurus bernhardus	●●●	Occasional		3
Munida rugosa	●●	Occasional		1
Hyas araneus	●●●	Occasional		2
Cancer pagurus	●●●	Occasional		2
Necora puber	●●	Present		1
Buccinum undatum	●●●●	Occasional		6
Modiolus modiolus	●●●	Occasional		3
Limaria hians	●●●●●	Abundant		24
Aequipecten opercularis	●●	Occasional		1
Pecten maximus	●●●	Rare		2
Asterias rubens	●●●●	Occasional		4
Ophiothrix fragilis	●●●●●	Common		11
Ophiocomina nigra	●●●	Common		5
Psammechinus miliaris	●●	Present		2
Echinus esculentus	●●●	Occasional		2

SS.SMX.IMx.Ost *Ostrea edulis* beds on shallow sublittoral muddy mixed sediment

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Sandy mud with some shells and occasionally gravel
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

IMX.Ost	97.06

Biotope description

Dense beds of the oyster *Ostrea edulis* can occur on muddy fine sand or sandy mud mixed sediments. There may be considerable quantities of dead oyster shell making up a substantial portion of the substratum. The clumps of dead shells and oysters can support large numbers of *Ascidiella aspersa* and *Ascidiella scabra*. Sponges such as *Halichondria bowerbanki* may also be present. Several conspicuously large polychaetes, such as *Chaetopterus variopedatus* and terebellids, as well as additional suspension-feeding polychaetes such as *Myxicola infundibulum* and *Sabella pavonina* may be important in distinguishing this biotope, whilst the Opisthobranch *Philine aperta* may also be frequent in some areas. A turf of seaweeds such as *Plocamium cartilagineum*, *Nitophyllum punctatum* and *Spyridia filamentosa* may also be present. This biotope description may need expansion to account for oyster beds in England.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Cliona celata	●●●	Occasional	1	
Halichondria bowerbanki	●●●●	Occasional	4	
Esperiopsis fucorum	●●●	Occasional	3	
Chaetopterus variopedatus	●●●●●	Occasional	5	
Terebellidae	●●●	Frequent	4	
Myxicola infundibulum	●●●	Frequent	4	
Sabella pavonina	●●●	Common	5	
Pomatoceros triqueter	●●●	Occasional	1	
Balanus crenatus	●●●	Occasional	1	
Pagurus bernhardus	●●●●	Occasional	5	
Philine aperta	●●●	Frequent	2	
Ostrea edulis	●●●●●	Common	16	
Aplidium punctum	●●●●	Occasional	4	
Ascidiella aspersa	●●●●	Frequent	8	
Ascidiella scabra	●●●	Frequent	3	
Corallinaceae	●●●	Frequent	1	
Plocamium cartilagineum	●●●●	Frequent	5	
Lomentaria clavellosa	●●●	Rare	1	
Compsothamnion thuyoides	●●●	Occasional	1	
Spyridia filamentosa	●●●	Frequent	4	
Nitophyllum punctatum	●●●	Occasional	3	
Polysiphonia elongata	●●●	Occasional	1	
Dictyota dichotoma	●●●	Occasional	2	
Laminaria saccharina	●●●	Rare	2	

SS.SMX.CMx Circalittoral mixed sediment

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Mixed sediment (with stones and shells)
Zone:	Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m, 30-50 m

Previous code

CMX	97.06

Biotope description

Mixed (heterogeneous) sediment habitats in the circalittoral zone (generally below 15-20m) including well mixed muddy gravelly sands or very poorly sorted mosaics of shell, cobbles and pebbles embedded in or lying upon mud, sand or gravel. Due to the variable nature of the seabed a variety of communities can develop which are often very diverse. A wide range of infaunal polychaetes, bivalves, echinoderms and burrowing anemones such as Cerianthus lloydii are often present in such habitat and the presence of hard substrata (shells and stones) on the surface enables epifaunal species to become established, particularly hydroids such as *Nemertesia* spp and *Hydrallmania falcata*. The combination of epifauna and infauna can lead to species rich communities. Coarser mixed sediment communities may show a strong resemblance, in terms of infauna, to biotopes within the SCS complex. However, infaunal data for this biotope complex is limited to that described under the biotope MysThyMx, and so are not representative of the infaunal component of this biotope complex.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Nemertesia antennina	••	Occasional		
Nemertesia ramosa	••	Occasional		
Hydrallmania falcata	•	Occasional		
Alcyonium digitatum	••	Occasional		
Cerianthus lloydii	•••	Frequent		
Urticina felina	••	Occasional		
NEMERTEA	••••	Common	2	31
NEMATODA	••••	Frequent	3	480
Pholoe inornata	••••	Frequent	2	103
Glycera alba	•••	Abundant	1	23
Goniada maculata	••••	Common	2	27
Nephtys	•••	Common	1	38
Nephtys hombergii	••••	Common	2	38
Lumbrineris gracilis	•••••	Common	4	155
Scoloplos armiger	•••••	Abundant	3	90
Levinsenia gracilis	•••	Common	1	67
Prionospio fallax	••••	Abundant	8	492
Spiophanes bombyx	••••	Frequent	2	75
Chaetozone setosa	•••••	Common	4	141
Mediomastus fragilis	•••	Common	2	147
Scalibregma inflatum	••••	Common	2	65
Galathowenia oculata	•••	Frequent	1	74
Owenia fusiformis	••••	Common	2	29
Terebellides stroemi	••••	Abundant	2	32
Terebellidae	••	Occasional		
Lanice conchilega	••	Occasional		
Pomatoceros triqueter	••	Occasional		
Ampelisca tenuicornis	••••	Frequent	2	111
Eudorella truncatula	•••	Abundant	1	37
Pagurus bernhardus	•••	Occasional		
Liocarcinus depurator	••	Occasional		
Buccinum undatum	••	Occasional		
Modiolus modiolus	••	Occasional		
Pecten maximus	••	Occasional		
Thyasira flexuosa	•••••	Common	7	375
Mysella bidentata	•••••	Frequent	5	249
Phaxas pellucidus	•••	Common	1	28
Abra alba	•••	Common	2	191
Chamelea gallina	••••	Common	2	44
Flustra foliacea	•	Occasional		
Phoronis	•••	Common	2	149
Crossaster papposus	••	Rare		
Asterias rubens	••••	Occasional		
Ophiothrix fragilis	••	Common		
Ophiocomina nigra	••	Frequent		
Amphiura filiformis	•••	Abundant	1	86
Ophiura albida	••	Frequent		
Echinus esculentus	••	Occasional		
Thyone fusus	••	Occasional		
Psolus phantapus	••	Occasional		
Corallinaceae	••	Occasional		

SS.SMX.CMx.ClloMx *Cerianthus lloydii* and other burrowing anemones in circalittoral muddy mixed sediment

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Sandy muddy gravel
Zone:	Infralittoral, Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m

Previous code

IMX.An	97.06

Biotope description

Circalittoral plains of sandy muddy gravel may be characterised by burrowing anemones such as *Cerianthus lloydii*. Other burrowing anemones such as *Cereus pedunculatus*, *Mesacmaea mitchellii* and *Aureliania heterocera* may be locally abundant. Relatively few conspicuous species are found in any great number in this biotope but typically they include ubiquitous epifauna such as *Asterias rubens*, *Pagurus bernhardus* and *Liocarcinus depurator* with occasional terebellid polychaetes such as *Lanice conchilega* and also the clam *Pecten maximus*. *Ophiura albida* may be frequent in some areas, and where surface shell or stones are present ascidians such as *Ascidiella aspersa* may occur in low numbers.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMX.ClloModHo	The current biotope is closely related to ClloModHo but lacks *Modiolus* and holothurians.
SMX.ClloMx.Nem	In areas of similar sediment but with a higher proportion of surface pebbles, cobbles and shells ClloMx is replaced by SMX.ClloMx.Nem

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Cerianthus lloydii	●●●●●	Frequent	59	
Urticina felina	●	Occasional	1	
Terebellidae	●●	Occasional	1	
Lanice conchilega	●●	Occasional	3	
Pagurus bernhardus	●●●	Occasional	5	
Liocarcinus depurator	●●	Frequent	4	
Pecten maximus	●●	Occasional	2	
Asterias rubens	●●●	Occasional	8	
Ophiura albida	●●	Frequent	1	
Ascidiella aspersa	●●	Occasional	1	
Callionymus lyra	●●	Occasional	1	

SS.SMX.CMx.ClloMx.Nem *Cerianthus lloydii* with *Nemertesia* spp. and other hydroids in circalittoral muddy mixed sediment

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Sandy muddy gravel with surficial cobbles, pebbles and shells
Zone:	Infralittoral - lower, Circalittoral
Depth band:	10-20 m, 20-30 m

Previous code

part of IMX.An	97.06

Biotope description

In sheltered muddy sandy gravel with appreciable quantities of surficial cobbles, pebbles and shells a community similar to ClloMx may develop with frequent *Cerianthus lloydii* and other burrowing anemones. However, the pebbles and cobbles embedded in the sediment are colonised by hydroids and in particular *Nemertesia antennina* and *N. ramosa*. Other hydroids may include *Kirchenpaueria pinnata* and *Halecium halecinum* whilst ascidians such as *Ascidiella aspersa* or *Corella parallelogramma* may also be present locally. *Pecten maximus* and *Pomatoceros triqueter* may also be frequent in certain areas.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMX.ClloMx	In areas of similar sediment but with fewer surface pebbles, cobbles and shells there are fewer sites of attachment for hydroids such as *Nemertesia* and ClloMx.Nem is replaced by SMX.ClloMx

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Halecium halecinum	••	Occasional	1	
Nemertesia antennina	••••	Occasional	8	
Nemertesia ramosa	•••	Occasional	8	
Cerianthus lloydii	•••••	Frequent	21	
Chaetopterus variopedatus	••	Occasional	1	
Terebellidae	••	Occasional	1	
Lanice conchilega	••	Occasional	3	
Pomatoceros triqueter	•••	Frequent	3	
Pagurus bernhardus	•••	Occasional	5	
Liocarcinus depurator	•••	Occasional	4	
Turritella communis	••	Frequent	1	
Aequipecten opercularis	••	Occasional	1	
Pecten maximus	•••	Occasional	5	
Asterias rubens	••••	Occasional	8	
Ophiura albida	••	Occasional	3	
Echinus esculentus	•••	Occasional	3	

SS.SMX.CMx.ClloModHo

Sparse *Modiolus modiolus*, dense *Cerianthus lloydii* and burrowing holothurians on sheltered circalittoral stones and mixed sediment

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Pebbles, boulders and cobbles on mud or muddy gravel
Zone:	Infralittoral - lower, Circalittoral
Depth band:	10-20 m, 20-30 m, 30-50 m

Previous code

SCR.ModHo	96.7
CMX.ModHo	97.06

Biotope description

Pebbles and cobbles on mud or muddy gravel in sealochs with frequent *Cerianthus lloydii* and occasional *Modiolus modiolus*. Large burrowing holothurians may include *Psolus phantapus*, *Paracucumaria hyndmani*, *Thyonidium commune*, *Thyone fusus* and *Leptopentacta elongate*. Many of these species only extend their tentacles above the sediment surface seasonally and are likely to be under recorded by epifaunal surveys. Other more conspicuous characterising taxa include *Pagurus bernhardus*, *Asterias rubens*, and *Buccinum undatum*. This biotope is well developed in the Clyde sealochs, although many examples are rather species-poor. Some examples in south-west Scottish sealochs have greater quantities of boulders and cobbles and therefore have a richer associated biota (compared with other sheltered *Modiolus* bed biotopes such as ModHAs). Examples in Shetland are somewhat different in having the cucumber *Cucumaria frondosa* amongst sparse *Modiolus* beds and a slightly different balance in abundance of other species; for example the brittlestar *Ophiopholis aculeata* is more abundant in these far northern examples in the voes and narrows

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SBR.ModHAs	ModHAs occurs in similar physiographic features, although ClloModHo is in softer sediment in some cases, and with a much lower abundance of *Modiolus*, and a lower diversity in general. There may some overlap in these two biotopes as several of the holothurians extend their tentacles above the surface of the sediment for only a limited amount of time during the year.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hydractinia echinata	••	Occasional	2	
Alcyonium digitatum	•••	Rare	2	
Cerianthus lloydii	•••••	Frequent	15	
Terebellidae	•••	Occasional	2	
Pomatoceros triqueter	•••	Occasional	4	
Pagurus bernhardus	•••••	Frequent	16	
Munida rugosa	••	Occasional	1	
Hyas araneus	••	Occasional	1	
Liocarcinus depurator	•••	Occasional	3	
Carcinus maenas	•••	Occasional	2	
Buccinum undatum	••••	Occasional	5	
Modiolus modiolus	••••	Occasional	9	
Aequipecten opercularis	•••	Occasional	2	
Asterias rubens	••••	Occasional	8	
Ophiura albida	•••	Frequent	3	
Psammechinus miliaris	•••	Occasional	5	
Echinus esculentus	•••	Occasional	4	
Thyone fusus	••	Occasional	1	
Corallinaceae	••	Occasional	1	

SS.SMX.CMx.MysThyMx *Mysella bidentata* and *Thyasira* spp. in circalittoral muddy mixed sediment

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak
Substratum:	Muddy sand and gravel
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m, 30-50 m, 50-100 m

Previous code

None

Biotope description

In moderately exposed or sheltered, circalittoral muddy sands and gravels a community characterised by the bivalves *Thyasira* spp. (often *Thyasira flexuosa*), *Mysella bidentata* and *Prionospio fallax* may develop. Infaunal polychaetes such as *Lumbrineris gracilis*, *Chaetozone setosa* and *Scoloplos armiger* are also common in this community whilst amphipods such as *Ampelisca* spp. and the cumacean *Eudorella truncatula* may also be found in some areas. The brittlestar *Amphiura filiformis* may also be abundant at some sites. Conspicuous epifauna may include encrusting bryozoans *Escharella* spp. particularly *Escharella immersa* and, in shallower waters, maerl (*Phymatolithon calcareum*), although at very low abundances and not forming maerl beds.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMU.AfilMysAnit	The current biotope is closely related to the muddier, less heterogeneous AfilMysAnit
SMU.ForThy	MysThyMx may be a shallower, less heterogeneous variant of the offshore ForThy biotope
SMU.PjefThyAfil	MysThyMx may be a shallower, less heterogeneous variant of the offshore PjefThyAfil biotope

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Scypha ciliata	••	Present	2	
Sertularia cupressina	••	Present	1	
Laomedea flexuosa	•••	Present	2	
ANTHOZOA	•		9	
NEMERTEA	••••	Common	2	31
NEMATODA	••••	Frequent	3	487
Pholoe inornata	••••	Frequent	2	104
Goniada maculata	••••	Common	2	27
Nephtys	•••	Common	1	38
Nephtys hombergii	••••	Common	2	39
Lumbrineris gracilis	•••••	Common	4	156
Scoloplos armiger	•••••	Abundant	3	92
Levinsenia gracilis	•••	Common	1	68
Prionospio fallax	•••••	Abundant	8	499
Spiophanes bombyx	••••	Frequent	2	76
Chaetozone setosa	•••••	Common	4	143
Mediomastus fragilis	•••	Common	2	149
Scalibregma inflatum	••••	Common	2	65
Galathowenia oculata	•••	Frequent	1	75
Owenia fusiformis	••••	Common	2	29
Terebellides stroemi	••••	Abundant	2	32
Ampelisca tenuicornis	••••	Frequent	2	113
Eudorella truncatula	•••	Abundant	1	38
Thyasira flexuosa	•••••	Common	7	377
Mysella bidentata	•••••	Frequent	5	245
Phaxas pellucidus	•••	Common	1	29
Abra alba	•••	Common	2	194
Chamelea gallina	••••	Common	2	44
Crisidia cornuta	••	Present	3	
Crisia	•••	Present	6	
Tubulipora	••	Present	4	
Alcyonidium diaphanum	••	Present	2	
Cribrilina punctata	•••	Present	6	
Escharoides coccinea	••	Present	2	
Escharella immersa	•••	Present	15	
Escharella ventricosa	••	Present	2	
Schizomavella auriculata	••	Present	2	
Microporella ciliata	••	Present	4	
Fenestrulina malusii	•••	Present	6	
Cellepora pumicosa	••	Present	2	
Aetea truncata	••	Present	1	
Electra pilosa	••	Present	4	
Phoronis	•••	Common	2	151
Amphiura filiformis	•••	Abundant	1	88
Hildenbrandia rubra	••	Present	5	
Corallinaceae	••	Present	9	
Phymatolithon calcareum	•••	Present	13	

SS.SMX.CMx.FluHyd *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Strong, Moderately strong
Substratum:	Boulders, cobbles or pebbles with gravel and sand
Zone:	Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m, 30-50 m

Previous code

MCR.Flu.SerHyd	97.06
part of MCR.SNemAdia	97.06

Biotope description

This biotope represents part of a transition between sand-scoured circalittoral rock where the epifauna is conspicuous enough to be considered as a biotope and a sediment biotope where an infaunal sample is required to characterise it and is possibly best considered an epibiotic overlay. *Flustra foliacea* and the hydroid *Hydrallmania falcata* characterise this biotope; lesser amounts of other hydroids such as *Sertularia argentea*, *Nemertesia antennina* and occasionally *Nemertesia ramose*, occur where suitably stable hard substrata is found. The anemone *Urticina feline* and the soft coral *Alcyonium digitatum* may also characterise this biotope. Barnacles *Balanus crenatus* and tube worms *Pomatoceros triqueter* may be present and the robust bryozoans *Alcyonidium diaphanum* and *Vesicularia spinosa* appear amongst the hydroids at a few sites. *Sabella pavonina* and *Lanice conchilega* may be occasionally found in the coarse sediment around the stones. In shallower (i.e. upper circalittoral) examples of this biotope scour-tolerant robust red algae such as *Polysiphonia nigrescens*, *Calliblepharis* spp. and *Gracilaria gracilis* are found.

Situation

This biotope is found around most coasts, although regional differences are seen where one or two similarly scour-tolerant species such as *Styela clava* and *Crepidula fornicata* (Solent) occupy the hard substrata

Temporal variation

No temporal data available.

Similar biotopes

SSA.ScupHyd	With increased scouring and more sand *S. cupressina* becomes more common and FluHyd may develop into ScupHyd.
SCS.PomB	On pebble plains, as tidal stream strength increases to a point at which the stones are regularly mobilised, all hydroids are scoured off leaving just *Pomatoceros*, bryozoan crusts, *Balanus crenatus* and coralline algae.
SMX.CreAsAn	CreAsAn is found in shallower water in slightly less exposed areas with a lower proportion of cobbles and pebbles and in slightly weaker currents.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Halecium halecinum	••	Occasional	1	
Nemertesia antennina	•••	Occasional	7	
Nemertesia ramosa	••	Occasional	1	
Hydrallmania falcata	••••	Occasional	11	
Sertularia argentea	•••	Occasional	3	
Alcyonium digitatum	•••	Occasional	5	
Urticina felina	••••	Occasional	8	
Pomatoceros triqueter	•••	Occasional	3	
Balanus crenatus	••	Frequent	1	
Pagurus bernhardus	•••	Occasional	6	
Alcyonidium diaphanum	•••	Occasional	5	
Vesicularia spinosa	••	Frequent	2	
Flustra foliacea	•••••	Frequent	18	
Crossaster papposus	••	Occasional	2	
Asterias rubens	••••	Occasional	10	

SS.SMX.CMx.OphMx *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Mixed sediment, often with cobbles and pebbles
Zone:	Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m, 30-50 m

Previous code

Part of MCR.Oph	97.06

Biotope description

Circalittoral sediment dominated by brittlestars (hundreds or thousands m-2) forming dense beds, living epifaunally on boulder, gravel or sedimentary substrata. *Ophiothrix fragilis* and *Ophiocomina nigra* are the main bed-forming species, with rare examples formed by *Ophiopholis aculeate*. Brittlestar beds vary in size, with the largest extending over hundreds of square metres of sea floor and containing millions of individuals. They usually have a patchy internal structure, with localized concentrations of higher animal density. *Ophiothrix fragilis* or *Ophiocomina nigra* may dominate separately or there may be mixed populations of the two species. *Ophiothrix* beds may consist of large adults and tiny, newly-settled juveniles, with animals of intermediate size living in nearby rock habitats or among sessile epifauna. Unlike brittlestar beds on rock, the sediment based beds may contain a rich associated epifauna (Warner, 1971; Allain, 1974; Davoult & Gounin, 1995). Large suspension feeders such as the octocoral *Alcyonium digitatum*, the anemone *Metridium senile* and the hydroid *Nemertesia antennina* are present mainly on rock outcrops or boulders protruding above the brittlestar-covered substratum. The large anemone *Urticina feline* may be quite common. This species lives half-buried in the substratum but is not smothered by the brittlestars, usually being surrounded by a 'halo' of clear space (Brun, 1969; Warner, 1971). Large mobile animals commonly found on Ophiothrix beds include the starfish *Asterias rubens*, *Crossaster papposus* and *Luidia ciliaris*, the urchins *Echinus esculentus* and *Psammechinus miliaris*, edible crabs *Cancer pagurus*, swimming crabs *Necora puber*, *Liocarcinus* spp., and hermit crabs *Pagurus bernhardus*. The underlying sediments also contain a diverse infauna including the bivalve *Abra alba*. Warner (1971) found that numbers and biomass of sediment dwelling animals were not significantly reduced under dense brittlestar patches.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Alcyonium digitatum	●●●	Occasional	7	
Urticina felina	●●●	Occasional	8	
Pomatoceros triqueter	●●	Frequent	3	
Pagurus bernhardus	●●	Occasional	2	
Crossaster papposus	●●	Occasional	2	
Asterias rubens	●●●	Occasional	4	
Ophiothrix fragilis	●●●●●	Abundant	56	
Ophiocomina nigra	●●●	Frequent	8	
Echinus esculentus	●●	Occasional	2	
Corallinaceae	●●	Frequent	1	

SS.SMX.OMx Offshore circalittoral mixed sediment

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	Not known
Substratum:	Mud and sandy muddy mixed sediments
Zone:	Circalittoral - lower
Depth band:	20-30 m, 30-50 m, 50-100 m

Previous code

part of COS	97.06

Biotope description

Offshore (deep) circalittoral habitats with slightly muddy mixed gravelly sand and stones or shell. This habitat may cover large areas of the offshore continental shelf although there is relatively little data available. Such habitats are often highly diverse with a high number of infaunal polychaete and bivalve species. Animal communities in this habitat are closely related to offshore gravels and coarse sands and in some areas populations of the horse mussel Modiolus modiolus may develop in these habitats (see SBR.ModMx). Only one biotope is currently described under this biotope complex.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
NEMERTEA	●●●●●	Abundant	3	91
Harmothoe	●●●●●	Common	2	78
Pseudomystides limbata	●●●●●	Present	1	24
Eumida sanguinea	●●●●●	Abundant	2	17
Nereiphylla lutea	●●●●	Abundant	1	51
Glycera lapidum	●●●●●	Common	2	92
Syllis	●●●●●	Present	1	25
Exogone hebes	●●●●	Frequent	1	23
Sphaerosyllis	●●●●	Frequent	1	79
Sphaerosyllis bulbosa	●●●●	Frequent	1	59
Sphaerosyllis tetralix	●●●●●	Present	1	35
Lumbrineris gracilis	●●●●●	Common	2	86
Aonides paucibranchiata	●●●●●	Common	5	241
Laonice bahusiensis	●●●●●	Common	3	60
Polydora caulleryi	●●●●●	Frequent	2	46
Caulleriella zetlandica	●●●●	Common	1	73
Mediomastus fragilis	●●●●●	Frequent	4	344
Scalibregma inflatum	●●●	Abundant	2	136
Polycirrus	●●●●●	Common	2	56
Hydroides norvegica	●●●●●	Frequent	1	24
Grania	●●●●	Common	1	40
Anoplodactylus petiolatus	●●●●●	Present	1	18
Leptochiton asellus	●●●●●	Common	2	84
Glycymeris glycymeris	●●●●	Abundant	1	30
Timoclea ovata	●●●●●	Common	2	59
Amphipholis squamata	●●●●	Abundant	1	203
Polycarpa fibrosa	●●●	Common	1	120

SS.SMX.OMx.PoVen Polychaete-rich deep *Venus* community in offshore mixed sediments

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	Weak
Substratum:	Gravelly sand and muddy mixed sediment
Zone:	Circalittoral
Depth band:	20-30 m, 30-50 m, 50-100 m

Previous code

part of CGS.Ven	97.06

Biotope description

In offshore circalittoral slightly muddy mixed sediments, a diverse community particularly rich in polychaetes with a significant venerid bivalve component may be found. Typical species include the polychaetes *Glycera lapidum*, *Aonides paucibranchiata*, *Laonice bahusiensis*, *Mediomastus fragilis*, *Lumbrineris gracilis*, *Pseudomystides limbata*, *Protomystides bidentata* and syllid species and bivalves such as *Timoclea ovata*, *Glycymeris glycymeris*, *Spisula elliptica* and *Goodallia triangularis*. This biotope has been recorded on surveys of the Lambay and Codling Deeps and other areas of the Irish Sea and collectively with MedLumVen comprise the 'Deep *Venus* Community' and the 'Boreal Off-Shore Gravel Association' as defined by other workers (Ford 1923; Jones 1950). Some examples of this biotope may have abundant juvenile *Modiolus modiolus*

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
NEMERTEA	●●●●●	Abundant	3	60
Golfingia	●●●●			
Harmothoe	●●●●●	Common	2	78
Pseudomystides limbata	●●●●●	Present	1	24
Protomystides bidentata	●●●●●	Common		
Eumida sanguinea	●●●●●	Abundant	2	17
Nereiphylla lutea	●●●●	Abundant	1	51
Glycera lapidum	●●●●●	Common	2	92
Glycera oxycephala	●●●	Present		
Syllis	●●●●●	Present	1	25
Eusyllis blomstrandi	●●●●●	Frequent		
Streptosyllis bidentata	●●●	Frequent		
Exogone hebes	●●●●	Frequent	1	23
Exogone verugera	●●●●●	Frequent		
Sphaerosyllis	●●●●	Frequent	1	79
Sphaerosyllis bulbosa	●●●●	Frequent	1	59
Sphaerosyllis tetralix	●●●●●	Present	1	35
Lumbrineris gracilis	●●●●●	Common		
Aricidea	●●●●	Common		
Paradoneis lyra	●●●●●	Common	1	18
Aonides paucibranchiata	●●●●●	Common	5	241
Laonice bahusiensis	●●●●●	Common	3	60
Polydora caulleryi	●●●●●	Frequent	2	46
Spiophanes kroyeri	●●●●	Frequent		
Cirratulidae	●●●●			
Caulleriella alata	●●●	Frequent	1	44
Caulleriella zetlandica	●●●●	Common	1	73
Mediomastus fragilis	●●●●●	Frequent	4	344
Notomastus	●●●●●	Present		
Praxillella affinis	●●●●●	Common		
Asclerocheilus	●●●●●	Frequent		
Scalibregma inflatum	●●●	Abundant	2	136
Polycirrus	●●●●●	Common	2	56
Hydroides norvegica	●●●●●	Frequent	1	24
Grania	●●●●	Common	1	40
Anoplodactylus petiolatus	●●●●●	Present	1	18
Ampelisca spinipes	●●●●●	Frequent		
Gammaropsis	●●●●●	Frequent		
Leptochiton asellus	●●●●●	Common	2	84
Modiolus modiolus	●●●●●	Super-abundant		
Glycymeris glycymeris	●●●●	Abundant	1	30
Mysella bidentata	●●●●	Frequent		
Spisula elliptica	●●●●	Common		
Abra alba	●●●●	Common		
Timoclea ovata	●●●●●	Common	2	59
Amphipholis squamata	●●●●	Abundant	1	203
Polycarpa fibrosa	●●●	Common	1	120

SS.SMP Sublittoral macrophyte-dominated communities on sediments

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt), Reduced (18-30ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Sand, mud, gravel and mixed sediments.
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

new habitat complex

Biotope description

This complex includes maerl beds, seaweed dominated mixed sediments (including kelps such as Laminaria saccharina and filamentous/foliose red and green algae), seagrass beds, and lagoonal angiosperm communities. These communities develop in a range of habitats from exposed open coasts to lagoons and are found in a variety of sediment types and salinity regimes.

Situation

No situation data available.

Temporal variation

No temporal data available.

SS.SMP.Mrl Maerl beds

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Gravels, clean sands
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

IGS.Mrl	97.06
IMX.MrlMx	97.06

Biotope description

Beds of maerl in coarse clean sediments of gravels and clean sands, which occur either on the open coast or in tide-swept channels of marine inlets (the latter often stony). In fully marine conditions the dominant maerl is typically *Phymatolithon calcareum* (SMP.Pcal), whilst under variable salinity conditions in some sealochs beds of *Lithothamnion glaciale* (SMP.Lgla) may develop.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Cerianthus lloydii	●●●	Frequent	3	
NEMERTEA	●●●	Present	2	30
NEMATODA	●●●●●	Common	9	1303
Harmothoe impar	●●●●	Common	1	73
Kefersteinia cirrata	●●●●●	Present	4	270
Eurysyllis tuberculata	●●●	Common	1	75
Trypanosyllis coeliaca	●●●	Frequent	1	55
Sphaerosyllis taylori	●●●	Frequent	2	150
Aonides paucibranchiata	●●●●	Present	1	15
Chaetopterus variopedatus	●●	Occasional	2	
Mediomastus fragilis	●●●●●	Frequent	4	325
Lanice conchilega	●●	Occasional	2	
Polycirrus	●●●●	Common	3	53
Chone duneri	●●●●	Common	5	313
Pomatoceros triqueter	●●	Occasional	2	
Grania	●●●	Abundant	6	428
Parametaphoxus fultoni	●●●●	Common	7	595
Socarnes erythrophthalmus	●●●	Abundant	4	1055
Austrosyrrhoe fimbriatus	●●	Common	1	105
Ceradocus semiserratus	●●●	Common	3	280
Gammaropsis cornuta	●●●	Frequent	2	98
Leptocheirus hirsutimanus	●●●	Frequent	2	168
Leptocheirus pectinatus	●●●	Abundant	3	1178
Cymodoce truncata	●●●	Present	2	100
Vauntompsonia cristata	●●●●	Present	2	98
Cumella pygmaea	●●●	Common	3	188
Nannastacus unguiculatus	●●●	Common	2	113
Pagurus bernhardus	●●●●	Occasional	6	
Liocarcinus depurator	●●●	Occasional	2	
Gibbula magus	●●	Occasional	1	
Gibbula cineraria	●●	Occasional	2	
Dikoleps pusilla	●●●	Abundant	2	138
Onoba aculeus	●●●	Super-abundant	3	408
Asterias rubens	●●●●	Occasional	10	
Amphipholis squamata	●●●●	Super-abundant	4	510
Echinus esculentus	●●	Occasional	2	
Neopentadactyla mixta	●●	Occasional	1	
Trailliella intricata	●●	Frequent	1	
Lithothamnion glaciale	●●	Frequent	1	
Phymatolithon calcareum	●●●●	Common	15	
Plocamium cartilagineum	●●●	Occasional	3	
Phycodrys rubens	●●	Occasional	1	
Brongniartella byssoides	●●	Occasional	1	
Dictyota dichotoma	●●●	Occasional	4	
Desmarestia viridis	●●	Occasional	1	
Chorda filum	●●	Frequent	1	
Laminaria saccharina	●●●	Occasional	5	

SS.SMPMrl.Pcal *Phymatolithon calcareum* maerl beds in infralittoral clean gravel or coarse sand

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Extremely sheltered
Tidal streams:	Moderately strong, Weak
Substratum:	Maerl gravel and sand
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

IGS.Phy	97.06

Biotope description

Maerl beds characterised by *Phymatolithon calcareum* in gravels and sands. Associated epiphytes may include red algae such as *Dictyota dichotoma, Halarachnion ligulatum, Callophyllis laciniata, Cryptopleura ramosa, Brongniartella byssoides* and *Plocamium cartilagineum*. Algal species may be anchored to the maerl or to dead bivalve shells amongst the maerl. Polychaetes, such as *Chaetopterus variopedatus, Lanice conchilega, Kefersteinia cirrata, Mediomastus fragilis, Chone duneri, Parametaphoxus fultoni* and *Grania* may be present. Gastropods such as *Gibbula cineraria, Gibbula magus, Calyptraea chinensis Dikoleps pusilla* and *Onoba aculeus* may also be present. *Liocarcinus depurator* and *Liocarcinus corrugatus* are often present, although they may be under-recorded; it would seem likely that robust infaunal bivalves such as *Circomphalus casina, Mya truncata, Dosinia exoleta* and other venerid bivalves are more widespread than available data currently suggests. It seems likely that stable wave-sheltered maerl beds with low currents may be separable from SMP.Pcal; having a generally thinner layer of maerl overlying a sandy /muddy substratum with a diverse cover of epiphytes (e.g. Bosence 1976; Blunden *et al.* 1977; 1981; Davies & Hall-Spencer 1996) but insufficient data currently exists on a national scale. Wave and current-exposed maerl beds, where thicker depths of maerl accumulate, frequently occur as waves and ridge / furrows arrangements (see Bosence 1976; Blunden *et al.* 1977; 1981; Irvine & Chamberlain 1994; Hall-Spencer 1995). At some sites where Pcal occurs, there may be significant patches of maerl gravel containing the rare burrowing anemone *Halcampoides elongatus*; this may be a separate biotope, but insufficient data exists at present. Northern maerl beds in the UK do not appear to contain *L. corallioides* but in south-west England and Ireland *L. corallioides* may occur to some extent in Pcal as well as Lcor, where it dominates.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMP.Pcal.R	Pcal.R is a shallower subtype with red seaweeds
SMP.Pcal.Nmix	Pcal.Nmix is a deeper subtype with notably less epiphytic seaweeds

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
PORIFERA	••	Present	1	
Porifera indet crusts	••	Frequent	1	
Obelia dichotoma	••	Common	2	
NEMERTEA	•••••	Present	2	30
NEMATODA	•••••	Common	9	1303
Harmothoe impar	••••	Common	1	73
Kefersteinia cirrata	•••••	Super-abundant	4	270
Eurysyllis tuberculata	••••	Common	1	75
Trypanosyllis coeliaca	••••	Frequent	1	55
Sphaerosyllis taylori	••••	Frequent	2	150
Aonides paucibranchiata	••••	Present	1	15
Mediomastus fragilis	•••••	Frequent	4	325
Polycirrus	•••••	Common	3	53
Chone duneri	•••••	Common	5	313
Grania	•••••	Abundant	6	428
Parametaphoxus fultoni	•••••	Common	7	595
Socarnes erythrophthalmus	••••	Abundant	4	1055
Austrosyrrhoe fimbriatus	•••	Common	1	105
Ceradocus semiserratus	••••	Common	3	280
Gammaropsis cornuta	•••••	Frequent	2	98
Leptocheirus hirsutimanus	••••	Frequent	2	168
Leptocheirus pectinatus	••••	Abundant	3	1178
Cymodoce truncata	•••••	Present	2	100
Vauntompsonia cristata	•••••	Present	2	98
Cumella pygmaea	••••	Common	3	188
Nannastacus unguiculatus	••••	Common	2	113
Liocarcinus depurator	••	Occasional	2	
Gibbula cineraria	••	Occasional	3	
Dikoleps pusilla	••••	Abundant	2	138
Onoba aculeus	••••	Super-abundant	3	408
Crisia	••	Present	1	
Alcyonidium diaphanum	••	Occasional	2	
Escharoides coccinea	••	Present	5	
Microporella ciliata	••	Present	1	
Cellepora pumicosa	••	Occasional	2	
Scrupocellaria reptans	••	Present	1	
Asterias rubens	•••	Occasional	7	
Amphipholis squamata	••••	Super-abundant	4	510
Clavelina lepadiformis	••	Occasional	2	
Didemnidae	••	Rare	2	
Callionymus lyra	••	Frequent	4	
Hildenbrandia rubra	••	Present	2	
Corallinaceae	••	Present	5	
Corallina officinalis	••	Present	3	
Lithothamnion glaciale	••	Present	1	
Phymatolithon calcareum	•••••	Present	36	
Laminaria saccharina	••	Occasional	1	

SS.SMPMrl.Pcal.R *Phymatolithon calcareum* maerl beds with red seaweeds in shallow infralittoral clean gravel or coarse sand

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Maerl gravel; coarse sand
Zone:	Infralittoral, Infralittoral - upper
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

IGS.Phy.R	97.06

Biotope description

Upper infralittoral maerl beds characterised by *Phymatolithon calcareum* in gravels and sand with a wide variety of associated red seaweeds. These algae typically include *Dictyota dichotoma*, *Plocamium cartilagineum*, *Phycodrys rubens*, *Chondrus crispus*, *Halarachnion ligulatum*, *Chylocladia verticillata*, *Hypoglossum hypoglossoides* and *Nitophyllum punctum*. These species are not restricted to maerl beds but their abundance on maerl beds differentiates this biotope from Pcal.Nmix. Anthozoans and echinoderms are much less common in this biotope than in Pcal.Nmix, which typically occurs deeper than Pcal.R.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMP.Pcal.Nmix	Pcal.R is similar but shallower with more red seaweeds

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Cerianthus lloydii	●●●	Frequent	2	
Chaetopterus variopedatus	●●●	Occasional	1	
Lanice conchilega	●●	Occasional	1	
Pomatoceros triqueter	●●●	Occasional	2	
Pagurus bernhardus	●●●●	Frequent	5	
Liocarcinus depurator	●●●	Occasional	2	
Gibbula cineraria	●●●	Occasional	3	
Asterias rubens	●●●●●	Occasional	6	
Echinus esculentus	●●●	Occasional	1	
Bonnemaisonia asparagoides	●●	Occasional	1	
Trailliella intricata	●●	Frequent	1	
Phymatolithon calcareum	●●●●●	Abundant	16	
Plocamium cartilagineum	●●●●	Frequent	3	
Cystoclonium purpureum	●●	Occasional	1	
Lomentaria clavellosa	●●●	Occasional	1	
Nitophyllum punctatum	●●●	Occasional	2	
Phycodrys rubens	●●●	Occasional	2	
Brongniartella byssoides	●●●	Occasional	2	
Dictyota dichotoma	●●●●	Occasional	4	
Desmarestia aculeata	●●●	Occasional	2	
Desmarestia viridis	●●●	Occasional	2	
Chorda filum	●●	Frequent	1	
Laminaria saccharina	●●●●	Frequent	6	
Ulva	●●●	Occasional	2	

SS.SMPMrl.Pcal.Nmix *Phymatolithon calcareum* maerl beds with *Neopentadactyla mixta* and other echinoderms in deeper infralittoral clean gravel or coarse sand

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Maerl gravel; coarse sand
Zone:	Infralittoral - lower, Circalittoral - upper
Depth band:	5-10 m, 10-20 m, 20-30 m

Previous code

IGS.Phy.HEc	97.06

Biotope description

Lower infralittoral maerl beds characterised by *Phymatolithon calcareum* in gravels and sand with a variety of associated echinoderms. The echinoderm *Neopentadactyla mixta* is frequently observed in this biotope. Other echinoderms such as *Echinus esculentus*, *Ophiura albida* and rarely *Luidia ciliaris* may also be present. Red seaweed such as *Plocamium cartilagineum* may be present but at a much lower abundance than in Pcal.R and with fewer species present. Other, more ubiquitous echinoderms such as *Asterias rubens* may also be found in low numbers throughout Pcal biotopes.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMP.Pcal.R	Pcal.R occurs shallower than Pcal.Nmix with a greater abundance and diversity of red seaweeds.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Cerianthus lloydii	●●●	Occasional	3	
Chaetopterus variopedatus	●●●	Occasional	2	
Lanice conchilega	●●●	Occasional	3	
Pomatoceros triqueter	●●●	Occasional	2	
Pagurus bernhardus	●●●●	Occasional	10	
Liocarcinus depurator	●●●	Occasional	3	
Tectura virginea	●●	Occasional	1	
Gibbula magus	●●●	Occasional	2	
Pecten maximus	●●●	Occasional	3	
Ensis	●●	Frequent	2	
Luidia ciliaris	●●	Rare	1	
Asterias rubens	●●●●●	Occasional	8	
Ophiura albida	●●	Occasional	1	
Echinus esculentus	●●●	Occasional	4	
Neopentadactyla mixta	●●●	Frequent	4	
Pomatoschistus	●●	Occasional	1	
Phymatolithon calcareum	●●●●	Common	20	
Plocamium cartilagineum	●●●	Occasional	2	
Desmarestia viridis	●●	Occasional	1	
Laminaria saccharina	●●●	Occasional	3	

SS.SMPMrl.Lgla *Lithothamnion glaciale* maerl beds in tide-swept variable salinity infralittoral gravel

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Maerl; shell gravel; stones and coarse sediment
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m

Previous code

IGS.Lgla	97.06

Biotope description

Upper infralittoral tide-swept channels of coarse sediment in full or variable salinity conditions support distinctive beds of *Lithothamnion glaciale* maerl 'rhodoliths'. *Phymatolithon calcareum* may also be present as a more minor maerl component. Associated fauna and flora may include species found in other types of maerl beds (and elsewhere), e.g. *Pomatoceros triqueter*, *Cerianthus lloydii*, *Sabella pavonina*, *Chaetopterus variopedatus*, *Lanice conchilega*, *Mya truncata*, *Plocamium cartilagineum* and *Phycodrys rubens*. Lgla, however, also has a fauna that reflects the slightly reduced salinity conditions, e.g. *Psammechinus miliaris* is often present in high numbers along with other grazers such as chitons and *Tectura* spp. *Hyas araneus*, *Ophiothrix fragilis*, *Ophiocomina nigra* and the brown seaweed *Dictyota dichotoma* are also typically present at sites. In Scottish lagoons this biotope may show considerable variation but the community falls within the broad description defined here.

Situation

This biotope can often be found at the upper end of Scottish sealochs where the variable salinity of the habitat may not be immediately obvious.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Cerianthus lloydii	••	Frequent	1	
Pomatoceros triqueter	••	Frequent	2	
Pagurus bernhardus	••	Frequent	2	
Carcinus maenas	•••	Occasional	3	
Gibbula cineraria	••	Occasional	1	
Buccinum undatum	••	Occasional	1	
Ostrea edulis	•	Frequent	1	
Asterias rubens	•••••	Occasional	11	
Ophiothrix fragilis	••••	Frequent	12	
Ophiocomina nigra	••••	Abundant	12	
Psammechinus miliaris	••	Frequent	3	
Echinus esculentus	•••	Occasional	1	
Trailliella intricata	••	Frequent	1	
Corallina officinalis	•••	Occasional	3	
Lithothamnion glaciale	••••	Abundant	16	
Phymatolithon calcareum	•	Abundant	2	
Chondrus crispus	•••	Occasional	2	
Dictyota dichotoma	•••	Frequent	6	
Chorda filum	••	Frequent	1	
Laminaria saccharina	••	Occasional	1	

SS.SMPMrl.Lcor *Lithothamnion corallioides* maerl beds on infralittoral muddy gravel

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Muddy maerl gravel
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

IMX.Lcor	97.06

Biotope description

Live maerl beds in sheltered, silty conditions which are dominated by *Lithothamnion corallioides* with a variety of foliose and filamentous seaweeds. Live maerl is at least common but there may be noticeable amounts of dead maerl gravel and pebbles. Other species of maerl, such as *Phymatolithon calcareum* and *Phymatolithon purpureum*, may also occur as a less abundant component. Species of seaweed such as *Dictyota dichotoma*, *Halarachnion ligulatum.* and *Ulva* spp. are often present, although are not restricted to this biotope, whereas *Dudresnaya verticillata* tends not to occur on other types of maerl beds. The anemones *Anemonia viridis* and *Cerianthus lloydii*, the polychaetes *Notomastus latericeus* and *Caulleriella alata*, the isopod *Janira maculosa* and the bivalve *Hiatella arctica* are typically found in SMP.Lcor where as *Echinus esculentus* tends to occur more in other types of maerl. The seaweeds *Laminaria saccharina* and *Chorda filum* may also be present in some habitats. Lcor has a south-western distribution in Britain and Ireland. Sheltered, stable, fully saline maerl beds in the north of Great Britain (where *L. corallioides* has not been confirmed to occur) may need to be described as an analogous biotope to Lcor (see Pcal).

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMP.Pcal.R	Pcal.R occurs in less stable environments

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Cerianthus lloydii	●●●	Frequent	4	
Anemonia viridis	●●●	Occasional	4	
NEMATODA	●●●●●	Present	11	
Pisione remota	●●	Present	2	
Harmothoe impar	●●●●	Present	2	
Pholoe inornata	●●	Present	2	
Glycera lapidum	●●●●	Present	5	
Kefersteinia cirrata	●●●●	Present	5	
Sphaerosyllis bulbosa	●●●●	Present	5	
Lumbrineris gracilis	●●●●	Present	5	
Protodorvillea kefersteini	●●●●	Present	2	
Aonides paucibranchiata	●●●●	Present	2	
Caulleriella alata	●●●●	Present	6	
Mediomastus fragilis	●●●●●	Present	12	
Notomastus latericeus	●●●●●	Present	6	
Terebellidae	●●●	Occasional	2	
Lanice conchilega	●●●	Occasional	1	
Pista cristata	●●●●	Present	2	
Nannonyx goesii	●●●●	Present	2	
Microdeutopus versiculatus	●●●●	Present	2	
Caprella acanthifera	●●●●	Present	2	
Janira maculosa	●●●●●	Present	6	
Pagurus bernhardus	●●●	Occasional	3	
Liocarcinus corrugatus	●●	Occasional	1	
Liocarcinus depurator	●●●	Occasional	3	
POLYPLACOPHORA	●●●●	Present	5	
Gibbula magus	●●●	Occasional	3	
Pecten maximus	●●	Occasional	1	
Mysella bidentata	●●●●	Present	2	
Parvicardium scabrum	●●●●	Present	2	
Gari tellinella	●●●●	Present	5	
Hiatella arctica	●●●●●	Present	6	
Asterias rubens	●●●●	Frequent	6	
Marthasterias glacialis	●●●	Occasional	3	
Amphipholis squamata	●●●●	Present	3	
Dudresnaya verticillata	●●●	Frequent	3	
Lithothamnion corallioides	●●●●●	Abundant	28	
Phymatolithon calcareum	●●	Common	2	
Halarachnion ligulatum	●●●	Frequent	4	
Dictyota dichotoma	●●●	Common	5	
Chorda filum	●●●	Frequent	3	
Laminaria saccharina	●●	Occasional	2	
Ulva	●●●	Frequent	2	

SS.SMPMrl.Lfas *Lithophyllum fasciculatum* maerl beds on infralittoral mud

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered
Tidal streams:	Weak, Very weak
Substratum:	Mud and muddy gravel with shell
Zone:	Infralittoral
Depth band:	0-5 m

Previous code

IMX.Lfas	97.06

Biotope description

Shallow, sheltered infralittoral muddy plains with *Lithophyllum fasciculatum* maerl. This rarely recorded maerl species forms flattened masses or balls several centimetres in diameter (Irvine & Chamberlain 1994). Lfas may be found on mud and muddy gravel mixed with shell. Species of anemone typical of sheltered conditions may be found in association, for example, *Anthopleura ballii*, *Cereus pedunculatus* and *Sagartiogeton undatus*. Polychaetes such as *Myxicola infundibulum* and terebellids, also characteristic of sheltered conditions, may be present as may hydroids such as *Kirchenpaueria pinnata*. Occasional *Chlamys varia* and *Thyone fuscus* are present in all records of this biotope and red seaweeds such as *Plocamium cartilagineum*, *Calliblepharis jubata* and *Chylocladia verticillata* are often present.

Similar biotopes

SMP.Lcor	Similar habitat with different dominant maerl species

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Suberites ficus	••••	Rare	2	
Hydractinia echinata	••••	Present	2	
Kirchenpaueria pinnata	••••	Occasional	3	
Anthopleura ballii	••••	Occasional	3	
Cereus pedunculatus	••••	Occasional	3	
Sagartiogeton undatus	••••	Occasional	3	
Terebellidae	•••••	Frequent	8	
Myxicola infundibulum	••••	Frequent	5	
Pagurus bernhardus	••••	Occasional	3	
Macropodia rostrata	••••	Rare	2	
Cancer pagurus	••••	Rare	2	
Liocarcinus depurator	••••	Occasional	3	
Carcinus maenas	•••••	Occasional	9	
Chlamys varia	•••••	Occasional	9	
Asterias rubens	••••	Occasional	3	
Ophiothrix fragilis	••••	Present	2	
Thyone fusus	•••••	Occasional	9	
Pomatoschistus pictus	••••	Occasional	3	
Lithophyllum fasciculatum	•••••	Common	18	
Plocamium cartilagineum	••••	Occasional	3	
Calliblepharis jubata	••••	Present	2	
Chylocladia verticillata	••••	Present	2	
Lomentaria clavellosa	••••	Present	2	
Spyridia filamentosa	••••	Present	2	

SS.SMP.KSwSS sediment — Kelp and seaweed communities on sublittoral

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Mixed sediment (with stones and shells)
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

IMX.KSwMx	97.06

Biotope description

Shallow sublittoral sediments which support seaweed communities, typically including the kelp *Laminaria saccharina*, the bootlace weed *Chorda filum* and various red and brown seaweeds, particularly filamentous types. The generally sheltered nature of these habitats enables the seaweeds to grow on shells and small stones which lie on the sediment surface; some communities develop as loose-lying mats on the sediment surface.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hydractinia echinata	••	Occasional		
Cerianthus lloydii	••	Occasional		
NEMERTEA	••	Abundant	1	45
NEMATODA	••	Frequent	11	8585
Anaitides mucosa	••	Present	2	30
Hediste diversicolor	•	Present	2	52
Nephtys hombergii	•	Present	2	25
Scoloplos armiger	••	Super-abundant	2	239
Pygospio elegans	••	Present	2	28
Chaetopterus variopedatus	••	Occasional		
Chaetozone setosa	••	Abundant	3	64
Capitella capitata	••	Common	5	192
Mediomastus fragilis	•••	Common	9	1154
Notomastus latericeus	••	Present	2	180
Arenicola marina	••	Occasional		
Terebellidae	••	Occasional		
Lanice conchilega	••	Occasional		
Pomatoceros triqueter	••	Occasional		
Heterochaeta costata	•	Abundant	4	52
Tubificoides benedii	••	Abundant	11	1380
Balanus crenatus	••	Occasional		
Urothoe elegans	••	Present	1	25
Ampelisca brevicornis	•••	Present	7	108
Corophium volutator	••	Super-abundant	13	177
Pagurus bernhardus	•••	Occasional		

Cancer pagurus	••	Rare		
Liocarcinus depurator	•••	Occasional		
Carcinus maenas	••	Occasional		
Gibbula magus	••	Occasional		
Gibbula cineraria	••	Occasional		
Buccinum undatum	••	Occasional		
Pecten maximus	••	Occasional		
Lucinoma borealis	••	Present	2	20
Mysella bidentata	••	Abundant	7	587
Abra alba	••	Present	3	46
Mya arenaria	••	Super-abundant	2	74
Asterias rubens	•••	Occasional		
Ophiura albida	•	Occasional		
Echinus esculentus	••	Occasional		
Ascidiella aspersa	••	Occasional		
Pomatoschistus minutus	••	Occasional		
Bonnemaisonia asparagoides	••	Occasional		
Trailliella intricata	••	Frequent		
Corallinaceae	••	Occasional		
Gracilaria gracilis	••	Frequent		
Phyllophora crispa	••	Occasional		
Polyides rotundus	•	Occasional		
Plocamium cartilagineum	••	Occasional		
Halarachnion ligulatum	••	Occasional		
Rhodophyllis divaricata	••	Occasional		
Lomentaria clavellosa	••	Occasional		
Pterothamnion plumula	••	Occasional		
Delesseria sanguinea	•	Occasional		
Phycodrys rubens	••	Occasional		
Brongniartella byssoides	••	Occasional		
Polysiphonia elongata	••	Occasional		
Dictyota dichotoma	••	Occasional		
Desmarestia aculeata	••	Occasional		
Desmarestia viridis	••	Occasional		
Chorda filum	•••	Occasional		
Laminaria saccharina	••••	Frequent		
Ulva	••	Occasional		

SMP.LsacR *Laminaria saccharina* and red seaweeds on infralittoral sediments

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Mixed muddy sand with gravel, pebbles and cobbles
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

Part of IMX.LsacX	97.06
MIR.EphR	97.06

Biotope description

On infralittoral mixed muddy substrata communities characterised by the kelp *Laminaria saccharina* and mixed filamentous and foliose red algae can be found. This biotope contains a number of sub-biotopes distinguished by the degree of either wave or tidal exposure. In moderately strong tidal streams in exposed areas *Laminaria* is sparse and dense stands of red seaweeds are found attached to the boulders and cobbles that make up a large proportion of the sediment (LsacR.CbPb). As the degree of wave and/or tidal exposure decreases there is a change in community structure, with the density of *Laminaria* and the diversity of red algal species increasing (LsacR.Gv). As the environment becomes more stable a number of brown algal species are able to inhabit this environment and a rich infauna develops (LsacR.Sa). In the most sheltered examples of this biotope a diverse muddy sediment infauna can be found and the *'Trailliella'* phase of *Bonnemaisonia hamifera* may develop (LsacR.Mu).

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Cerianthus lloydii	●●●	Occasional	2	
Chaetopterus variopedatus	●●	Occasional	1	
Terebellidae	●●	Occasional	2	
Lanice conchilega	●●	Occasional	2	
Pomatoceros triqueter	●●●	Occasional	2	
Pagurus bernhardus	●●●●	Occasional	6	
Liocarcinus depurator	●●●	Occasional	3	
Gibbula magus	●●	Occasional	1	
Gibbula cineraria	●●●	Occasional	2	
Asterias rubens	●●●●	Occasional	7	
Echinus esculentus	●●●	Occasional	2	
Bonnemaisonia asparagoides	●●	Occasional	2	
Corallinaceae	●●●	Occasional	2	
Plocamium cartilagineum	●●●	Occasional	4	
Halarachnion ligulatum	●●	Occasional	2	
Rhodophyllis divaricata	●●	Occasional	1	
Lomentaria clavellosa	●●	Occasional	1	
Pterothamnion plumula	●●	Occasional	1	
Delesseria sanguinea	●●	Occasional	1	
Phycodrys rubens	●●	Occasional	2	
Brongniartella byssoides	●●●	Occasional	2	
Polysiphonia elongata	●●	Occasional	2	
Dictyota dichotoma	●●	Occasional	2	
Desmarestia aculeata	●●	Occasional	2	
Desmarestia viridis	●●	Occasional	2	
Chorda filum	●●	Occasional	1	
Laminaria saccharina	●●●●	Occasional	7	
Ulva	●●	Occasional	2	

SS.SMP.KSwSS.LsacR.CbPb Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Exposed, Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak
Substratum:	Small boulders, cobbles and pebbles with gravel
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m
Other features:	Seasonally-disturbed substrata

Previous code

part of MIR.EphR	97.06

Biotope description

Shallow mixed substrata of cobbles and pebbles swept by moderately strong tidal streams in exposed areas, and characterised by dense stands of red seaweeds. Tide-swept infralittoral cobbles and pebbles which may be highly mobile, create an environment that is difficult for many algae to survive in. Foliose and filamentous seaweeds with an encrusting phase in their life history, or those that are able to withstand rolling of the substratum and scouring, can form dense turfs of seaweed in the more settled summer months. Characteristic red seaweeds include *Halarachnion ligulatum* which is able to survive attached to the pebbles and cobbles. Ephemeral algae grow rapidly in periods of relative stability. Other characteristic red seaweeds include *Plocamium cartilagineum*, *Hypoglossum hypoglossoides*, *Bonnemaisonia asparagoides* and *Brongniartella byssoides*. Coralline encrusting algae cover many of the cobbles and pebbles; some areas of cobbles may be quite barren, dominated only by encrusting coralline algae and brittlestars. Of the brown seaweeds scattered *Laminaria* spp. and *Desmarestia* spp. may be present on more stable large boulders or bedrock outcrops. *Chorda filum* and *Halidrys siliquosa* may be present in low abundance but where these seaweeds occur in greater abundance (typically >Frequent) refer to MIR.LsacChoR and MIR.HalXK respectively. Although the faunal component of this biotope is usually relatively sparse it can include a wide variety of species. Turfs of hydroids (*Nemertesia* spp., *Aglaophenia tubulifera*) and bryozoans (*Crisia* spp. and *Bugula* spp.) are the major components but sponges and anemones may also occur. Brittlestars, sea-urchins, hydroids and solitary ascidians are more prominent in the Scottish examples of this biotope, which tend to occur in deeper water, due in part to clearer waters.

Situation

Although not common, this biotope is widely distributed from Sussex to the shallow areas of the Sarns in Cardigan Bay, the west coast of Scotland and the north-east coast of Ireland. Despite the wide distribution, the red seaweed composition remains remarkably constant. In areas such as the Sarns, in Wales, where mixed substrata continue into the shallows, dense swathes of HIR.LsacChoR can be found. More stable but highly scoured areas adjacent to LsacR.CbPb can support the *Halidrys* biotope HIR.XKHal. Where bedrock or large boulders occur above the mixed substrata of LsacR.CbPb it may support a kelp forest or park (HIR.LhypR or MIR.Lhyp). At many sites the mixed substrata supporting the dense seaweed turf gives way to sediment of varying composition.

Temporal variation

This biotope will take on a much more depauperate appearance during the winter months, once the ephemeral seaweeds have died back in late summer/autumn. Storms can mobilise the loose pebbles and cobbles, removing all but the most resilient of seaweeds and animals. By summer, under more stable conditions, new growth will flourish and dense stands of seaweeds dominate the seabed.

Similar biotopes

SMP.LsacR.Gv	LsacR.Gv has a more dense covering of *L. saccharina* with less robust and some foliose red algal species present.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Urticina felina	••	Occasional	1	
Pomatoceros triqueter	•••	Occasional	2	
Balanus crenatus	••	Frequent	1	
Pagurus bernhardus	••	Occasional	1	
Gibbula cineraria	•••	Occasional	4	
Asterias rubens	•••	Occasional	4	
Ophiothrix fragilis	••	Occasional	1	
Clavelina lepadiformis	•••	Occasional	2	
Botryllus schlosseri	•••	Occasional	2	
Bonnemaisonia asparagoides	•••	Occasional	3	
Callophyllis laciniata	••	Occasional	2	
Corallinaceae	•••	Frequent	4	
Plocamium cartilagineum	•••	Occasional	4	
Halarachnion ligulatum	••••	Occasional	7	
Calliblepharis ciliata	••	Occasional	1	
Rhodophyllis divaricata	•••	Occasional	2	
Lomentaria orcadensis	••	Occasional	1	
Pterothamnion plumula	••	Occasional	1	
Cryptopleura ramosa	••	Occasional	2	
Delesseria sanguinea	••	Occasional	1	
Hypoglossum hypoglossoides	•••	Occasional	2	
Heterosiphonia plumosa	••	Occasional	1	
Brongniartella byssoides	••••	Occasional	5	
Rhodomela confervoides	••	Occasional	2	
Dictyota dichotoma	•••	Occasional	3	
Desmarestia aculeata	••	Occasional	1	
Laminaria saccharina	••	Occasional	1	

SS.SMP.KSwSS.LsacR.Gv *Laminaria saccharina* and robust red algae on infralittoral gravel and pebbles

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Gravel and coarse sand with some pebbles
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

part of MIR.EphR	97.06

Biotope description

Shallow kelp community found on gravel and gravelly sand in slightly less exposed areas than SMP.LsacR.CbPb but in moderately strong tidal currents, and characterised by occasional *Laminaria saccharina* with an undergrowth of robust red seaweeds. Characteristic red seaweeds, as with LsacR.CbPb, include *Plocamium cartilagineum*, *Halarachnion ligulatum* and *Brongniartella byssoides*; however the greater stability of this biotope allows a slightly more diverse range of red seaweeds to become established including *Polyides rotundus*, *Rhodophyllis divaricata*, *Delesseria sanguinea* and *Nitophyllum punctatum*. Coralline encrusting algae may be found covering the larger pebbles. *Laminaria hyperborea* may also be present within this biotope, although at low densities. Other brown algal species present include *Desmarestia* spp., *Dictyota dichotoma* and *Chorda filum*, all at low abundance. The ubiquitous green seaweed *Ulva* sp. may be found attached to larger pebbles.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMP.LsacR.CbPb	LsacR.CbPb has a less dense covering of *L. saccharina*, with a less diverse, more robust red algal community.
SMP.LsacR.Sa	Similar in species composition but differ in sediment characteristics and consequently infaunal species composition.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Cerianthus lloydii	••	Occasional	1	
Pomatoceros triqueter	••	Occasional	1	
Pagurus bernhardus	•••	Occasional	3	
Gibbula cineraria	••	Occasional	1	
Asterias rubens	•••	Occasional	4	
Bonnemaisonia asparagoides	•••	Occasional	2	
Trailliella intricata	••	Frequent	1	
Dilsea carnosa	•••	Occasional	1	
Callophyllis laciniata	••	Occasional	1	
Corallinaceae	•••	Occasional	3	
Gracilaria gracilis	••	Occasional	2	
Phyllophora crispa	••	Occasional	1	
Polyides rotundus	•••	Occasional	2	
Plocamium cartilagineum	••••	Occasional	5	
Halarachnion ligulatum	•••	Occasional	2	
Cystoclonium purpureum	••	Occasional	1	
Rhodophyllis divaricata	•••	Occasional	2	
Chylocladia verticillata	••	Occasional	1	
Lomentaria clavellosa	•••	Occasional	1	
Pterothamnion plumula	••	Occasional	1	
Cryptopleura ramosa	••	Occasional	1	
Delesseria sanguinea	•••	Occasional	3	
Hypoglossum hypoglossoides	••	Occasional	2	
Nitophyllum punctatum	•••	Occasional	2	
Phycodrys rubens	••	Occasional	1	
Brongniartella byssoides	•••	Occasional	2	
Polysiphonia elongata	••	Occasional	1	
Rhodomela confervoides	••	Occasional	1	
Dictyota dichotoma	•••	Occasional	3	
Desmarestia aculeata	•••	Occasional	2	
Desmarestia viridis	•••	Occasional	2	
Chorda filum	••	Occasional	2	
Laminaria hyperborea	•••	Occasional	2	
Laminaria saccharina	•••••	Occasional	10	
Ulva	••••	Occasional	5	

SS.SMP.KSwSS.LsacR.Sa *Laminaria saccharina* and filamentous red algae on infralittoral sand

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Sand with some gravel
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

part of IMX.LsacX	97.06

Biotope description

Shallow kelp community found on sand and slightly gravelly sand, in moderately exposed and sheltered conditions, with weak tidal currents. The community is characterised by occasional *Laminaria saccharina* with an undergrowth of red algae. Characteristic red seaweeds, as with LsacR.Gv, include *Plocamium cartilagineum*, *Polyides rotundus*, *Polysiphonia elongate* and *Lomentaria clavellosa*. Coralline encrusting algae is much less important in this biotope as a result of a lack of suitable substrate. Brown algal species present, as with other LsacR biotopes, include *Desmarestia* spp., *Dictyota dichotoma* and *Chorda filum*, all at low abundance. The ubiquitous green seaweed *Ulva* sp. may also be present. The sandy substrate is home to a variety of typical sand dwelling infauna including polychaetes (*Scoloplos armiger*, *Exogone hebes*, and *Aricidea minuta*), amphipods (*Ampelisca brevicornis*), and bivalves (*Lucinoma borealis* and *Abra alba*). *Arenicola* worm casts and *Lanice* worm tubes may be visible at the sediment surface.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMP.LsacR.Gv	Similar in species composition, but differ in sediment characteristics and therefore infaunal species composition.
SMP.LsacR.Mu	Similar in species composition, but differ in sediment characteristics and therefore in infaunal species composition.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Cerianthus lloydii	●●●	Occasional	2	
NEMERTEA	●●●●	Present	4	50
Exogone hebes	●●●●	Frequent	7	35
Scoloplos armiger	●●●●	Present	10	129
Aricidea minuta	●●●●	Present	6	40
Spiophanes bombyx	●●●●	Present	4	146
Chaetopterus variopedatus	●●●	Occasional	2	
Arenicola marina	●●●	Frequent	4	
Terebellidae	●●	Occasional	1	
Lanice conchilega	●●●	Occasional	3	
Pomatoceros triqueter	●●●	Occasional	2	
Urothoe elegans	●●●●	Present	4	15
Ampelisca brevicornis	●●●●●	Present	19	27
Pariambus typicus	●●●●	Present	4	10
Pagurus bernhardus	●●●●●	Frequent	8	
Cancer pagurus	●●●	Rare	1	
Liocarcinus depurator	●●●●	Occasional	5	
Gibbula magus	●●●	Occasional	2	
Gibbula cineraria	●●	Occasional	1	
Pecten maximus	●●	Occasional	1	
Lucinoma borealis	●●●●	Present	10	33
Ensis	●●	Frequent	2	
Ensis arcuatus	●●	Common	1	
Abra alba	●●●●	Present	10	18
Thracia villosiuscula	●●●●	Present	4	25
Cochlodesma praetenue	●●●●	Present	4	20
Asterias rubens	●●●●●	Occasional	7	
Echinus esculentus	●●●	Occasional	2	
Echinocardium cordatum	●●●●	Present	8	13
Pomatoschistus minutus	●●	Occasional	2	
Polyides rotundus	●●●	Occasional	2	
Plocamium cartilagineum	●●●	Occasional	2	
Lomentaria clavellosa	●●●	Occasional	2	
Ceramium	●●	Frequent	1	
Pterothamnion plumula	●●	Frequent	1	
Polysiphonia elongata	●●●	Occasional	3	
Desmarestia aculeata	●●	Occasional	1	
Desmarestia viridis	●●●	Occasional	2	
Chorda filum	●●●	Occasional	2	
Laminaria saccharina	●●●●●	Occasional	9	
Ulva	●●●	Occasional	2	

SS.SMP.KSwSS.LsacR.Mu *Laminaria saccharina* with red and brown seaweeds on lower infralittoral muddy mixed sediment

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Muddy gravelly mixed sediment
Zone:	Infralittoral, Infralittoral - lower
Depth band:	5-10 m, 10-20 m

Previous code

part of IMX.LsacX	97.06

Biotope description

Slightly deeper kelp community in the lower infralittoral, found on sandy gravelly mud, in sheltered and very sheltered conditions, with very weak tidal currents. The community is characterised by occasional *Laminaria saccharina* with an undergrowth of red and brown algae. Characteristic red seaweeds, as with other LsacR biotopes include *Plocamium cartilagineum* and *Phycodrys rubens*. However, the sheltered conditions of this biotope allow the '*Trailliella*' phase of *Bonnemaisonia hamifera* to develop (although not to the extent of forming distinct mats as in SMP.Tra), and the related species *Bonnemaisonia asparagoides*. Brown algal species present, as with other LsacR biotopes, include *Desmarestia* spp at low abundance. The ubiquitous green seaweed *Ulva* sp. may also be present. The muddy substrate is home to a variety of typical mud dwelling fauna including the burrowing anemone *Cerianthus lloydii*. The gravelly component of this biotope provides a substrate for encrusting species such as the polychaete *Pomatoceros triqueter* and coralline encrusting algae.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMP.LsacR.Sa	Similar species composition, however the two differ in their sediment characteristics and therefore in their infaunal communities.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Cerianthus lloydii	••••	Occasional	5	
Terebellidae	•••	Occasional	4	
Lanice conchilega	•••	Occasional	2	
Pomatoceros triqueter	•••	Occasional	2	
Pagurus bernhardus	••••	Occasional	8	
Liocarcinus depurator	••••	Occasional	5	
Gibbula magus	•••	Occasional	2	
Gibbula cineraria	•••	Occasional	2	
Pecten maximus	•••	Occasional	2	
Asterias rubens	••••	Occasional	7	
Ophiura albida	•••	Occasional	2	
Echinus esculentus	•••	Occasional	3	
Pomatoschistus minutus	••	Occasional	1	
Bonnemaisonia asparagoides	•••	Frequent	2	
Trailliella intricata	••	Occasional	2	
Corallinaceae	••	Occasional	1	
Plocamium cartilagineum	•••	Occasional	2	
Delesseria sanguinea	••	Occasional	1	
Phycodrys rubens	•••	Occasional	3	
Brongniartella byssoides	••	Frequent	1	
Desmarestia aculeata	••	Occasional	1	
Desmarestia viridis	•••	Occasional	2	
Laminaria saccharina	•••••	Occasional	8	
Ulva	••	Occasional	1	

SS.SMP.KSwSS.LsacCho *Laminaria saccharina* and *Chorda filum* on sheltered upper infralittoral muddy sediment

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Sandy mud and gravel
Zone:	Sublittoral fringe, Infralittoral - upper
Depth band:	0-5 m, 5-10 m

Previous code

part of IMX.LsacX 97.06

Biotope description

Shallow kelp community found on sandy mud and gravelly sandy mud, in sheltered or extremely sheltered conditions, with very weak tidal currents. The community is characterised by a reasonable covering of *Laminaria saccharina* and *Chorda filum*. Beneath the kelp canopy, *Ulva lactuca* is often frequent and some filamentous and foliose red algae may be present, along with filamentous brown ectocarpoid algae although in much lower abundance than in the LsacR biotopes. At the sediment surface ubiquitous fauna such as *Asterias rubens*, crabs such as *Pagurus bernhardus*, *Carcinus maenas*, and the gastropod *Gibbula cineraria* may be visable and in some areas *Sabella pavonina* may be present. Given the nature of the sediment it is likely that a wide range of infaunal bivalves and polychaetes are present including *Arenicola marina*, *Mediomastus fragilis* and *Anaitides mucosa*. In more tideswept areas with coarser and generally less muddy sediments SMP.LsacCho may be replaced by one of the sub biotopes of SMP.LsacR.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*	
Hydractinia echinata	●●●	Occasional	3		
Anaitides mucosa	●●●●●	Present	50		100
Mediomastus fragilis	●●●●●	Present	50		100
Arenicola marina	●●●	Frequent	5		
Balanus crenatus	●●	Occasional	1		
Pagurus bernhardus	●●●	Occasional	5		
Liocarcinus depurator	●●	Occasional	2		
Carcinus maenas	●●●●	Occasional	9		
Gibbula cineraria	●●	Occasional	2		
Buccinum undatum	●●	Occasional	2		
Asterias rubens	●●●	Occasional	4		
Ascidiella aspersa	●●	Frequent	2		
Polyides rotundus	●●	Occasional	2		
Chorda filum	●●●●●	Frequent	18		
Laminaria saccharina	●●●●●	Frequent	23		
Enteromorpha	●●	Occasional	1		
Ulva	●●	Occasional	3		

SS.SMP.KSwSS.LsacMxVS *Laminaria saccharina* with *Psammechinus miliaris* and/or *Modiolus modiolus* on variable salinity infralittoral mixed sediment

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Stoney mixed sediment
Zone:	Sublittoral fringe, Infralittoral
Depth band:	0-5 m, 5-10 m

Previous code

None

Biotope description

Shallow kelp community found on stoney mixed sediment, in full or variable salinity, in sheltered or moderately exposed conditions, with weak or very weak tidal currents. The community is characterised by a dense covering of *Laminaria saccharina*. Beneath the kelp canopy, frequent *Psammechinus miliaris* may be found grazing the algal turf and scattered *Modiolus modiolus* are characteristic of this biotope. Encrusting the suface of stones and pebbles are *Pomatoceros triqueter* and in the sediment between the stones, the burrowing anemone *Cerianthus lloydii* may also be present. Small patches of *Lithothamnion glaciale* may be found in this biotope, although these patches do not form distict beds as in SBR.Lgla. In addition, a more ubiquitous fauna such as *Asterias rubens* and *Pagurus bernhardus* are also present. This biotope is generally found in sealochs.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Cerianthus lloydii	●●●	Common	5	
Metridium senile	●●	Occasional	2	
Pomatoceros triqueter	●●●●	Frequent	8	
Pagurus bernhardus	●●●●	Occasional	9	
Carcinus maenas	●●●	Occasional	2	
Buccinum undatum	●●●	Occasional	3	
Modiolus modiolus	●●●●	Occasional	5	
Mya truncata	●●	Occasional	1	
Asterias rubens	●●●●	Occasional	8	
Psammechinus miliaris	●●●●	Frequent	10	
Gobiusculus flavescens	●●	Common	2	
Corallinaceae	●●●	Frequent	3	
Lithothamnion glaciale	●●●	Frequent	3	
Phycodrys rubens	●●●	Frequent	3	
Polysiphonia elongata	●●	Occasional	1	
Chorda filum	●●●	Occasional	2	
Laminaria saccharina	●●●●●	Common	20	

SS.SMP.KSwSS.LsacGraFS *Laminaria saccharina, Gracilaria gracilis* and brown seaweeds on full salinity infralittoral sediment

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong, Weak
Substratum:	Muddy sand and pebbles
Zone:	Sublittoral fringe, Infralittoral - upper
Depth band:	0-5 m, 5-10 m

Previous code

None

Biotope description

Shallow kelp community found on muddy sand, in moderately exposed or sheltered, fully marine conditions, with weak tidal currents. The community is characterised by a reasonable covering of *Laminaria saccharina*. Frequent *Chorda filum* may also form part of the canopy although not at the abundance in LsacCho. Beneath the canopy the community is characterised by the red algae *Gracilaria gracilis*, and various brown algal species particularly *Dictyota dichotoma*. Other members of the understory may include a variety of other filamentous and foliose red algae in particular *Ceramium nodulosum* and the green alga *Ulva*. The muddy sand substrate supports a variety of faunal species including polychaetes (*Lanice conchilega*) and gastropods (*Hinia reticulata*).

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMP.LsacGraVS	LsacGraVS has a more sparse covering of *L. saccharina*, and a greater number of sponges and ascidians.
SMP.LsacCho	*Chorda filum* is much more prominant in LsacCho than in the present biotope.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Cerianthus lloydii	••	Occasional	1	
Lanice conchilega	•••	Frequent	4	
Pagurus bernhardus	••	Occasional	1	
Carcinus maenas	•••	Frequent	4	
Hinia reticulata	•••	Occasional	2	
Dudresnaya verticillata	••	Occasional	1	
Corallinaceae	••	Occasional	1	
Gracilaria gracilis	•••••	Frequent	15	
Polyides rotundus	••	Occasional	2	
Halarachnion ligulatum	••	Occasional	1	
Rhodophyllis divaricata	••	Occasional	2	
Ceramium nodulosum	•••	Frequent	3	
Dictyota dichotoma	•••	Occasional	3	
Chorda filum	•••	Frequent	6	
Laminaria saccharina	•••••	Frequent	11	
Ulva	••••	Frequent	8	

SS.SMP.KSwSS.LsacGraVS *Laminaria saccharina* and *Gracilaria gracilis* with sponges and ascidians on variable salinity infralittoral sediment

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong, Weak
Substratum:	Stoney sediment
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m

Previous code

None

Biotope description

Shallow kelp community found on stony sediment, in extremely sheltered, variable salinity conditions, with moderately strong tidal currents. The community is characterised by a more sparse covering of *Laminaria saccharina*, particularly when compared to the fully marine version of this sub biotope (SMP.LsacGraFS). Beneath the canopy the community is characterised by the red algae *Gracilaria gracilis*, and a variety of faunal species in particular sponges (*Suberites ficus* and *Halichondria panacea*) and ascidians (*Ascidiella aspersa* and *Dendrodoa grossularia*). The stony substrate provides a surface for attachment for these and many other filter and suspension feeding species, particularly barnacles (*Balanus crenatus*), hydroids (*Urticina feline* and *Hydractinia echinata*) and anemones. Other members of the understory may include a variety of filamentous and foliose red algae in particular *Pterothamnion plumula*, and the green alga *Ulva*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Suberites ficus	●●●	Rare	3	
Halichondria panicea	●●●	Occasional	2	
Hydractinia echinata	●●	Occasional	1	
Urticina felina	●●	Frequent	2	
Cereus pedunculatus	●●●	Frequent	5	
Terebellidae	●●	Frequent	2	
Lanice conchilega	●●●	Occasional	2	
Pomatoceros	●●●	Occasional	2	
Balanus crenatus	●●●●	Frequent	7	
Pagurus	●●	Frequent	2	
Carcinus maenas	●●●●	Occasional	8	
Gibbula cineraria	●●●	Occasional	2	
Crepidula fornicata	●●●	Rare	2	
Asterias rubens	●●	Occasional	1	
Ascidiella aspersa	●●	Frequent	2	
Dendrodoa grossularia	●●●	Frequent	5	
Gracilaria gracilis	●●●	Frequent	5	
Antithamnionella spirographidis	●●	Occasional	1	
Griffithsia corallinoides	●●	Frequent	1	
Pterothamnion plumula	●●●	Frequent	3	
Laminaria saccharina	●●●	Occasional	4	
Ulva	●●●●	Occasional	5	

SS.SMP.KSwSS.Tra Mats of *Trailliella* on infralittoral muddy gravel

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Muddy gravel; muddy sand
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

IMX.Tra	97.06

Biotope description

Dense loose-lying beds of the '*Trailliella*' phase of *Bonnemaisonia hamifera* may occur in extremely sheltered shallow muddy environments. Beds of this alga are often 10 cm thick but may reach 100 cm at some sites. Other loose-lying algae may also occur such as *Audouinella floridula*, *Phyllophora crispa* and species of *Derbesia*. Often the mud is gravelly or with some cobbles and may be black and anoxic close to the sediment surface. This biotope is widely distributed in lagoons, sealochs and voes but should only be described as SMP.Tra when a continuous mat is found. It is likely that the infaunal component of this biotope may be considerably modified by the overwhelming quantity of loose-lying algae.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Cerianthus lloydii	••	Occasional	1	
Protodorvillea kefersteini	•••••	Present	3	350
Capitella capitata	•••••	Common	5	800
Mediomastus fragilis	•••••	Common	6	5600
Arenicola marina	••	Occasional	1	
Tubificoides benedii	•••••	Abundant	45	6450
Corophium acherusicum	•••••	Present	3	150
Pagurus bernhardus	•••	Occasional	5	
Liocarcinus depurator	•••	Occasional	4	
Carcinus maenas	•••	Occasional	3	
Gibbula magus	•••	Present	4	
Mytilus edulis	•••••	Present	3	100
Mysella bidentata	•••••	Abundant	19	2400
Mya arenaria	•••••	Present	3	300
Asterias rubens	•••	Occasional	6	
Ophiura albida	•••	Present	4	
Ascidiella aspersa	•••	Rare	6	
Pomatoschistus minutus	•••	Rare	5	
Rhodothamniella floridula	••	Present	2	
Bonnemaisonia hamifera	•••	Present	9	
Trailliella intricata	••••	Common	16	
Phyllophora crispa	•••	Rare	4	
Chorda filum	•••	Rare	5	
Laminaria saccharina	•••	Occasional	6	

SS.SMP.KSwSS.Pcri Loose-lying mats of *Phyllophora crispa* on infralittoral muddy sediment

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered
Tidal streams:	Weak, Very weak
Substratum:	Mud or muddy sand with shells, gravel or pebbles
Zone:	Infralittoral - lower
Depth band:	5-10 m, 10-20 m, 20-30 m

Previous code

IMX.Pcri	97.06

Biotope description

Infralittoral muddy sand and sandy mud, sometimes with some shells or pebbles, and a dense, loose-lying cover of *Phyllophora crispa*. This biotope occurs in very sheltered conditions such as those found in sealochs and voes. SMP.Pcri is similar to other biotopes described with dense, loose-lying algae but has been less frequently recorded, and from the few records available, appears to occur in slightly deeper infralittoral waters primarily between 10m to 30m and typically in fully saline waters. The seaweeds in this biotope may be epiphytised by ascidians such as *Ascidiella aspera*. Kelp such as *Laminaria saccharina* and red seaweeds including *Plocamium cartilagineum* may be present in some areas. The scallops *Pecten maximus* and *Aequipecten opercularis* may also be found occasionally in this biotope and *Trailliella*/*Bonnemaisonia hamifera* may also be present but not at the levels found in SMP.Tra.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMP.Tra	Similar to Pcri however, *Trailliea*, if present in Pcri, does not form distinct mats as in Tra.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hydractinia echinata	••	Occasional	2	
Cerianthus lloydii	••	Frequent	1	
Terebellidae	•••	Frequent	1	
Balanus crenatus	•••	Occasional	2	
Pagurus bernhardus	••••	Occasional	6	
Liocarcinus depurator	•••••	Frequent	14	
Carcinus maenas	•••	Occasional	3	
Aequipecten opercularis	•••	Occasional	2	
Pecten maximus	•••	Occasional	2	
Electra pilosa	••	Occasional	1	
Henricia	••	Rare	1	
Asterias rubens	•••	Occasional	6	
Echinus esculentus	•••	Occasional	3	
Ascidiella aspersa	•••	Frequent	5	
Bonnemaisonia hamifera	••	Common	2	
Phyllophora crispa	•••••	Abundant	27	
Plocamium cartilagineum	•••	Frequent	3	
Laminaria saccharina	•••	Frequent	3	

SS.SMP.KSwSS.FilG Filamentous green seaweeds on low salinity infralittoral mixed sediment or rock

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Muddy sediment with pebbles & cobbles & boulders
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m

Previous code

SIR.FiG	96.7
IMX.FiG	97.06

Biotope description

Shallow muddy sediments, often with boulders, cobbles and pebbles around the edges of lagoons, or other areas that are exposed to wide salinity variations are unsuitable for colonisation by many species. Such areas may be colonised by a dense blanket of ephemeral green algae such as *Enteromorpha* spp., *Chaetomorpha linum*, *Cladophora liniformis* or *Rhizoclonium riparium*. This biotope may also contain some red seaweeds, such as *Furcellaria lumbricalis*, but always at low abundance (compare with PolFur). Amongst the filamentous green algae, grazing molluscs and solitary ascidians may be present. Infauna may typically include *Corophium volutator*, *Heterochaeta costata*, *Tubificoides benedeni* and other taxa suited for low/variable salinity environments.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hediste diversicolor	••••	Present	7	174
Pygospio elegans	••••	Present	5	27
Arenicola marina	••	Occasional	5	
Heterochaeta costata	••••	Abundant	19	174
Tubificoides benedii	••••	Abundant	12	301
Mysidae	•••	Frequent	15	
Corophium volutator	•••••	Super-abundant	56	589
Corophium volutator	•		2	
Carcinus maenas	••	Occasional	2	
Gasterosteus aculeatus	••	Occasional	3	
Beggiatoa	••	Occasional	2	
Enteromorpha	••	Frequent	5	
Enteromorpha intestinalis	••	Frequent	18	
Chaetomorpha linum	••	Frequent	9	
Cladophora	••	Frequent	5	
Rhizoclonium riparium	••	Frequent	3	
Derbesia marina	•	Common	2	
Filamentous green algae	••	Common	9	

SS.SMP.SSgr Sublittoral seagrass beds

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Medium to fine sandy muds
Zone:	Sublittoral fringe, Infralittoral
Depth band:	0-5 m, 5-10 m

Previous code

IMS.Sgr	97.06

Biotope description

Beds of seagrass (*Zostera marina* or *Ruppia* spp.) in shallow sublittoral sediments. These communities are generally found in extremely sheltered embayments, marine inlets, estuaries and lagoons, with very weak tidal currents. They may inhabit low, variable and full salinity marine habitats. Whilst generally found on muds and muddy sands they may also occur in coarser sediments, particularly marine examples of *Zostera* communities.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Anemonia viridis	••	Occasional	1	
NEMERTEA	••	Common	1	12
NEMATODA	•	Common	1	791
Hediste diversicolor	•	Super-abundant	2	378
Pygospio elegans	••	Frequent	4	820
Capitella capitata	••	Frequent	2	565
Arenicola marina	••	Occasional	5	
Lanice conchilega	••	Occasional	2	
Heterochaeta costata	••	Super-abundant	19	5838
Tubificoides benedii	••	Frequent	3	4893
Enchytraeidae	••	Common	3	442
Mysidae	••	Frequent	6	
Idotea baltica	••	Present	3	153
Pagurus bernhardus	•	Occasional	1	
Carcinus maenas	••	Occasional	5	
Chironomida	•••	Abundant	28	6009
Asterias rubens	••	Occasional	1	
Ectocarpaceae	•	Frequent	2	
Chorda filum	••	Frequent	3	
Laminaria saccharina	••	Occasional	1	
Enteromorpha	•	Occasional	2	
Zostera marina	••••	Abundant	35	
Ruppia	••	Common	13	

SS.SMP.SSgr.Zmar *Zostera marina/angustifolia* beds on lower shore or infralittoral clean or muddy sand

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Clean sand to muddy fine sand or mud
Zone:	Infralittoral
Height band:	Lower shore
Depth band:	0-5 m, 5-10 m

Previous code

IGS.Zmar	96.7
IMS.ZmarBv	96.7
LMSND.ZOS	6.95

Biotope description

Expanses of clean or muddy fine sand and sandy mud in shallow water and on the lower shore (typically to about 5 m depth) can have dense stands of *Zostera marina/angustifolia* [Note: the taxonomic status of *Z. angustifolia* is currently under consideration]. In Zmar the community composition may be dominated by these *Zostera* species and therefore characterised by the associated biota. Other biota present can be closely related to that of areas of sediment not containing *Zostera marina*, for example, *Laminaria saccharina*, *Chorda filum* and infaunal species such as *Ensis* spp. and *Echinocardium cordatum* (e.g. Bamber 1993). From the available data it would appear that a number of sub-biotopes may be found within this biotope dependant on the nature of the substratum and it should be noted that sparse beds of *Zostera marina* may be more readily characterised by their infaunal community. For example, coarse marine sands with seagrass have associated communities similar to MoeVen, SLan or Glap whilst muddy sands may have infaunal populations related to EcorEns, AreISa and FfabMag. Muddy examples of this biotope may show similarities to SundAasp, PhiVir, Are or AfilMysAnit. At present the data does not permit a detailed description of these sub-biotopes but it is likely that with further study the relationships between these assemblages will be clarified. Furthermore, whilst the *Zostera* biotope may be considered an epibiotic overlay of established sedimentary communities it is likely that the presence of *Zostera* will modify the underlying community to some extent. For example, beds of this biotope in the south-west of Britain may contain conspicuous and distinctive assemblages of Lusitanian fauna such as *Laomedea angulata*, *Hippocampus* spp. and Stauromedusae. In addition, it is known that seagrass beds play an important role in the trophic status of marine and estuarine waters, acting as an important conduit or sink for nutrients and consequently some examples of *Zostera marina* beds have markedly anoxic sediments associated with them.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SSA.EcorEns	The overlap between these two biotopes requires examination

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Anemonia viridis	••	Occasional	3	
NEMERTEA	•••	Common	6	20
NEMATODA	••	Common	5	1318
Exogone hebes	••	Present	2	30
Platynereis dumerilii	••	Frequent	3	30
Scoloplos armiger	•••	Abundant	5	63
Pygospio elegans	••	Frequent	3	768
Spio filicornis	••	Frequent	2	30
Spiophanes bombyx	••	Present	1	7
Capitella capitata	••	Common	2	822
Mediomastus fragilis	••	Common	1	70
Notomastus latericeus	••	Present	2	14
Arenicola marina	••	Occasional	3	
Euclymene oerstedii	•	Common	1	12
Lanice conchilega	••	Occasional	3	
OLIGOCHAETA	••	Frequent	1	21
Heterochaeta costata	•	Super-abundant	3	4583
Tubificoides benedii	••	Frequent	4	7173
Urothoe elegans	••	Present	2	18
Atylus swammerdamei	••	Present	2	9
Dexamine spinosa	••	Frequent	2	44
Dexamine thea	••	Frequent	1	20
Ampelisca brevicornis	••	Frequent	3	33
Corophium volutator	••	Abundant	9	1711
Idotea baltica	••	Present	1	91
Apseudes latreillii	••	Frequent	1	515
Pagurus bernhardus	••	Occasional	2	
Carcinus maenas	•••	Occasional	3	
Chironomida	•	Abundant	3	2411
Gibbula cineraria	••	Occasional	1	
Hinia reticulata	••	Occasional	2	
Thyasira flexuosa	•	Present	2	22
Mysella bidentata	••	Common	3	555
Fabulina fabula	••	Present	3	15
Abra alba	••	Common	2	20
Asterias rubens	••	Occasional	2	
Amphipholis squamata	••	Abundant	1	16
Chorda filum	••	Frequent	4	
Laminaria saccharina	••	Occasional	2	
Ulva	••	Occasional	2	
Zostera marina	•••••	Abundant	52	

SS.SMP.SSgr.Rup *Ruppia maritima* in reduced salinity infralittoral muddy sand

Habitat classification

Salinity:	Reduced (18-30ppt)
Wave exposure:	Extremely sheltered
Tidal streams:	Very weak
Substratum:	Muddy fine sand to mud
Zone:	Infralittoral
Depth band:	0-5 m

Previous code

IMS.Rup	97.06

Biotope description

In sheltered brackish muddy sand and mud, beds of *Ruppia maritima* and more rarely *Ruppia spiralis* may occur. These beds may be populated by fish such as *Gasterosteus aculeatus* which is less common on filamentous algal-dominated sediments. Seaweeds such as *Chaetomorpha* spp., *Enteromorpha* spp., *Cladophora* spp., and *Chorda filum* are also often present in addition to occasional fucoids. In some cases the stoneworts *Lamprothamnium papulosum* and *Chara aspera* occur. Infaunal and epifaunal species may include mysid crustacea, the polychaete *Arenicola marina*, the gastropod *Hydrobia ulvae*, the amphipod *Corophium volutator* and oligochaetes such as *Heterochaeta costata*. In some areas *Zostera marina* may also be interspersed with the *Ruppia* beds.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Hediste diversicolor	••	Super-abundant	2	835
Pygospio elegans	••	Abundant	2	899
Capitella capitata	••	Present	1	179
Arenicola marina	••	Occasional	5	
Heterochaeta costata	••••	Super-abundant	27	7720
Enchytraeidae	•••	Present	3	457
Mysidae	•••	Frequent	13	
Gammarus locusta	••	Present	1	180
Gammarus zaddachi	•		2	2656
Corophium volutator	•••	Abundant	12	2459
Idotea baltica	••	Present	3	246
Carcinus maenas	••	Occasional	4	
Chironomida	••••	Abundant	43	11406
Gasterosteus aculeatus	••	Rare	3	
Ectocarpaceae	••	Occasional	2	
Enteromorpha	••	Occasional	2	
Enteromorpha intestinalis	••	Frequent	2	
Chaetomorpha linum	••	Occasional	2	
Filamentous green algae	••	Frequent	3	
Lamprothamnium papulosum	••	Frequent	2	
Zostera marina	•		1	
Ruppia	••••	Abundant	43	
Ruppia maritima	•	Abundant	2	

SS.SMP.Ang Angiosperm communities in reduced salinity

Habitat classification

Salinity:	Variable (18-35ppt), Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Extremely sheltered
Tidal streams:	Very weak
Substratum:	Sandy mud with some pebbles and boulders
Zone:	Infralittoral
Depth band:	0-5 m

Previous code

IMU.Ang	97.06

Biotope description

Lagoon communities, subject to reduced or low salinity conditions, dominated by angiosperms, including *Potamogeton pectinatus* beds and fringing habitats with reeds *Phragmites australis*.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Mysidae	•••	Frequent	25	
Potamopyrgus antipodarum	•••	Frequent	23	
Mytilus edulis	••	Occasional	4	
Enteromorpha intestinalis	•	Frequent	2	
Cladophora liniformis	••	Frequent	4	
Filamentous green algae	•	Occasional	2	
Chara aspera	•	Frequent	3	
Potamogeton	••••	Frequent	26	
Potamogeton pectinatus	••	Common	8	

SS.SMP.Ang.NVC A12 *Potamogeton pectinatus* community

Habitat classification

Salinity:	Variable (18-35ppt), Low (<18ppt)
Wave exposure:	Extremely sheltered, Ultra sheltered
Tidal streams:	Very weak
Substratum:	Mud and sandy mud (often with some stones and shells)
Zone:	Sublittoral fringe, Infralittoral
Depth band:	0-5 m

Previous code

IMU.Pot	96.7
IMU.NVC A12	97.06

Biotope description

Low and variable salinity infralittoral mud with beds of *Potamogeton pectinatus*. Other associated species are broadly similar to that of Rup, with blankets of filamentous green algae such as *Enteromorpha intestinalis*, *Cladophora liniformis* and *Rhizoclonium riparium*. The grazing gastropod *Potamopyrgus antipodarum* is found in this biotope and juvenile *Mytilus edulis* have been observed settled on *Potamogeton* leaves and amongst the algae. The nationally scarce charaphyte *Lamprothamnium papulosum* may be found to some extent in this biotope but more often in neighbouring habitats (see Plaza & Sanderson 1997). Mysids, trout (*Salmo trutta*), and sticklebacks *Gasterosteus aculeatus* can be found swimming amongst the vegetation. *Mya arenaria* may be found in some examples of this biotope, but the infaunal component of this biotope requires further investigation but is likely to contain oligochaetes, *Arenicola marina*, *Corophium volutator* and *Gammarus* spp.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMP.Rup	Similar associated species but *Ruppia*, if present in NVC A12, does not form distinct beds.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Mysidae	●●●	Frequent	25	
Hydrobia ulvae	●	Occasional	1	
Potamopyrgus antipodarum	●●●	Frequent	23	
Mytilus edulis	●●	Occasional	4	
Salmo trutta	●	Occasional	2	
Gasterosteus aculeatus	●●	Occasional	1	
Enteromorpha intestinalis	●	Frequent	2	
Cladophora liniformis	●●	Frequent	4	
Filamentous green algae	●	Occasional	2	
Chara aspera	●	Frequent	3	
Potamogeton	●●●●	Frequent	26	
Potamogeton pectinatus	●●	Common	8	

SS.SMP.Ang.NVC S4 *Phragmites australis* swamp and reed beds

Habitat classification

Salinity:	Low (<18ppt)
Wave exposure:	Extremely sheltered, Ultra sheltered
Tidal streams:	Very weak
Substratum:	Mud; peat; sand
Zone:	Infralittoral - upper
Depth band:	0-5 m

Previous code

IMU.Phr	96.7
IMU.NVC S4	97.06

Biotope description

Permanently low salinity muds or peaty muddy sands with some gravel which supports *Phragmites australis* reed beds. These reed beds are often found in enclosed water bodies influenced by freshwater inflow and may have notable quantities of decaying reed material. The substratum may be mixtures of mud, peaty mud, sand and some gravel. Filamentous green algae and charaphytes such as *Lamprothamnium papulosum* and *Chara aspera* may also be found in association with this biotope as well as a the freshwater quillwort *Myriophyllum* spp. The infaunal component of this biotope is poorly known. This biotope is further described as NVC type S4 (Rodwell 1995).

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Phragmites	●●●●●	Super-abundant		
Myriophyllum		Occasional		
Cladophora		Present		
Rhizoclonium		Present		
Chara aspera		Common		
Lamprothamnium papulosum		Common		

SS.SBR Sublittoral biogenic reefs on sediment

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Strong, Moderately strong, Weak, Very weak
Substratum:	Pebbles, gravel, sand and mud.
Zone:	Infralittoral, Circalittoral
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m, 30-50 m, 50-100 m

Previous code

New habitat complex

Biotope description

Sublittoral biogenic reef communities. This complex includes polychaete reefs, bivalve reefs (e.g. mussel beds) and cold water coral reefs. These communities develop in a range of habitats from exposed open coasts to estuaries, marine inlets and deeper offshore habitats and may be found in a variety of sediment types and salinity regimes.

Situation

No situation data available.

Temporal variation

No temporal data available.

SS.SBR.PoR Polychaete worm reefs (on sublittoral sediment)

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Muddy gravelly sand with pebbles
Zone:	Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m

Previous code

New biotope complex

Biotope description

Sublittoral reefs of polychaete worms in mixed sediments found in a variety of hydrographic conditions. Such habitats may range from extensive structures of considerable size to loose agglomerations of tubes. Such communities often play an important role in the structural composition or stability of the seabed and provide a wide range of niches for other species to inhabit. Consequently polychaete worm reefs often support a diverse flora and fauna.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Nemertesia antennina	●●●	Occasional	2	
Hydrallmania falcata	●●	Rare	1	
Urticina felina	●●	Occasional	1	
NEMERTEA	●●●	Common	3	27
NEMATODA	●●	Frequent	2	58
Harmothoe impar	●●●	Common	3	54
Pholoe synophthalmica	●●	Frequent	2	29
Eulalia tripunctata	●●	Abundant	3	31
Eumida sanguinea	●●	Abundant	1	13
Typosyllis armillaris	●●	Frequent	2	30
Nereis longissima	●●●	Present	2	10
Protodorvillea kefersteini	●●	Frequent	2	36
Scoloplos armiger	●●●	Abundant	2	66
Caulleriella zetlandica	●●	Frequent	2	49
Mediomastus fragilis	●●●	Common	7	294
Sabellaria alveolata	●●●	Super-abundant	24	684
Sabellaria spinulosa	●●●●	Abundant	15	773
Sabellaria spinulosa	●●●	Common	7	
Lanice conchilega	●●	Common	1	71
Sabella pavonina	●●	Occasional	1	
Pomatoceros triqueter	●●●	Frequent	6	
Serpula vermicularis	●●●	Common	9	
Balanus crenatus	●●	Occasional	2	
Ampelisca spinipes	●●	Frequent	1	42
Pagurus bernhardus	●●●●	Occasional	9	
Gibbula cineraria	●●●	Occasional	2	
Buccinum undatum	●●●	Occasional	4	
Aequipecten opercularis	●●	Occasional	1	
Abra alba	●●	Common	2	84
Alcyonidium diaphanum	●●	Occasional	2	
Flustra foliacea	●●●	Occasional	5	
Asterias rubens	●●●	Occasional	5	
Ophiothrix fragilis	●●●	Occasional	5	
Psammechinus miliaris	●●●	Frequent	6	
Diplosoma listerianum	●●	Frequent	2	
Ciona intestinalis	●●	Rare	1	
Ascidiella aspersa	●●	Frequent	2	
Ascidia mentula	●●●	Frequent	2	
Dendrodoa grossularia	●●●	Frequent	3	
Corallinaceae	●●	Occasional	1	

SS.SBR.PoR.SspiMx *Sabellaria spinulosa* on stable circalittoral mixed sediment

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	Strong, Moderately strong
Substratum:	Mixed sediment of sandy mud, muddy sand with gravel pebbles and cobbles
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m

Previous code

CMX.SspiMx	97.06

Biotope description

The tube-building polychaete *Sabellaria spinulosa* at high abundances on mixed sediment. These species typically forms loose agglomerations of tubes forming a low lying matrix of sand, gravel, mud and tubes on the seabed. The infauna comprises typical sublittoral polychaete species such as *Protodorvillea kefersteini*, *Pholoe synophthalmica*, *Harmothoe* spp, *Scoloplos armiger*, *Mediomastus fragilis*, *Lanice conchilega* and cirratulids, together with the bivalve *Abra alba*, and tube building amphipods such as *Ampelisca* spp. The epifauna comprise a variety of bryozoans including *Flustra foliacea*, *Alcyonidium diaphanum* and *Cellepora pumicosa*, in addition to calcareous tubeworms, pycnogonids, hermit crabs and amphipods. The reefs formed by *Sabellaria* consolidate the sediment and allow the settlement of other species not found in adjacent habitats leading to a diverse community of epifaunal and infauna species. The development of such reefs is assisted by the settlement behaviour of larval *Sabellaria* which are known to selectively settle in areas of suitable sediment and particularly on existing *Sabellaria* tubes (Tait and Dipper, 1997; Wilson 1929). These reefs are particularly affected by dredging or trawling and in heavily dredged or disturbed areas an impoverished community may be left (e.g. Pkef) particularly if the activity or disturbance is prolonged. However, it is likely that reefs of *S. spinulosa* can recover quite quickly from short term or intermediate levels of disturbance as found by Vorberg (2000) in the case of disturbance from shrimp fisheries and recovery will be accelerated if some of the reef is left intact following disturbance as this will assist larval settlement of the species.

Situation

S. spinulosa reefs are often found in areas with quite high levels of natural sediment disturbance

Temporal variation

In some areas the reefs are periodically destroyed by storm events leading to a cyclical shift in biotopes from SspiMx to other biotopes e.g. Pkef or AalbNuc with re-establishment of the *Sabellaria* colonies in the following year.

Similar biotopes

MCR.Sspi	*Sabellaria* on rock often with more associated hard substratum species. On sediment *Sabellaria* changes the habitat

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Halichondria panicea	●●●	Occasional	2	
Dysidea fragilis	●●●	Occasional	2	
Tubularia indivisa	●●●	Occasional	2	
Nemertesia antennina	●●●	Occasional	1	
Hydrallmania falcata	●●●●	Rare	4	
Urticina felina	●●●●	Occasional	4	
NEMERTEA	●●●●	Common	4	42
NEMATODA	●●	Frequent	1	88
Harmothoe impar	●●●●	Common	3	89
Pholoe synophthalmica	●●●	Frequent	4	49
Eteone longa	●●●	Present	2	22
Eumida sanguinea	●●	Abundant	1	17
Nereis longissima	●●●	Present	2	14
Protodorvillea kefersteini	●●●●	Frequent	4	61
Scoloplos armiger	●●●●	Abundant	3	107
Minuspio cirrifera	●●	Frequent	1	14
Caulleriella zetlandica	●●●	Frequent	4	83
Chaetozone setosa	●●	Abundant	1	198
Aphelochaeta marioni	●●●	Common	2	94
Mediomastus fragilis	●●●	Common	4	383
Sabellaria spinulosa	●●●●●	Abundant	27	1316
Sabellaria spinulosa	●●●●●	Common	22	
Lanice conchilega	●●	Occasional	1	
Lanice conchilega	●●●	Common	3	121
Pomatoceros triqueter	●●●	Frequent	4	
Balanus crenatus	●●●●	Occasional	5	
Ampelisca diadema	●●●	Common	2	182
Ampelisca spinipes	●●●	Frequent	3	72
Pagurus bernhardus	●●●●●	Frequent	9	
Calliostoma zizyphinum	●●●	Rare	1	
Buccinum undatum	●●●●	Rare	3	
Abra alba	●●●●	Common	4	143
Alcyonidium diaphanum	●●●●	Occasional	6	
Cellepora pumicosa	●●●	Frequent	2	
Flustra foliacea	●●●●●	Occasional	16	
Asterias rubens	●●	Occasional	1	
Dendrodoa grossularia	●●●	Occasional	2	

SS.SBR.PoR.SalvMx *Sabellaria alveolata* on variable salinity sublittoral mixed sediment

Habitat classification

Salinity:	Variable (18-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Strong, Weak
Substratum:	Mixed sandy sediment with pebble and cobbles
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m

Previous code

None

Biotope description

Tide-swept sandy mixed sediments with cobbles and pebbles, in variable salinity or fully marine conditions, may be characterised by surface accumulations of the reef building polychaete *Sabellaria alveolata*. The presence of *Sabellaria* sp. has a strong influence on the associated infauna as the tubes bind the surface sediments together and provide increased stability. Such reefs may form large structures up to a metre in height although they are considerably less extensive than the intertidal reefs formed by this species (Salv). Other associated species may include the polychaete *Melinna cristata*, itself often as dense aggregations, mobile surface feeding polychaetes including *Typosyllis armillary* and *Eulalia tripunctata*. Other polychaetes may include *Mediomastus fragilis* and *Pygospio elegans* whilst amphipods such as *Harpinia pectinata* and tubificid oligochaetes may also be found.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SBR.SspiMx	SalvMx has a reduced species richness in comparison with SspiMx, particularly in mature *S. alveolata* beds where the species tends to completely cover the seabed allowing few other species to colonise the habitat.
LBR.Salv	The reefs formed in sublittoral sediments are considerably less extensive than the intertidal reefs formed by this species.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Golfingia vulgaris vulgaris	●●●	Present	2	56
Eulalia tripunctata	●●●●	Abundant	7	74
Typosyllis armillaris	●●●	Frequent	66	4
Pygospio elegans	●●	Frequent	1	15
Mediomastus fragilis	●●●	Common	4	168
Sabellaria alveolata	●●●●●	Super-abundant	66	1646
Melinna cristata	●●●	Abundant	2	79
Harpinia pectinata	●●	Frequent	2	34

SS.SBR.PoR.Ser *Serpula vermicularis* reefs on very sheltered circalittoral muddy sand

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Calcareous tubes; pebbles; shells; gravel on sandy mud
Zone:	Infralittoral - lower, Circalittoral
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m

Previous code

SCR.Sver	96.7
CMS.Ser	97.06

Biotope description

Large clumps (mini 'reefs') of the calcareous tubes of *Serpula vermicularis*, typically attached to stones on muddy sediment in very sheltered conditions in sealochs and other marine inlets. A rich associated biota attached to the calcareous tube may include *Esperiopsis fucorum*, thin encrusting sponges, and the ascidians *Ascidiella aspersa*, *Ascidia mentula*, *Dendrodoa grossularia* and *Diplosoma listerianum*. The echinoderms *Ophiothrix fragilis* and *Psammechinus miliaris* and the queen scallop (*Aequipecten opercularis*) are also found throughout this biotope. In shallow water dense *Phycodrys rubens* may grow on the 'reefs'. This biotope has been recorded in the U.K. from Loch Creran, where these reefs have been well studied (Moore 1996), and Loch Sween, where they are reported to have deteriorated. The only other known sites for this biotope are Salt Lake, Cliffden and Killary Harbour, Co. Galway.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Esperiopsis fucorum	●●●	Frequent	2	
Nemertesia antennina	●●●	Occasional	1	
Sabella pavonina	●●●	Occasional	1	
Pomatoceros triqueter	●●●	Common	3	
Serpula vermicularis	●●●●●	Common	25	
Pagurus bernhardus	●●●●	Occasional	4	
Carcinus maenas	●●●●	Rare	2	
Gibbula cineraria	●●●	Occasional	2	
Buccinum undatum	●●●	Occasional	2	
Aequipecten opercularis	●●●●	Occasional	4	
Asterias rubens	●●●●	Occasional	4	
Ophiothrix fragilis	●●●●●	Occasional	8	
Psammechinus miliaris	●●●●●	Frequent	16	
Diplosoma listerianum	●●●	Frequent	2	
Ciona intestinalis	●●●	Occasional	1	
Corella parallelogramma	●●●	Frequent	1	
Ascidiella aspersa	●●●●	Frequent	5	
Ascidia mentula	●●●●	Rare	3	
Dendrodoa grossularia	●●●	Common	3	
Corallinaceae	●●●	Occasional	2	
Lithothamnion glaciale	●●	Occasional	1	
Phycodrys rubens	●●●	Occasional	2	

SS.SBR.SMus Sublittoral mussel beds (on sublittoral sediment)

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Strong, Moderately strong, Weak, Very weak
Substratum:	Muddy sand, sandy muds, gravel and pebbles
Zone:	Infralittoral - lower, Circalittoral
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m

Previous code

New biotope complex

Biotope description

Sublittoral mussel beds comprised of either the horse mussel *Modiolus modiolus* or the common mussel *Mytilus edulis*. These communities may be sublittoral extensions of littoral reefs or exist independently. Found in a variety of habitats ranging from sheltered estuaries and marine inlets to open coasts and offshore areas they may occupy a range of substrata, although due to the stabilising effect such communities have on the substratum muddy mixed sediments are typical. A diverse range of epibiota and infauna often exists in these communities.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
ANTHOZOA	••	Abundant	1	14
Alcyonium digitatum	••	Occasional	2	
Urticina felina	••	Occasional	1	
TURBELLARIA	••	Frequent	2	9
NEMERTEA	••••	Abundant	7	65
Harmothoe imbricata	••	Super-abundant	1	8
Harmothoe impar	••	Abundant	3	28
Eteone longa	••	Common	2	20
Kefersteinia cirrata	••	Super-abundant	2	16
Scoloplos armiger	••	Abundant	1	26
Capitella capitata	••	Common	2	25
Heteromastus filiformis	••	Common	2	38
Pomatoceros	••	Frequent	2	
Pomatoceros triqueter	••	Abundant	2	25
Pomatoceros triqueter	••	Frequent	3	
OLIGOCHAETA	••	Abundant	10	787
CIRRIPEDIA	••	Common	2	22
Balanus balanus	••	Occasional	1	
Balanus crenatus	••	Frequent	2	
Gammarus salinus	••	Super-abundant	8	612
Pagurus bernhardus	••••	Occasional	6	
Hyas araneus	••	Occasional	2	
Liocarcinus depurator	••	Occasional	1	
Gibbula cineraria	••	Occasional	1	
Nucella lapillus	••	Common	1	13
Buccinum undatum	•••	Occasional	4	
Mytilus edulis	••	Super-abundant	16	1395
Modiolus modiolus	•••••	Abundant	20	
Aequipecten opercularis	••	Frequent	3	
Antedon bifida	••	Occasional	1	
Crossaster papposus	•••	Rare	2	
Asterias rubens	••••	Occasional	8	
Ophiothrix fragilis	••••	Frequent	10	
Ophiocomina nigra	••	Frequent	2	
Echinus esculentus	••••	Occasional	6	
Corella parallelogramma	••	Occasional	1	
Dendrodoa grossularia	••	Occasional	1	
Corallinaceae	••	Frequent	2	
Phycodrys rubens	••	Frequent	2	

SS.SBR.SMus.ModT *Modiolus modiolus* beds with hydroids and red seaweeds on tide-swept circalittoral mixed substrata

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Strong, Moderately strong
Substratum:	Cobbles, pebbles and Modiolus shells
Zone:	Infralittoral - lower, Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m, 30-50 m

Previous code

MCR.ModT	97.06

Biotope description

Modiolus beds on mixed substrata (cobbles, pebbles and coarse muddy sediments) in moderately strong currents or wave exposed areas, typically on the open coast but also in tide-swept channels of marine inlets. *Ophiothrix fragilis* are often common in this biotope along with the calcareous tubes of *Pomatoceros triqueter*, anemones such as *Alcyonium digitatum* and *Urticina felina* and hydroids such as *Abietinaria abietina* and *Sertularia argentea*. *Buccinum undatum* may also be important and in some areas the clam *Chlamys varia* may be frequent but not in the same abundances as in ModCvar. Little information on the infaunal component is given here although it is likely that it is very rich and may highlight more subtle differences in the *Modiolus* biotopes. This biotope is typified by examples off the north-west Lleyn Peninsula in N Wales and off Co. Down, Northern Ireland.

Situation

No situation data available.

Temporal variation

No temporal data avaiable.

Similar biotopes

SBR.ModMx	Tends to occur in deeper water than ModT and has a more divesre infauna as a result of the lower tidal current strength.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Abietinaria abietina	●●●	Frequent	3	
Sertularia argentea	●●	Occasional	1	
Alcyonium digitatum	●●●●	Common	10	
Urticina felina	●●●	Occasional	2	
Pomatoceros triqueter	●●●	Frequent	4	
Balanus crenatus	●●	Frequent	1	
Pagurus bernhardus	●●●●	Occasional	3	
Buccinum undatum	●●●●	Occasional	4	
Modiolus modiolus	●●●●●	Abundant	27	
Crossaster papposus	●●	Rare	1	
Asterias rubens	●●●●●	Occasional	8	
Ophiothrix fragilis	●●●●	Common	13	
Ophiocomina nigra	●●●	Frequent	2	
Psammechinus miliaris	●●	Common	2	
Echinus esculentus	●●●	Occasional	2	
Ciona intestinalis	●●	Rare	1	
Phycodrys rubens	●●	Common	2	

SS.SBR.SMus.ModMx *Modiolus modiolus* beds on open coast circalittoral mixed sediment

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered
Tidal streams:	Moderately strong
Substratum:	Muddy gravel and sand, with shells and stones
Zone:	Circalittoral
Depth band:	50-100 m

Previous code

CMX.ModMx	97.06

Biotope description

Muddy gravels and coarse sands in deeper water of continental seas may contain venerid bivalves with beds of *Modiolus modiolus*. The clumping of the byssus threads of the *M. modiolus* creates a stable habitat that attracts a very rich infaunal community with a high density of polychaete species including *Glycera lapidum*, *Paradoneis lyra*, *Aonides paucibranchiata*, *Laonice bahusiensis*, *Protomystides bidentata*, *Lumbrineris* spp., *Mediomastus fragilis* and syllids such as *Exogone* spp. and *Sphaerosyllis* spp. Bivalves such as *Spisula elliptica*, *Timoclea ovata* and other venerid species are also common. Brittlestars such as *Amphipholis squamata* may also occur with this community. This biotope is very similar to SMX.PoVen and the 'boreal off-shore gravel association' and the 'deep Venus community' described by previous workers (Ford 1923; Jones 1951). Similar *Modiolus* beds (though with a less diverse infauna) on open coast stable boulders, cobbles and sediment are described under MCR.ModT.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMX.PoVen	PoVen is similar to ModMx but lacks the epifaunal *Modiolus* bed
SBR.ModT	ModT tends to occur at the entrance to channels where tidal streams are strong

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
NEMERTEA	●●●●●	Common	2	58
Harmothoe impar	●●●●●	Common	2	54
Protomystides bidentata	●●●●●	Common	2	53
Nereiphylla lutea	●●●●●	Abundant	1	56
Glycera lapidum	●●●●●	Common	3	94
Syllis	●●●●●	Frequent	1	22
Eusyllis blomstrandi	●●●●●	Frequent	1	39
Exogone hebes	●●●●●	Frequent	2	75
Exogone verugera	●●●●●	Common	3	151
Sphaerosyllis	●●●●●	Frequent	2	41
Sphaerosyllis bulbosa	●●●●	Frequent	1	203
Lumbrineris gracilis	●●●●●	Common	2	75
Paradoneis lyra	●●●●●	Common	2	90
Aonides paucibranchiata	●●●●●	Common	3	164
Laonice bahusiensis	●●●●●	Common	2	69
Polydora flava	●●●●●	Frequent	1	35
Mediomastus fragilis	●●●●●	Common	2	288
Clymenura johnstoni	●●●●	Abundant	1	52
Asclerocheilus intermedius	●●●●●	Frequent	1	32
Lysilla	●●●●●	Abundant	1	26
Polycirrus	●●●●●	Common	2	50
Hydroides norvegica	●●●●●	Frequent	1	35
Grania	●●●●●	Present	1	44
Leptochiton asellus	●●●●●	Abundant	2	122
Modiolus modiolus	●●●●●	Super-abundant	4	385
Spisula elliptica	●●●●●	Common	2	51
Timoclea ovata	●●●●●	Common	1	29
Amphipholis squamata	●●●●●	Abundant	2	71
Echinocyamus pusillus	●●●●	Abundant	2	140

SS.SBR.SMus.ModHAs *Modiolus modiolus* beds with fine hydroids and large solitary ascidians on very sheltered circalittoral mixed substrata

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Boulders, cobbles and shells on muddy sediment
Zone:	Infralittoral - lower, Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m

Previous code

SCR.ModHAs	97.06

Biotope description

Beds or scattered clumps of *Modiolus modiolus* in generally sheltered conditions with only slight tidal movement. Typically occurs in sealochs and the Shetland voes. Brittlestars *Ophiothrix fragilis* and *Ophiocomina nigra*, as well as *Ophiopholis aculeata* are often frequent, sometimes forming a dense bed as described in OphMx. The queen scallop *Aequipecten opercularis* is often present in moderate abundances. Large solitary ascidians (*Ascidiella aspersa*, *Corella parallelogramma, Dendrodoa grossularia*) and fine hydroids (*Kirchenpaueria pinnata*) are present attached to the mussel shells. Decapods such as hermit crabs (*Pagurus bernhardus*) and spider crabs (*Hyas araneus*) are typically present. Coralline algal crusts may be found on the mussel shells, with some red seaweeds in shallower water such as *Phycodrys rubens*. Little information on the infaunal component is given here although it is likely that it is very rich and may highlight more subtle differences in the *Modiolus* biotopes.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

SMX.ClloModHo	ClloModHo occurs in similar physiographic features, although seems to be in softer sediment in some cases and with a much lower abundance of *Modiolus* and a lower diversity in general.
SBR.ModCvar	ModCvar is a more species rich biotope with far more sponges and hydroids growing on and amongst the *Modiolus* and large numbers of *Chlamys varia*

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Kirchenpaueria pinnata	●●●	Occasional	1	
Terebellidae	●●	Occasional	1	
Pomatoceros triqueter	●●	Frequent	4	
Balanus balanus	●●●	Occasional	2	
Balanus crenatus	●●●	Occasional	2	
Pagurus bernhardus	●●●●	Occasional	6	
Hyas araneus	●●●●	Occasional	3	
Liocarcinus depurator	●●●	Occasional	2	
Gibbula cineraria	●●	Occasional	1	
Buccinum undatum	●●●●	Occasional	3	
Modiolus modiolus	●●●●●	Common	19	
Aequipecten opercularis	●●●●	Frequent	6	
Antedon bifida	●●	Occasional	1	
Crossaster papposus	●●●	Rare	2	
Asterias rubens	●●●●	Occasional	5	
Ophiothrix fragilis	●●●●	Frequent	8	
Ophiocomina nigra	●●	Frequent	2	
Ophiopholis aculeata	●●	Occasional	1	
Echinus esculentus	●●●●●	Occasional	8	
Corella parallelogramma	●●●	Occasional	2	
Ascidiella aspersa	●●	Frequent	1	
Dendrodoa grossularia	●●●	Occasional	3	
Corallinaceae	●●●	Frequent	2	
Phycodrys rubens	●●●	Occasional	1	

SS.SBR.SMus.ModCvar *Modiolus modiolus* beds with *Chlamys varia*, sponges, hydroids and bryozoans on slightly tide-swept very sheltered circalittoral mixed substrata

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Pebble, gravel and shells on sandy mud sediments
Zone:	Infralittoral, Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m

Previous code

SCR.ModCvar	97.06
SCR.ModSHBy	96.7

Biotope description

Dense *Modiolus modiolus* beds, covered by hydroids and bryozoans, on soft gravelly, shelly mud with pebbles in areas of slight or moderate tidal currents. The variable scallop (*Chlamys varia*) is frequently found in large numbers amongst the *Modiolus* shells. Hydroids such as *Halecium* spp. and *Kirchenpaueria pinnata* and ascidians such as *Ascidiella aspersa*, *Corella parallelogramma* and *Ciona intestinalis* may be found attached to pebbles or mussel shells. The echinoderms *Ophiothrix fragilis* and *Antedon bifida* are often frequent in this biotope as is the encrusting polychaete *Pomatoceros triqueter*. Similar communities have been found on cobble and pebble plains in stable, undisturbed conditions in some sealochs, although not all these examples have *Modiolus* beds.

Situation

No situtation data available.

Temporal variation

No temporal data available.

Similar biotopes

SBR.ModHAs	ModHAs is less species rich with far fewer sponges and hydroids growing on and amongst the *Modiolus* and few if any *Chlamys varia*

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Halecium halecinum	••	Frequent	1	
Kirchenpaueria pinnata	•••	Frequent	1	
Alcyonium digitatum	••••	Occasional	2	
Cerianthus lloydii	•••	Occasional	2	
Urticina felina	•••	Occasional	3	
Terebellidae	•••	Occasional		
Pomatoceros triqueter	•••••	Frequent	7	
Serpula vermicularis	••	Occasional		
Protula tubularia	•••	Frequent	2	
Balanus balanus	•••	Occasional	2	
Pagurus bernhardus	•••	Occasional	2	
Hyas araneus	••••	Occasional	3	
Inachus dorsettensis	•••	Occasional		
Macropodia rostrata	••••	Occasional		
Liocarcinus depurator	••••	Occasional	3	
Gibbula cineraria	•••	Occasional	1	
Calliostoma zizyphinum	•••	Occasional	1	
Buccinum undatum	•••••	Occasional	3	
Pleurobranchus membranaceus	••••	Frequent		
Modiolus modiolus	•••••	Common	9	
Chlamys varia	•••••	Occasional	4	
Aequipecten opercularis	•••	Occasional	1	
Antedon bifida	••••	Frequent	5	
Crossaster papposus	•••	Rare	1	
Asterias rubens	•••••	Frequent	5	
Ophiothrix fragilis	•••••	Frequent	7	
Ophiocomina nigra	••••	Occasional	2	
Ophiura albida	•••	Occasional	1	
Psammechinus miliaris	•••	Frequent		
Echinus esculentus	•••••	Occasional	5	
Thyone fusus	••	Rare		
Thyone roscovita	•••	Occasional		
Thyonidium drummondii	••	Occasional		
Ciona intestinalis	•••	Occasional	2	
Corella parallelogramma	•••	Occasional	2	
Ascidiella aspersa	•••	Frequent	3	
Pyura microcosmus	••	Occasional		
Corallinaceae	•••	Frequent	3	
Lithothamnion glaciale	••••	Occasional		
Phycodrys rubens	•••	Frequent	1	
Laminaria hyperborea	•••	Common	2	

SS.SBR.SMus.MytSS *Mytilus edulis* beds on sublittoral sediment

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	Moderately strong
Substratum:	Mixed muddy sediment
Zone:	Infralittoral, Circalittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

IMX.MytV	97.06

Biotope description

Shallow sublittoral mixed sediment, in fully marine coastal habitats or sometimes in variable salinity conditions in the outer regions of estuaries, are characterised by beds of the common mussel *Mytilus edulis*. Other characterising infaunal species may include the amphipod *Gammarus salinus* and oligochaetes of the genus *Tubificoides*. The polychaetes *Harmothoe* spp., *Kefersteinia cirrata* and *Heteromastus filiformis* are also important. Epifaunal species in addition to the *M. edulis* include the whelks *Nucella lapillus* and *Buccinum undatum*, the common starfish *Asterias rubens* the spider crab *Maja squinado* and the anemone *Urticina felina*. Relatively few records are available for this biotope and it is possible that as more data is accumulated separate estuarine and fully marine sub-biotopes may be described. Further clarification may also be required with regard to the overlap between littoral and sublittoral mussel beds and with regard to mussel beds biotopes on hard substratum.

Situation

No situation data available.

Temporal variation

No temporal data available.

Similar biotopes

LBR.Myt	MytSS may be an extension of the littoral biotope Myt
SMX.AphPol	AphPol may be separated from MytSS by the dominance of *M. edulis* in 'beds' rather than scattered individuals. Care must be taken with data to ensure juvenile spat recruitments are not classified as mussel beds.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
ANTHOZOA	●●●●	Abundant	2	35
Urticina felina	●●●	Occasional	7	
Actinothoe sphyrodeta	●●	Occasional	2	
TURBELLARIA	●●●●●	Frequent	2	24
NEMERTEA	●●●●●	Abundant	6	123
Harmothoe imbricata	●●●●	Super-abundant	2	20
Harmothoe impar	●●●●●	Abundant	4	69
Pholoe inornata	●●●●	Common	1	39
Eteone longa	●●●●	Abundant	2	48
Kefersteinia cirrata	●●●●●	Super-abundant	2	36
Nereididae	●●●●●	Present	1	9
Scoloplos armiger	●●●●	Abundant	1	63
Capitella capitata	●●●●	Common	2	62
Heteromastus filiformis	●●●●	Common	3	95
Pomatoceros triqueter	●●●●	Abundant	2	58
OLIGOCHAETA	●●●●●	Abundant	15	1966
CIRRIPEDIA	●●●●	Common	2	55
Gammarus salinus	●●●●●	Super-abundant	11	1531
Paguridae	●●	Occasional	1	
Pagurus bernhardus	●●	Frequent	3	
Maja squinado	●●●	Frequent	6	
Cancer pagurus	●●●	Occasional	4	
Necora puber	●●	Occasional	2	
Crepidula fornicata	●●	Occasional	1	
Nucella lapillus	●●●●	Common	2	34
Buccinum undatum	●●	Occasional	1	
Mytilus edulis	●●●●●	Super-abundant	25	3488
Mytilus edulis	●●●●●	Abundant	60	
Flustra foliacea	●●	Occasional	1	
Asterias rubens	●●●●	Abundant	2	22
Asterias rubens	●●	Occasional	3	
Pleuronectes platessa	●●	Rare	2	

SS.SBR.Crl Coral reefs

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Ultra sheltered
Tidal streams:	Moderately strong, Weak
Substratum:	Fine silt with occasional small cobbles or stones.
Zone:	Circalittoral - lower, Bathyal
Depth band:	50-100 m, 100-200 m, 200-500 m, 500-1000 m, 1000-2000 m

Previous code

New biotope complex

Biotope description

The coral reef structures in UK waters are found in cold (12-4øC), largely aphotic waters, generally along the shelf edge and in offshore waters down to 2000m. In the north east Atlantic, *Lophelia pertusa* is the dominant colonial coral and is the characterising species of the biotope described under this biotope complex. *Lophelia* and its deep-water allies lack the symbiotic algae of their tropical relatives, so can live in the permanent darkness of the deep sea. These corals form colonies and can aggregate into patches and banks which may be described as reefs. These deep-sea corals can support and shelter hundreds of other species, including sponges, polychaete worms, echinoderms (starfish, sea urchins, brittle stars) and bryozoans (sea mats). Some 200-300 species can be found in one of these coral habitats, a number comparable to that found in other important deep-water habitats. Unlike tropical coral reef systems, they are dominated by only a few hard-coral species, and there are far fewer fish species.

Situation

No situation data available.

Temporal variation

No temporal data available.

SS.SBR.Crl.Lop *Lophelia* reefs

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely sheltered
Tidal streams:	Moderately strong, Weak
Substratum:	Fine silt, rock and other hard substrata
Zone:	Circalittoral - lower, Bathyal
Depth band:	50-100 m, 100-200 m, 200-500 m, 500-1000 m, 1000-2000 m

Previous code

COR.Lop	97.06

Biotope description

Reefs of the coral *Lophelia pertusa*, typically supporting a range of other biota. *Lophelia* reefs are generally found in areas of elevated current. The coral provides a 3 dimensional structure and a variety of microhabitats that provide shelter and a surface of attachment for other species. Boring sponges, anemones, bryozoans, gorgonians including *Paragorgia arborea*, *Paramuricea placomus*, *Primnoa resedaeformis*, polychaetes, barnacles, squat lobsters (*Munida sarsi*) and bivalves have all been recorded within and among the corals (Wilson, 1979; Mortensen et al., 1995) Other hard corals such as *Madrepora oculata* and *Solenosmilia variabilis* may also be present. Mobile species present include the redfish (*Sebastes viviparous* and *Sebastes marinus*), Ling (*Molva molva*) and tusk (*Brosme brosme*) (Husebo et al., 2002).

Situation

In British waters *Lophelia* reefs have been found on fine silt sediment and rock on the continental slope, on rock on the continental shelf, and on other hard structures such as the legs of oil platforms.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Lophelia pertusa	●●●●●	Abundant		

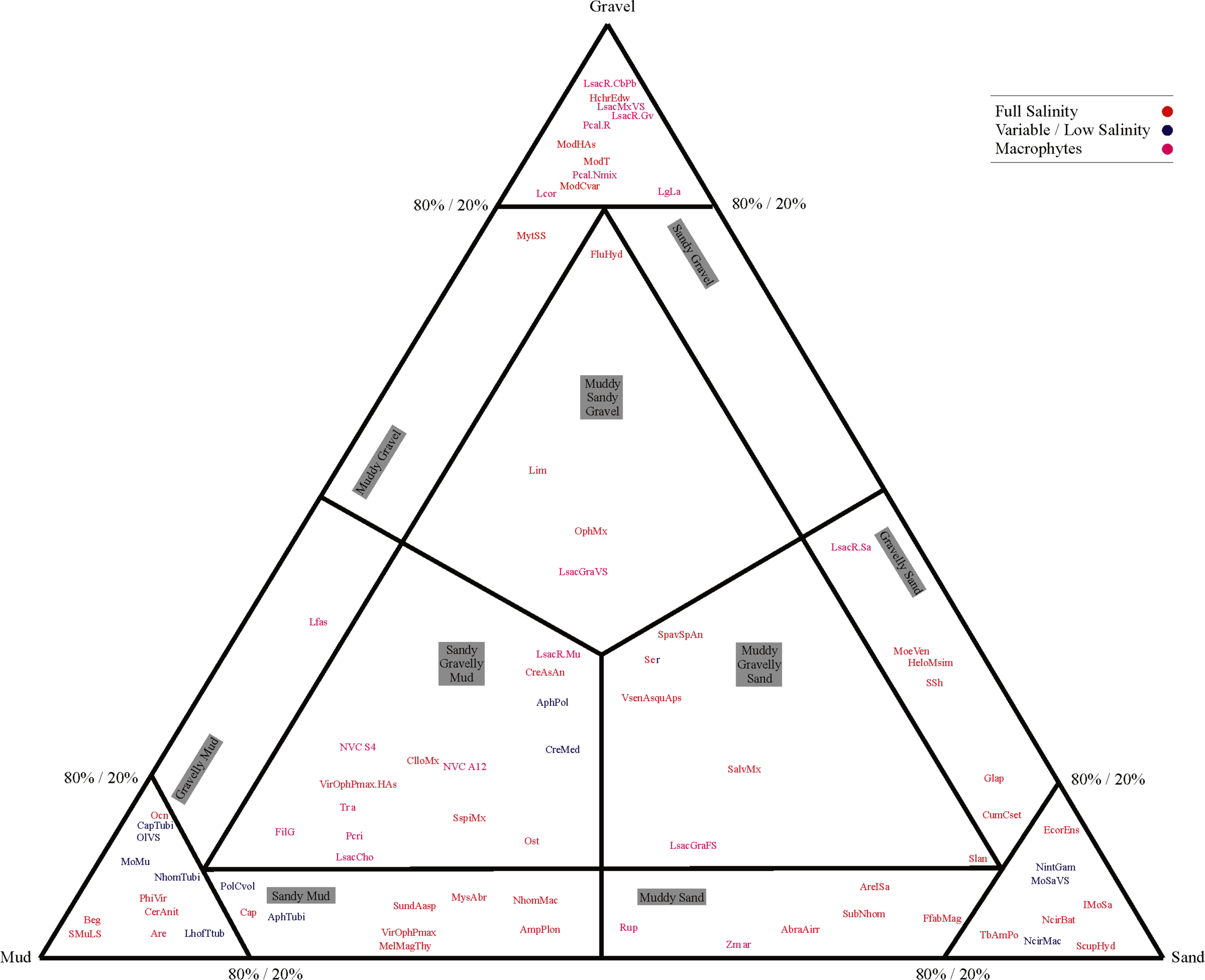
Sublittoral coarse sediment SCS		Sublittoral sand SSa								
Sublittoral coarse sediment in variable salinity (estuaries) SCSVS	Infralittoral coarse sediment ICS	Circalittoral coarse sediment CCS	Offshore circalittoral coarse sediment OCS		Sublittoral sand in low or reduced salinity (lagoons) SSaLS	Sublittoral sand in variable salinity (estuaries) SSaVS	Infralittoral fine sand IFiSa	Infralittoral muddy sand IMuSa	Circalittoral fine sand CFiSa	Circalittoral muddy sand CMuSa	Offshore circalittoral sand OSa
	SSh	PomB	GlapThyAmy			MoSaVS	IMoSa	EcorEns	EpusOborApri	AalbNuc	MalEdef
	HchrEdw	MedLumVen	HeloPkef			NcirMac	ScupHyd	FfabMag	ApriBatPo	AbraAirr	OfusAfil
	MoeVen	Pkef				NintGam	NcirBat	AreISa			
	HeloMsim	Nmix					TbAmPo	SsubNhom			
	Glap	Blan									
	CumCset										
	SLan										

Sublittoral sediment
SS

	Sublittoral mud SMu		Sublittoral mixed sediment SMx

	Sublittoral mud in low or reduced salinity (lagoons) SMuLS	Sublittoral mud in variable salinity (estuaries) SMuVS	Infralittoral sandy mud ISaMu	Infralittoral fine mud IFiMu	Circalittoral sandy mud CSaMu	Circalittoral fine mud CFiMu	Offshore circalittoral mud OMu		Sublittoral mixed sediment in low or reduced salinity (lagoons) SMxLS	Sublittoral mixed sediment in variable salinity (estuaries) SMxVS	Infralittoral mixed sediment IMx	Circalittoral mixed sediment CMx	Offshore circalittoral mixed sediment OMx
		PolCvol	NhomMac	CerAnit	AfilMysAnit	SpnMeg	AfalPova			AphPol	CreAsAn	ClloMx	PoVen
		AphTubi	SundAasp	Are	ThyNten	SpnMeg.Fun	ForThy			CreMed	SpavSpAn	ClloMx.Nem	
		NhomTubi	MysAbr	PhiVir	AfilNten	MegMax	StyPse				VsenAsquAps	ClloModHo	
		MoMu	MelMagThy	Ocn	VirOphPmax	BlyrAchi	CapThy				Lim	MysThyMx	
		CapTubi	AmpPlon	Beg	VirOphPmax.HAs		CapThy.Odub				Ost	FluHyd	
		OlVS	Cap		LkorPpel		LevHet					OphMx	
		LhofTtub					PjefThyAfil						
							MyrPo						

	Sublittoral macrophyte-dominated sediment SMp				Sublittoral biogenic reefs SBR		
	Maerl beds Mrl	Kelp and seaweed communities on sublittoral sediment KSwSS	Sublittoral seagrass beds SSgr	Angiosperm communities in brackish conditions Ang	Sublittoral polychaete reefs PoR	Sublittoral mussel beds SMus	Coral reefs Crl
	Pcal	LsacR	Zmar	NVC A12	SspiMx	ModT	Lop
	Pcal.R	LsacR.CbPb	Rup	NVC S4	SalvMx	ModMx	
	Pcal.Nmix	LsacR.Gv			Ser	ModHAs	
	Lgla	LsacR.Sa				ModCvar	
	Lcor	LsacR.Mu				MytSS	
	Lfas	LsacCho					
		LsacMxVS					
		LsacGraFS					
		LsacGraVS					
		Tra					
		Pcri					
		FilG					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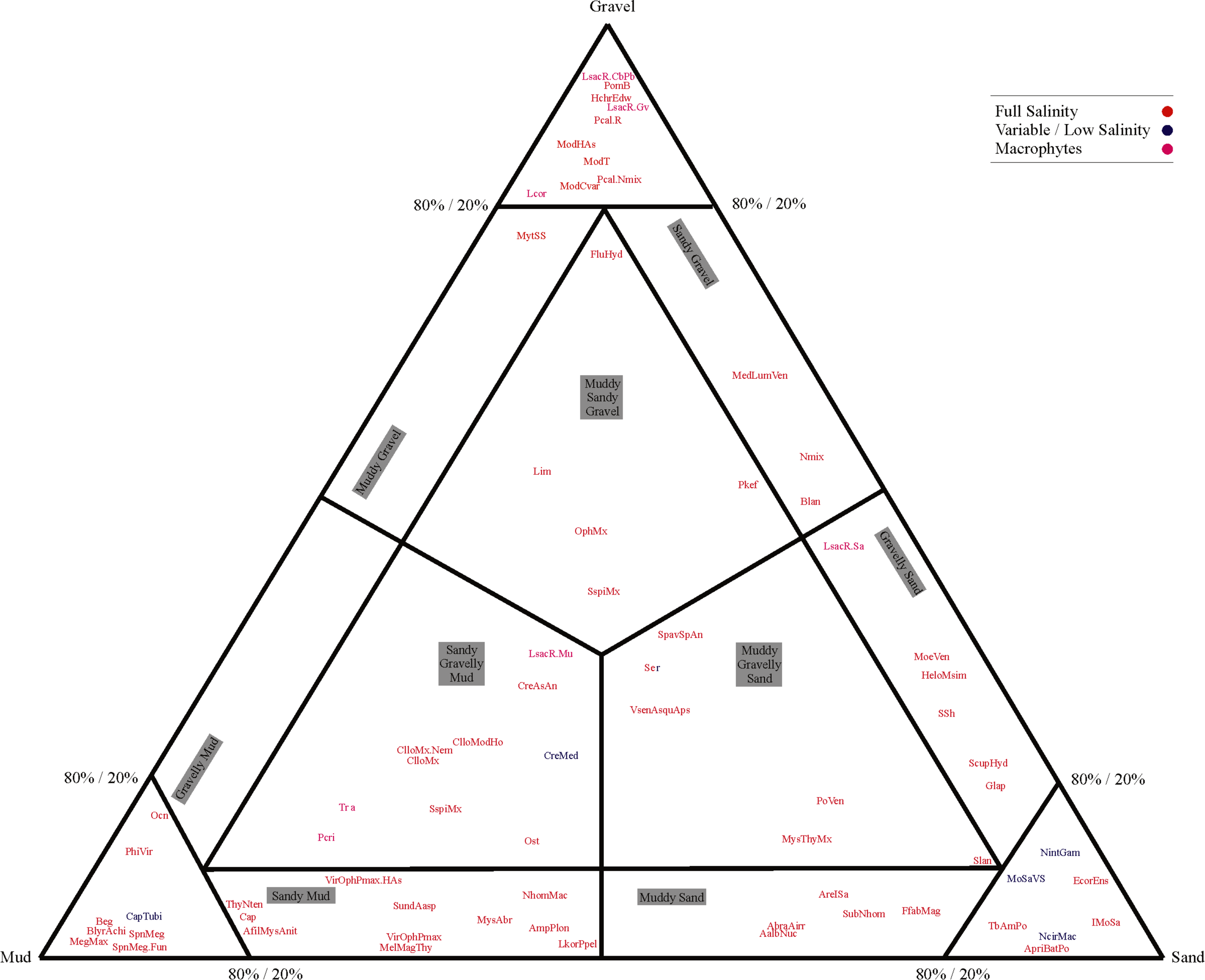
HchrEdw
LsacMxVS
LsacR.Gv
Pcal.R
ModHAs
ModT
Pcal.Nmix
ModCvar
Lcor
LgLa
80% / 20%
80% / 20%
MytSS
FluHyd
Sandy Gravel
Muddy Sandy Gravel
Muddy Gravel
Lim
OphMx
LsacGraVS
LsacR.Sa
Gravelly Sand
Lfas
SpavSpAn
Sandy Gravelly Mud
LsacR.Mu
Ser
Muddy Gravelly Sand
MoeVen
HeloMsim
CreAsAn
SSh
AphPol
VsenAsquAps
NVC S4
CreMed
Gravelly Mud
ClloMx
NVC A12
SalvMx
80% / 20%
VirOphPmax.HAs
Glap
80% / 20%
Tra
Ocn
CapTubi
OlVS
SspiMx
CumCset
FilG
Pcri
Ost
EcorEns
LsacGraFS
Slan
MoMu
NhomTubi
NintGam
MoSaVS
PolCvol
Sandy Mud
AreISa
PhiVir
MysAbr
NhomMac
Muddy Sand
IMoSa
Cap
SundAasp
SubNhom
CerAnit
AphTubi
FfabMag
NcirBat
Beg
Rup
AbraAirr
TbAmPo
SMuLS
Are
LhofTtub
VirOphPmax
AmpPlon
NcirMac
MelMagThy
Zmar
ScupHyd
Mud
Sand
80% / 20%
80% / 20%
Full Salinity
Variable / Low Salinity
Macrophytes


Gravel
LsacR.CbPb
PomB
HchrEdw
LsacR.Gv
Pcal.R
ModHAs
ModT
Pcal.Nmix
ModCvar
Lcor
80% / 20%
80% / 20%
MytSS
FluHyd
Sandy Gravel
MedLumVen
Muddy Sandy Gravel
Muddy Gravel
Nmix
Lim
Pkef
Blan
OphMx
LsacR.Sa
Gravelly Sand
SspiMx
SpavSpAn
Sandy Gravelly Mud
LsacR.Mu
Muddy Gravelly Sand
Ser
MoeVen
HeloMsim
CreAsAn
VsenAsquAps
SSh
ClloModHo
ClloMx.Nem
ClloMx
CreMed
ScupHyd
Glap
80% / 20%
Gravelly Mud
Tra
SspiMx
PoVen
Ocn
Pcri
Ost
MysThyMx
PhiVir
NintGam
Slan
MoSaVS
EcorEns
VirOphPmax.HAs
Sandy Mud
NhomMac
Muddy Sand
AreISa
ThyNten
SundAasp
SubNhom
FfabMag
Cap
MysAbr
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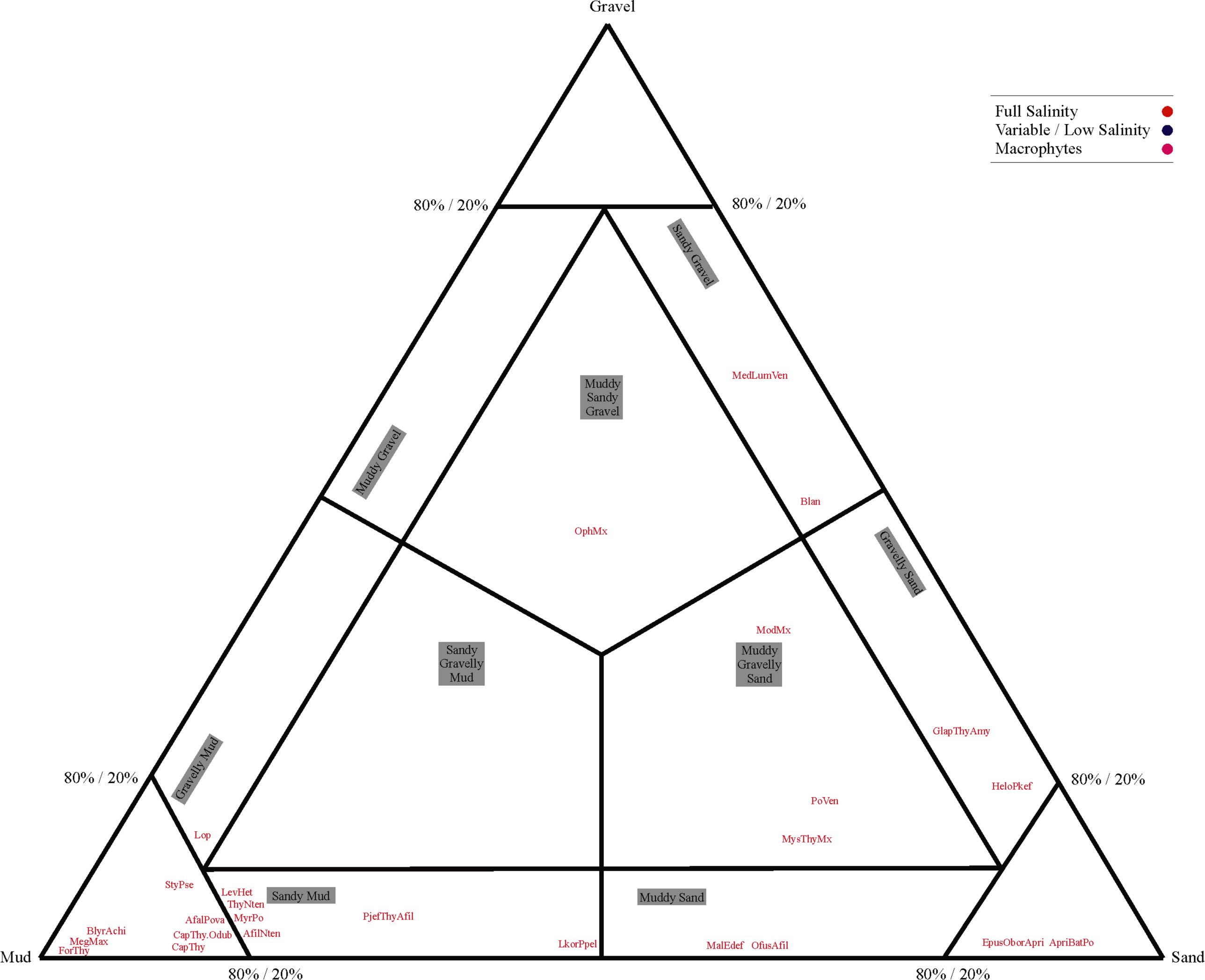
CapTubi
AfilMysAnit
AmpPlon
AbraAirr
TbAmPo
BlyrAchi
SpnMeg
AalbNuc
NcirMac
MegMax
VirOphPmax
SpnMeg.Fun
MelMagThy
LkorPpel
ApriBatPo
Mud
Sand
80% / 20%
80% / 20%
Full Salinity
Variable / Low Salinity
Macrophytes


Gravel
80% / 20%
80% / 20%
Full Salinity
Variable / Low Salinity
Macrophytes
Muddy Gravel
Sandy Gravel
Muddy Sandy Gravel
MedLumVen
Blan
OphMx
Gravelly Sand
ModMx
Sandy Gravelly Mud
Muddy Gravelly Sand
GlapThyAmy
Gravelly Mud
80% / 20%
HeloPkef
80% / 20%
PoVen
Lop
MysThyMx
StyPse
LevHet
ThyNten
Sandy Mud
Muddy Sand
AfalPova
MyrPo
PjefThyAfil
BlyrAchi
MegMax
ForThy
CapThy.Odub
AfilNten
CapThy
LkorPpel
MalEdef
OfusAfil
EpusOborApri
ApriBatPo
Mud
Sand
80% / 20%
80% / 20%

The Marine Habitat Classification for Britain and Ireland. Version 04.05

Littoral Rock Section

This document is an extract from:

DAVID W. CONNOR, JAMES H. ALLEN, NEIL GOLDING, KERRY L. HOWELL, LOUISE M. LIEBERKNECHT, KATE O. NORTHEN AND JOHNNY B. REKER (2004)
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ISBN 1 861 07561 8 (internet version)
www.jncc.gov.uk/MarineHabitatClassification

Contents

LR Littoral rock (and other hard substrata)

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt), Reduced/low (0.5-30ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Bedrock; boulders; cobbles and pebbles
Zone:	Supralittoral, Littoral fringe, Eulittoral
Height band:	Strandline, Upper shore, Mid shore, Lower shore

Biotope description

Littoral rock includes habitats of bedrock, boulders and cobbles which occur in the intertidal zone (the area of the shore between high and low tides) and the splash zone. The upper limit is marked by the top of the lichen zone and the lower limit by the top of the laminarian kelp zone. There are many physical variables affecting rocky shore communities - wave exposure, salinity, temperature and the diurnal emersion and immersion of the shore. Wave exposure is most commonly used to characterise littoral rock, from 'extremely exposed' on the open coast to 'extremely sheltered' in enclosed inlets. Exposed shores tend to support faunal-dominated communities of barnacles and mussels and some robust seaweeds. Sheltered shores are most notable for their dense cover of fucoid seaweeds, with distinctive zones occurring down the shore. In between these extremes of wave exposure, on moderately exposed shores, mosaics of seaweeds and barnacles are more typical.

LR.HLR High energy littoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed
Tidal streams:	Very strong, Strong, Moderately strong
Substratum:	Bedrock, large boulders
Zone:	Eulittoral - upper
Height band:	Upper shore, Mid shore, Lower shore

Biotope description

Extremely exposed to moderately exposed or tide-swept bedrock and boulder shores. Extremely exposed shores dominated by mussels and barnacles, occasionally with robust fucoids or turfs of red seaweed. Tide-swept shores support communities of fucoids, sponges and ascidians on the mid to lower shore. Three biotope complexes have been described: Communities on very exposed to moderately exposed upper and mid eulittoral bedrock and boulders dominated by the mussel *Mytilus edulis*, barnacles *Chthamalus* spp. and/or *Semibalanus balanoides* and the limpets *Patella* spp. (LR.HLR.MusB); red and brown seaweeds able to tolerate the extreme conditions of exposed rocky shores, primarily the physical stresses caused by wave action (LR.HLR.FR), and tide-swept shores in more sheltered areas (such as narrow channels in sea loch) with canopy forming fucoids and a rich filter-feeding community (LR.HLR.FT).

LR.HLR.MusB Mussel and/or barnacle communities

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	
Substratum:	Bedrock; large boulders
Zone:	Eulittoral - upper, Eulittoral - mid
Height band:	Upper shore, Mid shore
Other features:	Also on sheltered vertical bedrock

Previous code

LRK.BP	6.95
ELR.MB	97.06

Biotope description

Communities on very exposed to moderately exposed upper and mid eulittoral bedrock and boulders dominated by the mussel *Mytilus edulis* (MytB), barnacles *Chthamalus* spp. and/or *Semibalanus balanoides* and limpets *Patella* spp. (Cht, Sem). Several variants are identified. Some shores are characterised by dense bands of the barnacle *Semibalanus balanoides* and the limpet *Patella vulgata* (Sem). The barnacles may be covered by *Porphyra umbilicalis* on the upper shore of exposed sites. Cracks and crevices in the rock provide a refuge for small individuals of the mussel *M. edulis*, winkles *Littorina saxatilis* and the whelk *Nucella lapillus*. Red seaweeds also frequently occupy damp crevices, particularly *Ceramium shuttleworthianum*, *Corallina officinalis*, *Osmundea pinnatifida* and encrusting coralline algae, but the non-vesiculate form of the wrack *Fucus vesiculosus* might be present (Sem.FvesR). Large numbers of the winkle *Littorina littorea* often dominate fields of large boulders or shores with a more mixed substratum (Sem.LitX). There is much regional variation affecting the zonation of barnacles in the British Isles. In the north-west *C. montagui* and/or *C. stellatus* can form a distinct band above *S. balanoides*. In the south-west *C. montagui* and/or *C. stellatus* can be the dominant barnacles throughout the eulittoral zone (Cht.Cht). On the east coasts *S. balanoides* is able to extend to the upper shore due to the absence of *Chthamalus* spp. and thereby any competition. The lichen *Lichina pygmaea* may be prominent, especially in the south, where it can form distinct patches or even a separate zone among the *Chthamalus* spp. (Cht.Lpyg). In areas of soft rock (e.g. shales), the barnacles may be scarce or absent and the rock dominated by *P. vulgata*.

Situation

This biotope complex is found in the mid to upper eulittoral on very to moderately exposed shores below the lichen dominated biotopes (Lic) and is typically characterised by patches of mussels *M. edulis* interspersed with barnacles. Below the MusB biotopes is a community dominated by the wrack *Himanthalia elongata* and red seaweeds such as *C. officinalis*, *Mastocarpus stellatus* and *O. pinnatifida* (LR.HLR.FR). With decreasing wave exposure *F. vesiculosus* is able to survive, gradually replacing the barnacles and *P. vulgata* biotope (FvesB). On such moderately exposed shores MusB biotopes may occur on steep and vertical faces, while fucoids dominate the flatter areas (Sem.FvesR, FvesB).

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Actinia equina	••	Occasional	1	
Chthamalus montagui	•	Rare	1	
Semibalanus balanoides	•••••	Common	33	
Patella vulgata	••••	Common	21	
Littorina	••	Common	1	
Littorina littorea	••	Frequent	6	
Littorina saxatilis	••	Frequent	2	
Nucella lapillus	•••	Frequent	5	
Mytilus edulis	••••	Frequent	15	
Porphyra umbilicalis	••	Frequent	1	
Palmaria palmata	••	Occasional	1	
Corallina officinalis	••	Occasional	1	
Mastocarpus stellatus	••	Occasional	1	

LR.HLR.MusB.MytB *Mytilus edulis* and barnacles on very exposed eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed
Tidal streams:	
Substratum:	Bedrock
Zone:	Eulittoral
Other features:	Also occurs on vertical and steep bedrock on moderately exposed shores

Previous code

ELR.MB.MytB	97.06
LRK.MB	6.95

Biotope description

On very exposed to exposed rocky shores the eulittoral zone, particularly the mid and lower shore, is typically characterised by patches of small individuals of the mussel *Mytilus edulis* interspersed with patches of the barnacle *Semibalanus balanoides* and individuls of the limpet *Patella vulgata*. Amongst the mussels small individuals of red seaweeds including *Ceramium* spp., *Corallina officinalis* and *Mastocarpus stellatus* can be found. The foliose red seaweeds *Porphyra umbilicalis* and *Palmaria palmata* are commonly found as epiphytes on *M. edulis* where they can form luxuriant growths. The abundance of the red seaweeds generally increases down the shore and in the lower eulittoral they may form a distinct zone in which mussels or barnacles are scarce (FR, Coff.Coff or Him). Where *M. edulis* occurs on steep rock, red seaweeds are scarce and restricted to the lower shore. The whelk *Nucella lapillus* and a few winkles such as *Littorina* spp. can occur where cracks and crevices provide a refuge in the rock. Fucoids are generally absent, although some non-vesiculate *Fucus vesiculosus* may occur where the shore slopes more gently. This biotope also occurs on steep moderately exposed shores which experience increased wave energy.

Situation

MytB is generally found above a zone of either mixed turf-forming red seaweeds (FR), *Himanthalia elongata* (Him) or above the sublittoral fringe kelp *Alaria esculenta* (Ala) zone. Above MytB there may be a *Verrucaria maura* zone (Ver.Ver), a *V. maura* and sparse barnacle zone (Ver.B), often with *P. umbilicalis* or a denser barnacle and limpet zone (Sem; FvesB). In addition, patches of lichen *Lichina pygmaea* with the barnacle *Chthamalus montagui* (Cht.Cht) may also occur above this biotope, particularly on southern shores.

Temporal variation

Severe winter storms can cause periodic removal of this mussel and barnacle community.

Similar biotopes

LR.HLR.MusB.Cht.Cht	Occurs at same wave exposure, but on more steep faces in the upper eulittoral zone. *Chthamalus* spp. dominate and the abundance of *M. edulis* is lower (Occasional). The presence of red seaweeds is more sparse, but the black lichen *Verrucaria* spp. may be present.
LR.HLR.MusB.Sem.Sem	Typically occurs in less wave exposed conditions. The abundance of *M. edulis* is lower (Occasional) or confined to crevices where they may be dense. Red seaweeds are also scarce.
LR.MLR.MusF.MytFves	Occurs on moderately exposed coasts, but otherwise in similar physical conditions. It has a higher species diversity and the wrack *Fucus vesiculosus* is present (Common).
LR.MLR.MusF.MytFR	Occurs on moderately exposed coasts, but otherwise in similar physical conditions. It has a higher species diversity and more red seaweeds are usually present. The wrack *Fucus serratus* is usually present (Common).

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	●●●●●	Common	24	
Patella vulgata	●●●●●	Common	19	
Littorina	●●	Common	2	
Nucella lapillus	●●●	Frequent	5	
Mytilus edulis	●●●●●	Abundant	32	
Porphyra umbilicalis	●●●	Frequent	5	
Corallina officinalis	●●●	Occasional	2	
Mastocarpus stellatus	●●	Occasional	1	
Ceramium shuttleworthianum	●●	Occasional	1	

LR.HLR.MusB.Cht *Chthamalus* spp. on exposed upper eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	
Substratum:	Bedrock; large boulders
Zone:	Eulittoral - upper, Eulittoral - mid
Height band:	Upper shore, Mid shore
Other features:	Also on sheltered vertical bedrock

Previous code

ELR.BPat.Cht	97.06
ELR.BPat.Cat	97.06
ELR.BPat.Lic	97.06

Biotope description

Very exposed to moderately exposed upper and mid eulittoral bedrock and boulders characterised by a dense community of barnacles, including *Chthamalus montagui*, *Chthamalus stellatus* and *Semibalanus balanoides*, and the limpet *Patella vulgata*. Damp cracks and crevices in the rock provide a refuge for small individuals of the mussel *Mytilus edulis* and the winkles *Melarhaphe neritoides* and *Littorina saxatilis*. These crevices can also be occupied by encrusting coralline algae and the anemone *Actinia equina*. Black patches of the lichen *Verrucaria maura* may be found in this zone. There is much regional variation in the distribution and zonation of *Chthamalus* spp. On the west coast *Chthamalus* spp. dominate the upper eulittoral, often forming a distinct white band above a darker band of *S. balanoides* in the mid eulittoral zone. *C. montagui* is better adapted to resist desiccation and, therefore, extends further up the shore. On some shores, particularly in the south-west, *Chthamalus* spp. is the dominant barnacle throughout the eulittoral zone (Cht.Cht). On other shores, particularly in the south, *Lichina pygmaea* can form a distinct zone (Cht.Lpyg).

Situation

Cht is found below the black lichen *Verrucaria maura* (Ver.B or Ver.Ver) on very exposed shores and above the mussel *Mytilus edulis* and barnacle biotope (MytB). On slightly less exposed shores the wrack *Fucus vesiculosus* is able to survive and a mixed barnacle and *F. vesiculosus* biotope may occur (Sem.FvesR) beneath Cht. On such moderately exposed shores Cht may still occur on steep and vertical faces, while fucoids dominate the flatter areas (Sem.FvesR or Fves), though these communities should not be confused with Sem.FvesR. Cht can also occur above Sem. On very sheltered sea lochs in Argyll, West Scotland *Chthamalus* spp. are unusually abundant in the upper eulittoral zone.

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Actinia equina	●●●	Occasional	2	
Chthamalus montagui	●●●●●	Abundant	27	
Chthamalus stellatus	●●●●	Frequent	7	
Semibalanus balanoides	●●●	Frequent	6	
Patella vulgata	●●●●	Common	16	
Littorina	●●●	Common	3	
Melarhaphe neritoides	●●	Common	5	
Littorina saxatilis	●●●●	Frequent	14	
Mytilus edulis	●●●●	Occasional	5	
Lichina pygmaea	●●	Frequent	2	
Verrucaria maura	●●	Frequent	2	

LR.HLR.MusB.Cht.Cht *Chthamalus montagui* and *Chthamalus stellatus* on exposed upper eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	
Substratum:	Bedrock; large boulders
Zone:	Eulittoral - upper, Eulittoral - mid
Height band:	Upper shore, Mid shore
Other features:	Also on sheltered vertical rock

Previous code

ELR.BPat.Cat in part	97.06
ELR.BPat.Cht in part	97.06

Biotope description

Very exposed to moderately exposed upper and mid eulittoral bedrock and boulders characterised by a dense community of barnacles, including *Chthamalus montagui*, *Chthamalus stellatus* and *Semibalanus balanoides*, and the limpet *Patella vulgata*. Damp cracks and crevices in the rock provide a refuge for small individuals of the mussel *Mytilus edulis*, and the winkles *Melarhaphe neritoides* and *Littorina saxatilis*. These crevices can also be occupied by encrusting coralline algae and the anemone *Actinia equina*. Patches of the black lichen *Verrucaria maura* and the green seaweed *Enteromorpha intestinalis* may be present, though in low abundance (Occasional). Shaded vertical littoral fringe and upper eulittoral bedrock may be characterised by the shade-tolerant red seaweeds *Catenella caespitosa*, *Bostrychia scorpioides* and/or *Lomentaria articulata*. Where the turf of *C. caespitosa* is well established, barnacles are rare. Geographical variation: There is much regional variation in the distribution and zonation of *Chthamalus* spp. On the west coast *Chthamalus* spp. dominate the upper eulittoral, often forming a distinct white band above a darker band of *S. balanoides* in the mid eulittoral zone (Sem). *C. montagui* is better adapted to resist desiccation and, therefore, extends further up the shore. In the south-west *Chthamalus* spp. can be the dominant barnacles throughout the eulittoral zone.

Situation

Cht.Cht is found below the black lichen *Verrucaria maura* (Ver.B or Ver.Ver) on very exposed shores. It is found above the mussel *Mytilus edulis* and barnacles biotope (MytB). On slightly less exposed shores the wrack *Fucus vesiculosus* is able to survive and a mixed barnacle and *F. vesiculosus* biotope may occur (Sem.FvesR) beneath the Cht. On such moderately exposed shores Cht may still occur on steep and vertical faces, while fucoids dominate the flatter areas (Sem.FvesR or Fves), though these communities should not be confused with Sem.FvesR. Cht can also occur above Sem. On very sheltered sea lochs in Argyll, West Scotland *Chthamalus* spp. are unusually abundant in the upper eulittoral zone.

Temporal variation

Unknown.

Similar biotopes

LR.FLR.Lic.Ver.Ver	Occurs in the littoral fringe above the Cht.Cht biotope. The barnacles *C. montagui* and *S. balanoides* and limpets *P. vulgata* are sparse (all Occasional) while *V. maura* occurs at a higher abundance (Abundant).
LR.HLR.MusB.Cht.Lpyg	Found especially in the south. *Lichina pygmaea* forms a distinct band, often with the bivalve *Lasaea adasoni* embedded in the thalli. The species composition is similar though red and green seaweeds such as *Corallinaceae* and *Enteromorpha* spp. are not present.
LR.HLR.MusB.Sem.FvesR	Occurs in the mid eulittoral zone on slightly less exposed shores. It notably lacks *Chthamalus* spp. and is dominated by a higher abundance of *S. balanoides* and the whelk *Nucella lapillus.* Usually, a sparse flora of seaweeds is present including the wrack *Fucus vesiculosus* and the green seaweed *Enteromorpha* spp.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Actinia equina	●●●	Occasional	2	
Chthamalus montagui	●●●●●	Abundant	29	
Chthamalus stellatus	●●●	Common	7	
Semibalanus balanoides	●●●	Frequent	7	
Patella vulgata	●●●●●	Common	19	
Littorina	●●	Common	2	
Melarhaphe neritoides	●●	Common	3	
Littorina saxatilis	●●●●	Frequent	11	
Mytilus edulis	●●●●	Occasional	6	
Enteromorpha intestinalis	●●	Frequent	2	
Verrucaria maura	●●	Frequent	2	

LR.HLR.MusB.Cht.Lpyg *Chthamalus* spp. and *Lichina pygmaea* on steep exposed upper eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	
Substratum:	Bedrock
Zone:	Littoral fringe - lower, Eulittoral - upper
Other features:	Steep sunny rock

Previous code

ELR.BPat.Lic	97.06
ELR.BPat.Lpyg	96.7
LRK.LPYG	6.95

Biotope description

Areas of steep and vertical rock in the upper eulittoral on very exposed to moderately exposed shores characterised by tufts of the dark brownish lichen *Lichina pygmaea* and the barnacles *Chthamalus montagui* and *Chthamalus stellatus*, although long-established patches of *L. pygmaea* ultimately exclude barnacles. The rigid branching thallus of *L. pygmaea* provides an ideal habitat for the bivalve *Lasaea adasoni*, the winkles *Littorina saxatilis* and *Melarhaphe neritoides*. The anemone *Actinia equina* and the mussel *Mytilus edulis* are confined to moist cracks and crevices, while the limpet *Patella vulgata* is found on the open bedrock. In the south-west the top shell *Gibbula umbilicalis* can be found on *L. pygmaea*. On the north-east coast this biotope does not have *Chthamalus* spp., *L. pygmaea* being the most important characterising species on these sites.

Situation

The band of *L. pygmaea* lies between the *Verrucaria maura* zone (Ver.B or Ver.Ver) above and the barnacle-*P. vulgata* zone (Sem) below. Other upper shore biotopes (Ver.B or Ver.Ver) may contain occasional patches of *L. pygmaea*, particularly on steep sunny faces, though not forming a distinct zone. *L. pygmaea* also occurs on less steeply-sloping shores if they are in a sunny aspect. In some areas, a high abundance of *L. pygmaea* results in a distinct zone, particularly in the south. On *Chthamalus* spp. dominated shores (south and west coasts) the band of *L. pygmaea* lies within the barnacle zone, whereas on *Semibalanus balanoides* dominated shores (north and east coasts) Cht.Lpyg lies astride the upper limit of the barnacles (Sem).

Temporal variation

Unknown.

Similar biotopes

LR.FLR.Lic.Ver.Ver	Occurs above Cht.Lpyg. *V. maura* is the dominant lichen. *C. montagui* occurs at a lower density.
LR.HLR.MusB.Cht.Cht	Occurs in similar physical conditions. Similar species composition though red and green seaweeds such as coralline algae and *Enteromorpha* spp. can be present in small numbers. *L. pygmaea* do not form a distinct band, but may be present in small patches.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Actinia equina	••	Frequent	2	
Chthamalus montagui	•••••	Common	22	
Chthamalus stellatus	•••••	Frequent	9	
Patella vulgata	••••	Abundant	15	
Littorina	••••	Frequent	6	
Melarhaphe neritoides	••••	Common	6	
Littorina saxatilis	•••••	Common	17	
Mytilus edulis	•••	Occasional	3	
Lasaea adansoni	••	Occasional	1	
Lichina pygmaea	•••••	Frequent	12	

LR.HLR.MusB.Sem *Semibalanus balanoides* on exposed to moderately exposed or vertical sheltered eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Bedrock; large boulders
Zone:	Eulittoral - upper, Eulittoral - mid
Height band:	Upper shore, Mid shore
Other features:	Also on sheltered vertical bedrock

Previous code

SLR.FX.Blit	97.06
ELR.BPat.Sem	97.06
ELR.BPat.Fvesl	97.06

Biotope description

Exposed to moderately exposed mid to upper eulittoral bedrock and large boulders characterised by dense barnacles *Semibalanus balanoides* and the limpet *Patella vulgata*. The community has a relatively low diversity of species though occasional cracks and crevices in the rock can provide a refuge for small individuals of the mussel *Mytilus edulis*, the winkle *Littorina saxatilis* and the whelk *Nucella lapillus*. Seaweeds are usually not found in high numbers though fissures and crevices in the bedrock can hold a sparse algal community including the green seaweed *Enteromorpha intestinalis*. On some shores the olive green lichen *Verrucaria mucosa* can be present in some abundance (Frequent). Three variants have been described: A *S. balanoides* and *P. vulgata* dominated community on bedrock (Sem.Sem); *S. balanoides* and sparse *Fucus vesioculosus* and red seaweeds (Sem.FvesR); and barnacles and *L. littorea* eulittoral boulders and cobbles (Sem.LitX).

Situation

On very exposed to exposed shores *Chthamalus* spp. (see Cht for geographical variation) often forms a distinct white band above a darker band of *S. balanoides* in the mid eulittoral zone. Alternatively, the black lichen *Verrucaria maura* dominated biotopes (Ver.Ver or Ver.B) may be found above Sem. In the lower eulittoral and the sublittoral fringe a community dominated by the wrack *Himanthalia elongata* and various red seaweeds such as *Corallina officinalis*, *Mastocarpus stellatus* and *Osmundea pinnatifida* (Him; Coff; Osm) often occurs. Sem may also occur on steep and vertical faces on more sheltered shores, while fucoids dominate the flatter areas (FvesB; Sem.FvesR).

Temporal variation

Periods with little scour or calmer weather can allow a seaweed community to develop, creating a more diverse biotope (i.e. Fves or FvesB). This is a dynamic process, which will change individual sites over time. More information is required to determine the exact nature of this process.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	•••••	Abundant	38	
Patella vulgata	••••	Common	18	
Littorina	•••	Common	8	
Littorina saxatilis	••	Frequent	5	
Nucella lapillus	•••	Frequent	5	
Mytilus edulis	••••	Occasional	9	
Enteromorpha intestinalis	••	Occasional	2	
Verrucaria mucosa	••	Frequent	2	

LR.HLR.MusB.Sem.Sem *Semibalanus balanoides, Patella vulgata* and *Littorina* spp. on exposed to moderately exposed or vertical sheltered eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	
Substratum:	Bedrock; large boulders
Zone:	Eulittoral - upper, Eulittoral - mid
Height band:	Upper shore, Mid shore
Other features:	Also on sheltered vertical bedrock

Previous code

ELR.BPat.Sem	97.06

Biotope description

Very exposed to sheltered mid to upper eulittoral bedrock and large boulders characterised by dense barnacles *Semibalanus balanoides* and the limpet *Patella vulgata*. The community has a relatively low diversity of species though occasional cracks and crevices in the rock can provide a refuge for small individuals of the mussel *Mytilus edulis*, the winkle *Littorina* spp. and the whelk *Nucella lapillus*. Seaweeds are usually not found in high numbers though fissures and crevices in the bedrock can hold a sparse algae community, though patches of the red seaweed *Osmundea pinnatifida* can be present throughout the zone. On some shores the olive green lichen *Verrucaria mucosa* can be present in some abundance (Frequent). Records should not be assigned to this species impoverished biotope if there is a significant number or abundance of seaweeds.

Situation

On very exposed to exposed shores *Chthamalus* spp. (see Cht.Cht for geographical variation) often forms a distinct white band above a darker band of *S. balanoides* in the mid eulittoral zone. Alternatively, found above Sem are the black lichen *Verrucaria maura* dominated biotopes (Ver.Ver or Ver.B). In the lower eulittoral and the sublittoral fringe is a community dominated by the wrack *Himanthalia elongata* and various red seaweeds including *Corallina officinalis*, *Mastocarpus stellatus* and *Osmundea pinnatifida* (Him; Coff; Osm) or the mussel and barnacle dominated biotope MytB. Sem.Sem may occur on steep and vertical faces on more sheltered shores, while fucoids dominate the flatter areas (Sem.FvesR; FvesB).

Temporal variation

Periods with little scour or less severe storms can allow a seaweed community to develop creating a more diverse biotope (i.e. Fves). This is a dynamic process, which will change individual sites over time. More information is required to validate this hypothesis.

Similar biotopes

LR.HLR.MusB.Sem.FvesR	Occurs on slightly less exposed shores. It has a higher abundance of *S. balanoides* (Abundant) and has a sparse seaweed community. The anemone *Actinia equina* is usually present in cracks and crevices.
LR.HLR.MusB.Cht.Cht	Usually occurs above Sem in the upper eulittoral zone. It is dominated by the barnacles *Chthamalus* spp. which often are favoured on very exposed shores. *S. balanoides* can still be present in significant numbers.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	●●●●●	Common	35	
Patella vulgata	●●●●	Common	32	
Nucella lapillus	●●●	Frequent	4	
Mytilus edulis	●●●●	Occasional	9	
Enteromorpha intestinalis	●●	Occasional	2	
Verrucaria mucosa	●●	Frequent	2	

LR.HLR.MusB.Sem.FvesR *Semibalanus balanoides, Fucus vesiculosus* and red seaweeds on exposed to moderately exposed eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Bedrock
Zone:	Eulittoral - upper, Eulittoral - mid
Height band:	Mid shore
Other features:	The growth form *Fucus vesiculosus* f. *linearis* is often present

Previous code

MLR.BPat.Fvesl	97.06

Biotope description

Exposed and moderately exposed upper and mid eulittoral bedrock characterised by the barnacle *Semibalanus balanoides*, the limpet *Patella vulgata* and the whelk *Nucella lapillus* with a sparse community of seaweeds. Turfs of the wrack *Fucus vesiculosus* can be present on the more horizontal parts of the shore though usually in low abundance (Occasional). Individuals of *F. vesiculosus* can lack the characteristic twin air bladders due to environmental stress (i.e. wave exposure). A sparse seaweed community consisting of foliose red seaweeds such as *Osmundea pinnatifida* and *Mastocarpus stellatus* are usually present along with the *Corallina officinalis* and the green seaweed *Enteromorpha intestinalis*. The algal community is usually restricted to fissures and cracks in the bedrock surface. Moist cracks and crevices also provide a refuge for small individuals of the mussel *Mytilus edulis* and the winkles *Littorina saxatilis* and *Littorina littorea*. These crevices can also be occupied by encrusting coralline algae and the anemone *Actinia equina*.

Situation

On exposed and moderately exposed shores Sem.FvesR is found below the black lichen *Verrucaria maura* and sparse barnacles biotope (Ver.B) and/or below the *Chthamalus* spp. and *P. vulgata* biotopes (Cht). Sem.FvesR is found above the biotope dominated by the wrack *Himanthalia elongata* (Him) or the red seaweed biotopes (Coff).

Temporal variation

On some shores, particularly those which are moderately exposed to wave action, temporal fluctuations in the abundance of limpets, barnacles and fucoid seaweeds may occur. As a result, over a number of years, a single shore may cycle between the barnacle-*P. vulgata* dominated biotope (Sem.FvesR) and a *F. vesiculosus*-dominated biotope (Fves). Individuals of *F. vesiculosus* growing in stressed environmental conditions (i.e. high wave exposure) do not always develop the characteristic twin air bladders.

Similar biotopes

LR.HLR.MusB.Cht	Occurs in the upper eulittoral zone on slightly more exposed shores. It is dominated by the barnacles *Chthamalus* spp. and has a lower abundance of *S. balanoides* and *N. lapillus*. It lacks the sparse flora of seaweeds that are characteristic of Sem.FvesR.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Actinia equina	••••	Occasional	4	
Semibalanus balanoides	•••••	Abundant	27	
Patella vulgata	•••••	Abundant	19	
Littorina	••	Frequent	8	
Littorina littorea	•••	Occasional	2	
Littorina saxatilis	•••	Occasional	2	
Nucella lapillus	••••	Frequent	3	
Mytilus edulis	••••	Occasional	6	
Corallinaceae	••••	Occasional	4	
Corallina officinalis	•••	Occasional	2	
Mastocarpus stellatus	•••	Occasional	2	
Osmundea pinnatifida	••••	Occasional	3	
Fucus vesiculosus	••••	Occasional	4	
Enteromorpha intestinalis	••••	Occasional	4	

LR.HLR.MusB.Sem.LitX *Semibalanus balanoides* and *Littorina* spp. on exposed to moderately exposed eulittoral boulders and cobbles

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Boulders; cobbles; pebbles
Zone:	Eulittoral
Height band:	Mid shore

Previous code

BLlit in part	97.06
LMXD.BLIT in part	6.95

Biotope description

Large patches of boulders, cobbles and pebbles in the eulittoral zone on exposed to moderately exposed shores colonised by the barnacle *Semibalanus balanoides* and, on larger rocks, the limpet *Patella vulgata*. The winkles *Littorina littorea* and *Littorina saxatilis* and the whelk *Nucella lapillus* are typically found in high numbers on and around cobbles and smaller boulders, while the anemone *Actinia equina* occurs in damp areas between and underneath larger boulders. Between the cobbles and pebbles, the mussel *Mytilus edulis* occasionally occurs, but always at low abundance, as do the crab *Carcinus maenas* and gammarid amphipods. Ephemeral green seaweeds such as *Enteromorpha intestinalis* may cover cobbles and boulders. The foliose red seaweeds *Chondrus crispus*, *Mastocarpus stellatus* and *Osmundea pinnatifida* as well as the wrack *Fucus vesiculosus* may also occur in low abundance on cobbles and boulders. The top shells *Gibbula cineraria* and *Gibbula umbilicalis* can, on more sheltered shores, be found among the seaweeds or underneath the boulders. The barnacle *Elminius modestus* is present on some shores.

Situation

On exposed shores with large boulders Sem.LitX is found below the black lichen *Verrucaria maura* and sparse barnacles biotope (Ver.Ver or Ver.B) and/or below the *Chthamalus* spp. and *P. vulgata* biotope (Cht). Below this biotope the *Himanthalia elongata* dominated biotopes may occur (Him; Coff). On less exposed shores Sem.LitX can be found above the *Fucus serratus* biotope on boulders (Fser.Bo).

Temporal variation

Seasonally mobile boulders, cobbles and pebbles are likely to have a sparser coverage of flora and fauna, because the rocks can be subject to turning. Ephemeral green seaweeds can dominate during the summer.

Similar biotopes

LR.HLR.MusB.Sem.FvesR	Occurs at a similar wave exposure in the eulittoral zone, but usually on bedrock. Due to the more stable substrata *N. lapillus* (Frequent) and *P. vulgata* (Abundant) are found in higher abundance. *L. littorea* are not present in high abundance (Occasional) and *C. maenas* are rare.
LR.HLR.MusB.Sem.Sem	Occurs at a similar wave exposure in the eulittoral zone, but on bedrock shores. This biotope has a lower species diversity and notably lacks *A. equina* and *L. littorea*, while *L. saxatilis* is common. Seaweeds are also usually rare due to wave scourge.
LR.FLR.Eph.BLitX	Occurs on sheltered to extremely sheltered shores with mixed substrata and often with reduced salinity. Large boulders or bedrock are not present. The species diversity and their abundance are impoverished with the notable absence of red seaweeds.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Actinia equina	●●●	Occasional	4	
Semibalanus balanoides	●●●●●	Abundant	25	
Carcinus maenas	●●●	Occasional	2	
Patella vulgata	●●●●●	Common	15	
Littorina littorea	●●●●●	Common	22	
Littorina saxatilis	●●●●	Frequent	7	
Nucella lapillus	●●●	Occasional	4	
Mytilus edulis	●●●●	Occasional	5	
Corallinaceae	●●●	Occasional	1	
Mastocarpus stellatus	●●●	Occasional	1	
Fucus vesiculosus	●●●	Occasional	2	
Enteromorpha intestinalis	●●	Occasional	1	

LR.HLR.FR Robust fucoid and/or red seaweed communities

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed
Tidal streams:	
Substratum:	Bedrock
Zone:	Eulittoral
Height band:	Upper shore, Mid shore, Lower shore

Previous code

MLR.R in part	97.06
ELR.FR in part	97.06

Biotope description

This biotope complex encompasses those seaweeds that are able to tolerate the extreme conditions of very exposed to moderately exposed rocky shores. The physical stresses caused by wave action often results in dwarf forms of the individual seaweeds. The strong holdfasts and short tufts structure of the wracks *Fucus distichus* and *Fucus spiralis* f. *nana* allow these fucoids to survive on extremely exposed shores in the north and north-west (Fdis). Another seaweed able to tolerate the wave-wash is the red seaweed *Corallina officinalis*, which can form a dense turf on the mid to lower shore (Coff). The wrack *Himanthalia elongata* occurs on the lower shore and can extend on to moderately exposed shores (Him). The red seaweed *Mastocarpus stellatus* is common on both exposed and moderately exposed shores, where it may form a dense turf (particularly on vertical or overhanging rock faces, Mas). Very exposed to moderately exposed lower eulittoral rock can support a pure stand of the red seaweed *Palmaria palmata*. It is found either as a dense band or in large patches above the main sublittoral fringe (Pal). Exposed to moderately exposed lower eulittoral rock characterised by extensive areas or a distinct band of *Osmundea pinnatifida* (Osm). Outcrops of fossilised peat in the eulittoral are soft enough to allow a variety of piddocks, such as *Barnea candida* and *Petricola pholadiformis*, to bore into them (RPid). This biotope is rare. Other species such as the anemone *Halichondria panicea*, the barnacle *Semibalanus balanoides*, the limpet *Patella vulgata*, the mussel *Mytilus edulis* and the whelk *Nucella lapillus* can be present as well, but they are never dominant as in the MusB-complex. There is also a higher number of seaweeds present including the red *Palmaria palmata*, *Lomentaria articulata*, *Ceramium* spp. and the brown seaweeds *Laminaria digitata* and *Fucus serratus. The green seaweeds* Enteromorpha intestinalis, Ulva lactuca *and* Cladophora rupestris *are occasionally present.*

Situation

This biotope complex is present on extremely exposed to moderately exposed upper to lower shores.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Halichondria panicea	••	Occasional	1	
Semibalanus balanoides	••••	Frequent	10	
Patella vulgata	••••	Common	10	
Littorina neglecta	••	Frequent	1	
Nucella lapillus	•••	Occasional	3	
Mytilus edulis	•••	Occasional	4	
Palmaria palmata	•••	Occasional	3	
Corallinaceae	•••	Frequent	4	
Corallina officinalis	••••	Frequent	10	
Mastocarpus stellatus	••••	Frequent	10	
Lomentaria articulata	•••	Occasional	2	
Ceramium	••	Occasional	1	
Osmundea pinnatifida	••••	Frequent	6	
Laminaria digitata	••	Occasional	1	
Fucus serratus	•••	Occasional	2	
Himanthalia elongata	••••	Common	11	
Enteromorpha	•••	Occasional	3	
Ulva	••	Occasional	2	
Cladophora	••	Occasional	1	

LR.HLR.FR.Fdis *Fucus distichus* and *Fucus spiralis* f. *nana* on extremely exposed upper shore rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed
Tidal streams:	
Substratum:	Bedrock
Zone:	Littoral fringe - lower, Eulittoral - upper

Previous code

LRK.FDIS	6.95
ELR.FR.Fdis	97.06

Biotope description

Extremely exposed gently or steeply sloping upper shore bedrock which supports a mixture of the wracks *Fucus distichus* and *Fucus spiralis* f. *nana*, the latter often at the top of the zone. On some sites *F. distichus* dominates and *F. spiralis* is not present. Other seaweeds normally found on exposed coasts are common in this biotope. These include ephemeral species such as the foliose red *Porphyra umbilicalis* and the green *Enteromorpha* spp. The winkles *Melarhaphe neritoides* and *Littorina saxatilis* can be found grazing on the bedrock or on the fucoids, while red crusts of *Hildenbrandia rubra* and the mussel *Mytilus edulis* are restricted to moist cracks and crevices. A sparse covering of the black lichens *Verrucaria maura* and *Verrucaria mucosa* can be found in the upper part of this biotope competing for space with barnacle *Semibalanus balanoides* and the limpet *Patella vulgata*. This biotope is very rare and restricted to the far north and west coasts.

Situation

This mixed band of *F. distichus* and *F. spiralis* f. *nana* is generally found between the *Verrucaria maura* and *Porphyra* spp. zone (Ver.Ver or Ver.B) above, and the *M. edulis* and barnacle zone below (MytB). It may also occur above a red algal zone consisting of *Mastocarpus stellatus* as recorded on Barra.

Temporal variation

Due to the occurrence of this biotope on very exposed coasts a certain amount of fluctuation between this biotope and the Ver.B biotope from year to year is to be expected. More information is required to validate this hypothesis. There can be seasonal fluctuations in the density of ephemeral green algae.

Similar biotopes

LR.FLR.Eph.Ent	Occurs over a wide range of wave exposures and from the supralittoral to the upper eulittoral zone on freshwater influenced or unstable rock. Brown seaweeds including the wracks *Pelvetia canaliculata*, *F. spiralis* and *F. distichus* are not present, while different species of *Enteromorpha* dominate this biotope.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	●●●●●	Occasional	7	
Patella vulgata	●●●●●	Frequent	11	
Littorina	●●●●	Common	3	
Melarhaphe neritoides	●●●	Common	7	
Littorina saxatilis	●●●	Common	5	
Mytilus edulis	●●●●	Occasional	4	
Porphyra umbilicalis	●●●●	Frequent	6	
Hildenbrandia rubra	●●●	Common	5	
Corallinaceae	●●●	Frequent	3	
Fucus distichus	●●●●	Frequent	5	
Fucus spiralis	●●●●	Common	7	
Enteromorpha intestinalis	●●●●●	Common	19	
Verrucaria maura	●●●●	Frequent	7	
Verrucaria mucosa	●●	Frequent	2	

LR.HLR.FR.Coff *Corallina officinalis* on exposed to moderately exposed lower eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock
Zone:	Eulittoral - lower
Height band:	Lower shore

Previous code

LRK.RED.COR	6.95

Biotope description

Very exposed to moderately exposed lower eulittoral rock that supports a dense turf of the red seaweed *Corallina officinalis*, often on wave surged rocky slopes. There is usually a low abundance of other turf-forming red seaweeds including *Lomentaria articulata*, *Mastocarpus stellatus*, *Palmaria palmata* and *Osmundea pinnatifida*. Other seaweeds that occur in low abundance includes the wrack *Himanthalia elongata*, *Laminaria digitata* while the brown seaweed *Leathesia difformis* can be found growing on and around the other seaweeds. The green seaweeds *Enteromorpha intestinalis*, *Ulva lactuca* and *Cladophora rupestris* are present as well. A number of invertebrates are present on the bedrock underneath the coralline turf, including the barnacle *Semibalanus balanoides*, the mussel *Mytilus edulis*, the sponges *Halichondria panicea* and *Hymeniacidon perleve*, the anemone *Actinia equina* and the limpets *Patella ulyssiponensis* and *Patella vulgata*. The brown seaweed *Bifurcaria bifurcata* and the barnacle *Balanus perforatus* may occur in the extreme south-west. Two variants have been described: *C. officinalis* and kelp (Coff.Coff) and *C. officinalis*, *H. elongata* and the limpet *P. ulyssiponensis* (Coff.Puly).

Situation

This community usually forms a distinct band just above the kelp zone (Ala, Ala.Ldig or Ldig). It can be found below the barnacle and *P. vulgata* dominated biotopes (Cht; Sem; Sem.FvesR).

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Halichondria panicea	●●●	Occasional	1	
Hymeniacidon perleve	●●●	Occasional	1	
Actinia equina	●●●	Occasional	2	
Semibalanus balanoides	●●●	Common	5	
Patella ulyssiponensis	●●●●	Common	7	
Patella vulgata	●●●	Common	4	
Mytilus edulis	●●●	Occasional	2	
Palmaria palmata	●●●	Occasional	2	
Corallinaceae	●●●●	Common	6	
Corallina officinalis	●●●●●	Abundant	17	
Mastocarpus stellatus	●●●●●	Frequent	3	
Lomentaria articulata	●●●	Frequent	10	
Osmundea pinnatifida	●●●●	Frequent	7	
Leathesia difformis	●●	Occasional	1	
Laminaria digitata	●●●	Occasional	2	
Bifurcaria bifurcata	●	Occasional	1	
Enteromorpha intestinalis	●●●●	Occasional	4	
Ulva lactuca	●●	Occasional	2	

LR.HLR.FR.Coff.Coff *Corallina officinalis* on exposed to moderately exposed lower eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Bedrock
Zone:	Eulittoral - lower
Height band:	Lower shore

Previous code

LRK.RED.COR	6.95
ELR.Coff	97.06

Biotope description

Exposed lower eulittoral rock or moderately exposed lower eulittoral vertical rock that supports a dense turf of the red seaweed *Corallina officinalis*, often on wave surged rocky slopes. There is usually a low abundance of other turf-forming red seaweeds such as *Lomentaria articulata*, *Mastocarpus stellatus*, *Palmaria palmata* and *Osmundea pinnatifida*. Other seaweeds that occur in low abundance includes the wrack *Himanthalia elongata* and the kelp *Laminaria digitata*, while the brown seaweed *Leathesia difformis* can be found growing on and around the other seaweeds. Green seaweeds such as *Enteromorpha intestinalis*, *Ulva lactuca* and *Cladophora rupestris* are also present. The coralline turf creates a micro-habitat for small animals such as the colonial tube building polychaete *Pomatoceros* sp. and the barnacle *Semibalanus balanoides*. The mussel *Mytilus edulis* is often found in small cracks and crevices while the sponges *Halichondria panicea* and *Hymeniacidon perleve* can be found in shaded areas or on overhangs. The limpets *Patella ulyssiponensis* and *Patella vulgata* can be found on the bedrock underneath the turf. The brown seaweed *Bifurcaria bifurcata* and the barnacle *Balanus perforatus* may occur in the extreme south-west.

Situation

This community usually forms a distinct band just above the kelp zone (Ala, Ala.Ldig or Ldig). It can be found below the barnacle and *P. vulgata* dominated biotopes (Cht; Sem.Sem; Sem.FvesR).

Temporal variation

If there is many of the characteristic *H. elongata* buttons present in early spring careful comparison with the Him biotope should be made (See Similar biotopes).

Similar biotopes

LR.HLR.FR.Coff.Puly	Occurs on exposed to very exposed coasts, but otherwise similar physical conditions. The limpet *Patella ulyssiponensis* is present and sponges such as *Grantia compressa* and *H. perleve* are also present. The barnacles *Chthamalus stellatus* and *Balanus perforatus* are present though *C. officinalis* occur at high abundance (Common). *H. elongata* can dominate this biotope (Abundant).
LR.HLR.FR.Him	Occurs in similar physical conditions. *H. elongata* is always present in high abundance (Common) either as buttons (early spring) or with long erect fronds (summer), while *C. officinalis* is not dominating (Frequent). *H. perleve* are usually absent.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Halichondria panicea	●●●	Occasional	1	
Hymeniacidon perleve	●●●	Occasional	2	
Pomatoceros	●●●	Occasional	2	
Semibalanus balanoides	●●●●	Common	11	
Patella ulyssiponensis	●●●	Common	2	
Patella vulgata	●●●●	Common	7	
Mytilus edulis	●●●	Occasional	1	
Palmaria palmata	●●●	Occasional	1	
Corallinaceae	●●●●	Common	8	
Corallina officinalis	●●●●●	Abundant	17	
Mastocarpus stellatus	●●●●●	Common	13	
Lomentaria articulata	●●●	Frequent	3	
Osmundea pinnatifida	●●●●	Frequent	5	
Leathesia difformis	●●●	Occasional	2	
Laminaria digitata	●●	Occasional	1	
Himanthalia elongata	●●●	Frequent	3	
Enteromorpha intestinalis	●●●●	Occasional	4	
Ulva lactuca	●●	Occasional	2	
Cladophora rupestris	●●	Occasional	1	

LR.HLR.FR.Coff.Puly *Corallina officinalis, Himanthalia elongata* and *Patella ulyssiponensis* on very exposed lower eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed
Tidal streams:	
Substratum:	Bedrock
Zone:	Eulittoral - lower
Height band:	Lower shore

Previous code

ELR.Coff in part	97.06

Biotope description

Very exposed to exposed lower eulittoral bedrock shores in the south-west can support a dense turf of the red seaweed *Corallina officinalis* found underneath the long erect fronds of the wrack *Himanthalia elongata*. The rock surface is pitted with the limpet *Patella ulyssiponensis*. Also found on the bedrock is the barnacle *Chthamalus stellatus* or the limpet *Patella vulgata*, while numerous cracks and crevices provide shelter for anemones such as *Actinia equina* or the mussel *Mytilus edulis*. Other turf-forming red seaweeds include *Lomentaria articulata*, *Mastocarpus stellatus*, *Palmaria palmata*, *Gastroclonium ovatum*, *Ceramium* spp. and *Osmundea pinnatifida* which can be found along with the kelp *Laminaria digitata*. Foliose green seaweeds such as *Enteromorpha intestinalis* and *Ulva lactuca* may also be present along with siphonous *Codium* spp. Sponges such *as Grantia compressa*, *Halichondria panicea* and *Hymeniacidon perleve* may be present in shaded areas. The brown seaweed *Bifurcaria bifurcata* and the barnacle *Balanus perforatus* may occur in the extreme south-west.

Situation

This community usually forms a distinct band just above the kelp zone (Ala; Ala.Ldig or Ldig). It can be found below the barnacle and *P. vulgata* dominated biotopes (Cht; Sem or Sem.FvesR).

Temporal variation

There might be some fluctuations in the abundance of the individual species from year to year, which reverts this biotope into either the Coff.Coff or the Him biotopes.

Similar biotopes

LR.HLR.FR.Coff.Coff	Occurs on moderately exposed to exposed coasts, but otherwise similar physical conditions. The biotope is dominated by *C. officinalis* while *H. elongata* is not present in high abundance (Frequent). *C. stellatus* is usually absent.
LR.HLR.FR.Him	Occurs in similar physical conditions. *H. elongata* is always present in high abundance (Common) while *C. officinalis* is not dominating (Frequent). *C. stellatus* and *P. ulyssiponensis* are usually absent.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Actinia equina	••••	Occasional	4	
Chthamalus stellatus	•••	Common	3	
Patella ulyssiponensis	•••••	Common	13	
Patella vulgata	••	Frequent	2	
Mytilus edulis	•••	Frequent	2	
Porphyra umbilicalis	••	Occasional	1	
Palmaria palmata	•••	Occasional	2	
Corallinaceae	•••	Common	3	
Corallina officinalis	•••••	Common	14	
Mastocarpus stellatus	••••	Occasional	6	
Chondrus crispus	•••	Occasional	2	
Gastroclonium ovatum	•••	Occasional	1	
Lomentaria articulata	•••	Occasional	2	
Ceramium	•••	Occasional	3	
Osmundea pinnatifida	•••••	Frequent	8	
Laminaria digitata	••••	Occasional	2	
Himanthalia elongata	••••	Abundant	10	
Enteromorpha intestinalis	••••	Occasional	3	
Ulva lactuca	•••	Occasional	1	
Codium	••	Occasional	1	

LR.HLR.FR.Him *Himanthalia elongata* and red seaweeds on exposed to moderately exposed lower eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Bedrock
Zone:	Eulittoral - lower
Other features:	$himanthalia elongata$ may only be present as buttons in early spring

Previous code

ELR.FR.Him	97.06
LRK.HIM	6.95

Biotope description

Exposed to moderately exposed lower eulittoral bedrock characterised by the wrack *Himanthalia elongata* with a dense turf of red seaweeds beneath. *H. elongata* may occur on tide-swept, sheltered shores in sea lochs (e.g. Loch Maddy). The wrack *Fucus serratus* is normally present as well. The predominant red seaweeds are usually *Mastocarpus stellatus*, *Osmundea pinnatifida*, *Corallina officinalis* and *Palmaria palmata* that tend to grow over a crust of the pink coralline algae *Lithothamnion* spp. Any patches between the algal turf may be colonised by barnacles *Semibalanus balanoides*, or *Balanus perforatus* in the south-west, and by the limpet *Patella vulgata*. Pits and crevices in the rock often provide a refuge for the whelk *Nucella lapillus*, the winkle *Littorina* spp. and small individuals of the mussel *Mytilus edulis*. Besides the dominant seaweeds there are a number of other red, brown and green seaweeds present. These include species such as the red seaweeds *Dumontia contorta*, *Lomentaria articulata*, *Porphyra* spp., the kelp *Laminaria digitata* and the green seaweeds *Enteromorpha intestinalis*, *Ulva lactuca* and *Cladophora rupestris*.

Situation

On some shores this biotope may occur as a distinct zone between a *Fucus serratus* and red algal turf (Fser.R) and the kelp *Alaria esculenta* and *L. digitata* community (Ala.Ldig). This biotope generally characterises those shores which are too exposed for *F. serratus* to form a dense canopy, often occurring as large patches within the *F. serratus* / red seaweed turf zone (Fser.R). Consequently, *F. serratus* plants frequently occur amongst the *H. elongata* and red seaweed turf.

Temporal variation

In early spring only characteristic *H. elongata* buttons are present, while the long erect parts of the thalli appears later in the season. This biotope may therefore appear very similar to Coff.Coff biotope in the spring and care should be taken when assessing these biotopes in early spring (See Similar biotopes).

Similar biotopes

LR.HLR.FR.Coff.Coff	Occurs in the lower eulittoral zone on exposed to moderately exposed shores. *C. officinalis* dominates instead of *H. elongata* and the limpet *Patella ulyssiponensis* can be common. The species richness of red seaweeds are higher, while kelp such as *Alaria esculenta* and wracks such as *Fucus* spp. are not as common if present at all.
LR.HLR.FR.Coff.Puly	Occurs on very exposed to exposed shores. The limpet *P. ulyssiponensis* and sponges such as *Grantia compressa* and *Hymeniacidon perleve* are present. Also the barnacles *Chthamalus stellatus* and *Balanus perforatus* are present and *C. officinalis* occur at higher abundance (Common). *H. elongata* can still be present at high abundance (Abundant.)

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	••••	Common	10	
Patella vulgata	••••	Common	10	
Littorina	••	Frequent	2	
Nucella lapillus	••••	Occasional	4	
Mytilus edulis	•••	Frequent	4	
Palmaria palmata	•••	Occasional	2	
Dumontia contorta	•••	Occasional	1	
Corallinaceae	•••	Frequent	3	
Corallina officinalis	•••••	Frequent	9	
Lithothamnion	••	Frequent	2	
Mastocarpus stellatus	•••••	Frequent	10	
Lomentaria articulata	•••	Occasional	1	
Osmundea pinnatifida	••••	Frequent	5	
Laminaria digitata	•••	Occasional	2	
Fucus serratus	•••	Frequent	3	
Himanthalia elongata	•••••	Common	18	
Enteromorpha intestinalis	•••	Occasional	2	
Ulva lactuca	••	Occasional	1	
Cladophora rupestris	•••	Frequent	2	

LR.HLR.FR.Pal *Palmaria palmata* on very exposed to moderately exposed lower eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	
Substratum:	Bedrock; boulders
Zone:	Eulittoral - lower

Previous code

MLR.R.Pal	97.06
MLR.R.Pal	96.7
LRK.RED.PAL	6.95

Biotope description

Very exposed to moderately exposed lower eulittoral rock which supports a pure stand of dulse *Palmaria palmata* as a dense band or in large patches above the main kelp zone. *P. palmata* favours shaded or overhanging rock and often forms a band at the top of overhanging rock. Relatively low abundance of other seaweeds, such as the red seaweed *Porphyra umbilicalis* or the green seaweeds *Enteromorpha intestinalis, Ulva lactuca* and *Cladophora rupestris* may also occur in this biotope although *P. palmata* always dominates. On the rock underneath the seaweed turf are the barnacle *Semibalanus balanoides* and the limpet *Patella vulgata and the olive-green lichen* Verrucaria mucosa.. Sites should only be recorded as Pal where *P. palmata* forms a distinct band or occurs in large patches on the shore.

Situation

This biotope is found below the biotopes dominated by the *P. vulgata, S. balanoides,* the wrack *Fucus distichus* or *E. intestinalis* (Sem; Fdis; Ent). It is found above biotopes dominated by the kelp *Alaria esculenta* and *Laminaria digitata* (Ala.Ldig; Ldig.Ldig).

Temporal variation

It is likely that the *P. palmata* biotope represents an opportunistic assemblage of fast-growing species which occupy gaps within or between the canopies of long lived perennials such as the wrack *Fucus serratus*.

Similar biotopes

LR.HLR.MusB.MytB	Occurs on exposed shores where *P. palmata* often forms a luxurious growth on *M. edulis* on exposed shores in which case it should be recorded as MytB. *P. palmata* is a common component of adjacent biotopes.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	●●●●●	Frequent	14	
Patella vulgata	●●●●●	Frequent	15	
Porphyra umbilicalis	●●●●	Occasional	6	
Palmaria palmata	●●●●●	Abundant	37	
Enteromorpha intestinalis	●●●	Frequent	3	
Ulva lactuca	●●●●	Occasional	6	
Cladophora rupestris	●●●●	Occasional	8	
Verrucaria mucosa	●●●●	Rare	4	

LR.HLR.FR.Mas *Mastocarpus stellatus* and *Chondrus crispus* on very exposed to moderately exposed lower eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Bedrock; boulders
Zone:	Eulittoral - lower
Other features:	Vertical faces on very exposed rock

Previous code

MLR.R.Mas	97.06
MLR.R.Mas	96.7
LRK.RED.MAS	6.95

Biotope description

Exposed to moderately exposed lower eulittoral vertical to almost horizontal bedrock characterised by a dense turf of *Mastocarpus stellatus* and *Chondrus crispus* (either together or separately). Beneath these foliose seaweeds the rock surface is covered by encrusting coralline algae and the barnacle *Semibalanus balanoides*, the limpet *Patella vulgata* and spirorbid polychaetes. Other seaweeds including the red *Lomentaria articulata* and *Osmundea pinnatifida*, *Palmaria palmata*, *Corallina officinalis* and coralline crusts. The wrack *Fucus serratus* and the green seaweeds *Enteromorpha intestinalis* and *Ulva lactuca* may also be present though usually at a low abundance. Although both *M. stellatus* and *C. crispus* are widespread in the lower eulittoral and the sublittoral fringe, they occur only infrequently in a distinct band, or in large enough patches, to justify separation from Fser.R. Consequently, where only small patches of these species occur within a larger area of mixed red algal turf, then records should be assigned to more general mixed red algal turf biotope (Coff; Him). *M. stellatus* can be present in high abundance in a number of biotopes (Coff: Him; Fser.R etc.) found on the shore. At least one other species normally co-dominates and records should be assigned to the appropriate biotope. Caution should be taken regarding the characterising species list due to the low number of records. More information needed to validate this description.

Situation

This biotope can form a band above the main kelp zone, above *Alaria esculenta* (Ala) or the mussel *Mytilus edulis* (MytB) or within a *F. serratus*-red algal mosaic (Fser.R).

Temporal variation

M. stellatus is more resistant to wave action than *C. crispus* and may therefore dominate more exposed shores; it can dominate vertical rock at very exposed sites (e.g. Mingulay, Outer Hebrides). On more sheltered shores, especially in the south-west, *M. stellatus* may give way to *C. crispus* which has a faster growth rate.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Spirorbidae	●●●	Frequent	2	
Semibalanus balanoides	●●●●●	Frequent	9	
Patella vulgata	●●●●●	Common	13	
Palmaria palmata	●●●●	Occasional	3	
Corallinaceae	●●●●	Occasional	4	
Corallina officinalis	●●●●●	Occasional	8	
Mastocarpus stellatus	●●●●●	Abundant	21	
Chondrus crispus	●●●	Occasional	1	
Lomentaria articulata	●●●●	Occasional	4	
Osmundea pinnatifida	●●●●●	Occasional	7	
Fucus serratus	●●●●	Rare	2	
Enteromorpha intestinalis	●●●	Occasional	4	
Ulva lactuca	●●●●●	Occasional	10	

LR.HLR.FR.Osm *Osmundea pinnatifida* on moderately exposed mid eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Bedrock; boulders
Zone:	Eulittoral - mid

Previous code

MLR.R.Osm	97.06
MLR.R.Osm	96.7
LRK.RED.LAU	6.95

Biotope description

Exposed to moderately exposed lower eulittoral rock characterised by extensive areas or a distinct band of *Osmundea pinnatifida* and *Gelidium pusillum* (either together or separately). This community usually occurs on shores on which a fucoid canopy is reduced in extent, or even absent. Other turf-forming red seaweeds, such as *Corallina officinalis*, *Mastocarpus stellatus*, *Ceramium* spp. and *Callithamnion hookeri* may be present, although *O. pinnatifida* always dominate. On flatter, more sheltered shores, *Osmundea hybrida* may also occur. Small patches of bare rock amongst the algal turf are occupied by barnacles *Semibalanus balanoides*, the limpet *Patella vulgata*, the whelk *Nucella lapillus* and small individuals of the mussel *Mytilus edulis*. The winkles *Littorina littorea* and *Littorina saxatilis* can be present on the rock or among the seaweeds. A variation of this biotope has been described for the chalk platforms in Kent where extensive turfs of *G. pusillum* occur in the mid eulittoral above the main *O. pinnatifida* zone.

Situation

This biotope can be found below barnacles *S. balanoides* or red seaweed dominated community, which includes the species *Palmaria palmata*, *C. officinalis* or *M. stellatus* (Sem; Coff; Cor). It is found above biotopes dominated by the wrack *Fucus serratus* and red seaweeds (FcdR; MytFR; Fser.R) or above biotopes dominated by the kelp *Laminaria digitata* (Ldig.Ldig).

Temporal variation

Unknown.

Similar biotopes

LR.HLR.FR.Coff	Occurs in the lower eulittoral zone, but in otherwise similar physical conditions. The same species can occur in both biotopes although sponges such as *Halichondria panicea* and *Hymeniacidon perleve* can be present in Coff. *C. officinalis* (Abundant) dominates instead of *O. pinnatifida* (Frequent).
LR.HLR.FR.Sem	Occurs in the mid eulittoral zone above Osm. It has a similar species composition, but lacks the red algae community.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Actinia equina	••	Frequent	2	
Semibalanus balanoides	••••	Frequent	9	
Patella vulgata	•••	Frequent	6	
Littorina littorea	••••	Common	11	
Littorina saxatilis	•••	Occasional	2	
Nucella lapillus	•••	Occasional	4	
Mytilus edulis	•••	Occasional	4	
Corallinaceae	••••	Occasional	6	
Corallina officinalis	•••	Occasional	2	
Mastocarpus stellatus (Petrocelis)	•••	Occasional	3	
Osmundea pinnatifida	•••••	Abundant	41	
Fucus serratus	•••	Occasional	3	

LR.HLR.FR.RPid *Ceramium* sp. and piddocks on eulittoral fossilised peat

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	
Substratum:	Peat
Zone:	Eulittoral
Other features:	Soft rock

Previous code

MLR.R.Pid	97.06
MLR.R.Pid	96.7
LRK.PID.PEAT	6.95

Biotope description

Outcrops of fossilised peat in the eulittoral are soft enough to allow a variety of piddocks such as *Barnea candida* and *Petricola pholadiformis* to bore into them. The surface of the peat can be characterised by a dense algal mat, predominantly the red seaweed *Ceramium* spp. and with the green seaweeds *Ulva lactuca* and *Enteromorpha intestinalis*. Damp areas in the algal mat are covered by aggregations of the polychaetes *Lanice conchilega* and *Polydora* sp. The crabs *Carcinus maenas* and *Cancer pagurus* occur in crevices in the peat. Small pools on the peat may contain hydroids, such as *Obelia longissima* and *Kirchenpaueria pinnata*, the brown alga *Dictyota dichotoma* and the crustacean *Crangon crangon*. Description derived largely from sites in north Norfolk and this community could possibly be found on other "soft" substrata. Further records of this community are required in order to validate the description.

Situation

More records required

Temporal variation

Unknown.

Similar biotopes

LR.MLR.BF.Fser.Pid	Occurs in similar physical conditions, but the soft rock allows a *Fucus serratus* community to develop instead of the ephemeral seaweeds of RPid.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Obelia longissima	••••	Occasional	6	
Polydora	••••	Common	11	
Lanice conchilega	•••••	Frequent	19	
Carcinus maenas	••••	Occasional	6	
Petricola pholadiformis	••••	Common	13	
Barnea candida	••	Common	6	
Ceramium	•	Common	1	
Enteromorpha intestinalis	••••	Common	13	
Ulva lactuca	•••••	Common	20	

LR.HLR.FT Fucoids in tide-swept conditions

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered, Ultra sheltered
Tidal streams:	Very strong, Strong, Moderately strong
Substratum:	Bedrock, stable boulders, cobbles
Zone:	
Height band:	Mid shore, Lower shore

Biotope description

Biotope complex description Fucoid seaweeds in tide-swept conditions on sheltered to extremely sheltered mid eulittoral to lower eulittoral rocky shores, such as narrow channels in sea lochs. The middle shore can be dominated by the wrack *Ascophyllum nodosum* (AscT), while *Fucus serratus* is dominating the lower shore (FserT, FserTX). The high levels of water movement encourages a rich associated fauna including several filter-feeding groups. These include the sponges *Grantia compressa*, *Halichondria panicea* and *Hymeniacidon perleve* which frequently occur on steep and overhanging faces of boulders and bedrock. It also includes the sea squirts *Dendrodoa grossularia* and *Ascidiella scabra*, which occur on steep surfaces and beneath boulders. Hydroids such as the pink *Clava multicornis* can form colonies on *A. nodosum* while *Dynamena pumila* is more often found on *Fucus vesiculosus* or *F. serratus*. Underneath the canopy formed by the brown seaweeds is a diverse community of the red seaweeds *Gelidium pusillum*, *Chondrus crispus*, *Lomentaria articulata*, *Membranoptera alata* and coralline crusts, but the green seaweeds *Enteromorpha intestinalis*, *Ulva lactuca* and *Cladophora rupestris* can be present. The filamentous red seaweed *Polysiphonia lanosa* can usually be found growing on *A. nodosum*. On the rock beneath are the limpet *Patella vulgata* and the barnacle *Semibalanus balanoides*, while the crab *Carcinus maenas* and a variety of winkles including *Littorina littorea*, *Littorina mariae* and *Littorina obtusata* can be found on or among the boulders. The whelk *Nucella lapillus* can either be found in cracks and crevices.

Situation

Sheltered tide-swept shores (i.e. estuaries and sea lochs) below the *Fucus spiralis* and *F. vesiculosus* band and above the kelp dominated zone in the sublittoral.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Halichondria panicea	••••	Occasional	4.64	
Hymeniacidon perleve	•••	Occasional	2	
Dynamena pumila	••••	Frequent	5	
Pomatoceros triqueter	•••	Occasional	2	
Spirorbidae	••	Frequent	2	
Semibalanus balanoides	•••	Frequent	3	
Carcinus maenas	•••	Occasional	3	
Patella vulgata	••••	Occasional	5	
Gibbula cineraria	•••	Frequent	2	
Littorina littorea	•••	Occasional	2	
Littorina obtusata/mariae	••••	Occasional	5	
Nucella lapillus	••••	Occasional	4	
Mytilus edulis	••	Occasional	1	
Dendrodoa grossularia	•••	Frequent	2	
Corallinaceae	••••	Frequent	5	
Mastocarpus stellatus	•••	Frequent	3	
Chondrus crispus	•••	Frequent	3	
Lomentaria articulata	•••	Occasional	2	
Polysiphonia lanosa	••	Frequent	2	
Ascophyllum nodosum	•••	Abundant	6	
Fucus serratus	•••••	Common	10	
Fucus vesiculosus	•••	Occasional	2	
Enteromorpha intestinalis	••••	Occasional	4	
Ulva lactuca	••••	Occasional	4	
Cladophora rupestris	••	Frequent	2	

LR.HLR.FT.AscT *Ascophyllum nodosum*, sponges and ascidians on tide-swept mid eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Very sheltered, Extremely sheltered
Tidal streams:	Very strong, Strong, Moderately strong
Substratum:	Bedrock; boulders; cobbles
Zone:	Eulittoral - mid

Previous code

SLR.ASC.T	97.06

Biotope description

Very sheltered to extremely sheltered areas of mid eulittoral rock that are subject to strong to moderate tidal streams, such as the narrows in sea lochs, and characterised by the wrack *Ascophyllum nodosum*. The wracks *Fucus vesiculosus* and *Fucus serratus* are occasionally present. The increased water movement encourages a rich associated fauna including several filter-feeding groups. These include the sponges *Leucosolenia* spp., *Grantia compressa*, *Halichondria panicea* and *Hymeniacidon perleve* which frequently occur on steep and overhanging faces of boulders and bedrock. It also includes the sea squirts *Dendrodoa grossularia* and *Ascidiella scabra*, which occur on steep surfaces and beneath boulders. Hydroids such as the pink *Clava multicornis* can form colonies on *A. nodosum* while *Dynamena pumila* is more often found on *F. vesiculosus* or *F. serratus*. Underneath the canopy formed by the brown seaweeds is a diverse community of the red seaweeds *Gelidium pusillum*, *Chondrus crispus*, *Lomentaria articulata*, *Membranoptera alata* and coralline crusts, but the green seaweeds *Enteromorpha intestinalis*, *Ulva lactuca* and *Cladophora rupestris* can be present. The filamentous red seaweed *Polysiphonia lanosa* can usually be found growing on *A. nodosum*. On the rock beneath are the limpet *Patella vulgata* and the barnacle *Semibalanus balanoides*, while the crab *Carcinus maenas* and a variety of winkles including *Littorina littorea*, *Littorina mariae* and *Littorina obtusata* can be found on or among the boulders. The whelk *Nucella lapillus* can either be found in cracks and crevices or preying on the barnacles.

Situation

This biotope occurs lower on the shore than the *Fucus spiralis* biotope (Fspi) although on some shores a narrow zone of *F. vesiculosus* (Fves) may occur immediately above the *A. nodosum*. Asc.T is found above the tide-swept *F. serratus* dominated biotope (Fserr.T).

Temporal variation

A. nodosum can reach an age of 25 years and the communities are usually very stable. *F. vesiculosus* or *F. serratus* can occur in patches where the *A. nodosum* has been removed.

Similar biotopes

LR.LLR.F.Asc.FS	Occurs on bedrock with weak tidal streams. Lower diversity of filter feeders and lacks species such as the sponges *Leucosolenia* spp. and *G. compressa*, the hydroid *C. multicornis* or the sea squirt *D. grossularia* .
LR.LLR.FVS.AscVS	Occurs on bedrock or mixed substrata with variable salinity. Coralline crusts and *C. crispus*, *N. lapillus* and anemone *Actinia equina* are not usually present in this species impoverished biotope. It is also lacks the filter feeders mentioned above.
LR.LLR.F.Asc.X	Occurs on mixed substrata in fully marine conditions. Has a lower abundance and diversity of red seaweeds and lacks species such as *Leucosolenia* spp. and *G. compressa*, the hydroid *C. multicornis* and the sea squirt *D. grossularia*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Grantia compressa	●●●	Occasional	1	
Halichondria panicea	●●●●	Occasional	3	
Hymeniacidon perleve	●●●	Rare	1	
Clava multicornis	●●●	Frequent	3	
Dynamena pumila	●●●●●	Frequent	6	
Semibalanus balanoides	●●●●	Occasional	5	
Carcinus maenas	●●●●	Occasional	2	
Patella vulgata	●●●●●	Occasional	6	
Littorina littorea	●●	Frequent	1	
Littorina obtusata/mariae	●●●	Occasional	1	
Nucella lapillus	●●●●●	Occasional	4	
Dendrodoa grossularia	●●●●	Frequent	3	
Gelidium pusillum	●●●	Frequent	2	
Corallinaceae	●●●●	Frequent	4	
Chondrus crispus	●●●	Frequent	1	
Lomentaria articulata	●●●	Occasional	2	
Membranoptera alata	●●●	Rare	1	
Polysiphonia lanosa	●●●●●	Frequent	6	
Ascophyllum nodosum	●●●●●	Super-abundant	19	
Fucus serratus	●●●●	Occasional	3	
Fucus vesiculosus	●●●●	Occasional	4	
Enteromorpha intestinalis	●●●●	Occasional	3	
Ulva lactuca	●●●●	Occasional	4	
Cladophora rupestris	●●●	Frequent	2	

LR.HLR.FT.FserT *Fucus serratus*, sponges and ascidians on tide-swept lower eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Very strong, Strong, Moderately strong
Substratum:	Bedrock; boulders; cobbles
Zone:	Eulittoral - lower

Previous code

SLR.Fserr.T	97.06
SLR.Fser.T	96.7
LRK.FSE.T	6.95

Biotope description

Sheltered to extremely sheltered lower eulittoral bedrock, boulders and cobbles that are subject to increased tidal water movement and characterised by the wrack *Fucus serratus* and a rich assemblage of filter-feeding fauna. This community is encouraged by the increased water movement. It includes species such as the sponges *Halichondria panicea* and *Hymeniacidon perleve*, which occur frequently on steep and overhanging faces. Underneath the *F. serratus* canopy is a diverse flora of foliose red seaweeds including *Mastocarpus stellatus*, *Lomentaria articulata*, *Membranoptera alata* and *Chondrus crispus*. The green seaweeds *Cladophora* spp., *Enteromorpha intestinalis* and *Ulva lactuca* and the wrack *Ascophyllum nodosum* are present though usually in small numbers. On the rock underneath the seaweed canopy, species such as the limpet *Patella vulgata*, the barnacles *Semibalanus balanoides* and *Balanus crenatus* and the whelk *Nucella lapillus* can be found though in lower abundance than higher up the shore. Also present on the rock are the tube-forming polychaetes *Pomatoceros triqueter* and spirorbids and more mobile species such as the winkles *Littorina mariae* and *Littorina littorea*, *the top shell* Gibbula cineraria *and the crab* Carcinus maenas. *Lastly, several species of bryozoans are usually present including* Electra pilosa *and* Alcyonidium gelatinosum, *all competing for space with the hydroid* Dynamena pumila, *which can form dense populations on the* F. serratus *fronds.*

Situation

Areas where increased tidal movement influences such a community are in the narrows and/or intertidal sills of Scottish sea lochs and the rias in south-west England. In the few cases where the rock is also subject to variable salinity, an impoverished community results and records should be classified as Fserr.VS rather than the present biotope.

Temporal variation

Unknown.

Similar biotopes

LR.MLR.BF.Fser.Bo	Occurs on bedrock and boulders at a wide range of wave exposures. It also has a high species richness due to a diversity of micro-habitats. Mobile species such as *Pisidia longicornis*, *Porcellana platycheles* and *Cancer pagurus* are usually present.
LR.LLR.F.Fserr.FS	Occurs on bedrock and in weak tidal streams. It has a lower species diversity and sponges such as *H. perleve* and hydroids such as *Alcyonidium* spp. and *Electra pilosa* are usually not present.
LR.LLR.FVS.FserVS	Occurs on variable salinity lower eulittoral bedrock and boulders. The individual *M. edulis* are large and the barnacle *Elminius modestus* can be present in high numbers. Sponges such as *Halichondria panicea* and foliose red seaweeds such as *Lomentaria articulata* or *Chondrus crispus* are absent.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Halichondria panicea	●●●●●	Frequent	6	
Hymeniacidon perleve	●●●	Occasional	1	
Dynamena pumila	●●●●	Frequent	5	
Pomatoceros triqueter	●●●	Occasional	2	
Spirorbidae	●●●	Frequent	3	
Semibalanus balanoides	●●●	Frequent	2	
Balanus crenatus	●●●	Common	2	
Carcinus maenas	●●●	Occasional	2	
Patella vulgata	●●●●	Occasional	4	
Gibbula cineraria	●●●	Occasional	1	
Littorina littorea	●●●	Occasional	1	
Littorina mariae	●●●	Occasional	1	
Nucella lapillus	●●●●	Occasional	3	
Alcyonidium gelatinosum	●●	Common	1	
Corallinaceae	●●●●	Frequent	5	
Mastocarpus stellatus	●●●●	Frequent	5	
Chondrus crispus	●●●	Occasional	2	
Lomentaria articulata	●●●	Occasional	2	
Membranoptera alata	●●●	Occasional	1	
Ascophyllum nodosum	●●●	Occasional	2	
Fucus serratus	●●●●●	Abundant	19	
Enteromorpha intestinalis	●●●●	Frequent	3	
Ulva lactuca	●●●●	Frequent	3	
Cladophora	●●●	Occasional	4	

LR.HLR.FT.FserTX *Fucus serratus* with sponges, ascidians and red seaweeds on tide-swept lower eulittoral mixed substrata

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered
Tidal streams:	Moderately strong
Substratum:	Boulders, cobbles and pebbles on muddy sediments
Zone:	Eulittoral - lower
Height band:	Lower shore

Previous code

LMXD.SAR	6.95
SLR.FserX.T	97.06

Biotope description

Sheltered lower shore boulders, cobbles and pebbles on muddy sediments that are subject to enhanced tidal water movement and characterised by a species rich community. Dominant species include the sponges *Halichondria panicea* and *Hymeniacidon perleve*, the sea squirts *Ascidiella aspera*, *Ascidiella scabra*, *Styela clava* and *Botryllus schlosseri*. A number of filamentous red seaweeds including *Halurus flosculosus*, *Ceramium* spp., *Gracilaria gracilis*, *Polysiphonia fucoides* and foliose seaweeds *Mastocarpus stellatus* and *Chondrus crispus* are usually present. The brown seaweed *Dictyota dichotoma* and the wrack *Fucus serratus* with colonies of the hydroid *Dynamena pumila*, and *Ectocarpus* sp. may be found on more stable substrata. Boulders and large cobbles provide substrata for the top shell *Gibbula cineraria*, the whelk *Nucella lapillus* and barnacles such as *Semibalanus balanoides*, *Balanus crenatus*, or in areas with variable salinity *Elminius modestus*, and the tube-forming polychaete *Pomatoceros triqueter*. Patches of sand or mud are often characterised by the polychaete *Lanice conchilega* and the polychaete *Sabella pavonina*. Aggregations of the mussel *Mytilus edulis* and, in southern and eastern England the limpet *Crepidula fornicata*, may be found attached to cobbles and pebbles. Sites in Scottish sea lochs may support maerl *Lithothamnion* spp. and bivalves *Venerupis senegalensis* (see also VsenMtru).

Situation

This biotope is found above a community dominated by kelp such as *Laminaria digitata* (Ldig) or seagrass beds dominated by *Zostera marina* (Zmar) depending on the substrata found below. It is found below biotopes dominated by wrack *Fucus vesiculosus* (Fves) or *M. edulis* beds (MytFab; Myt.Myt).

Temporal variation

Unknown.

Similar biotopes

LR.HLR.FT.FserT	Occurs on bedrock and large boulders in areas with moderately strong tidal streams. It has a lower species richness and it lacks species associated with the mixed substrata such as *L. conchilega*, while filterfeeders such as spirorbid polychaetes are usually present.
LR.LLR.F.Fserr.X	Occurs on similar substrata, but is not tide-swept. It lacks the filter-feeding community associated with tide-swept conditions. Species not found include sponges such as *H. perleve* and bryozoans such as *Electra pilosa*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Halichondria panicea	●●●	Occasional	4	
Hymeniacidon perleve	●●●	Occasional	2	
Lanice conchilega	●●●	Occasional	3	
Sabella pavonina	●●	Occasional	1	
Pomatoceros triqueter	●●●	Occasional	5	
Semibalanus balanoides	●●●	Occasional	3	
Balanus crenatus	●●	Occasional	1	
Elminius modestus	●●●	Occasional	3	
Carcinus maenas	●●●	Occasional	3	
Gibbula cineraria	●●●●	Frequent	6	
Littorina littorea	●●●●	Occasional	5	
Crepidula fornicata	●●	Occasional	1	
Nucella lapillus	●●●	Occasional	2	
Mytilus edulis	●●●	Occasional	4	
Ascidiella scabra	●●	Occasional	1	
Styela clava	●●	Rare	1	
Botryllus schlosseri	●●	Rare	1	
Corallinaceae	●●●●	Occasional	3	
Lithothamnion	●	Occasional	1	
Gracilaria gracilis	●●●	Occasional	3	
Mastocarpus stellatus	●●●	Occasional	3	
Chondrus crispus	●●●	Frequent	6	
Ceramium	●●●	Occasional	3	
Polysiphonia fucoides	●●●	Rare	1	
Fucus serratus	●●●●	Frequent	4	
Enteromorpha intestinalis	●●●●	Occasional	4	
Ulva lactuca	●●●●	Frequent	4	

LR.MLR Moderate energy littoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Moderately strong
Substratum:	Bedrock, boulders, cobbles
Zone:	Eulittoral
Height band:	Strandline, Upper shore, Mid shore, Lower shore

Biotope description

Moderately exposed shores (bedrock, boulders and cobbles) characterised by mosaics of barnacles and fucoids on the mid and upper shore; with fucoids and red seaweed mosaics on the lower shore. Where freshwater or sand-scour affects the shore ephemeral red or green seaweeds can dominate. Other shores support communities of mussels and fucoids in the mid to lower shore. Two biotope complexes have been described: Mussels and fucoids (MusF) and barnacles and fucoids (BF).

LR.MLR.MusF Mussels and fucoids on moderately exposed shores

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Bedrock; large boulders
Zone:	Eulittoral - mid, Eulittoral - lower

Previous code

MLR.Myt	96.7
MLR.MF	97.06

Biotope description

Mid and lower eulittoral exposed to moderately exposed bedrock, often with nearby sediment, may be densely covered by large individuals of the mussel *Mytilus edulis*. Three biotopes have been described: In the mid eulittoral, the mussels may form a band or large patches with scattered bladder wrack *Fucus vesiculosus* (MytFves). In the lower eulittoral a range of red seaweeds including *Mastocarpus stellatus* and *Palmaria palmata* occur amongst the mussels (in higher abundance than the mid eulittoral) (MytFR). Clay outcrops in the mid to lower eulittoral may be bored by a variety of piddocks including *Pholas dactylus*, *Barnea candida* and *Petricola pholadiformis*, while the surface is characterised by small clumps of the mussel *M. edulis*, the barnacle *Elminius modestus* and the winkle *Littorina littorea* (MytPid). Ephemeral green seaweeds such as *Enteromorpha intestinalis* and *Ulva lactuca* commonly occur on the shells of the mussels. Barnacles are common on both the mussel valves and on patches of bare rock, where the limpet *Patella vulgata* is found as well, often at high abundance. The whelk *Nucella lapillus* and a range of littorinids also occur within the mussel bed. A dense *M. edulis* community may be found on more sheltered coasts on mixed substrata (Myt).

Situation

Above this biotope complex is a *M. edulis* and *S. balanoides* dominated zone (MF) or a *F. vesiculosus* dominated biotope (FvesB). In the lower eulittoral zone below is a zone dominated by the wrack *Fucus serratus*, *M. edulis* and a variety of red seaweeds (BF) while kelp dominate the sublittoral fringe.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Semibalanus balanoides	●●●●●	Common	12
Patella vulgata	●●●●	Frequent	7
Littorina littorea	●●●	Frequent	4
Nucella lapillus	●●●●	Frequent	7
Mytilus edulis	●●●●●	Abundant	30
Palmaria palmata	●●●	Frequent	2
Corallinaceae	●●●	Occasional	2
Mastocarpus stellatus	●●●	Frequent	3
Fucus serratus	●●●	Common	3
Fucus vesiculosus	●●	Common	4
Enteromorpha intestinalis	●●●	Frequent	5
Ulva lactuca	●●●	Occasional	3

LR.MLR.MusF.MytFves *Mytilus edulis* and *Fucus vesiculosus* on moderately exposed mid eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Bedrock; large boulders
Zone:	Eulittoral - mid
Height band:	Mid shore
Other features:	Silted habitat

Previous code

MLR.Myt.Fves	96.7
MLR.MytFves	97.06

Biotope description

Mid eulittoral exposed to moderately exposed bedrock, often with nearby sediment, covered by a dense band or large patches of the mussel *Mytilus edulis*. The community often supports scattered *Fucus vesiculosus* and occasional foliose red seaweeds such as *Porphyra umbilicalis, Osmundea pinnatifida, Mastocarpus stellatus, Palmaria palmata* or the calcareous algae *Corallina officinalis* . The ephemeral green seaweeds *Enteromorpha intestinalis* and *Ulva lactuca* commonly occur on the shells of the mussels. The barnacle *Semibalanus balanoides* is common on both the mussel valves and on patches of bare rock, where the limpet *Patella vulgata* also can be found. The whelk *Nucella lapillus* and the winkle *Littorina littorea* can be found within the mussel bed.

Situation

Above this biotope is a *M. edulis* and *S. balanoides* dominated biotope (Sem) or a *F. vesiculosus* dominated biotope (FvesB). In the lower eulittoral zone below MytFves is a biotope dominated by the wrack *Fucus serratus, M. edulis* and a higher diversity of red seaweeds (MytFR; Fser.R).

Temporal variation

Unknown.

Similar biotopes

LR.HLR.MusB.MytB	Occurs on more exposed shores. Has lower species richness with the notable absence of species such as *F. vesiculosus* and *L. littorea*.
LR.MLR.MusF.MytFR	Occurs in similar wave exposure but in the lower eulittoral zone. *F. serratus* dominates and *F. vesiculosus* is usually absent. Kelp such as *Laminaria digitata* can be present and usually the abundance of the red seaweeds is higher.
LS.LMX.LMus..Myt	Occurs on mixed substrata, typically in more sheltered conditions. *F. vesiculosus* can be present at low abundance (Occasional) while *L. littorea* occurs in higher density. Red seaweeds are scarce and the barnacle *Elminius modestus* can be present.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Semibalanus balanoides	●●●●●	Common	15
Patella vulgata	●●●●●	Common	11
Littorina littorea	●●●	Frequent	5
Nucella lapillus	●●●●●	Occasional	9
Mytilus edulis	●●●●●	Abundant	26
Porphyra umbilicalis	●●●	Occasional	3
Palmaria palmata	●●	Common	1
Corallina officinalis	●●●	Occasional	1
Mastocarpus stellatus	●●	Occasional	1
Osmundea pinnatifida	●●●	Occasional	1
Fucus vesiculosus	●●●●●	Common	10
Enteromorpha intestinalis	●●●●	Frequent	3
Ulva lactuca	●●	Occasional	2

LR.MLR.MusF.MytFR *Mytilus edulis, Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	
Substratum:	Bedrock; large boulders
Zone:	Eulittoral - lower
Other features:	Sand or silt affected

Previous code

MLR.MytFR	97.06
MLR.Myt.R	96.7

Biotope description

Lower eulittoral moderately exposed bedrock covered by a dense community of large individuals of the mussel *Mytilus edulis*, often with a scarce covering of the wrack *Fucus serratus* and red seaweeds. The red seaweeds may include *Palmaria palmata*, *Mastocarpus stellatus*, *Ceramium* spp., *Audouinella* spp. and *Chondrus crispus*. Ephemeral green seaweeds such as *Enteromorpha intestinalis* and *Ulva lactuca* commonly occur on the shells of the mussels. The barnacle *Semibalanus balanoides* is common on both the mussel valves and on patches of bare rock, where the limpet *Patella vulgata* is also found, often at high abundance. The whelk *Nucella lapillus* and the winkle *Littorina littorea* occur within the mussel bed, as well as the polychaete *Pomatoceros triqueter* and the crab *Carcinus maenas*. The anemone *Actinia equina* is present in cracks and crevices. These moist areas can be overgrown by coralline crusts.

Situation

Above this biotope on sand influenced shores is a *M. edulis* and *F. vesiculosus* dominated biotope (MytFves). In the sublittoral fringe below MytFR is a biotope dominated by the kelp *Laminaria digitata* (Ldig.Ldig).

Temporal variation

Unknown.

Similar biotopes

LR.HLR.MusB.MytB	Occurs on more exposed shores. Has lower species richness with the notable absence of species such as *F. serratus* and *L. littorea.*
LR.MLR.MusF.MytFves	Occurs in similar wave exposure though in the mid eulittoral zone. *F. vesiculosus* dominates though *F. serratus* can be present in low abundance. Kelp such as *L. digitata* are not present and usually the abundance of the red seaweeds is lower.
LS.LMX.LMus.Myt	Occurs on mixed substrata, and *F. serratus* is typically absent, while *L. littorea* occurs in higher abundance. Red seaweeds are usually not scarce; the barnacle *Elminius modestus* can be present.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Actinia equina	••	Occasional	1
Pomatoceros triqueter	•••	Occasional	1
Semibalanus balanoides	••••	Common	9
Carcinus maenas	••	Frequent	1
Patella vulgata	••••	Occasional	5
Littorina littorea	•••	Frequent	2
Nucella lapillus	••••	Frequent	6
Mytilus edulis	•••••	Abundant	29
Audouinella	••	Frequent	2
Palmaria palmata	••••	Occasional	5
Corallinaceae	•••	Frequent	2
Mastocarpus stellatus	••••	Frequent	5
Chondrus crispus	•••	Occasional	1
Ceramium	•••	Frequent	2
Fucus serratus	••••	Common	4
Enteromorpha intestinalis	•••	Common	4
Ulva lactuca	•••	Occasional	4

LR.MLR.MusF.MytPid *Mytilus edulis* and piddocks on eulittoral firm clay

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Clay; cobbles
Zone:	Eulittoral
Height band:	Lower shore

Previous code

MLR.MytPid	97.06
MLR.Myt.Pid	96.7
LRK.PID.CLY	6.95

Biotope description

Clay outcrops in the mid to lower eulittoral which are bored by a variety of piddocks including *Pholas dactylus*, *Barnea candida* and *Petricola pholadiformis*. The surface of the clay is characterised by small clumps of the mussel *Mytilus edulis*, the barnacle *Elminius modestus* and the winkle *Littorina littorea*. Seaweeds are generally sparse on the clay, although small patches of the red seaweeds *Mastocarpus stellatus*, *Halurus flosculosus* and *Ceramium* spp. can occur, usually attached to loose-lying cobble or mussel shells. Also the green seaweeds *Enteromorpha* spp. and *Ulva lactuca* may be present. The polychaete *Lanice conchilega* can sometimes be present in the clay, while the crustacean *Carcinus maenas* is present as well. More data are required to validate this description.

Situation

MytPid can usually be found beneath a *M. edulis* or barnacle and *Littorina* spp. dominated biotope (Myt.Myt; BLitX). It is found above a *Laminaria digitata* and piddocks dominated biotope (Ldig.Pid).

Temporal variation

The *C. maenas* population may migrate off shore during the winter season.

Similar biotopes

LR.HLR.FR.RPid	Occurs on fossilised peat and chalk. It has a higher density of ephemeral seaweeds such as *Enteromorpha intestinalis* and *Ceramium* spp. while *M. edulis* and *E. modestus* are usually absent.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Lanice conchilega	••	Rare	1
Elminius modestus	•••	Occasional	5
Carcinus maenas	•••••	Frequent	16
Littorina littorea	•••	Frequent	5
Mytilus edulis	•••••	Frequent	24
Petricola pholadiformis	••	Frequent	4
Pholas dactylus	••	Frequent	1
Barnea candida	•••	Frequent	11
Mastocarpus stellatus	••	Occasional	2
Ceramium	••	Frequent	1
Halurus flosculosus	••	Common	4
Enteromorpha intestinaloides	•••	Abundant	8
Ulva lactuca	•••	Frequent	6

LR.MLR.BF Barnacles and fucoids on moderately exposed shores

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	
Substratum:	Bedrock; boulders
Zone:	Eulittoral
Height band:	Upper shore, Mid shore, Lower shore

Biotope description

Moderately exposed rocky shores characterised by a mosaic of fucoids and barnacles on bedrock and boulders, where the extent of the fucoid cover is typically less than the blanket cover associated with sheltered shores. Other species are normally present as well in this habtat including the winkle *Littorina littorea*, the whelk *Nucella lapillus* and the red seaweed *Mastocarpus stellatus*. Beneath the band of yellow and grey lichens at the top of the shore is a zone dominated by the wrack *Pelvetia canaliculata*, scattered barnacles, while the black lichen *Verrucaria maura* covers the rock surface (PelB). Below, on the mid shore the wrack *Fucus vesiculosus* generally forms a mosaic with the barnacle *Semibalanus balanoides* and the limpet *Patella vulgata* (FvesB). Finally, the wrack *Fucus serratus*, dominates the lower shore, while a variety of red seaweeds can be found underneath the *F. serratus* canopy (Fser). A number of variants have been described: lower shore bedrock and boulders characterised by mosaics of *F. serratus* and turf-forming red seaweeds (Fser.R); where the density of *F. serratus* is greater (typically Common - Superabundant) and the abundance of red seaweeds less Fserr.FS should be recorded. The presence of boulders and cobbles on the shore can increase the micro-habitat diversity, which often results in a greater species richness. Although the upper surface of the boulders may bear very similar communities to Fserr.FS there is often an increase in fauna (crabs, tube-forming polychaetes, sponges and bryozoans) and Fser.Bo should be recorded. Sand-influenced exposed to moderately exposed lower shore rock can be characterised by dense mats of *Rhodothamniella floridula* (Rho).

Situation

Mid and lower eulittoral moderately exposed bedrock with a lichen zone above and a kelp dominated community below in the sublittoral zone.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Semibalanus balanoides	••••	Frequent	
Patella vulgata	••••	Frequent	
Littorina littorea	••	Frequent	
Nucella lapillus	•••	Occasional	
Mastocarpus stellatus	•••	Frequent	
Fucus serratus	••••	Abundant	
Fucus vesiculosus	••	Frequent	
Pelvetia canaliculata	••	Common	
Enteromorpha intestinalis	•••	Occasional	
Verrucaria maura	••	Common	

LR.MLR.BF.PelB *Pelvetia canaliculata* and barnacles on moderately exposed littoral fringe rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Bedrock; boulders; cobbles
Zone:	Littoral fringe - lower
Height band:	Upper shore
Other features:	Also on steep sheltered bedrock

Previous code

MLR.BF.PelB	97.06
LRK.PEL in part	6.95

Biotope description

Exposed to moderately exposed steep, lower littoral fringe rock and mixed substrata characterised by the wrack *Pelvetia canaliculata* and sparse barnacles *Chthamalus montagui* and *Semibalanus balanoides*. On sheltered shores the biotope is restricted to vertical faces. The limpet *Patella vulgata* and the wrack *Fucus spiralis* are usually present as well. *P. canaliculata* typically overgrows a crust of the black lichen *Verrucaria maura* or on occasion *Verrucaria mucosa*, in contrast to the red crust *Hildenbrandia rubra* on very sheltered shores. The winkle *Littorina saxatilis* is frequently present underneath the fronds of *P. canaliculata.* Some geographical variation are present and southern and western shores are typically characterised by the barnacle *C. montagui* or *Chthamalus stellatus* while *S. balanoides* dominates on northern and eastern shores. On mixed substrata the barnacle *Elminius modestus* may be present.

Situation

PelB is generally found below the *V. maura* and barnacle zone (Ver.B; Ver.Ver). On exposed shores PelB is found above the biotope dominated by *F. spiralis* (Fspi) or the mussel *Mytilus edulis* and barnacles biotope (MytB) or the barnacles and *P. vulgata* biotopes (Sem). In addition, patches of lichen *Lichina pygmaea* with the barnacle *Chthamalus montagui* (Cht.Lpyg) may also occur at the same level or above this biotope, particularly on southern shores. On sheltered to extremely sheltered shores this biotope is limited to very steep or vertical faces.

Temporal variation

Unknown.

Similar biotopes

LR.LLR.F.Pel	Occurs in the lower littoral fringe on more sheltered shores, where upward facing rock allows a more dense *P. canaliculata* population to flourish. It has a lower species diversity and it lacks species such as the barnacles *S. balanoides, C. montagui* and the winkle *Melarhaphe neritoides.*
LR.LLR.F.Fspi	Occurs slightly lower on the shore and is dominated by *F. spiralis* (Common), whilst *P. canaliculata* is usually present in low abundance or absent.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Chthamalus montagui	●●●	Frequent	3
Semibalanus balanoides	●●●●	Occasional	9
Patella vulgata	●●●	Occasional	19
Littorina saxatilis	●●●●	Frequent	4
Fucus spiralis	●●●	Occasional	3
Pelvetia canaliculata	●●●●●	Common	33
Verrucaria maura	●●●●	Common	17
Verrucaria mucosa	●●	Frequent	2

LR.MLR.BF.FspiB *Fucus spiralis* on full salinity exposed to moderately exposed upper eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Bedrock; boulders; cobbles
Zone:	Eulittoral - upper
Other features:	Also on steep/vertical sheltered bedrock

Previous code

SLR.Fspi in part	97.06

Biotope description

Exposed to moderately exposed upper eulittoral bedrock characterised by a band of the spiral wrack *Fucus spiralis* overlying the black lichen *Verrucaria maura* and the olive green lichen *Verrucaria mucosa*. Underneath the fronds of *F. spiralis* is a community consisting of the limpet *Patella vulgata*, the winkles *Littorina saxatilis* and *Littorina littorea*, the mussel *Mytilus edulis* and the barnacle *Semibalanus balanoides.* The whelk *Nucella lapillus* can be found in cracks and crevices preying on the mussels and barnacles. During the summer months ephemeral green seaweeds such as *Enteromorpha intestinalis* can be common. The insect *Anurida maritima* can be present in this zone taking shelter in cracks and crevices when the tide comes in.

Situation

This zone usually lies below a zone dominated by the wrack *Pelvetia canaliculata* (PelB), but occasional clumps of *P. canaliculata* may be present (usually less than common) amongst the *F. spiralis*. FspiB occurs above the wrack *Fucus vesiculosus* (FvesB) zones. Vertical surfaces in this zone, especially on moderately exposed shores, often lack the fucoids and are characterised by a barnacle-limpet dominated community (Sem).

Temporal variation

Unknown.

Similar biotopes

LR.LLR.FVS.FspiVS	Occurs in sheltered areas with variable salinity. The species diversity is lower and species such as *P. vulgata* and *M. edulis* usually absent as well as the lichen *Verrucaria maura*. The barnacle *Elminius modestus* can be present.
LR.LLR.F.Fspi.X	Occurs on mixed substrata and in sheltered areas. It has a similar species composition, although amphipods, the crab *Carcinus maenas* and the whelk *Nucella lapillus* may occur underneath and/or among the boulders and cobbles. S. balanoides is not occurring in same high abundance (Occasional). In sheltered areas (behind boulders) *A. nodosum* can be found.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Semibalanus balanoides	●●●●●	Abundant	29
Anurida maritima	●●●	Occasional	2
Patella vulgata	●●●●	Frequent	8
Littorina littorea	●●●	Frequent	5
Littorina saxatilis	●●●●	Frequent	9
Nucella lapillus	●●●	Occasional	2
Mytilus edulis	●●●●	Occasional	5
Fucus spiralis	●●●●●	Common	24
Enteromorpha intestinalis	●●●	Occasional	2
Verrucaria maura	●●	Frequent	2
Verrucaria mucosa	●●	Occasional	2

LR.MLR.BF.FvesB *Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Bedrock; boulders
Zone:	Eulittoral - mid

Previous code

LRK.FVES.BP	6.95
MLR.FvesB	97.06

Biotope description

Exposed to moderately exposed mid eulittoral bedrock and boulders are frequently characterised by a mosaic of the barnacle *Semibalanus balanoides* and the wrack *Fucus vesiculosus*. The limpet *Patella vulgata* and the whelk *Nucella lapillus* are typically present, whilst the anemone *Actinia equina* and small individuals of the mussel *Mytilus edulis* are confined to crevices. Underneath the *F. vesiculosus* is a community of red seaweeds, including *Corallina officinalis, Mastocarpus stellatus* and *Osmundea pinnatifida*, usually with the winkles *Littorina littorea* and *Littorina* spp. present. Opportunistic seaweeds such as *Enteromorpha intestinalis* may occur in patches recently cleared on the rock or growing on the *M. edulis*.

Situation

On exposed shores FvesB is found below the black lichen *Verrucaria maura* and sparse barnacles biotope (Ver.B) and/or below the *Chthamalus* spp. and *P. vulgata* biotopes (Cht.Cht). FvesB is found above the biotope dominated by the wrack *Himanthalia elongata* (Him) or the red seaweed biotopes (Coff; R). FvesB forms an intermediate along the wave exposure gradient between the exposed shore barnacle-*P. vulgata* biotopes (Sem.FvesR) and the sheltered shore *F. vesiculosus* biotope (Fves). Vertical surfaces tend to be dominated by the barnacle-*P. vulgata* biotope (Sem).

Temporal variation

On some shores, particularly those, which are moderately exposed to wave action, temporal fluctuations in the abundance of limpets, barnacles and fucoid seaweeds may occur. As a result, over a number of years, a single shore may cycle between the barnacle-*P. vulgata* dominated biotope (Sem.FvesR), through this mosaic (FvesB) to a *F. vesiculosus*-dominated biotope (Fves).

Similar biotopes

LR.HLR.MusB.Sem.FvesR	Occurs at a similar wave exposure, but also on steeper slopes and vertical faces. The community is similar to FvesB, but *F. vesiculosus* is present at lower abundance (Occasional) and wracks such as *Fucus serratus* and *Ascophyllum nodosum* are usually not present. *F. vesiculosus* can be non-vesiculate (i.e. bladderless).
LR.LLR.F.Fves	Occurs on more sheltered shores on bedrock and large boulders. *F. vesiculosus* dominates (Abundant) and there is a lower red seaweed diversity. *S. balanoides*, *P. vulgata* and *N. lapillus* occur less frequently and at lower abundance when present.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Actinia equina	●●●	Occasional	2
Semibalanus balanoides	●●●●●	Abundant	21
Patella vulgata	●●●●●	Common	16
Littorina	●●	Common	7
Littorina littorea	●●●	Frequent	2
Nucella lapillus	●●●●	Frequent	3
Mytilus edulis	●●●●	Occasional	5
Corallinaceae	●●●●	Occasional	2
Corallina officinalis	●●●	Occasional	2
Mastocarpus stellatus	●●●	Occasional	2
Osmundea pinnatifida	●●●	Occasional	3
Fucus vesiculosus	●●●●●	Common	18
Enteromorpha intestinalis	●●●●	Occasional	4

LR.MLR.BF.Fser *Fucus serratus* on moderately exposed lower eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock; boulders
Zone:	Eulittoral - lower

Previous code

MLR.BF..Fser	97.06
LRK.FSE	6.95

Biotope description

Lower eulittoral bedrock and stable boulders on moderately exposed to sheltered shores with a canopy of the wrack *Fucus serratus* and an associated fauna consisting of the limpet *Patella vulgata*, the barnacle *Semibalanus balanoides*, the whelk *Nucella lapillus*, the anemone *Actinia equina* and the sponge *Halichondria panicea*. Green seaweeds such as *Enteromorpha intestinalis* and *Ulva lactuca* are usually present among/beneath the *F. serratus* canopy. Three variants of this biotope are described. These are: *F. serratus* with red seaweeds (Fser.R) and *F. serratus* with under-boulder communities (Fser.Bo) with sponges. Lastly, a *F. serratus* and piddocks community on soft rock has been identified (Fser.Pid). Dense *F. serratus* with fewer red seaweeds occurs on more sheltered shores (Fserr).

Situation

Above the *F. serratus* biotope on moderately exposed bedrock shores is the *Fucus vesiculosus* and/or *S. balanoides* and *P. vulgata* dominated biotopes (Sem; Sem.FvesR; FvesB). On more sheltered shores are biotopes dominated by the wracks *F. vesiculosus* and *Ascophyllum nodosum* (Fves; Asc.FS). On moderately exposed shores, the sublittoral fringe below Fser is dominated by the kelp *Laminaria digitata* and on vertical faces the kelp *Alaria esculenta* may be present (Ldig.LdigBo; Ala.Ldig). On more sheltered shores the kelp *Laminaria saccharina* is found among the *L. digitata* (Lsac.Ldig; Lsac.Ft).

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	••••	Occasional	3
Actinia equina	•••	Occasional	1
Spirorbidae	•••	Frequent	2
Semibalanus balanoides	••••	Frequent	5
Carcinus maenas	•••	Occasional	1
Patella vulgata	•••••	Frequent	8
Gibbula cineraria	•••	Occasional	2
Littorina littorea	•••	Frequent	2
Nucella lapillus	••••	Occasional	3
Corallinaceae	••••	Common	6
Corallina officinalis	•••	Occasional	2
Mastocarpus stellatus (Petrocelis)	••••	Frequent	7
Chondrus crispus	•••	Occasional	3
Lomentaria articulata	•••	Occasional	3
Osmundea pinnatifida	••••	Frequent	4
Fucus serratus	•••••	Abundant	20
Enteromorpha intestinaloides	•••	Occasional	3
Ulva lactuca	••	Occasional	2

LR.MLR.BF.Fser.R *Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	
Substratum:	Bedrock; boulders
Zone:	Eulittoral - lower
Height band:	Lower shore

Previous code

MLR.BF.Fser.R	97.06
LRK.FSE.RED	6.95

Biotope description

Moderately exposed lower eulittoral bedrock characterised by mosaics of the wrack *Fucus serratus* and turf-forming red seaweeds including *Osmundea pinnatifida*, *Mastocarpus stellatus* or *Corallina officinalis*. The hydroid *Dynamena pumila* can occur in dense populations on the *F. serratus* fronds whilst the sponge *Halichondria panicea* can cover the bedrock beneath. Underneath the canopy a number of other red seaweeds may be present including *Palmaria palmata*, *Lomentaria articulata*,*Membranoptera alata* and *Chondrus crispus*. Green seaweeds such as *Cladophora rupestris*, *Enteromorpha intestinalis* and *Ulva lactuca* are present though usually in small numbers. In addition, such shores provide a greater number of permanently damp refuges between the stones and underneath the seaweed canopy. Within these micro-habitats species such as the limpet *Patella vulgata*, the barnacle *Semibalanus balanoides* or the whelk *Nucella lapillus* can be found in lower abundance than higher up the shore. If a few boulders are present then the winkle *Littorina littorea* and the crab *Carcinus maenas* can be found on or underneath the boulders.

Situation

Above the *F. serratus* biotope on moderately exposed bedrock shores are the wrack *Fucus vesiculosus* and/or *S. balanoides* and *P. vulgata* dominated biotopes (Sem; Sem.FvesR; FvesB). The sub littoral fringe below on moderately exposed shores is dominated by the kelp *Laminaria digitata* and on vertical faces the kelp *Alaria esculenta* (Ldig.LdigBo; Ala.Ldig). On uneven bedrock *F. serratus* and red seaweeds often dominate the upper-facing surfaces, while steep or vertical rock is characterised by *S. balanoides* and *P. vulgata* dominated biotopes (see above).

Temporal variation

Fluctuations from year to year in the abundance of the *F. serratus* and the red seaweeds due to factors such as severe storms may convert this biotope into either Fserr.FS or into a red seaweed dominated biotope. The *C. maenas* population may migrate offshore during the winter.

Similar biotopes

LR.MLR.BF.Fser.Bo	Occurs on large boulders and in a wider exposure range. Mobile species such as the crabs *Porcellana platycheles* and *Cancer pagurus* and the starfish *Asterias rubens* are present in low numbers.
LR.HLR.FT.FserT	Occurs on bedrock and boulders in very sheltered conditions. It has a very high species diversity and sponges such as *Halichondria panicea* and *Hymeniacidon perleve* and bryozoans such as *Electra pilosa* or *Alcyonidium gelatinosum* are characteristic for this tide-swept biotope.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	••••	Occasional	3
Dynamena pumila	•••	Occasional	3
Spirorbidae	•••	Frequent	2
Semibalanus balanoides	••••	Frequent	6
Carcinus maenas	•••	Occasional	1
Patella vulgata	••••	Frequent	7
Littorina littorea	••	Occasional	1
Nucella lapillus	••••	Occasional	3
Palmaria palmata	•••	Frequent	3
Corallinaceae	••••	Common	7
Corallina officinalis	•••	Occasional	2
Mastocarpus stellatus	•••••	Frequent	7
Chondrus crispus	•••	Occasional	2
Lomentaria articulata	••••	Occasional	3
Membranoptera alata	•••	Occasional	1
Osmundea pinnatifida	••••	Frequent	4
Fucus serratus	•••••	Abundant	19
Enteromorpha intestinalis	•••	Occasional	2
Ulva lactuca	•••	Occasional	3
Cladophora rupestris	•••	Occasional	2

LR.MLR.BF.Fser.Bo *Fucus serratus* and under-boulder fauna on lower eulittoral boulders

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	
Substratum:	Boulders
Zone:	Eulittoral - lower
Other features:	Under-boulder habitats

Previous code

MLR.Fser.Bo	96.7
LRK.FSE.BO	6.95
MLR.Fser.Fser.Bo	97.06

Biotope description

Exposed to sheltered lower eulittoral boulders with the wrack *Fucus serratus* community of a high species richness as the presence of the boulders increases the micro-habitat diversity. The upper surfaces of the boulders are colonised by a very similar fauna to the other *F. serratus* biotopes, including species such as the limpet *Patella vulgata*, the whelk *Nucella lapillus*, the anemone *Actinia equina* and the barnacle *Semibalanus balanoides*. The shaded sides of the boulders are, depending on environmental conditions, often colonised by a variety of foliose red seaweeds, including *Mastocarpus stellatus*, *Lomentaria articulata*, *Osmundea pinnatifida*, *Palmaria palmata* and *Chondrus crispus*. Coralline algae such as the *Corallina officinalis* and coraline crusts as well as the green seaweeds *Enteromorpha intestinalis* and *Ulva lactuca* can be found underneath the *F. serratus* canopy or in patches on the boulders. The species composition underneath the boulders varies considerably depending on the underlying substratum. On muddy shores the fauna living under the boulders may be limited to a few infaunal species, such as the polychaete *Cirratulus cirratus*. Where more space is available beneath the boulders there may be a rich assemblage of animals. Characteristic mobile species include the crabs *Porcellana platycheles* and *Carcinus maenas*. Also present on and beneath the boulders are the tube-forming polychaete *Pomatoceros triqueter*, spirorbid polychaetes and a few winkles such as *Littorina obtusata/mariae* and *Littorina littorea* or even the top shell *Gibbula cineraria*. Encrusting colonies of the sponge *Halichondria panicea* are also typical of the undersides of boulders, while the hydroid *Dynamena pumila* colonies can be found on the *F. serratus* fronds. The richest examples of this biotope also contain a variety of brittlestars, ascidians and small hydroids.

Situation

This biotope usually occurs immediately below a *Fucus vesiculosus*-barnacle mosaic (FvesB) on moderately exposed shores or a dense canopy of *F. vesiculosus* (Fves) or *Ascophyllum nodosum* (Asc.FS) on sheltered shores. The sublittoral fringe below on moderately exposed shores is dominated by the kelp *Laminaria digitata* (Ldig; Ldig.LdigBo), while the kelp *Laminaria saccharina* may co-dominate on sheltered shores (Lsac.Ldig; Lsac.Ft). Low abundance of these kelp may also occur in this biotope.

Temporal variation

Unknown.

Similar biotopes

LR.MLR.BF.Fser.R	Occurs on bedrock rather than boulders. The species diversity and abundance of red seaweeds is higher, whilst the faunal component is less diverse due to the lack of micro-habitats. Mobile species such as the crabs *Porcellana platycheles* and *Cancer pagurus* and the starfish *Asterias rubens* are usually not present.
LR.LLR.F.Fserr.FS	Occurs on bedrock rather than boulders. Has a lower species richness and the abundance of many species are lower. Mobile species such as the crabs *Porcellana platycheles* and *Cancer pagurus* and the starfish *Asterias rubens* are usually not present.
LR.HLR.FT.FserT	Occurs on bedrock and boulders in very sheltered conditions. It also has a very high species diversity and sponges such as *Halichondria panicea* and *Hymeniacidon perleve* and bryozoans such as *Electra pilosa* or *Alcyonidium gelatinosum* are characteristic for this tide-swept biotope.
LR.LLR.FVS.FserVS	Occurs on variable salinity lower eulittoral bedrock and boulders. The individual *M. edulis* is large and the barnacle *Elminius modestus* can be present in high numbers. Sponges such as *Halichondria panicea* and red seaweeds such as *Lomentaria articulata* or *Chondrus crispus* are not present.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	●●●	Occasional	2
Dynamena pumila	●●●	Occasional	2
Actinia equina	●●●	Occasional	1
Pomatoceros triqueter	●●●	Occasional	2
Spirorbidae	●●●	Common	3
Semibalanus balanoides	●●●●	Frequent	4
Porcellana platycheles	●●●	Frequent	1
Carcinus maenas	●●●	Occasional	2
Patella vulgata	●●●●●	Frequent	7
Gibbula cineraria	●●●●	Occasional	4
Littorina littorea	●●●	Frequent	2
Nucella lapillus	●●●●	Occasional	3
Palmaria palmata	●●●	Frequent	1
Corallinaceae	●●●●	Frequent	5
Corallina officinalis	●●●	Occasional	2
Mastocarpus stellatus	●●●●	Frequent	6
Chondrus crispus	●●●	Occasional	3
Lomentaria articulata	●●●	Occasional	2
Osmundea pinnatifida	●●●	Frequent	2
Fucus serratus	●●●●●	Abundant	20
Enteromorpha intestinalis	●●●	Occasional	3
Ulva lactuca	●●●	Occasional	2

LR.MLR.BF.Fser.Pid *Fucus serratus* and piddocks on lower eulittoral soft rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	
Substratum:	Bedrock; boulders
Zone:	Eulittoral - lower
Height band:	Mid shore, Lower shore
Other features:	Soft rock (chalk)

Previous code

MLR.BF.Fser.Pid	97.06
LRK.FSE.PID	6.95

Biotope description

The lower eulittoral zone on soft rock shores (e.g. chalk) characterised by the wrack *Fucus serratus.* Much of the community associated with this biotope is the same as the biotope Fserr.FS, but certain taxa are specific to the soft underlying substrata. Rock-boring fauna including the piddocks *Barnea* spp., *Pholas dactylus* and *Hiatella arctica* can occur in dense aggregations. Burrowing polychaetes such as *Polydora* spp. can also occur in high numbers only visible due to their long, slender palps waving in the water as they occupy holes in the top few centimetres of the rock. A dense red algal turf occurs beneath the *F. serratus* and includes *Gelidium pusillum*, *Osmundea pinnatifida*, *Palmaria palmata*, *Lomentaria articulata* and *Rhodothamniella floridula*, but also calcareous algae such as *Corallina officinalis* and coralline crusts including the red-violet encrusting algae *Phymatolithon lenormandii* are present. Infaunal taxa such as various amphipods may be common amongst the seaweeds. The empty piddock holes may provide a refuge for species such as the anemone *Actinia equina* and the mussel *Mytilus edulis* while the barnacle *Semibalanus balanoides*, the limpet *Patella vulgata* can be present on the surface of the soft rock. The whelk *Nucella lapillus*, the winkles *Littorina littorea* and *Littorina mariae* and the top shell *Gibbula cineraria* are all present on the soft rock among the seaweeds. The high number of characterising species is partly caused by the low number of records used to define this biotope. The high % frequency of occurrence is partly a result of the low number of records. More data is needed to validate this biotope description.

Situation

This biotope usually occurs immediately below either a *Fucus vesiculosus*-barnacle mosaic (FvesB) or a *Mytilus edulis* and piddocks-dominated biotope (MytPid) on moderately exposed shores or a dense canopy of *F. vesiculosus* (Fves) or *Ascophyllum nodosum* (Asc.FS) on sheltered shores. The littoral fringe below are on moderately exposed shores dominated by the kelp *Laminaria digitata* (Ldig.Pid), while the kelp *Laminaria saccharina* may co-dominate on sheltered shores (Lsac.Ldig; Lsac.Ft).

Temporal variation

Unknown, but probably as Fserr.FS

Similar biotopes

LR.LLR.F.Fserr.FS	Occurs on hard bedrock. Has a similar species composition, but lacks the rock-boring piddocks such as *H. arctica* and *P. dactylus* or burrowing polychaetes such as *Polydora* spp.
LR.MLR.BF.Fser.R	Occurs on bedrock, but otherwise similar physical conditions. Has a similar species composition, but lack the rock-boring piddocks such as *H. arctica* and *P. dactylus* or burrowing polychaetes such as *Polydora* spp. The encrusting calcareous red algae *Phymatolithon lenormandii* are also missing.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Actinia equina	••••	Rare	2
Polydora	••••	Abundant	7
Pomatoceros lamarcki	••••	Occasional	2
Semibalanus balanoides	••••	Frequent	5
AMPHIPODA	••••	Common	4
Patella vulgata	•••••	Occasional	5
Gibbula cineraria	•••	Occasional	1
Littorina littorea	••••	Occasional	4
Littorina mariae	•••••	Occasional	4
Nucella lapillus	•••	Present	1
Mytilus edulis	•••	Present	1
Hiatella arctica	••••	Occasional	2
Pholas dactylus	••••	Common	2
Rhodothamniella floridula	••••	Present	1
Gelidium pusillum	••••	Occasional	2
Palmaria palmata	••••	Occasional	2
Corallinaceae	••••	Common	3
Corallina officinalis	••••	Frequent	5
Phymatolithon lenormandii	••••	Common	5
Chondrus crispus	••••	Frequent	3
Lomentaria articulata	•••	Occasional	2
Osmundea pinnatifida	••••	Common	5
Fucus serratus	•••••	Abundant	17
Ulva lactuca	••••	Occasional	3

LR.MLR.BF.Rho *Rhodothamniella floridula* on sand-scoured lower eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock; boulders
Zone:	Eulittoral - lower
Height band:	Lower shore
Other features:	Sand-scour

Previous code

MLR.Eph.Rho	97.06
MLR.Aud	96.7
LRK.FSE.AUD	6.95

Biotope description

Lower eulittoral and sublittoral fringe bedrock and boulders subject to mild sand-scouring characterised by a canopy of the wracks *Fucus serratus* or *Fucus vesiculosus*, beneath which a mat of the sand-binding red seaweed *Rhodothamniella floridula* occurs. These mats can form distinct areas without *F. serratus*. The small hummocks of *R. floridula* also contain a diversity of other red seaweeds tolerant of sand scour, e.g. *Palmaria palmata, Chondrus crispus*, coralline crusts and *Mastocarpus stellatus*. The brown seaweed *Cladostephus spongiosus* or the ephemeral green seaweed *Enteromorpha intestinalis, Ulva lactuca* or *Cladophora rupestris* may occur. The hydroid *Dynamena pumila* can form colonies on the *F. serratus* fronds. The barnacle *Semibalanus balanoides*, the limpet *Patella vulgata*, the anemone *Actinia equina* and the polychaete *Pomatoceros triqueter* may be present where bedrock are available along with a few winkles such as *Littorina littorea*. In addition, polychaetes and amphipods may burrow into the *R. floridula* mat, while the mussel *Mytilus edulis* is restricted to small crevices in the bedrock. The species diversity of this biotope is normally low and there can be much variation in the species composition from site to site.

Situation

Above this biotope in sand influenced areas are a community dominated by *M. edulis* and *F. vesiculosus* or where the sand scour is more severe, is a biotope dominated by ephemeral seaweeds such as *Enteromorpha* spp. and the red seaweed *Porphyra* spp. (EntPor). Below this biotope are biotopes dominated by *F. serratus* and/or red seaweeds (see Fser variants) or biotopes dominated by kelp such as *Alaria esculenta* and/or *Laminaria digitata* (Ala.Ldig).

Temporal variation

Where sand scour is more severe, fucoids and *R. floridula* may be rare or absent and green ephemeral seaweeds dominate the substratum (EntPor).

Similar biotopes

LR.MLR.BF.Fser	These biotopes occurs on lower shore rock, but lack the sand scour. *R. floridula* is not usually present in sufficient density to form a mat on the rock.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Dynamena pumila	••	Occasional	2
Actinia equina	••	Occasional	1
Semibalanus balanoides	•••	Occasional	7
Carcinus maenas	••	Occasional	1
Patella vulgata	••	Occasional	6
Littorina littorea	••	Occasional	2
Mytilus edulis	••	Occasional	1
Rhodothamniella floridula	•••••	Abundant	27
Palmaria palmata	•••	Occasional	3
Corallinaceae	•••	Common	3
Mastocarpus stellatus	••••	Frequent	8
Chondrus crispus	••	Frequent	2
Cladostephus spongiosus	•••	Occasional	3
Fucus serratus	••••	Abundant	8
Fucus vesiculosus	••	Occasional	1
Enteromorpha intestinalis	•••	Common	7
Ulva lactuca	••••	Occasional	6
Cladophora rupestris	••	Occasional	2

LR.LLR Low energy littoral rock (fucoid shores)

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt), Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock, boulders, cobbles and pebbles, mixed substrata on sand and mud
Zone:	Eulittoral
Height band:	Upper shore, Mid shore, Lower shore

Biotope description

Sheltered to extremely sheltered rocky shores with very weak to weak tidal streams are typically characterised by a dense cover of fucoid seaweeds which form distinct zones (the wrack *Pelvetia canaliculata* on the upper shore through to the wrack *Fucus serratus* on the lower shore). Where salinity is reduced (such as at the head of a sea loch or where streams run across the shore) *Fucus ceranoides* may occur. Fucoids also occur on less stable, mixed substrata (cobbles and pebbles on sediment) although in lower abundance and with fewer associated epifaunal species; beds of mussels *Mytilus edulis* are also common. In summer months, dense blankets of ephemeral green and red seaweeds can dominate these mixed shores. Two biotope complexes have been described: Dense blankets of fucoid seaweeds dominating sheltered, fully marine littoral rocky shores (LR.LLR.F) and fucoids dominating variable salinity rocky shores (LR.LLR.FVS).

LR.LLR.F Fucoids on sheltered marine shores

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Bedrock; stable boulders; cobbles
Zone:	Eulittoral
Height band:	Upper shore, Mid shore, Lower shore

Previous code

SLR.F	97.06

Biotope description

Dense blankets of fucoid seaweeds dominating sheltered to extremely sheltered rocky shores and/or in locally sheltered patches on exposed to moderately exposed rocky shores. Typically, the wrack *Pelvetia canaliculata* (Pel) occurs on the upper shore, with the wrack *Fucus spiralis* (Fspi) below. The middle shore is dominated by vast areas of the wrack *Ascophyllum nodosum* or the wrack *Fucus vesiculosus* (Asc, Fves) or a mixture of both. The wrack *Fucus serratus* covers lower shore bedrock and boulders (Fser). Sheltered to very sheltered mixed substrata (pebbles and cobbles overlying muddy sand and gravel) shores can support fucoid communities (Fspi.X; Fves.X; Asc.X; Fserr.X).

Situation

Sheltered shores (i.e. estuaries and sea lochs) below the lichen dominated zone and above the kelp dominated zone in the sublittoral or sheltered patches on more wave exposed shores.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Semibalanus balanoides	●●●	Frequent		
Carcinus maenas	●●●	Occasional		
Patella vulgata	●●●	Frequent		
Littorina littorea	●●●	Frequent		
Littorina saxatilis	●●	Frequent		
Littorina obtusata/mariae	●●	Common		
Mytilus edulis	●●	Occasional		
Ascophyllum nodosum	●●●	Common		
Ascophyllum nodosum mackaii	●	Rare		
Fucus ceranoides	●	Rare		
Fucus serratus	●●	Frequent		
Fucus spiralis	●●	Common		
Fucus vesiculosus	●●●	Common		
Enteromorpha intestinalis	●●●	Occasional		

LR.LLR.F.Pel *Pelvetia canaliculata* on sheltered littoral fringe rock

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Bedrock; stable boulders; cobbles
Zone:	Littoral fringe - lower
Height band:	Upper shore

Previous code

LRK.PEL in part	6.95
SLR.F.Pel in part	97.06

Biotope description

Lower littoral fringe bedrock or stable boulders and mixed substrata in sheltered to extremely sheltered conditions characterised by a dense cover of the wrack *Pelvetia canaliculata*. The biotope may be present in localised sheltered patches on moderately exposed shores. *P. canaliculata* overgrows a crust of black lichens *Verrucaria maura* or the non-calcified red algae *Hildenbrandia rubra* on very sheltered shores. Individuals of the wrack *Fucus spiralis* can usually be found among the *P. canaliculata* and/or in lower part of the biotope. This biotope lacks the density of barnacles found amongst the *P. canaliculata* on more exposed shores. The winkle *Littorina saxatilis* occurs, as do a variety of amphipods. The red alga *Catenella caespitosa* can be present especially in more shaded areas while the green seaweed *Enteromorpha* spp. can be present in moist areas.

Situation

This biotope is found in the lower littoral fringe on sheltered shores below biotopes dominated by *V. maura* (Ver.Ver) and above biotopes dominated by *F. spiralis* (Fspi). Though not typical, this biotope may occur on moderately exposed shores where local topography provides shelter.

Temporal variation

Unknown.

Similar biotopes

LR.MLR.BF.PelB	Occurs on shores with a slightly higher exposure, but otherwise in similar physical conditions. Barnacles such as *Chthamalus montagui, Chthamalus stellatus* or *Semibalanus balanoides* are always present and the limpet *Patella vulgata* can be present.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Littorina saxatilis	••••	Frequent	19	
Hildenbrandia rubra	••	Occasional	2	
Fucus spiralis	•••	Occasional	3	
Pelvetia canaliculata	•••••	Common	51	
Verrucaria maura	•••	Common	14	

LR.LLR.F.Fspi *Fucus spiralis* on moderately exposed to very sheltered upper eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Bedrock; stable boulders; cobbles
Zone:	Eulittoral - upper

Previous code

SLR.F.Fspi	97.06
LRK.FSP	6.95

Biotope description

Moderately exposed to very sheltered upper eulittoral bedrock is typically characterised by a band of the spiral wrack *Fucus spiralis* overlying the black lichen *Verrucaria maura*. Underneath the fronds of *F. spiralis* and the occasional *Pelvetia canaliculata* is a community consisting of the limpet *Patella vulgata*, the winkles *Littorina saxatilis* and *Littorina littorea* and the barnacle *Semibalanus balanoides.* The rock surface can often be covered by the red crust *Hildenbrandia rubra*. During the summer months the ephemeral green seaweed *Enteromorpha intestinalis* can be common. Two variants have been described: Upper eulittoral bedrock characterised by *F. spiralis*, the black lichen *Verrucaria maura* and the olive green lichen *Verrucaria mucosa* (Fspi.FS). Upper eulittoral mixed substrata characterised by *F. spiralis* with occasional clumps of the wrack *Pelvetia canaliculata* (Fspi.X). Please notice that a *F. spiralis* biotope has descriped for variable salinity (FspiVS).

Situation

This zone usually lies below a zone dominated by the wrack *Pelvetia canaliculata* (PelB: Pel), but occasional clumps of *P. canaliculata* may be present (usually less than common) amongst the *F. spiralis*. In areas of extreme shelter, such as in Scottish sea lochs, the *P. canaliculata* and *F. spiralis* zones often merge together forming a very narrow band. Fspi occurs above the wracks *Ascophyllum nodosum* (Asc) and/or *Fucus vesiculosus* (Fves) zones and these two fucoids may also occur, although *F. spiralis* always dominates. Vertical surfaces in this zone, especially on moderately exposed shores, often lack the fucoids and are characterised by a barnacle-limpet dominated community (Sem).

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	••••	Occasional	6	
Patella vulgata	•••	Frequent	4	
Littorina littorea	•••	Occasional	3	
Littorina saxatilis	••••	Occasional	9	
Fucus spiralis	•••••	Common	50	
Pelvetia canaliculata	••	Occasional	1	
Enteromorpha intestinalis	•••	Frequent	8	
Verrucaria maura	••	Frequent	3	

LR.LLR.F.Fspi.FS *Fucus spiralis* on full salinity moderately exposed to very sheltered upper eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	
Substratum:	Bedrock; stable boulders; cobbles
Zone:	Eulittoral - upper

Previous code

LRK.FSP	6.95
SLR.Fspi in part	97.06

Biotope description

Moderately exposed upper eulittoral bedrock characterised by a band of the spiral wrack *Fucus spiralis* overlying the black lichen *Verrucaria maura* and the olive green lichen *Verrucaria mucosa*. Underneath the fronds of *F. spiralis* is a community consisting of the limpet *Patella vulgata*, the winkles *Littorina saxatilis* and *Littorina littorea* and sparse individuals of the barnacle *Semibalanus balanoides* while the mussel *Mytilus edulis* can be found attached in cracks and crevices. A variety of red algae including *Hildenbrandia rubra* may be present underneath the fronds. During the summer months ephemeral green seaweeds such as *Enteromorpha intestinalis* can be common.

Situation

This zone usually lies below a zone dominated by the wrack *Pelvetia canaliculata* (PelB; Pel), but occasional clumps of *P. canaliculata* may be present (usually less than common) amongst the *F. spiralis*. In areas of extreme shelter, such as in Scottish sea lochs, the *P. canaliculata* and *F. spiralis* zones often merge together forming a very narrow band. Fspi occurs above the wracks *Ascophyllum nodosum* (Asc) and/or *Fucus vesiculosus* (Fves) zones and these two fucoids may also occur, although *F. spiralis* always dominates. Vertical surfaces in this zone, especially on moderately exposed shores, often lack the fucoids and are characterised by a barnacle-limpet dominated community (Sem).

Temporal variation

Unknown.

Similar biotopes

LR.LLR.F.Fspi.X	Occurs in fully marine conditions, but on mixed substrata. It has a similar species composition, although amphipods, the crab *Carcinus maenas* and the whelk *Nucella lapillus* may occur underneath and/or among the boulders and cobbles. In sheltered areas (behind boulders) *A. nodosum* can be found.
LR.LLR.FVS.FspiVS	Occurs in sheltered areas with variable salinity. The species diversity is lower and species such as *P. vulgata* and *M. edulis* usually absent as well as the lichen *Verrucaria maura*. The barnacle *Elminius modestus* can be present.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	●●●	Occasional	6	
Patella vulgata	●●●●	Frequent	10	
Littorina littorea	●●●	Occasional	3	
Littorina saxatilis	●●●●	Occasional	11	
Mytilus edulis	●●	Rare	2	
Hildenbrandia rubra	●●	Occasional	5	
Fucus spiralis	●●●●●	Common	43	
Enteromorpha intestinalis	●●●	Occasional	5	
Verrucaria maura	●●●	Frequent	4	
Verrucaria mucosa	●●	Frequent	3	

LR.LLR.F.Fspi.X *Fucus spiralis* on full salinity upper eulittoral mixed substrata

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	
Substratum:	Mixed substrata
Zone:	Eulittoral - upper

Previous code

LRK.FSP	6.95
SLR.Fspi in part	97.06

Biotope description

Moderately exposed to sheltered full salinity upper eulittoral mixed substrata characterised by a band of the wrack *Fucus spiralis*. Occasional clumps of the wrack *Pelvetia canaliculata* can be overgrowing the black lichen *Verrucaria maura* and the olive green lichen *Verrucaria mucosa*. On the more stable boulders underneath the fronds the red crust *Hildenbrandia rubra* can be found along with the barnacle *Semibalanus balanoides* and the limpet *Patella vulgata*. The winkles *Littorina littorea* and *Littorina saxatilis* can be found on and among the boulders and cobbles, while amphipods and the crab *Carcinus maenas* can be present either underneath the boulders or among the brown seaweeds. The green seaweed *Enteromorpha intestinalis* can occur in some abundance especially during the summer.

Situation

This zone usually lies below a zone dominated by the wrack *P. canaliculata* (PelB; Pel). Vertical surfaces in this zone, especially on moderately exposed shores, often lack the fucoids and are characterised by a barnacle-limpet dominated community (Sem).In areas of extreme shelter, such as in Scottish sea lochs, the *P. canaliculata* and *F. spiralis* zones often merge together forming a very narrow band. Fspi.X occur above the wracks *Ascophyllum nodosum* (Asc.X) and/or *Fucus vesiculosus* (Fves.X) zones. These two fucoids may also occur among the *F. spiralis*, although *F. spiralis* always dominates. Fspi.X can also be found above a barnacle *S. balanoides* and winkle *L. littorea* dominated biotope (BLitX).

Temporal variation

Ephemeral green seaweeds such as *E. intestinalis* can occur in some abundance during the summer when the growth conditions are optimal.

Similar biotopes

LR.LLR.F.Fspi.FS	Occurs in moderately exposed conditions on rock. It has a similar species composition, though amphipods, the crab *C. maenas* and the whelk *Nucella lapillus* is usually absent.
LR.LLR.FVS.FspiVS	Occurs in sheltered areas with variable salinity. The species diversity is lower and the species *P. vulgata* and *M. edulis* are absent. The barnacle *Elminius modestus* can be present.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	●●●	Occasional	5	
AMPHIPODA	●●	Frequent	3	
Carcinus maenas	●●	Occasional	1	
Patella vulgata	●●●	Occasional	5	
Littorina littorea	●●	Frequent	3	
Littorina saxatilis	●●●●	Frequent	12	
Hildenbrandia rubra	●●	Occasional	2	
Ascophyllum nodosum	●●	Occasional	1	
Fucus spiralis	●●●●●	Common	42	
Pelvetia canaliculata	●●	Occasional	2	
Enteromorpha intestinalis	●●	Occasional	2	
Verrucaria maura	●●	Frequent	3	
Verrucaria mucosa	●●	Frequent	1	

LR.LLR.F.Fves *Fucus vesiculosus* on moderately exposed to sheltered mid eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered
Tidal streams:	
Substratum:	Bedrock; boulders
Zone:	Eulittoral - mid
Height band:	Mid shore

Previous code

SLR.F.Fves	97.06
LRK.FVES.LIT	6.95

Biotope description

Moderately exposed to very sheltered mid eulittoral bedrock and large boulders characterised by a dense canopy of the wrack *Fucus vesiculosus* (Abundant to Superabundant). Beneath the seaweed canopy the rock surface has a sparse covering of the barnacle *Semibalanus balanoides* and the limpet *Patella vulgata*. The mussel *Mytilus edulis* is confined to pits and crevices. A variety of winkles including *Littorina littorea* and *Littorina saxatilis* can be found grazing on the fucoid fronds. The whelk *Nucella lapillus* is found beneath the seaweed canopy. In areas of localised shelter the wrack *Ascophyllum nodosum* may occur, though never at high abundance. The crab *Carcinus maenas* may be present in pools or among the boulders. Two variants have been described: Bedrock and large boulders (Fves.FS) and mixed substrata (Fves.X). Please notice that a *F. vesioculosus* biotope subject to variable salinity (FvesVS) has been identified.

Situation

This biotope usually occurs between the wrack *Fucus spiralis* (Fspi) and the *Fucus serratus* (Fserr) zones; both of these fucoids may be present in this biotope, though never at high abundance (typically less than Frequent). In some sheltered areas *F. vesiculosus* forms a narrow zone above the *A. nodosum* zone (Asc). Where freshwater runoff occurs on more gradually sloping shores *F. vesiculosus* may be replaced by the wrack *Fucus ceranoides* (Fcer).

Temporal variation

On some shores, particularly those which are moderately exposed to wave action, temporal fluctuations in the abundance of limpets, barnacles and fucoid seaweeds may occur. As a result, over a number of years, a single shore may cycle between the barnacle-*P. vulgata* dominated biotope (Sem.FvesR), through this mosaic (FvesB) to a *F. vesiculosus*-dominated biotope (Fves).

Similar biotopes

LR.HLR.MusB.Sem.FvesR	Occurs on more exposed shores or on steep or vertical faces. Sparse *F. vesiculosus* is present (Occasional) and the density of *S. balanoides* and *P. vulgata* is high (Abundant). More species of red seaweeds are present, while the wracks *A. nodosum* and *F. serratus* are absent.
LR.MLR.BF.FvesB	Occurs on more exposed shores on bedrock and large boulders. *F. vesiculosus* is dominating, though less abundant (Common) and there is a higher diversity of red seaweeds. *S. balanoides*, *P. vulgata* and *N. lapillus* occurs more frequently and at a higher abundance.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	••••	Frequent	10	
Carcinus maenas	•••	Occasional	3	
Patella vulgata	•••	Frequent	6	
Littorina littorea	••••	Frequent	3	
Littorina saxatilis	••	Occasional	11	
Nucella lapillus	•••	Occasional	4	
Mytilus edulis	••	Occasional	2	
Ascophyllum nodosum	••	Occasional	2	
Fucus vesiculosus	•••••	Abundant	41	
Enteromorpha intestinalis	•••	Frequent	5	

LR.LLR.F.Fves.FS *Fucus vesiculosus* on full salinity moderately exposed to sheltered mid eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	
Substratum:	Bedrock; boulders
Zone:	Eulittoral - mid
Height band:	Mid shore

Previous code

SLR.F.Fves	97.06
LRK.FVES.LIT	6.95

Biotope description

Moderately exposed to sheltered mid eulittoral bedrock and large boulders characterised by a dense canopy of the wrack *Fucus vesiculosus* (Abundant to Superabundant). Beneath the seaweed canopy the rock surface has a sparse covering of the barnacle *Semibalanus balanoides* and the limpet *Patella vulgata*. The mussel *Mytilus edulis* is confined to pits and crevices. A variety of winkles including *Littorina littorea*, *Littorina saxatilis* and the whelk *Nucella lapillus* are found beneath the seaweeds, whilst *Littorina obtusata/mariae* graze on the fucoid fronds. The calcareous tube-forming polychaete *Spirorbis spirorbis* may also occur epiphytically on the fronds. In areas of localised shelter the wrack *Ascophyllum nodosum* may occur, though never at high abundance. Damp cracks and crevices often contain patches of the red seaweed *Mastocarpus stellatus* and even the wrack *Fucus serratus* may be present. The crab *Carcinus maenas* may be present in pools or among the boulders.

Situation

This biotope usually occurs between the wrack *Fucus spiralis* (Fspi) and the *F. serratus* (Fserr) zones; both of these fucoids may be present in this biotope, though never at high abundance (typically less than Frequent). In some sheltered areas *F. vesiculosus* forms a narrow zone above the *A. nodosum* zone (Asc). Where freshwater runoff occurs on more gradually sloping shores *F. vesiculosus* may be replaced by the wrack *Fucus ceranoides* (Fcer).

Temporal variation

On some shores, particularly those which are moderately exposed to wave action, temporal fluctuations in the abundance of limpets, barnacles and fucoid seaweeds may occur. As a result, over a number of years, a single shore may cycle between the barnacle-*P. vulgata* dominated biotope (Sem.FvesR), through this mosaic (FvesB) to a *F. vesiculosus*-dominated biotope (Fves).

Similar biotopes

LR.HLR.MusB.Sem.FvesR	Occurs on more exposed shores or on steep or vertical faces. Sparse *F. vesiculosus* is present (Occasional) and the density of *S. balanoides* and *P. vulgata* is high (Abundant). More species of red seaweeds are present, while the wracks *Ascophyllum nodosum* and *Fucus serratus* are absent.
LR.MLR.BF.FvesB	Occurs on more exposed shores on bedrock and large boulders. *F. vesiculosus* is dominating, though less abundant (Common) and there is a higher diversity of red seaweeds. *S. balanoides*, *P. vulgata* and *N. lapillus* occurs more frequently and at higher abundance.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	●●●●●	Frequent	13	
Carcinus maenas	●●	Occasional	1	
Patella vulgata	●●●●	Frequent	10	
Littorina littorea	●●●●	Frequent	3	
Littorina saxatilis	●●	Occasional	8	
Nucella lapillus	●●●	Occasional	2	
Mytilus edulis	●●	Occasional	2	
Mastocarpus stellatus	●●	Occasional	2	
Ascophyllum nodosum	●●	Occasional	2	
Fucus serratus	●●	Occasional	1	
Fucus vesiculosus	●●●●●	Abundant	35	
Enteromorpha intestinalis	●●●	Frequent	4	

LR.LLR.F.Fves.X *Fucus vesiculosus* on mid eulittoral mixed substrata

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Pebbles and cobbles on sand/mud
Zone:	Eulittoral
Other features:	Silt and/or variable salinity

Previous code

LMXD.FVES	6.95
SLR.FvesX	97.06

Biotope description

Sheltered and very sheltered mid eulittoral pebbles and cobbles lying on sediment in fully marine conditions typically characterised by the wrack *Fucus vesiculosus*. The wrack *Ascophyllum nodosum* can occasionally be found on larger boulders while the barnacle *Semibalanus balanoides* and the limpet *Patella vulgata* also can be present on the cobbles with the whelk *Nucella lapillus* preying on the barnacles and on the mussel *Mytilus edulis*. Winkles, particularly *Littorina littorea* and *Littorina obtusata*, commonly graze the biofilm on the seaweeds, while *Littorina saxatilis* can be found in crevices. Ephemeral seaweeds such as *Enteromorpha intestinalis* may be present in this biotope. The sediment between patches of hard substrata often contains the polychaete *Arenicola marina* or the polychaete *Lanice conchilega*, while a variety of gastropods and the crab *Carcinus maenas* occur on and under cobbles.

Situation

Fves.X can be found below the biotope dominated by the wrack *Fucus spiralis* (Fspi.X) or a community dominated by *S. balanoides*, *P. vulgata* and *L. littorea* (BLitX). It is found above a community dominated by *M. edulis* beds (Myt.Myt) or the wrack *Fucus serratus* (Fserr.X).

Temporal variation

Some variation in the ephemeral seaweeds and their abundance depending on season is likely.

Similar biotopes

LR.LLR.F.Fves.FS	Occurs on bedrock, but otherwise similar physical conditions. Similar species composition, but the *F. vesiculosus* canopy is more dense due to more stable substrata.
LR.LLR.FVS.FvesVS	Occurs on similar substrata, but in variable salinity conditions. Similar species composition though lower species richness. *P. vulgata* and *L. saxatilis*. are notably absent.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	●●●	Frequent	7	
Carcinus maenas	●●	Occasional	3	
Patella vulgata	●●●	Frequent	5	
Littorina littorea	●●●●●	Frequent	3	
Littorina saxatilis	●●	Frequent	18	
Littorina obtusata/mariae	●●	Frequent	1	
Nucella lapillus	●●●	Occasional	5	
Mytilus edulis	●●●	Occasional	3	
Ascophyllum nodosum	●●	Occasional	3	
Fucus vesiculosus	●●●●●	Common	36	
Enteromorpha intestinalis	●●●	Occasional	4	

LR.LLR.F.Asc *Ascophyllum nodosum* on very sheltered mid eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Bedrock; stable boulders
Zone:	Eulittoral - mid

Previous code

SLR.F.Asc	97.06
LRK.ASC	6.95

Biotope description

Sheltered to extremely sheltered mid eulittoral rock with the wrack *Ascophyllum nodosum*. The red seaweed *Polysiphonia lanosa* is often found growing as an epiphyte on the *A. nodosum* fronds while disturbed areas among the *A. nodosum* is colonised by the wrack *Fucus vesiculosus* and the green seaweed *Enteromorpha intestinalis*.e barnacle *Semibalanus balanoides*, the limpet *Patella vulgata* and *Littorina littorea* can all be found on the bedrock underneath the *A. nodosum* canopy along with coralline crusts. The whelk *Nucella lapillus* can be found preying on the barnacles and limpets. Three variants of this biotope are described. These are: full salinity (Asc.FS), mixed substrata (Asc.X) and the loose lying growth form *A. nodosum* ecad *mackaii* found on very sheltered shores (Asc.mac). To other biotopes has been identified as well tide-swept (AscT) and variabel salinity (AscVS).

Situation

This biotope is usually found between the wrack *Fucus spiralis* (Fspi) and *F. serratus* dominated biotopes (Fserr), although on some shores a narrow zone of *F. vesiculosus* (Fves) may occur immediately above the *A. nodosum*. With increasing wave exposure the *A. nodosum* canopy is replaced by *F. vesiculosus* (FvesB; Fves). Asc can occur on more exposed shores, where there is localised shelter.

Temporal variation

A. nodosum communities are generally very stable communities with individual plants reaching ages of more than 25 years on shores with little wave-action.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	••••	Frequent	7	
Carcinus maenas	•••	Occasional	4	
Patella vulgata	•••	Frequent	4	
Littorina littorea	•••	Occasional	6	
Nucella lapillus	••	Occasional	1	
Corallinaceae	••	Frequent	2	
Polysiphonia lanosa	••••	Frequent	6	
Ascophyllum nodosum	•••••	Abundant	33	
Ascophyllum nodosum mackaii	•	Rare	1	
Fucus vesiculosus	••••	Frequent	10	
Enteromorpha intestinalis	••	Occasional	2	

LR.LLR.F.Asc.FS *Ascophyllum nodosum* on full salinity mid eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Bedrock; boulders; cobbles
Zone:	Eulittoral - mid
Other features:	Disturbance allows$ Fucus vesiculosus$ to occupy patches in the canopy

Previous code

LRK.ASC.ASC	6.95
SLR.Asc.Asc	97.06

Biotope description

Bedrock, stable boulders and cobbles in the mid-eulittoral zone of moderately exposed to extremely sheltered shores, in fully marine conditions, characterised by a dense canopy of the wrack *Ascophyllum nodosum*. Another wrack *Fucus vesiculosus* may in some places co-dominate the canopy. The hydroid *Dynamena pumila* can form colonies on the wracks *F. vesiculosus* and *Fucus serratus*. Variations in the ratio of *A. nodosum* and *F. vesiculosus* in the overlying canopy have little effect on the under-storey species. Beneath the canopy are a diverse array of filamentous and foliose red seaweeds, including *Mastocarpus stellatus*, *Chondrus crispus*, *Gelidium pusillum* and coralline crusts. The filamentous red seaweed *Polysiphonia lanosa* is usually present on *A. nodosum* as an epiphyte. A few green seaweeds including *Cladophora rupestris* and *Enteromorpha* spp. are also present in moderate to low densities. On the bedrock and boulders beneath the seaweed canopy is a fauna including the barnacle *Semibalanus balanoides*, the limpet *Patella vulgata*, tube-forming spirorbid polychaetes and the anemone *Actinia equina*. The latter can be present in damp cracks and crevices. On and among the seaweeds are mobile species including the winkles *Littorina littorea* and *Littorina obtusata*, the whelk *Nucella lapillus* or even the crab *Carcinus maenas*. At the top of the *A. nodosum* zone there might be the occasional presence of the olive green lichen *Verrucaria mucosa*.

Situation

This biotope is usually found between the wrack *Fucus spiralis* (Fspi) and *F. serratus* dominated biotopes (Fserr), although on some shores a narrow zone of *F. vesiculosus* (Fves) may occur immediately above the *A. nodosum*. With increasing wave exposure the *A. nodosum* canopy is replaced by *F. vesiculosus* (FvesB; Fves). Asc.FS can occur on more exposed shores, where there is localised shelter.

Temporal variation

A. nodosum can reach an age of 25 years on sheltered shores and the communities are, once established, usually very stable. *F. vesiculosus* or *F. serratus* can occur in patches where the *A. nodosum* has been removed.

Similar biotopes

LR.HLR.FT.AscT	Occurs on bedrock or mixed substrata with strong tidal streams. High diversity of filter feeders including the sponges *Leucosolenia* spp. and *Grantia compressa*, the hydroid *Clava multicornis* and the sea squirt *Dendrodoa grossularia*.
LR.LLR.FVS.AscVS	Occurs on bedrock or mixed substrata with variable salinity. Coralline crusts and *C. crispus*, *N. lapillus* and *A. equina* are usually absent in this species impoverished biotope.
LR.LLR.F.Asc.X	Occurs on mixed substrata. Has a lower abundance and diversity of red seaweeds and lacks species such as *D. pumila* and *V. mucosa*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Dynamena pumila	●●●	Occasional	2	
Actinia equina	●●●	Occasional	2	
Spirorbidae	●●	Frequent	2	
Semibalanus balanoides	●●●●	Frequent	7	
Carcinus maenas	●●●	Occasional	2	
Patella vulgata	●●●●	Frequent	6	
Littorina littorea	●●●●	Occasional	4	
Littorina obtusata	●●●	Frequent	4	
Nucella lapillus	●●●	Occasional	2	
Gelidium pusillum	●●	Frequent	1	
Corallinaceae	●●●	Frequent	4	
Mastocarpus stellatus	●●●	Occasional	1	
Chondrus crispus	●●	Occasional	1	
Polysiphonia lanosa	●●●●	Frequent	6	
Ascophyllum nodosum	●●●●●	Abundant	28	
Fucus serratus	●●●	Occasional	2	
Fucus vesiculosus	●●●●	Frequent	8	
Enteromorpha intestinalis	●●	Occasional	1	
Cladophora rupestris	●●	Frequent	1	
Verrucaria mucosa	●●	Occasional	1	

LR.LLR.F.Asc.X *Ascophyllum nodosum* on full salinity mid eulittoral mixed substrata

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Mixed cobbles, boulders and pebbles on sediment
Zone:	Eulittoral - mid

Previous code

SLR.FX.AscX	97.06
LMXD.ASC	6.95

Biotope description

Sheltered to extremely sheltered full salinity mixed substrata (cobbles, boulders and pebbles on sediment) characterised by a canopy formed by a mosaic of the wracks *Ascophyllum nodosum* and *Fucus vesiculosus*. The red seaweed *Polysiphonia lanosa* can often be found as an epiphyte on the *A. nodosum*. The mussel *Mytilus edulis* often occurs in clumps, and provides further suitable substrata for the attachment of fucoids and red and green seaweeds such as *Polysiphonia* spp. and *Enteromorpha intestinalis* or the barnacle *Semibalanus balanoides.* Winkles are common and *Littorina littorea* and *Littorina obtusata/mariae* may occur in high densities, while species such as the limpet *Patella vulgata*, the crab *Carcinus maenas* and the whelk *Nucella lapillus* may occur on and around the boulders. Gammarids can be found underneath the boulders or among the seaweeds, while tube-forming spirorbids are found on the boulders, shells or on the *F. vesiculosus*. Infaunal species including the polychaetes *Arenicola marina* and *Lanice conchilega* may occur in the sediment between the cobbles.

Situation

A sparse *S. balanoides*, *P. vulgata* and *L. littorea* community (BLitX) can occur above this biotope. On shores with a proportion of smaller cobbles and boulders, large *A. nodosum* plants become uncommon and *F. vesiculosus* dominates the canopy (Fves.X). *F. vesiculosus* also tends to replace *A. nodosum* in areas with freshwater influence. Below this biotope are either a *Fucus serratus* dominated biotope (Fserr.X) or a *M. edulis* dominated biotope (Myt.Myt).

Temporal variation

A. nodosum communities tend to be stable due to longevity of the individual *A. nodosum*, but because of the mixed substrata some variation in the densities of *F. vesiculosus* and *A. nodosum* can be expected.

Similar biotopes

LR.LLR.F.Asc.FS	Occurs on bedrock. Has a higher abundance and diversity of red seaweeds and species such as the hydroid *Dynamena pumila* and the lichen *Verrucaria mucosa* are present.
LR.LLR.FVS.AscVS	Occurs on bedrock or mixed substrata with variable salinity. Similar species composition but species, such as the hydroid *D. pumila* and the barnacle *Elminius modestus* are usually present.
LR.HLR.FT.AscT	Occurs on rock and mixed substrata in fully marine conditions. Has a high abundance and diversity of red seaweeds and filter feeding species such as the sponges *Leucosolenia* spp. and *Grantia compressa*, the hydroid *Clava multicornis* and the sea squirt *Dendrodoa grossularia*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Spirorbidae	••	Occasional	1	
Semibalanus balanoides	••••	Occasional	6	
Gammaridae	••	Frequent	1	
Carcinus maenas	•••	Occasional	4	
Patella vulgata	•••	Occasional	4	
Littorina littorea	••••	Occasional	8	
Littorina obtusata/mariae	••	Common	3	
Nucella lapillus	•••	Occasional	2	
Mytilus edulis	•••	Occasional	3	
Polysiphonia	••	Occasional	1	
Polysiphonia lanosa	•••	Frequent	5	
Ascophyllum nodosum	•••••	Abundant	33	
Fucus vesiculosus	•••••	Frequent	13	
Enteromorpha intestinalis	•••	Occasional	2	

LR.LLR.F.Fserr *Fucus serratus* on sheltered lower eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Bedrock; boulders; cobbles
Zone:	Eulittoral - lower

Previous code

SLR.FX.FserX	97.06
SLR.F.Fserr	97.06
SLR.Fser	6.95
LRK.FSE in part	6.95

Biotope description

Sheltered to extremely sheltered lower eulittoral rock with *Fucus serratus* (for detailed description of the rich associated community please see Fserr.FS). Two variants of this biotope have been described. Fully marine conditions (Fserr.FS) and mixed substrata (Fserr.X). Please notice that three other biotopes with a *F. serratus* dominance have been described: Variable salinity (FserVS), tide-swept (FserT) and tide-swept on mixed substrata (FserXT).

Situation

This biotope usually occurs immediately below a dense canopy of *Fucus vesiculosus* (Fves) on sheltered shores or an *Ascophyllum nodosum* zone (Asc.FS) on sheltered shores; consequently low densities of these species may occur in this biotope. The sublittoral fringe below is dominated by the kelps *Laminaria saccharina* and *Laminaria digitata* on sheltered shores (Lsac.Ldig; Lsac.Ft).

Temporal variation

Unknown.

Similar biotopes

LR.MLR.BF.Fser.Bo	Occurs on large boulders and in a wider exposure range. Has a high species richness and mobile species such as the crabs *Porcellana platycheles* and *Cancer pagurus* and the starfish *Asterias rubens* are present in low numbers.
LR.MLR.BF.Fser.R	Occurs in slightly more wave exposed conditions. The species diversity and abundance of red seaweeds are higher. *D. pumila* can form dense populations on the *F. serratus* fronds.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Halichondria panicea	●●●	Occasional	3	
Semibalanus balanoides	●●●	Frequent	6	
Carcinus maenas	●●●	Occasional	2	
Patella vulgata	●●●	Occasional	3	
Littorina littorea	●●●	Occasional	4	
Mytilus edulis	●●	Occasional	3	
Corallinaceae	●●●	Frequent	3	
Mastocarpus stellatus	●●●	Frequent	4	
Ascophyllum nodosum	●●	Occasional	2	
Fucus serratus	●●●●●	Abundant	34	
Enteromorpha intestinalis	●●●	Frequent	3	
Ulva lactuca	●●	Frequent	2	
Cladophora rupestris	●●	Frequent	1	

LR.LLR.F.Fserr.FS Dense *Fucus serratus* on moderately exposed to very sheltered full salinity lower eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Bedrock
Zone:	Eulittoral - lower
Height band:	Lower shore

Previous code

SLR.F.Fserr	97.06
LRK.FSE.FSE	6.95

Biotope description

Moderately exposed to extremely sheltered lower eulittoral rock subject to fully marine conditions characterised by a dense canopy of the wrack *Fucus serratus*. There is a wide range of associated species found on the surface of the rock underneath the canopy, including the barnacle *Semibalanus balanoides*, limpets *Patella vulgata*, winkles *Littorina littorea*, and even mussels *Mytilus edulis* can be present in cracks and crevices. These species are usually found in higher abundance further up on the shore. There may also be a number of other seaweeds present, including the red *Corallina officinalis* and *Mastocarpus stellatus*, the wrack *Fucus vesiculosus* and the green *Enteromorpha intestinalis*, *Ulva lactuca* or *Cladophora rupestris*, though these usually are present in low numbers if present at all. The sponge *Halichondria panicea* can be present underneath the *F. serratus* canopy in moist cracks or minor overhangs. Polychaetes such as *Pomatoceros triqueter* and *Spirorbis* spp. are present in their white calcareous tubes on the rock.

Situation

This biotope usually occurs immediately below a *Fucus vesiculosus*-barnacle mosaic (FvesB) on moderately exposed shores or a dense canopy of *F. vesiculosus* (Fves) or *Ascophyllum nodosum* (Asc.FS) on sheltered shores; consequently low densities of these species (typically less than Frequent) may also occur in this biotope. The sub littoral fringe below on moderately exposed shores is dominated by the kelp *Laminaria digitata* (Ldig; Ldig.LdigBo), while the kelp *Laminaria saccharina* may co-dominate on sheltered shores (Lsac.Ldig; Lsac.Ft).

Temporal variation

Fluctuations from year to year in the abundance of the *F. serratus* and the red seaweeds due to e.g. severe storms may convert this biotope into either Fser.R or into a red seaweed dominated biotope on moderately exposed shores.

Similar biotopes

LR.MLR.BF.Fser.Bo	Occurs on large boulders and in a wider exposure range. Has a high species richness and mobile species such as the crabs *Porcellana platycheles* and *Cancer pagurus* and the starfish *Asterias rubens* are present in low numbers.
LR.MLR.BF.Fser.R	Occurs in slightly more wave exposed conditions. The species diversity and abundance of red seaweeds are higher. *D. pumila* can form dense populations on the *F. serratus* fronds.
LR.HLR.FT.FserT	Occurs on bedrock and boulders in very sheltered conditions. It has a very high species diversity and sponges such as *H. panicea* and *Hymeniacidon perleve* and bryozoans such as *Electra pilosa* or *Alcyonidium gelatinosum* are characteristic for this tide-swept biotope.
LR.LLR.FVS.FserVS	Occurs on variable salinity lower eulittoral rock. Similar species composition, but the individual *M. edulis* are large and the barnacle *Elminius modestus* can be present in high numbers.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Halichondria panicea	••	Frequent	1	
Pomatoceros triqueter	••	Occasional	2	
Spirorbidae	••	Common	2	
Spirorbis	••	Occasional	2	
Semibalanus balanoides	•••	Frequent	8	
Patella vulgata	•••	Occasional	8	
Littorina littorea	•••	Occasional	4	
Mytilus edulis	••	Occasional	1	
Corallina officinalis	••	Occasional	1	
Mastocarpus stellatus	•••	Frequent	4	
Fucus serratus	•••••	Abundant	44	
Fucus vesiculosus	••	Occasional	1	
Enteromorpha intestinalis	••	Frequent	4	
Ulva lactuca	••	Occasional	2	
Cladophora rupestris	•••	Frequent	5	

LR.LLR.F.Fserr.X *Fucus serratus* on full salinity lower eulittoral mixed substrata

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Mixed cobbles, boulders and pebbles on sediment
Zone:	Eulittoral - lower

Previous code

SLR.Fser.X	97.06

Biotope description

Sheltered to extremely sheltered full salinity lower eulittoral mixed substrata with dense stands of the wrack *Fucus serratus*. The crab *Carcinus maenas* and a large number of winkles such as *Littorina littorea* and *Littorina obtusata/mariae* can be found amongst the pebbles and cobbles as well as large individuals of the mussel *Mytilus edulis*, commonly occurring in clumps. On these mussels and on larger cobbles are the barnacle *Semibalanus balanoides* and the limpet *Patella vulgata*. Red algae such as coralline crusts including *Lithothamnion* spp. and the tube-forming polychaetes *Pomatoceros triqueter* and *Spirorbis* spp. can be found on cobbles and boulders. *Spirorbis* spp. can also be found on the *F. serratus* fronds. Sediment in the spaces between the loose substrata may support infauna including the polychaete *Arenicola marina*. The red seaweed *Mastocarpus stellatus* and the wrack *Ascophyllum nodosum* can occur in patches, while the green seaweeds *Enteromorpha intestinalis* and *Cladophora* spp. can be found among the mussels and underneath the *F. serratus* canopy.

Situation

Fserr.X occurs in the lower eulittoral below the biotopes dominated by the wrack *Fucus vesiculosus* and *A. nodosum* (Fves.X or Asc.X) on mixed substrata shores, or on sediment shores where mixed substrata occurs in discrete patches on the lower shore. Fserr.X occurs above biotopes dominated by the kelp *Laminaria digitata* or *Laminaria saccharina* (Ldig.Ldig; Lsac.Ldig; Lsac.Ft) depending on the substrata.

Temporal variation

Unknown.

Similar biotopes

LR.HLR.FT.FserTX	Occurs on similar, but tide-swept substrata. It has a community dominated by filter-feeders such as the sponges *Hymeniacidon perleve* and the bryozoan *Electra pilosa*.
LR.HLR.FT.FserT	Occurs in full salinity on lower eulittoral bedrock and boulders, which are influenced by strong tidal streams. Filter-feeders such as hydroids *Dynamena pumila* or the bryozoans *Alcyonidium* spp. are present. Sponges such as *Halichondria panicea* and foliose red seaweeds such as *Lomentaria articulata* or *Chondrus crispus* are present.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Pomatoceros triqueter	●●●	Occasional	3	
Spirorbis	●●●	Common	7	
Semibalanus balanoides	●●	Occasional	1	
Carcinus maenas	●●	Occasional	1	
Patella vulgata	●●	Occasional	2	
Littorina littorea	●●●●	Frequent	12	
Littorina mariae	●●●	Common	6	
Corallinaceae	●●●	Frequent	2	
Lithothamnion	●●	Frequent	1	
Mastocarpus stellatus	●●●	Occasional	5	
Ascophyllum nodosum	●●	Occasional	2	
Fucus serratus	●●●●●	Abundant	34	
Fucus vesiculosus	●●●	Frequent	5	
Enteromorpha intestinaloides	●●●	Frequent	3	
Cladophora	●●	Occasional	1	

LR.LLR.FVS Fucoids in variable salinity conditions

Habitat (physical) description

Salinity:	Variable (18-35ppt), Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered, Ultra sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock, boulders and cobbles
Zone:	Eulittoral, Eulittoral - upper, Eulittoral - mid, Eulittoral - lower
Height band:	Upper shore, Mid shore, Lower shore

Biotope description

Blankets of fucoid seaweeds dominating sheltered to extremely sheltered rocky shores with variable salinity. The wrack *Pelvetia canaliculata* (PelVS) occurs on the upper shore, with the wrack *Fucus spiralis* (FspiVS) below. The middle shore is dominated by vast areas of the wrack *Ascophyllum nodosum* or the wrack *Fucus vesiculosus* (AscVS, FvesVS) or a mixture of both. The wrack *Fucus serratus* covers lower shore bedrock and boulders (FserVS). Fucus ceranoides can be found on extremly sheltered shores with variable or low salinity (Fcer). The variable salinity communities are species impoverished compared to fucoids in full salinity or in tide-swept conditions as red seaweeds and sponges are usually absent. Underneath the canopy are a few green seaweeds including *Enteromorpha intestinalis* and *Cladophora* spp., while the red seaweed *Polysiphonia lanosa* can be found as an epiphyte on *A. nodosum*. On the rock and among the boulders are the winkles *Littorina littorea* and *Littorina saxatilis*, the crab *Carcinus maenas*, the barnacles *Semibalanus balanoides* and *Elminius modestus* and even the occasional mussel *Mytilus edulis.*

Situation

On sheltered eulittoral rocky shores with variable salinity conditions, such as sea loch or estuaries.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	●●●	Frequent	11	
Elminius modestus	●●	Frequent	6	
Gammaridae	●●	Frequent	3	
Carcinus maenas	●●●	Occasional	7	
Littorina littorea	●●●	Occasional	7	
Littorina obtusata/mariae	●●●●	Occasional	3	
Mytilus edulis	●●	Occasional	4	
Ascophyllum nodosum	●●●	Common	11	
Fucus serratus	●●	Frequent	2	
Fucus spiralis	●●	Frequent	7	
Fucus vesiculosus	●●●	Frequent	13	
Pelvetia canaliculata	●	Rare	1	
Enteromorpha intestinalis	●●●	Occasional	8	

LR.LLR.FVS.PelVS *Pelvetia canaliculata* on sheltered, variable salinity littoral fringe rock

Habitat (physical) description

Salinity:	Variable (18-35ppt)
Wave exposure:	Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Bedrock; boulders; cobbles
Zone:	Littoral fringe - lower
Height band:	Upper shore

Previous code

SLR.Pel in part	97.06

Biotope description

Lower littoral fringe bedrock or stable boulders and mixed substrata on very sheltered to extremely sheltered variable salinity shores characterised by a dense cover of the wrack *Pelvetia canaliculata*, which often overgrows a crust of black lichens *Verrucaria maura*. The wrack *Fucus spiralis* can be present among the *P. canaliculata.* This biotope lacks the density of barnacles found among the *P. canaliculata* on more exposed shores though the occasional *Semibalanus balanoides* or *Elminius modestus* can be found. The winkle *Littorina saxatilis* occurs, as do a variety of amphipods. The red alga *Catenella caespitosa* can be present in more shaded areas as well as the green seaweed *Enteromorpha intestinalis*.

Situation

This biotope are found in the lower littoral fringe on sheltered shores below biotopes dominated by *V. maura* (Ver.Ver) and above biotopes dominated by *F. spiralis* (Fspi).

Temporal variation

Unknown.

Similar biotopes

LR.MLR.BF.PelB	Occurs on shores with a higher wave exposure, and fully marine conditions. Barnacles such as *Chthamalus montagui, Chthamalus stellatus* or *S. balanoides* are always present and the limpet *Patella vulgata* can be present.
LR.LLR.F.Pel	Occurs on more exposed shores and in fully marine conditions. The species composition is very similar. Barnacles such as *S. balanoides* can be present as well as the crab *Carcinus maenas* or the red alga *Hildenbrandia rubra*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	••	Occasional	2	
Elminius modestus	••	Occasional	3	
Littorina saxatilis	•••	Frequent	7	
Catenella caespitosa	•••	Frequent	4	
Fucus spiralis	•••	Occasional	3	
Pelvetia canaliculata	•••••	Common	54	
Enteromorpha intestinalis	••	Occasional	3	
Verrucaria maura	••••	Common	14	

LR.LLR.FVS.FspiVS *Fucus spiralis* on sheltered variable salinity upper eulittoral rock

Habitat (physical) description

Salinity:	Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Bedrock; stable boulders; cobbles
Zone:	Eulittoral - upper

Previous code

LRK.FSP	6.95
SLR.Fspi in part	97.06

Biotope description

Sheltered to extremely sheltered upper eulittoral bedrock or mixed substrata (boulders, large cobbles or shells on mud) in variable salinity conditions characterised by a band of the spiral wrack *Fucus spiralis*. The ephemeral green seaweed *Enteromorpha intestinalis* is usually found in this species poor biotope. The barnacles *Semibalanus balanoides* and *Elminius modestus* can be found where suitable substrata are available, while gammarids can be found underneath the fronds of *F. spiralis* and/or underneath the boulders and cobbles. Also found underneath the fronds and among the boulders are the winkles *Littorina saxatilis* and *Littorina littorea* and the crab *Carcinus maenas*.

Situation

This zone usually lies below a zone dominated by the wrack *Pelvetia canaliculata* (Pel) and occasional clumps of *P. canaliculata* may be present (usually less than common) amongst the *F. spiralis*. In areas of extreme shelter and variable salinity conditions (e.g. in Scottish sea lochs), the *P. canaliculata* and *F. spiralis* zones often merge together forming a very narrow band. Fspi.VS occurs above the wracks *Ascophyllum nodosum* (Asc.VS) and/or *Fucus vesiculosus* (Fves.VS) zones and these two fucoids may also occur, although *F. spiralis* always dominates. It can also be found above a zone dominated by the wrack *Fucus ceranoides* (Fcer).

Temporal variation

During the summer months ephemeral green seaweeds such as *E. intestinalis* can be common.

Similar biotopes

LR.LLR.F.Fspi.X	Occurs in fully marine conditions. It has a higher species richness, and species such as the limpet *Patella vulgata* are usually present. More seaweeds including the brown *A. nodosum* and *Fucus vesiculosus* and the red non-calcified crust *Hildenbrandia rubra* occur.
LR.LLR.F.Fspi.FS	Occurs on moderately exposed bedrock in fully marine conditions. It has a higher species richness, and species such as the limpet *Patella vulgata* and the lichens *V. maura* and *Verrucaria mucosa* are usually present.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	••••	Occasional	5	
Elminius modestus	••	Occasional	3	
Gammaridae	••	Occasional	4	
Carcinus maenas	•••	Occasional	4	
Littorina littorea	•••	Occasional	2	
Littorina saxatilis	••••	Occasional	3	
Fucus spiralis	•••••	Common	62	
Enteromorpha intestinalis	•••	Occasional	10	

LR.LLR.FVS.FvesVS *Fucus vesiculosus* on mid eulittoral variable salinity boulders and stable mixed substrata

Habitat (physical) description

Salinity:	Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Boulders; Pebbles and cobbles on sand/mud
Zone:	Eulittoral
Other features:	Variable salinity and/or silt

Previous code

SLR.Fves in part	97.06

Biotope description

Sheltered to extremely sheltered mid eulittoral pebbles and cobbles lying on sediment subject to variable salinity and characterised by the wrack *Fucus vesiculosus*. The wrack *Ascophyllum nodosum* can occasionally be found on larger boulders, while the barnacles *Semibalanus balanoides* and *Elminius modestus* and the mussel *Mytilus edulis* can be present on cobbles. Winkles, particularly *Littorina littorea*, commonly graze on the seaweeds, while *Littorina saxatilis* can be found in crevices. Ephemeral seaweeds such as *Enteromorpha intestinalis* can occupy available space. Patches of sediment found between the hard substrata often contains the polychaete *Arenicola marina* or the polychaete *Lanice conchilega*, while the crab *Carcinus maenas* and gammarids and amphipods occur on and under cobbles.

Situation

Fves.VS can be found below the biotope dominated by the wracks *Fucus spiralis* or *Fucus ceranoides* (Fspi.X; Fcer) or a community dominated by *S. balanoides*, *P. vulgata* and *L. littorea* (BLitX). It is found above a community dominated by *M. edulis* (Myt.Myt) or the wrack *Fucus serratus* (Fserr.VS).

Temporal variation

Some variation in the ephemeral seaweeds and their abundance depending on the season is likely.

Similar biotopes

LR.LLR.F.Fves.FS	Occurs in marine conditions, but otherwise a similar habitat. Higher species richness and the *F. vesiculosus* canopy is more dense due to less siltation. The limpet *Patella vulgata* is present.
LR.LLR.F.Fves.X	Occur on similar substrata, but in fully marine conditions. Similar species composition though higher species richness. *P. vulgata* and *L. saxatilis*.
LR.FLR.Eph.BLitX	Occur on more unstable substrata, which do not allow *F. vesiculosus* (Occasional) to become established in any high abundance.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	●●●	Frequent	10	
Elminius modestus	●●	Frequent	3	
Gammaridae	●●	Frequent	2	
Carcinus maenas	●●●	Occasional	6	
Littorina littorea	●●●	Occasional	7	
Littorina saxatilis	●●	Frequent	2	
Mytilus edulis	●●●	Occasional	3	
Ascophyllum nodosum	●●	Occasional	3	
Fucus vesiculosus	●●●●●	Common	46	
Enteromorpha intestinaloides	●●●	Frequent	8	

LR.LLR.FVS.AscVS *Ascophyllum nodosum* and *Fucus vesiculosus* on variable salinity mid eulittoral rock

Habitat (physical) description

Salinity:	Variable (18-35ppt)
Wave exposure:	Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock; boulders; cobbles
Zone:	Eulittoral

Previous code

SLR.F.Asc.VS	97.06
LRK.ASC.VS	6.95

Biotope description

Very sheltered to extremely sheltered mid eulittoral bedrock, boulders or cobbles subject to variable salinity characterised by an impoverished community dominated by a mixture of the wracks *Ascophyllum nodosum* and *Fucus vesiculosus*. Underneath the canopy are a few green seaweeds including *Enteromorpha intestinalis* and *Cladophora* spp., while the red seaweed *Polysiphonia lanosa* can be found as an epiphyte on *A. nodosum*. On the rock and among the boulders are the winkles *Littorina littorea* and *Littorina saxatilis*, the crab *Carcinus maenas*, the barnacles *Semibalanus balanoides* and *Elminius modestus* and even the occasional mussel *Mytilus edulis*. Among the seaweeds and underneath the boulders a variety of gammarids can be found.

Situation

This biotope usually lies below the *Fucus spiralis* biotope (Fspi.VS) or the *Fucus ceranoides* dominated biotopes (Fcer) and above the variable salinity *F. serratus* dominated biotope (Fserr.VS), although on some shores a narrow zone of *F. vesiculosus* (Fves) may occur immediately above the *A. nodosum*. With increasing wave exposure the *A. nodosum* canopy can be more dense (Asc.FS).

Temporal variation

A. nodosum can reach an age of 25 years and the communities are usually stable. *F. vesiculosus* or *F. serratus* can occur in patches where the *A. nodosum* has been removed.

Similar biotopes

LR.LLR.F.Asc.FS	Occurs on bedrock in full salinity. This biotope has higher species diversity and species such as the red coralline crusts and the foliose red seaweed *Chondrus crispus*, the whelk *Nucella lapillus* and anemone *Actinia equina* are usually present.
LR.HLR.FT.AscT	Occurs on bedrock or mixed substrata with strong tidal streams. High diversity of filter-feeders including the sponges *Leucosolenia* spp. and *Grantia compressa*, the hydroid *Clava multicornis* and the sea squirt *Dendrodoa grossularia*.
LR.LLR.F.Asc.X	Occurs on mixed substrata in full marine conditions. Similar species composition, but lacks species, such as *D. pumila* and *E. modestus*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	●●●	Frequent	8	
Elminius modestus	●●●	Frequent	5	
Gammaridae	●●	Frequent	1	
Carcinus maenas	●●●●	Occasional	6	
Littorina littorea	●●●	Occasional	6	
Littorina saxatilis	●●	Occasional	1	
Mytilus edulis	●●●	Occasional	5	
Polysiphonia lanosa	●●●	Frequent	5	
Ascophyllum nodosum	●●●●●	Abundant	35	
Fucus vesiculosus	●●●●	Frequent	10	
Enteromorpha intestinalis	●●●	Occasional	3	
Cladophora	●●	Rare	1	

LR.LLR.FVS.Ascmac *Ascophyllum nodosum* ecad *mackaii* beds on extremely sheltered mid eulittoral mixed substrata

Habitat (physical) description

Salinity:	Variable (18-35ppt)
Wave exposure:	Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Pebbles and cobbles on mud and sand
Zone:	Eulittoral - mid

Previous code

LMXD.AMAC	6.95
SLR.AscX.mac	97.06

Biotope description

Extremely sheltered mid shore mixed substrata, usually subject to variable salinity due to freshwater runoff, which support beds of the non-attached growth form of the wrack *Ascophyllum nodosum* ecad *mackaii*. Cobbles and other hard substrata are often characterised by the normal form of *A. nodosum* with the red seaweed *Polysiphonia lanosa* growing as an epiphyte and other fucoids such as *Fucus vesiculosus*. The loose mats of *A. nodosum* ecad *mackaii* provide a cryptic and humid habitat for mobile species including gammarids, the crab *Carcinus maenas* and the winkles *Littorina littorea, Littorina obtusata* and *Littorina saxatilis.* The barnacle *Semibalanus balanoides* and the mussel *Mytilus edulis* are commonly attached to pebbles and cobbles on the sediment, while the infauna may contain the polychaetes *Arenicola marina* and *Lanice conchilega*. NB: This biotope is a BAP-habitat.

Situation

Occurs in extremely sheltered conditions at the heads of Scottish sea lochs (but is also known from other sheltered areas).

Temporal variation

A. nodosum ecad *mackaii* develops initially from broken fragments of *A. nodosum* and can in sheltered conditions grow in unattached, often bladderless, wig-shaped masses in the mid to upper tide zone. Note: "Ecad" has no official status in International Code of Botanical Nomenclature, but the terminology has been applied to the free-living form of *A. nodosum* since the beginning of the 19th century. The term was first employed by Clements (1905) to denote a form which results from adaptation or a change in morphology due to a new habitat - phenotypic variation.

Similar biotopes

LR.LLR.F.Asc.X	Occurs in fully marine conditions and the non-attached growth form *A. nodosum* ecad *mackaii* is not present.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	●●●	Occasional	5	
Gammaridae	●●●	Frequent	7	
Carcinus maenas	●●●●	Rare	9	
Littorina littorea	●●●●	Occasional	10	
Littorina saxatilis	●●●	Occasional	5	
Littorina obtusata/mariae	●●●	Frequent	3	
Polysiphonia lanosa	●●	Present	2	
Ascophyllum nodosum	●●●●	Rare	10	
Ascophyllum nodosum mackaii	●●●●●	Occasional	24	
Fucus vesiculosus	●●●●	Occasional	11	

LR.LLR.FVS.FserVS *Fucus serratus* and large *Mytilus edulis* on variable salinity lower eulittoral rock

Habitat (physical) description

Salinity:	Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Strong, Moderately strong, Weak, Very weak
Substratum:	Bedrock; boulders; cobbles
Zone:	Eulittoral - lower
Height band:	Lower shore

Previous code

SLR.F.Fserr.VS	97.06
SLR.Fser.VS	6.95
LRK.FSE.VS	6.95

Biotope description

Areas of very sheltered lower eulittoral rock or mixed substrata subject to variable salinity, which support an impoverished community dominated by the wrack *Fucus serratus*. The hydroid *Dynamena pumila* can form colonies on the *F. serratus* and clumps of large individuals of the mussel *Mytilus edulis* may be present on the bedrock beneath. The canopy of *F. serratus* is not usually as dense as in the other *F. serratus* dominated biotopes due the presence of the wracks *Ascophyllum nodosum* and *Fucus vesiculosus*, which are better adapted to the variable salinity. A few red seaweeds are present which includes the species *Mastocarpus stellatus*, *Chondrus crispus* and coralline crusts. Underneath the canopy is a sparse fauna consisting of barnacles *Semibalanus balanoides*, *Balanus crenatus* and *Elminius modestus*, the limpet *Patella vulgata* or the occasional presence of the winkles *Littorina obtusata* and *Littorina mariae* and the crab *Carcinus maenas*. The tube-forming polychaetes *Pomatoceros triqueter* or spirorbid polychaetes can be found. In areas (such as the Scottish sea lochs) where variable salinity water passes through tide-swept narrows and the associated biota is impoverished such records should be classified as FserVS rather than FserT.

Situation

This biotope may be found below the variable salinity *F. vesiculosus* dominated biotope or *A. nodosum* dominated biotope (AscVS; FvesVS), particularly in Scottish sea lochs. FserVS can be found above the biotopes dominated by the kelp *Laminaria saccharina* (LsacVS.Psa; LsacVS.Phy).

Temporal variation

The canopy of *F. serratus* is not as dense as in the other *F. serratus* dominated biotopes due the presence of the wracks *A. nodosum* and *F. vesiculosus*, which are better adapted to the variable salinity. They will therefore out-compete *F. serratus* on the lower shore and an ecological shift can occur (In the Baltic Sea *F. vesiculosus* is the dominant sublittoral brown seaweed). Due to the variable or low salinity conditions the individual red seaweeds may not be as large as specimens found in fully marine conditions and they can lack sexually reproductive structures.

Similar biotopes

LR.MLR.BF.Fser.R	Occurs in fully marine, moderately exposed conditions on bedrock. The species diversity and abundance of red seaweeds are high including species such as *Palmaria palmata* or *Lomentaria articulata.*
LR.MLR.BF.Fser.Bo	Occurs on bedrock and boulders at a wide range of wave exposures and full salinity. It has a high species richness due to a diversity of micro-habitats. Mobile species such as *Pisidia longicornis, Porcellana platycheles* and *Cancer pagurus* are usually present.
LR.LLR.F.Fserr.FS	Occurs on bedrock and in fully marine conditions. It has a higher abundance of *F. serratus, P. vulgata* and *Littorina* spp.
LR.HLR.FT.FserT	Occurs in full salinity on lower eulittoral bedrock and boulders influenced by strong tidal streams. Filter-feeders such as hydroids *D. pumila* or the bryozoans *Alcyonidium* spp. are present. Sponges such as *Halichondria panicea* and foliose red seaweeds such as *Lomentaria articulata* or *C. crispus* are present.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Dynamena pumila	••	Occasional	1	
Pomatoceros triqueter	••	Occasional	3	
Spirorbidae	••	Frequent	2	
Semibalanus balanoides	••••	Frequent	10	
Balanus crenatus	••	Occasional	2	
Elminius modestus	••	Common	2	
Carcinus maenas	•••	Occasional	2	
Patella vulgata	••	Occasional	2	
Littorina littorea	•••	Frequent	6	
Littorina obtusata/mariae	••	Frequent	2	
Mytilus edulis	•••	Frequent	6	
Corallinaceae	••	Occasional	2	
Mastocarpus stellatus	••	Frequent	2	
Chondrus crispus	•••	Occasional	2	
Ascophyllum nodosum	•••	Occasional	3	
Fucus serratus	•••••	Common	37	
Fucus vesiculosus	•••	Occasional	5	
Enteromorpha intestinalis	••	Occasional	1	

LR.LLR.FVS.Fcer *Fucus ceranoides* on reduced salinity eulittoral rock

Habitat (physical) description

Salinity:	Variable (18-35ppt), Reduced (18-30ppt)
Wave exposure:	Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Bedrock; boulders
Zone:	Littoral fringe, Eulittoral - upper

Previous code

SLR.Fcer	97.06
SLR.FcerX	97.06
LRK.FCER	6.95

Biotope description

Very sheltered to extremely sheltered bedrock and stable boulders in the eulittoral zone that are subject to reduced salinity and characterised by the wrack *Fucus ceranoides*. Species richness is typically low in this biotope. The green seaweeds *Enteromorpha intestinalis* and *Ulva lactuca* may be present together with the crab *Carcinus maenas* and the occasional barnacle *Elminius modestus* and *Semibalanus balanoides*.

Situation

As *F. ceranoides* is more tolerant of reduced salinity than the other fucoids, *F. ceranoides* tends to replace the wracks *Fucus spiralis*, *Fucus vesiculosus* and *Ascophyllum nodosum* towards the upper reaches of estuaries and sea lochs or in areas with freshwater influence. This biotope may, however, still contain other fucoids, although *F. ceranoides* always dominates. This biotope is often found on artificial substrata such as sea defences or bridge supports.

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	••	Occasional	2	
Elminius modestus	••	Occasional	3	
Carcinus maenas	•••	Occasional	4	
Fucus ceranoides	•••••	Common	66	
Enteromorpha intestinalis	•••	Frequent	13	
Ulva lactuca	••	Occasional	2	

LR.FLR Features on littoral rock (lichens, caves, rockpools and ephemeral seaweeds)

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt), Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Bedrock, boulders, cobbles and pebbles
Zone:	Supralittoral, Littoral fringe, Eulittoral
Height band:	Strandline, Upper shore, Mid shore, Lower shore

Biotope description

Littoral rock features includes lichens and algae crusts (LR.FLR.Lic) in the supralittoral zone and rockpools (LR.FLR.Rkp), ephemeral algae (LR.FLR.Eph) and caves (LR.FLR.CvOv) in the intertidal zone (the area of the shore between high and low tides). These features are present throughout the littoral rock zone from the upper limit at the top of of the lichen zone and the lower limit by the top of the laminarian kelp zone. These features can be found on most rocky shores regardless of wave exposure. Lichens can be found in the supralittoral zone on shores with suitable substratum. The lichen band is wider and more distinct on more exposed shores. Rockpools occur where the topography of the shore allows seawater to be retained within depressions in the bedrock producing 'pools' on the retreat of the tide. As these rockpool communities are permanently submerged they are not directly affected by height on the shore and normal rocky shore zonation patterns do not apply allowing species from the sublittoral to survive. Ephemeral seaweeds occur on disturbed littoral rock in the lower to upper shore. The shaded nature of caves and overhangs diminishes the amount of desiccation suffered by biota during periods of low tides which allows certain species to proliferate. In addition, the amount of scour, wave surge, sea spray and penetrating light determines the unique community assemblages found in upper, mid and lower shore caves, and on overhangs on the lower shore.

LR.FLR.Lic Lichens or small green algae on supralittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed, Sheltered, Very sheltered
Tidal streams:	
Substratum:	Bedrock; boulders; cobbles
Zone:	Supralittoral, Littoral fringe
Height band:	Upper shore

Previous code

LR.L	97.06

Biotope description

Lichens occur on all rocky shores (bedrock, boulders and cobbles) where there is sufficient seawater spray to maintain a viable population. Several biotopes have been identified. Yellow and grey lichens such as *Xanthoria parietina, Caloplaca marina, Caloplaca thallincola or* Ramalina *sp.* dominate the supralittoral rock (YG) with the distinctive black band of *Verrucaria maura* occurring below in the littoral fringe (Ver.Ver; Ver.B). On very exposed shores the lichen zone may extend 10s of metres up the shore, whereas on very sheltered shores the same zone can be extremely compressed or absent. Small green seaweeds can sometimes be found in this splash zone, where localised conditions allow growth in what would otherwise be inhospitable conditions for seaweeds. Such an example is the green seaweed *Prasiola stipitata* which occurs in areas of nitrate enrichment from nearby roosting seabirds (Pra). The littoral fringe on soft rock can be characterised by the green seaweed *Blidingia minima* (Bli) while steep and vertical rock influenced by freshwater in the littoral fringe can be dominated by the green seaweeds *Ulothrix flacca, Urospora penicilliformis* and *Urospora wormskioldii* (UloUro). The winkle *Littorina saxatilis* is one of the few 'marine' species found in this environment.

Situation

This biotope complex is found in the littoral fringe and the supralittoral zone on all rocky shores if there is sufficient seawater spray to maintain a viable community.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Littorina saxatilis	••	Frequent	5	
Ulothrix flacca	•	Present	1	
Blidingia minima	•	Present	1	
Prasiola stipitata	•	Rare	1	
Urospora penicilliformis	•	Present	1	
Urospora wormskioldii	•	Present	1	
Caloplaca marina	••	Occasional	5	
Caloplaca thallincola	••	Occasional	17	
Ramalina	••	Frequent	2	
Verrucaria maura	•••••	Common	61	
Xanthoria parietina	•••	Frequent	9	
Grey lichens	••	Frequent	7	

LR.FLR.Lic.YG Yellow and grey lichens on supralittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed, Sheltered, Very sheltered
Tidal streams:	
Substratum:	Bedrock; stable boulders
Zone:	Supralittoral

Previous code

LR.L.YG	97.06
SUR.YG	96.7

Biotope description

Vertical to gently sloping bedrock and stable boulders in the supralittoral (or splash zone) of the majority of rocky shores are typically characterised by a diverse maritime community of yellow and grey lichens, such as *Xanthoria parietina*, *Caloplaca marina*, *Lecanora atra* and *Ramalina* spp. The black lichen *Verrucaria maura* is also present, but usually in lower abundance than in the littoral fringe zone. In wave exposed conditions, where the effects of sea-spray extend further up the shore, the lichens generally form a wide and distinct band. This band then becomes less distinct as wave exposure decreases, and in sheltered locations, cobbles and pebbles may also support the biotope. Pools, damp pits and crevices in the rock are occasionally occupied by winkles such as *Littorina saxatilis* and halacarid mites may also be present.

Situation

This biotope is usually found at the top of the shore, immediately above a zone of the black lichen *V. maura* (Ver.Ver; Ver.B). Above the band of YG, and occasionally in crevices in the rock alongside the lichens, terrestrial plants such as the thrift *Armeria maritima* and other angiosperms often occur. In sheltered areas the transition from YG to Ver.Ver is often indistinct and a mixed zone of YG and Ver.Ver may occur. In estuaries, this biotope is often restricted to artificial substrata such as sea defences.

Temporal variation

Unknown.

Similar biotopes

LR.FLR.Lic.Pra	Occurs in similar physical conditions, but this biotope is usually confined to a nitrate enriched environment such as below bird rocks. Pra has a characteristic high abundance of the small green seaweed *Prasiola stipitata*, which overgrows the yellow and grey lichens.
LR.FLR.Lic.Ver.Ver	Occurs in similar physical conditions but usually below the YG biotope. *V. maura* and the winkle *L. saxatilis* are present in a higher abundance and dominates this biotope. See also "Situation" above.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Caloplaca marina	●●●	Occasional	12	45
Caloplaca thallincola	●●	Occasional	4	567
Lecanora atra	●●	Frequent	4	56
Ramalina	●●●	Frequent	6	
Verrucaria maura	●●●●	Frequent	21	78
Xanthoria parietina	●●●●	Frequent	27	
Grey lichens	●●●	Frequent	17	67823

LR.FLR.Lic.Pra *Prasiola stipitata* on nitrate-enriched supralittoral or littoral fringe rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Bedrock; boulders
Zone:	Supralittoral, Littoral fringe
Height band:	Upper shore
Other features:	Nitrate enrichment

Previous code

LR.L.Pra	97.06
LRK.PRA	6.95

Biotope description

Exposed to moderately exposed bedrock and large boulders in the supralittoral and littoral fringe that receives nitrate enrichment from nearby roosting sea birds and is characterised by a band or patches of the ephemeral tufty green seaweed *Prasiola stipitata* or *Prasiola* spp. This typically grows over the black lichen *Verrucaria maura* in the littoral fringe or yellow and grey lichens in the supralittoral zone. In damp pits and crevices, species such as the winkle *Littorina saxatilis*, amphipods and halacarid mites are occasionally found. Pra often covers a smaller area than 5m x 5m and care should be taken to notice/record this biotope. The biotope can be associated with artificial substrata such as septic tanks, and in supralittoral areas influenced by sewage seeps or agricultural run-off.

Situation

This biotope is found at the top of rocky shores in the splash zone below colonies of nesting or roosting birds growing. Pra may also be found at the entrances to and on the ceilings of littoral caves or in patches on large boulders, where birds may be roosting. It can be found in the YG or Ver.Ver zones.

Temporal variation

P. stipitata reaches its maximum abundance during the winter months. It generally dies out during the summer in southern Britain, when the biotope reverts to either YG or Ver.Ver. In the cooler northern areas it may be present all year round.

Similar biotopes

LR.FLR.Lic.YG	Occurs in similar physical conditions in the supralittoral zone, but is not subject to a nitrate enriched environment. Pra has a higher density of *P. stipitata*, which overgrows any yellow and grey lichens that may survive in the littoral fringe.
LR.FLR.Lic.Ver.Ver	Occurs in similar physical conditions in the littoral fringe, but is not subject to a nitrate enriched environment. Pra has a higher density of *P. stipitata*, which overgrows *V. maura*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Littorina saxatilis	●●●	Frequent	9	
Prasiola stipitata	●●●●●	Common	52	
Verrucaria maura	●●●●	Abundant	35	

LR.FLR.Lic.Ver *Verrucaria maura* on littoral fringe rock

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Bedrock; stable boulders and cobbles
Zone:	Littoral fringe

Previous code

LR.L.Ver	97.06
LRK.VER	6.95

Biotope description

Bedrock or stable boulders and cobbles in the littoral fringe which is covered by the black lichen *Verrucaria maura*. This lichen typically covers the entire rock surface giving a distinct black band in the upper littoral fringe. The winkle *Littorina saxatilis* is usually present. Two variants are defined which both occur in a wide range of wave exposures. On exposed shores *V. maura* may occur with sparse barnacles such as *Chthamalus* spp. or *Semibalanus balanoides* and may be covered by a band of ephemeral seaweeds such as *Porphyra umbilicalis* or *Enteromorpha* spp. (Ver.B). Above Ver.B or on more sheltered shores is a species poor community consisting mainly of *V. maura* and *L. saxatilis* (Ver.Ver).

Situation

This biotope occurs below the yellow and grey lichen zone (YG) and above eulittoral communities of barnacles and fuciod algae.

Temporal variation

Discint band of red or green ephemeral algae may obscure the black lichen band at certain times of the year.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Littorina saxatilis	●●●	Frequent	10	
Verrucaria maura	●●●●●	Abundant	81	

LR.FLR.Lic.Ver.B *Verrucaria maura* and sparse barnacles on exposed littoral fringe rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	
Substratum:	Bedrock; stable boulders
Zone:	Littoral fringe

Previous code

LR.L.Ver.B	97.06
LR.L.Ver.Por	97.06
LRK.VER.B	6.95

Biotope description

The littoral fringe of very exposed to moderately exposed rocky shores with a sparse covering of the barnacles *Semibalanus balanoides* and/or *Chthamalus montagui* over the black lichen *Verrucaria maura*. Winkles *Littorina saxatilis* and *Melarhaphe neritoides* are usually present although *M. neritoides* tends to be found on more exposed shores. The limpet *Patella vulgata* is often present though at a low abundance (Occasional). This biotope can be dominated by ephemeral seaweeds including the red seaweed *Porphyra umbilicalis*, the green seaweeds *Enteromorpha* spp. or, particulary in the north, microscopic blue-green algae (Cyanophyceae), which overgrow *V. maura*. The wrack *Pelvetia canaliculata* (Rare) may also be present, becoming increasingly more common with greater shelter (see PelB). Geographical variation: On northern and eastern shores the barnacle is usually *S. balanoides*, which is normally restricted to the lower littoral fringe, with a band of *V. maura* only in the upper littoral fringe. On south-west and western shores the barnacle is usually *C. montagui* which may extend over the whole of the littoral fringe zone.

Situation

Ver.B is usually found on more exposed coasts below the *V. maura* biotope Ver.Ver. It is found above the mussel *Mytilus edulis* and barnacles biotope (MytB) or above the barnacle and *Patella* spp. zone (Cht.Cht; Sem). Ver.B also occurs on vertical faces of moderately exposed shores where the *P. canaliculata* biotope (PelB) usually dominates on non-vertical faces.

Temporal variation

The abundance of *P. umbilicalis* shows considerable seasonal and geographical variation. During warm weather *P. umbilicalis* is often bleached light brown and sticks to the rock as it dries out. On southern shores it may be absent during the summer on all but the most exposed shores, as it dies back leaving a barnacle and lichen dominated community. In the cooler north the *P. umbilicalis* covering persists throughout the year. *Porphyra linearis* can also be found in the among the *P. umbilicalis* during the late winter and spring.

Similar biotopes

LR.FLR.Lic.Ver.Ver	Occurs in similar physical conditions in the upper littoral fringe. The fauna is less diverse and barnacles and ephemeral seaweeds like *P. umbilicalis* and *Enteromorpha* spp. are usually absent.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Chthamalus montagui	●●●	Occasional	6	
Semibalanus balanoides	●●●	Occasional	4	
Patella vulgata	●●●	Occasional	6	
Melarhaphe neritoides	●●●	Frequent	6	
Littorina saxatilis	●●●●●	Frequent	22	
Pelvetia canaliculata	●●	Rare	1	
Verrucaria maura	●●●●●	Abundant	46	

LR.FLR.Lic.Ver.Ver *Verrucaria maura* on very exposed to very sheltered upper littoral fringe rock

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed, Sheltered, Very sheltered
Tidal streams:	
Substratum:	Bedrock; stable boulders; stable cobbles
Zone:	Littoral fringe - upper

Previous code

LR.L.Ver.Ver	97.06
LRK.VER.VER	6.95

Biotope description

Upper littoral fringe bedrock, boulders and stable cobbles on very exposed to very sheltered shores which have a blanket covering of the black lichen *Verrucaria maura*. The winkle *Littorina saxatilis* is often present. Due to the nature of this biotope it is species poor, but occasionally a range of species may be present in low abundance. These species include the yellow lichen *Caloplaca marina* and the winkle *Melarhaphe neritoides*, the barnacles *Chthamalus montagui* and *Semibalanus balanoides* or the ephemeral seaweeds *Porphyra umbilicalis* and *Enteromorpha* spp. can be present in low abundance (see Ver.B). If one or more of these species is present compare with Ver.B. On northern shores *Littorina saxatilis* var. *rudis* can dominate along with the occasional presence of the lichens *Verrucaria mucosa* and *Xanthoria parietina*. V. maura can be found overlying stable mud in N. Ireland sea loughs.

Situation

The black lichen zone is normally found below the yellow and grey lichen zone (YG). In very sheltered areas there is not always a clear transition from one zone to the next and a mixed zone of YG and Ver.Ver is common. The wrack *Pelvetia canaliculata* can occur on these more sheltered shores. With increasing wave exposure the two lichen zones become wider and more distinct, and the Ver.Ver gives way to a lichen and barnacle dominated community (Ver.B) in the lower littoral fringe.

Temporal variation

In areas with nitrate enrichment *V. maura* can be overgrown by the small green seaweed *Prasiola stipitata* (Pra) which reaches its maximum abundance during the winter months. It generally dies out during the summer in southern Britain, reverting the biotope to Ver.Ver.

Similar biotopes

LR.FLR.Lic.YG	Occurs in similar physical conditions, but usually above the Ver.Ver biotope. Yellow and grey lichens such as *Xanthoria parietina*, *C. marina* and *Lecanora atra* dominate this biotope, and *V. maura* is less common.
LR.FLR.Lic.Ver.B	Occurs in similar physical conditions (absent on sheltered shores) below the Ver.Ver biotope. The fauna is more diverse and barnacles *C. montagui* or *S. balanoides* are present. Ephemeral seaweeds such as the red seaweed *P. umbilicalis* and the green seaweed *Enteromorpha intestinalis* can be present in high abundance.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Littorina saxatilis	●●●	Frequent	7	
Verrucaria maura	●●●●●	Abundant	87	

LR.FLR.Lic.Bli *Blidingia* spp. on vertical littoral fringe soft rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	
Substratum:	Bedrock
Zone:	Littoral fringe
Other features:	Soft rock (chalk); vertical faces

Previous code

LR.L.Bli	97.06
LRK.BLID	6.95

Biotope description

Vertical soft rock in the littoral fringe may be characterised by a band of the green seaweeds *Blidingia minima* and *Blidingia marginata*. Unbranched filamentous green seaweeds, including *Ulothrix flacca* and *Urospora wormskioldii*, are found amongst the *Blidingia* spp. The siphonous Xanthophyceae *Vaucheria* spp. can also occur in high abundance in this biotope, where they can form dense mats. During low tide terrestrial fauna such as red mites, insects and centipedes migrate into this zone. More information is needed to improve this description.

Situation

Bli is found below the *Verrucaria maura* zone (Ver.Ver) and above a band of the similar looking green algae *Enteromorpha* spp. (Ent and EntPor), where these occur in habitats not influenced by freshwater.

Temporal variation

Unknown.

Similar biotopes

LR.FLR.Lic.UloUro	Occurs in similar physical conditions, but usually on freshwater influenced rock. *Ulothrix flacca* and *Urospora* spp. are the dominant species.
LR.FLR.Eph.Ent	Occurs similar physical conditions at a wide exposure range. Also on freshwater-influenced rock, but below the Bli. *Enteromorpha* spp. dominate instead of *Blidingia* spp., but care should be taken in distinguishing and recording these as separate biotopes as the green seaweeds are superficially similar.

Characterising species

	% Frequency	***Abundance (SACFOR)***	***%Contribution to similarity***	***Abundance (nos / m ^{2})***
Enteromorpha intestinalis				
Blidingia marginata				
Blidingia minima				
Urospora wormskioldii				
Vaucheria				

LR.FLR.Lic.UloUro *Ulothrix flacca* and *Urospora* spp. on freshwater-influenced vertical littoral fringe soft rock

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	
Substratum:	Bedrock
Zone:	Littoral fringe
Other features:	Vertical soft rock, Freshwater influence

Previous code

LR.L.UloUro	97.06
LRK.UU	6.95

Biotope description

An assemblage of the small un-branched filamentous green seaweeds *Ulothrix flacca*, *Urospora penicilliformis* and *Urospora wormskioldii* at High Water Spring Tide level on steep and vertical rock often influenced by freshwater. The community is also present in areas with freshwater seepage. It is visually recognised as a closely adherent, often shiny, green mat of filamentous growth. Associated species include the green seaweeds *Blidingia minima* and *Enteromorpha prolifera*, the barnacle *Semibalanus balanoides* and the limpet *Patella vulgata*, but these species are not common. Although this biotope does occur on rock other than chalk, this description has been derived from chalk coast sites. More information is needed to improve this description.

Situation

On chalk coasts this community can include *Enteromorpha* spp. and the transition from UloUro to Ent is often indistinct and a mixed zone of UloUro and Ent can occur.

Temporal variation

This biotope is more easily identifiable from autumn to spring as both *Urospora* spp. and *Bangia atropurpurea* may dry out and disappear during the summer. In late winter the red seaweed *B. atropurpurea* may be predominant and the community then appears as shiny blackish mats of filamentous growth.

Similar biotopes

LR.FLR.Lic.Bli	Vertical soft rock in the littoral fringe characterised by a band of the foliose green seaweeds *B. minima* and *Blidingia marginata*. The filamentous, un-branched green seaweeds *U. flacca* and *Urospora* spp. may be present in this biotpe.
LR.FLR.Eph.Ent	Occurs on the lower shore and is characterised by *Enteromorpha* sp.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Polydora	••••	Occasional	7	
Semibalanus balanoides	••••	Present	7	
Patella vulgata	••••	Present	7	
Ulothrix	•••••	Occasional	36	
Ulothrix flacca	••	Present	1	
Enteromorpha	•••••	Rare	34	
Urospora penicilliformis	••	Present	1	
Urospora wormskioldii	••••	Frequent	9	

LR.FLR.Rkp Rockpools

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed, Sheltered
Tidal streams:	
Substratum:	Bedrock
Zone:	Supralittoral, Littoral fringe, Eulittoral
Height band:	Upper shore, Mid shore, Lower shore

Previous code

LR.Rkp	97.06
RKP	96.7

Biotope description

Rockpools occur where the topography of the shore allows seawater to be retained within depressions in the bedrock producing 'pools' on the retreat of the tide. As these rockpool communities are permanently submerged they are not directly affected by height on the shore and normal rocky shore zonation patterns do not apply. For this reason rockpools have been dealt with as a separate biotope complex, apart from the scheme of wave exposure and shore height. Four main rockpool biotopes have been described, and although it is accepted that an enormous variety of rockpool communities exist, it is hoped that these biotope descriptions are broad enough to adequately encompass most types. It would be meaningless to include the characterising species in a description at the biotope complex level. Rockpools on the upper shore which are subject to rainwater influence and wide fluctuations in temperature are typically dominated by green seaweeds such as *Enteromorpha* spp. and *Cladophora* spp. (G). Shallow rockpools in the mid to upper shore characterised by encrusting coralline algae and *Corallina officinalis* (Cor); several variants of these coralline pools occur in south-west Britain and Ireland (Cor.Par, Cor.Bif and Cor.Cys). Deeper rockpools on the mid to lower shore can support fucoids and some sublittoral species such as kelp (FK). Those rockpools influenced by the presence of sand are characterised by sand-tolerant seaweed such as *Furcellaria lumbricalis* and *Polyides rotundus* (SwSed). Where more stable sand occurs in the base of the rockpool sea-grass beds can occur (SwSed). Shallow rockpools on mixed cobbles, pebbles, gravel and sand may be characterised by hydroids (H). A very rough guideline to the terms "shallow" and "deep" rockpools: "shallow" rockpools do not support kelp, whereas "deep" rockpools do. This rockpool complex (LR.FLR.Rkp) does not include shallow standing water on compacted sediment or mixed substrata.

Situation

Rockpools occur in the littoral zone where the topography of the shore allows seawater to be retained within depressions in the bedrock producing 'pools' on the retreat of the tide.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Actinia equina	●●●	Occasional	3	
Patella vulgata	●●●	Occasional	5	
Gibbula cineraria	●●	Occasional	1	
Littorina littorea	●●	Common	5	
Nucella lapillus	●●	Occasional	1	
Mytilus edulis	●●	Occasional	2	
Palmaria palmata	●●	Occasional	1	
Dumontia contorta	●●	Occasional	1	
Corallinaceae	●●●●	Abundant	20	
Corallina officinalis	●●●●●	Common	19	
Mastocarpus stellatus	●●	Occasional	2	
Chondrus crispus	●●●	Occasional	3	
Ceramium nodulosum	●●	Frequent	2	
Laminaria digitata	●●●	Occasional	3	
Fucus serratus	●●	Occasional	2	
Enteromorpha intestinalis	●●●	Frequent	5	
Ulva lactuca	●●●	Occasional	4	
Cladophora	●●●	Occasional	1	

LR.FLR.Rkp.G Green seaweeds (*Enteromorpha* spp. and *Cladophora* spp.) in shallow upper shore rockpools

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed, Sheltered
Tidal streams:	
Substratum:	Bedrock
Zone:	Littoral fringe, Eulittoral - upper
Height band:	Upper shore
Other features:	Rockpool

Previous code

LR.Rkp.G	97.06
RKP.G	96.7
LRK.CHL	95.6

Biotope description

Rockpools in the littoral fringe or upper eulittoral zone subject to widely fluctuating temperatures and salinity are characterised by ephemeral green alga of the genus *Enteromorpha*, along with *Cladophora* spp. and *Ulva lactuca*. Due to the physical stress imposed on these upper shore pools, grazing molluscs such as the limpet *Patella vulgata* and the winkles *Littorina littorea* and *Littorina saxatilis* are generally in lower abundance than eulittoral pools, allowing the green seaweeds to proliferate under reduced grazing pressures. The bright orange copepod *Tigriopus fulvus* is tolerant of large salinity fluctuations and may occur in large numbers in these upper shore pools, along with gammarid amphipods.

Situation

Rockpools throughout the upper eulittoral and lower littoral fringe in bedrock.

Temporal variation

Fluctuations especially in the abundance of the green seaweeds will occur due to marked changes in salinity and temperature during the year. *Enteromorpha intestinalis* can often be bleached during the summer.

Similar biotopes

LR.FLR.Eph.Ent	Occurs on very exposed to very sheltered shores from the supralittoral to the upper eulittoral zone. This biotope does not includes rockpools. It has a similar species composition.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Patella vulgata	••	Occasional	2	
Littorina littorea	••	Frequent	4	
Littorina saxatilis	••	Occasional	3	
Enteromorpha intestinalis	••••	Abundant	77	
Cladophora rupestris	••	Frequent	5	

LR.FLR.Rkp.Cor *Corallina officinalis*, coralline crusts and brown seaweeds in shallow eulittoral rockpools

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed, Sheltered
Tidal streams:	
Substratum:	Bedrock; boulders
Zone:	Littoral fringe, Eulittoral
Height band:	Upper shore, Mid shore
Other features:	Rockpool

Previous code

LR.Rkp.Cor	97.06
Includes RKP.Gas	96.7

Biotope description

Shallow and smaller rockpools throughout the eulittoral zone in a wide range of wave exposures characterised by a covering of encrusting coralline algae on which *Corallina officinalis* often forms a dense turf. The bottom of these pools can be covered in coarse gravel and cobbles. These 'coralline' pools have a striking appearance as they are dominated by red seaweeds. Foliose red seaweeds found in these pools include *Mastocarpus stellatus*, *Chondrus crispus* and the filamentous *Ceramium nodulosum*. The ephemeral green seaweeds *Cladophora rupestris*, *Ulva lactuca* and *Enteromorpha* spp. can also occur in high abundance. The pools may hold large numbers of grazing molluscs, particularly the winkle *Littorina littorea* (which often occur in exceptionally high densities in upper shore pools) and the limpet *Patella vulgata*. Gastropods may graze these pools to such an extent that they is devoid of any foliose red seaweeds, and the flora are reduced to encrusting coralline algae and large numbers of gastropods. Large brown seaweeds are generally absent. Within the pools, pits and crevices are often occupied by the anemone *Actinia equina* and small individuals of the mussel *Mytilus edulis*. The whelk *Nucella lapillus* can be found on the rock surface preying on the barnacles and mussels. A number of variants have been identified. Pools dominated by coralline algae and foliose red seaweeds with a distribution throughout the UK (see Cor.Cor). In Ireland, the sea urchin *Paracentrotus lividus* can dominate these shallow coralline pools (see Cor.Par). In south-west Britain, the brown seaweed *Bifurcaria bifurcata* (Cor.Bif) or *Cystoseira* spp. (Cor.Cys) can be regionally dominant.

Situation

Rockpools throughout the eulittoral and lower littoral fringe on rocky shores.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Actinia equina	●●●	Occasional	4	
Patella vulgata	●●●	Frequent	6	
Littorina littorea	●●●	Common	6	
Nucella lapillus	●●	Occasional	1	
Mytilus edulis	●●	Occasional	2	
Corallinaceae	●●●●●	Abundant	26	
Corallina officinalis	●●●●●	Common	23	
Mastocarpus stellatus	●●	Occasional	1	
Chondrus crispus	●●	Occasional	1	
Ceramium nodulosum	●●	Frequent	2	
Enteromorpha intestinalis	●●●	Frequent	7	
Ulva lactuca	●●	Occasional	3	
Cladophora	●●	Occasional	1	

LR.FLR.Rkp.Cor.Cor *Corallina officinalis* and coralline crusts in shallow eulittoral rockpools

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed, Sheltered
Tidal streams:	
Substratum:	Bedrock
Zone:	Eulittoral - upper, Eulittoral - mid
Height band:	Upper shore, Mid shore
Other features:	Rockpool

Previous code

LR.Cor	97.06

Biotope description

Shallow and smaller rockpools throughout the eulittoral zone in a wide range of wave exposures characterised by a covering of encrusting coralline algae on which *Corallina officinalis* often forms a dense turf. The bottom of these pools can be covered in coarse gravel and cobbles. These 'coralline' pools have a striking appearance as they are dominated by red seaweeds. Foliose red seaweeds found in these pools include *Mastocarpus stellatus*, *Chondrus crispus* and the filamentous *Ceramium nodulosum*. The ephemeral green seaweeds *Cladophora rupestris*, *Ulva lactuca* and *Enteromorpha* spp. can also occur in high abundance. The pools may hold large numbers of grazing molluscs, particularly the winkle *Littorina littorea* (which often occurs in exceptionally high densities in upper shore pools), the limpet *Patella vulgata* and top shell *Gibbula cineraria*. Gastropods may graze these pools to such an extent that they is devoid of any foliose red seaweeds, and the flora are reduced to encrusting coralline algae and large numbers of gastropods. Large brown seaweeds are generally absent. Within the pools, pits and crevices are often occupied by the anemone *Actinia equina* and small individuals of the mussel *Mytilus edulis*, while the barnacle *Semibalanus balanoides* can be found on the rock surface. The whelk *Nucella lapillus* can be found on the rock surface preying on the barnacles and mussels.

Situation

Rockpools throughout the eulittoral and lower littoral fringe rocky shores.

Temporal variation

The ephemeral green seaweeds *Enteromorpha intestinalis* and *Ulva lactuca* can occur during the summer.

Similar biotopes

LR.FLR.Rkp.Cor.Par	Occurs in similar physical conditions though mostly on exposed to very exposed shores (and it is only reported from Ireland). It has a higher species richness and is dominated by *P. lividus* though the anemone *Anemonia viridis* can also be present.
LR.FLR.Rkp.Cor.Bif	Occurs in similar physical conditions. The brown seaweed *Bifurcaria bifurcata* dominates this biotope. The diversity of red seaweeds is higher and includes species such as *Palmaria palmata* and *Gastroclonium ovatum*.
LR.FLR.Rkp.Cor.Cys	Occurs in similar physical conditions. The brown seaweed *Cystoseira* spp. dominates, and species such as *Scytosiphon lomentaria*, *Laminaria digitata* and *Laminaria hyperborea* are usually present (Rare to Occasional).
LR.FLR.Rkp.G	Similar sized pools in the littoral fringe generally lack the encrusting coralline algae and are characterised by green seaweeds such as *Enteromorpha intestinalis*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Actinia equina	●●●	Occasional	4	
Semibalanus balanoides	●●	Occasional	1	
Patella vulgata	●●●	Frequent	7	
Littorina littorea	●●●	Common	7	
Nucella lapillus	●●	Occasional	1	
Mytilus edulis	●●	Occasional	3	
Corallinaceae	●●●●●	Abundant	27	
Corallina officinalis	●●●●●	Common	24	
Mastocarpus stellatus	●●	Occasional	2	
Chondrus crispus	●●	Occasional	1	
Ceramium nodulosum	●●●	Frequent	7	
Ulva lactuca	●●	Occasional	2	
Cladophora	●●	Occasional	1	

LR.FLR.Rkp.Cor.Par Coralline crusts and *Paracentrotus lividus* in shallow eulittoral rockpools

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed
Tidal streams:	
Substratum:	Bedrock
Zone:	Eulittoral
Other features:	Rockpool

Previous code

LR.Rkp.Cor.Par	97.06

Biotope description

Shallow and relatively smal rockpools throughout the eulittoral zone on very exposed to exposed shores, characterised by a covering of encrusting coralline algae on which *Corallina officinalis* forms a dense turf. The bottom of these pools can be covered in coarse gravel and cobbles. In south and west Ireland these coralline pools may be dominated by the sea urchin *Paracentrotus lividus* and the seaweed diversity is generally low due to the grazing pressure of *P. lividus*, the top shells *Gibbula cineraria* and *Gibbula umbilicalis*, and winkles such as *Littorina littorea*. Within the pools, pits and crevices are often occupied by the anemone such as *Actinia equina* and *Anemonia viridis* and small individuals of the mussel *Mytilus edulis*. The siphonous green seaweed *Codium* spp. can also be present along with the wrack *Himanthalia elongata* and the brown seaweed *Leathesia difformis* and the filamentous red seaweed *Ceramium* spp. The barnacle *Semibalanus balanoides* is either absent or occurs at low abundance in these rockpools, presumably due to the grazing pressure on the larval stage and the predation pressure from the whelk *Nucella lapillus*. Soft bedrock, such as limestone, allows *P. lividus* to bore into the rock.

Situation

Rockpools throughout the eulittoral and lower littoral fringe in bedrock on very exposed to exposed shores.

Temporal variation

The ephemeral green seaweeds *Enteromorpha intestinalis* and *Ulva lactuca* can occur during the summer.

Similar biotopes

LR.FLR.Rkp.Cor.Cor	Occurs in similar physical conditions over a wide range of wave exposures. *P. lividus* is not present and foliose red seaweeds such as *Mastocarpus stellatus* and *Chondrus crispus* can be present.
LR.FLR.Rkp.Cor.Bif	Occurs in similar physical conditions. The brown seaweed *Bifurcaria bifurcata* dominate this biotope. The diversity of red seaweeds is higher, and includes species such as *Palmaria palmata* and *Gastroclonium ovatum.*
LR.FLR.Rkp.Cor.Cys	Occurs in similar physical conditions. The brown seaweed *Cystoseira* spp. dominates though species such as *Scytosiphon lomentaria*, *Laminaria digitata* and *Laminaria hyperborea* are usually present (Rare to Occasional).

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Actinia equina	●●●●●	Frequent	8	
Anemonia viridis	●●●	Rare	1	
Patella vulgata	●●●●	Frequent	6	
Gibbula cineraria	●●	Frequent	1	
Gibbula umbilicalis	●●●●	Occasional	4	
Littorina littorea	●●●	Common	3	
Nucella lapillus	●●●	Occasional	2	
Mytilus edulis	●●●	Occasional	1	
Paracentrotus lividus	●●●●●	Common	17	
Corallinaceae	●●●●●	Abundant	16	
Corallina officinalis	●●●●●	Common	11	
Ceramium	●●●●	Occasional	3	
Leathesia difformis	●●●	Occasional	1	
Himanthalia elongata	●●●	Rare	1	
Enteromorpha intestinaloides	●●●	Frequent	5	
Ulva lactuca	●●●●	Occasional	5	
Codium	●●●	Occasional	3	

LR.FLR.Rkp.Cor.Bif *Bifurcaria bifurcata* in shallow eulittoral rockpools

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	
Substratum:	Bedrock
Zone:	Eulittoral
Other features:	Rockpool

Previous code

LR.Rkp.Cor.Bif	97.06

Biotope description

Eulittoral rockpools in south-west Britain on very exposed to moderately exposed shores dominated by the brown seaweed *Bifurcaria bifurcata* and encrusting coralline algae and *Corallina officinalis*. Kelps are present and include the species *Laminaria digitata*, *Laminaria saccharina* and the wrack *Himanthalia elongata*. Underneath the canopy formed by these species is a high diversity of red seaweeds including the foliose species *Chondrus crispus*, *Palmaria palmata*, *Osmundea pinnatifida* and *Mastocarpus stellatus*. Other red seaweeds include *Gastroclonium ovatum*, *Ceramium nodulosum*, *Calliblepharis jubata* and *Mesophyllum lichenoides*. The green seaweeds *Ulva lactuca* and *Enteromorpha intestinalis* occur where space allows. Often found in small cracks and crevices are the anemones *Actinia equina* and *Anemonia viridis*, while the limpet *Patella vulgata* can be found on the rock surface. Coarse gravel, cobbles and mobile boulders often cover the bottom of these rockpools, where *Gibbula umbilicalis* can be found.

Situation

Rockpools throughout the eulittoral to the upper littoral fringe in bedrock on very exposed to moderately exposed shores. *B. bifurcata* is at the edge of its range in Britain; in France it occurs in deeper lower shore pools where the alga forms a noticeable band in the mid pool level, below a band of *C. officinalis* and coralline crusts.

Temporal variation

The ephemeral green seaweeds *Enteromorpha intestinalis* and *Ulva lactuca* can occur during the summer.

Similar biotopes

LR.FLR.Rkp.Cor.Cor	Occurs in similar physical conditions at a wide range of wave exposure. Winkles such as *Littorina littorea* and *Littorina saxatilis* can be present and the diversity of red seaweeds is lower. The brown seaweed *B. bifurcata* is absent.
LR.FLR.Rkp.Cor.Par	Occurs at extremely exposed and exposed shores. The diversity of red seaweeds is low due the grazing pressure of the sea urchin *Paracentrotus lividus*, which dominates this biotope. The brown seaweed *B. bifurcata* is absent.
LR.FLR.Rkp.Cor.Cys	Occurs in similar physical conditions. The brown seaweed *Cystoseira* spp. dominates, though species such as *Scytosiphon lomentaria*, *Laminaria digitata* and *Laminaria hyperborea* are usually present (Rare to Occasional).

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Actinia equina	●●●	Occasional	3	
Anemonia viridis	●●●	Occasional	2	
Patella vulgata	●●	Frequent	1	
Gibbula umbilicalis	●●	Frequent	1	
Palmaria palmata	●●●	Occasional	2	
Corallinaceae	●●●●	Abundant	12	
Corallina officinalis	●●●●●	Abundant	21	
Mesophyllum lichenoides	●●	Occasional	1	
Mastocarpus stellatus	●●	Occasional	1	
Chondrus crispus	●●●	Frequent	2	
Calliblepharis jubata	●●●	Occasional	2	
Gastroclonium ovatum	●●●	Occasional	3	
Ceramium nodulosum	●●●	Occasional	2	
Osmundea pinnatifida	●●●	Occasional	1	
Laminaria digitata	●●●	Frequent	4	
Himanthalia elongata	●●●	Frequent	3	
Bifurcaria bifurcata	●●●●●	Common	13	
Enteromorpha intestinalis	●●●	Frequent	3	
Ulva lactuca	●●●●	Occasional	7	

LR.FLR.Rkp.Cor.Cys *Cystoseira* spp. in eulittoral rockpools

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	
Substratum:	Bedrock
Zone:	Eulittoral
Other features:	Rockpool

Previous code

LR.Rkp.Cor.Cys	97.06

Biotope description

Eulittoral rockpools on exposed to moderately exposed south-western shores dominated by the brown alga *Cystoseira* spp. (including *Cystoseira tamariscifolia*), coralline crusts and *Corallina officinalis*. These pools generally support dense red algal growth comprising: *Ceramium* spp., *Calliblepharis jubata*, *Chondrus crispus*, *Osmundea pinnatifida* and *Gelidium latifolium*. Wracks such as *Himanthalia elongata* and the epiphytic brown seaweed *Colpomenia peregrina* are present while the kelp *Laminaria digitata* can occupy the deeper parts of the pool. The green seaweeds *Enteromorpha intestinalis* and *Ulva lactuca* are usually present as well. The pools usually contain some sand and pebbles at the base of the pool while spirorbid polychaetes and *Pomatoceros* spp. build their tubes on any small boulders present. In addition, these pools can support high numbers of grazing gastropods including the top shells *Gibbula cineraria* and *Gibbula umbilicalis* but also the limpet *Patella vulgata*, while sponges such *Hymeniacidon perleve* and *Halichondria panicea* can be found overgrowing the small boulders or on and around the seaweeds. The shanny *Lipophrus pholis* is present hiding underneath boulder and cobbles, while the anemone *Actinia equina* is found in cracks and crevices.. number of available records and care should be taken not to interpret this solely as a very high species richness.

Situation

Rockpools throughout the eulittoral zone in bedrock on very exposed to moderately exposed south-western shores.

Temporal variation

Unknown.

Similar biotopes

LR.FLR.Rkp.Cor.Cor	Occurs in similar physical conditions at a wide range of wave exposures. Winkles such as *Littorina littorea* and *Littorina saxatilis* can be present and the diversity of red seaweeds is lower. The brown seaweed *B. bifurcata* is absent.
LR.FLR.Rkp.Cor.Par	Occurs on extremely exposed and exposed shores. The diversity of red seaweeds is low due the grazing pressure of the sea urchin *Paracentrotus lividus*, which dominates this biotope. The brown seaweed *B. bifurcata* is absent.
LR.FLR.Rkp.Cor.Bif	Occurs in similar physical conditions, and also in the littoral fringe. The brown seaweed *Bifurcaria bifurcata* dominates.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Halichondria panicea	●●●	Occasional	2	
Hymeniacidon perleve	●●●●	Occasional	3	
Actinia equina	●●●	Occasional	1	
Pomatoceros	●●●	Frequent	3	
Spirorbidae	●●●	Occasional	2	
Patella vulgata	●●●	Frequent	3	
Gibbula cineraria	●●●	Occasional	2	
Gibbula umbilicalis	●●●	Occasional	1	
Lipophrys pholis	●●●	Occasional	2	
Gelidium latifolium	●●●●●	Occasional	5	
Corallinaceae	●●●●●	Common	10	
Corallina officinalis	●●●●●	Abundant	9	
Chondrus crispus	●●●	Frequent	2	
Calliblepharis jubata	●●●●	Frequent	3	
Ceramium	●●●	Frequent	3	
Osmundea pinnatifida	●●●	Rare	1	
Colpomenia peregrina	●●●	Occasional	2	
Laminaria digitata	●●●●	Occasional	3	
Himanthalia elongata	●●●	Rare	1	
Cystoseira	●●●●●	Common	15	
Enteromorpha intestinalis	●●●●	Occasional	3	
Ulva lactuca	●●●	Frequent	4	

LR.FLR.Rkp.FK Fucoids and kelp in deep eulittoral rockpools

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Bedrock
Zone:	Eulittoral - mid, Eulittoral - lower
Height band:	Mid shore, Lower shore
Other features:	Deep rockpool with fucoids and kelp

Previous code

LR.Rkp.FK	97.06
RKP.FK.Bed	96.7
RKP.FK.Bo in part	96.7
LRK.FK.BEP	6.95

Biotope description

Deep or larger rockpools in the mid to lower eulittoral zone on exposed to moderately exposed shores characterised by the wrack *Fucus serratus* and the kelp *Laminaria digitata* and the red seaweed *Corallina officinalis* while encrusting coralline algae cover the rock surface. Other large brown seaweeds, including the kelp *Laminaria saccharina* and *Halidrys siliquosa* may also occur. A wide variety of filamentous and foliose seaweeds occur beneath the brown algal canopy. The species includes the red seaweeds *Palmaria palmata*, *Chondrus crispus*, *Mastocarpus stellatus*, *Ceramium nodulosum* and *Dumontia contorta*, but green seaweeds such as *Enteromorpha intestinalis*, *Ulva lactuca* and *Cladophora rupestris* can be present as well. Algal-free vertical and overhanging faces often support the sponge *Halichondria panicea* and anemones including *Actinia equina* and *Urticina felina*. Grazing molluscs including the limpet *Patella vulgata*, the top shell *Gibbula cineraria* and the winkle *Littorina littorea* are present on the rock surface while the mussel *Mytilus edulis* can be found in cracks and crevices. The whelk *Nucella lapillus* can be found preying on the mussels. Where boulders occur in these pools they provide a greater variety of micro-habitats which support a variety of fauna. Mobile crustaceans including the crabs *Pagurus bernhardus* and *Carcinus maenas*, brittlestars such as *Ophiothrix fragilis* and *Amphipholis squamata*, encrusting bryozoans and ascidians are typically found beneath and between boulders.

Situation

Rockpools throughout the eulittoral zone in bedrock on exposed and moderately exposed shores.

Temporal variation

The abundance of grazing molluscs can vary considerably both spatially and temporally, resulting in fluctuations in algal diversity and abundance.

Similar biotopes

LR.FLR.Rkp.Cor	The variants of the Cor biotope do not have the same presence of large brown seaweeds and they occur across a broader range of wave exposure.
LR.FLR.Rkp.FK.Sar	Similar type of rockpool with similar species richness and species composition though the brown seaweed *Sargassum muticum* dominates instead of *F. serratus*. *Ulva lactuca* occursat a high abundance (Common).

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Halichondria panicea	••	Occasional	1	
Actinia equina	••	Occasional	2	
Patella vulgata	•••	Occasional	3	
Gibbula cineraria	••	Occasional	1	
Littorina littorea	•••	Frequent	3	
Nucella lapillus	••	Occasional	1	
Mytilus edulis	••	Occasional	1	
Palmaria palmata	•••	Occasional	2	
Dumontia contorta	•••	Occasional	2	
Corallinaceae	••••	Abundant	13	
Corallina officinalis	•••••	Common	15	
Mastocarpus stellatus	•••	Occasional	3	
Chondrus crispus	•••	Occasional	4	
Ceramium nodulosum	•••	Frequent	3	
Laminaria digitata	••••	Occasional	8	
Laminaria saccharina	••	Occasional	1	
Fucus serratus	•••	Frequent	5	
Halidrys siliquosa	••	Frequent	2	
Ulva lactuca	•••	Occasional	4	
Cladophora	••	Occasional	1	
Cladophora rupestris	••	Occasional	1	

LR.FLR.Rkp.FK.Sar *Sargassum muticum* in eulittoral rockpools

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	
Substratum:	Bedrock
Zone:	Eulittoral - mid, Eulittoral - lower
Height band:	Mid shore, Lower shore
Other features:	Rockpool

Previous code

LR.Rkp.FK.Sar	97.06

Biotope description

Shallow rockpools throughout the eulittoral zone on exposed to moderately exposed shores dominated by the brown seaweed *Sargassum muticum* and the red seaweed *Corallina officinalis*. Other brown seaweeds, including the kelp *Laminaria saccharina*, *Laminaria digitata* and the wrack *Fucus serratus* may occur along with *Dictyota dichotoma*, but *S. muticum* always dominates. Underneath the canopy is a rich red seaweed community which includes both foliose and filamentous species such as *Palmaria palmata*, *Chondrus crispus*, *Lomentaria articulata*, *Osmundea pinnatifida*, *Ceramium* spp. and *Dumontia contorta*. Encrusting coralline algae and *Hildenbrandia rubra* often cover the rock surface. The foliose green seaweed *Ulva lactuca* is usually present in high abundance growing on the mobile gravel and boulders on the bottom of the rockpools, often along with other ephemeral green seaweeds such as *Cladophora rupestris* and *Enteromorpha intestinalis*. The winkle *Littorina littorea*, the limpet *Patella vulgata* and the top shells *Gibbula cineraria* and *Gibbula umbilicalis* can often be found grazing on the biofilm of the rock surface or the seaweeds. Crevices and fissures in the rock provide cover for anemones such as *Actinia equina* and *Anemonia viridis*, cover while the prawn *Palaemon serratus* often can be found in large numbers hiding underneath the seaweed canopy or along the boulders on the bottom. Some sand scour can affect these rockpools.

Situation

Rockpools throughout the eulittoral zone in bedrock on exposed and moderately exposed shores. The non-native *S. muticum* is an opportunistic alga which has spread extensively around the south-west coast of Britain since its introduction to UK waters in the early 1970s from the northern Pacific ocean. It is spreading to other parts of the UK. It can dominate rockpools (and other habitats), often to the exclusion of other native species such as *Laminaria* spp. and fucoids.

Temporal variation

As all the available records are from the south-west of Britain some changes in the species composition can be expected from more northern sites.

Similar biotopes

LR.FLR.Rkp.Cor	The variants of the Cor biotope do not have the same presence of large brown seaweeds and they occur across a broader range of wave exposures.
LR.FLR.Rkp.FK	Occurs at the same wave exposure in the mid to lower eulittoral zone. Similar species richness and species composition, though *F. serratus* and *L. digitata* dominate instead of *S. muticum*. Due to less environmental stress (from scour) *Ulva lactuca* is not found in high abundance (Occasional).

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Actinia equina	••••	Occasional	2	
Anemonia viridis	•••	Occasional	1	
Palaemon serratus	•••	Occasional	2	
Patella vulgata	•••	Occasional	2	
Gibbula cineraria	•••	Frequent	1	
Gibbula umbilicalis	••••	Occasional	2	
Littorina littorea	••••	Frequent	3	
Palmaria palmata	•••	Occasional	1	
Dumontia contorta	•••	Frequent	2	
Hildenbrandia rubra	••	Occasional	1	
Corallinaceae	••••	Frequent	5	
Corallina officinalis	•••••	Common	10	
Chondrus crispus	••••	Frequent	4	
Calliblepharis jubata	•••	Frequent	1	
Lomentaria articulata	•••	Occasional	1	
Ceramium	••••	Occasional	1	
Osmundea pinnatifida	•••	Occasional	1	
Dictyota dichotoma	•••	Occasional	2	
Laminaria digitata	•••	Occasional	1	
Laminaria saccharina	•••	Occasional	1	
Fucus serratus	••••	Occasional	3	
Sargassum muticum	•••••	Abundant	14	
Enteromorpha intestinalis	•••	Frequent	3	
Ulva lactuca	•••••	Common	9	
Cladophora rupestris	•••	Occasional	1	

LR.FLR.Rkp.SwSed Seaweeds in sediment-floored eulittoral rockpools

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	
Substratum:	Bedrock with cobbles, pebbles and/ or sand
Zone:	Eulittoral
Height band:	Mid shore, Lower shore
Other features:	Sand abrasion/ covered rock in rockpool; or unstable sediment (gravel/pebbles)

Previous code

LR.Rkp.SwSed	97.06
Includes RKP.RBwn	96.7
RKP.FK.Snd	96.7
LRK.FK.SP	6.95

Biotope description

Rockpools with sediment (mud, sand, gravel) floors support distinct communities of scour-tolerant seaweeds. Deep pools with sediment are similar to FK, and are typically dominated by fucoids and kelp (*Fucus serratus*, *Laminaria digitata*, *Laminaria saccharina* and *Saccorhiza polyschides*). Areas of hard substrata near to the interface with the sediment are, however, characterised by a range of sand-tolerant seaweeds such as *Furcellaria lumbricalis*, *Polyides rotundus*, *Ahnfeltia plicata* and *Rhodochorton purpureum* (compare with FK). *Chorda filum* may occur attached to pebbles and shells embedded within the sediment while the top shell *Gibbula cineraria* can be found underneath or among the pebbles. In pools with large areas of sand, infaunal species such as *Arenicola marina* and *Lanice conchilega* often occur. The seagrass *Zostera* spp. may occur in some pools where stable sand is present. Shallow rockpools with cobble and pebble floors, often with an underlying layer of sediment, support red algal tufts consisting of coralline crust, *Corallina officinalis*, *Chondrus crispus*, *Mastocarpus stellatus* mixed with *Ceramium* spp. and the green seaweeds *Cladophora* spp. and *Enteromorpha intestinalis*. The long list of characterising species is partly due to low similarity between the available records and care should be taken not to interpret this solely as a very high species richness.

Situation

Rockpools throughout the eulittoral zone in bedrock on exposed to sheltered shores.

Temporal variation

Seasonal fluctuations in the abundance of ephemeral seaweeds will occur.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Arenicola marina	••	Rare	1	
Patella vulgata	••	Occasional	2	
Gibbula cineraria	•••	Occasional	2	
Littorina littorea	•••	Frequent	5	
Corallinaceae	••••	Frequent	11	
Corallina officinalis	••••	Frequent	13	
Mastocarpus stellatus (Petrocelis)	••	Frequent	2	
Chondrus crispus	••••	Occasional	6	
Polyides rotundus	••	Occasional	1	
Furcellaria lumbricalis	••	Occasional	1	
Ceramium	•••	Frequent	3	
Ceramium nodulosum	••	Frequent	3	
Laminaria digitata	•••	Frequent	3	
Fucus serratus	•••	Occasional	5	
Enteromorpha intestinalis	••	Frequent	3	
Ulva lactuca	•••	Occasional	5	
Cladophora	•••	Occasional	2	

LR.FLR.Rkp.H Hydroids, ephemeral seaweeds and *Littorina littorea* in shallow eulittoral mixed substrata pools

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	
Substratum:	Cobbles; pebbles; gravel; sand
Zone:	Eulittoral
Height band:	Mid shore
Other features:	Rockpool or standing water

Previous code

LR.Rkp.H	97.06
LMXD.HYD	6.95

Biotope description

Shallow pools on mixed cobbles, pebbles, gravel and sand characterised by abundant hydroids. Species present may include *Obelia geniculata*, *O. dichotoma*, *O. longissima*, *Sertularia cupressina*, *Tublaria indivisa* and *Thuiaria thuja*. The difficulty in identifying hydroids suggests many more species may be also be present. Other species typically found in this biotope include ephemeral green algae (*Enteromorpha* spp. and *Ulva* sp.), red algae (*Chondrus crispus* and Coralline algae) and the winkle *Littorina littorea*. Within the pools, patches of sand may be occupied by the lugworm *Arenicola marina* and sand mason worms *Lanice conchilega*. These pools are often associated with mussel beds (MytX), with *Mytilus edulis* frequently recorded within the pools. Barnacles (*Semibalanus balanoides* and *Elminius modestus*) and the keel worm *Pomatoceros triqueter* may be attached to shells and small stones. Mobile species typical of rock pool habitats, such as *Crangon crangon* and *Pomatoschistus minutus* will also be found within the pool.

Situation

No situation data available.

Temporal variation

No temporal data available.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
HYDROZOA	●●●●●	Abundant		
Obelia longissima	●●	Common		
Arenicola marina	●●	Present		
Lanice conchilega	●●●	Occasional		
Pomatoceros triqueter	●●	Rare		
Semibalanus balanoides	●●●	Frequent		
Elminius modestus	●●●	Frequent		
Crangon crangon	●●	Present		
Carcinus maenas	●●●	Rare		
Littorina littorea	●●●	Common		
Mytilus edulis	●●●●	Abundant		
Corallinaceae	●●●	Frequent		
Chondrus crispus	●●●	Occasional		
Fucus vesiculosus	●●	Rare		
Enteromorpha	●●●●	Rare		

LR.FLR.CvOv Littoral caves and overhangs

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed, Sheltered, Very sheltered
Tidal streams:	
Substratum:	Bedrock
Zone:	Littoral fringe, Eulittoral
Height band:	Upper shore, Mid shore, Lower shore

Biotope description

Where caves and overhangs occur on rocky shores, the shaded nature of the habitat diminishes the amount of desiccation suffered by biota during periods of low tides which allows certain species to proliferate. In addition, the amount of scour, wave surge, sea spray and penetrating light determines the unique community assemblages found in upper, mid and lower shore caves and overhangs on the lower shore. Biotopes from the surrounding shore such as MytB, Sem or any of the fucoid communities occasionally extend into cave entrances. Sem often extends some way into the cave. Other open shore biotopes may also be found within caves, such as the green seaweed *Prasiola stipitata* on cave roofs where birds roost (Pra), and localised patches of green algae where freshwater seepage influences the rock (Ent). Rockpools containing encrusting coralline algae (Cor), fucoids and kelp (FK) and hydroids and littorinid molluscs may occur also on the floor of cave entrances. The cave biotope descriptions are largely based on data obtained from surveys of Berwickshire caves (ERT,2000), chalk caves from the Thanet coast (Tittley *et al*, 1998; Tittley & Spurrier 2001) and data from Wales (CCW Phase 1 data). In general, the biomass and diversity of algal species found in upper and mid-shore littoral caves decreases with increasing depth into the cave as the light levels diminish. Fucoids are usually only found at the entrances to caves, but red algae, and filamentous and encrusting green algae are able to penetrate to lower light intensities towards the back of the cave, and mats of the turf forming red seaweed *Audouinella purpurea* and/or patches of the green seaweed *Cladophora rupestris* may occur on the upper walls (AudCla). Brownish velvety growths of the brown algae *Pilinia maritima* occurring in mats with the red alga *A. purpurea* on cave walls and upper littoral levels of cliffs (AudPil) should not be confused with the green (GCv) or golden brown algal stains often found above this zone on the ceilings of the caves (AudPil; ChrHap). Below is a zone of *Verrucaria mucosa* and/or *Hildenbrandia rubra* on the inner and outer reaches (VmucHil). Fauna usually only occur on the lower and mid walls of the caves and generally comprise barnacles, anemones and tube-forming polychaetes (ScrFa; FaCr) depending on the level of boulder scour or wave surge. Where the floors of caves consist of mobile cobbles and small boulders, little algae and fauna occur due to the effects of scouring (BarCv). Vertical or steeply sloping cave walls and overhangs on the mid and lower shore, subject to wave-surge but without scour, support a rich biota of sponges, hydroids, ascidians and shade-tolerant red algae (SByAs, SR or SR.Den).

Situation

Caves and overhangs in the littoral zone in hard rock and limestone (including chalk).

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Grantia compressa	••	Occasional	3	
Halichondria panicea	••••	Frequent	16	
Hymeniacidon perleve	•••	Occasional	5	
Dynamena pumila	••	Frequent	5	
Actinia equina	••	Occasional	3	
Spirorbidae	•	Frequent	4	
Semibalanus balanoides	••	Frequent	7	
Patella vulgata	••	Frequent	3	
Mytilus edulis	••	Occasional	2	
Umbonula littoralis	••	Occasional	1	
Palmaria palmata	••	Occasional	2	
Corallinaceae	•••	Frequent	7	
Lomentaria articulata	••	Frequent	5	
Plumaria plumosa	••	Frequent	4	
Osmundea pinnatifida	••	Frequent	2	
Ulva lactuca	••	Occasional	1	

LR.FLR.CvOv.ChrHap Chrysophyceae and Haptophyceae on vertical upper littoral fringe soft rock

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt), Reduced/low (0.5-30ppt)
Wave exposure:	Moderately exposed
Tidal streams:	
Substratum:	Bedrock
Zone:	Littoral fringe - upper
Other features:	Vertical; soft rock

Previous code

LRK.CHR	6.95
LR.Chr	97.06

Biotope description

Orange, brownish or blackish gelatinous bands of algae at high tide and supralittoral levels on open cliff faces and on upper walls and ceilings at entrances and to the rear of upper and mid-shore hard and soft rock (chalk) caves. This dark brown band consists of an assemblage of Haptophyceae such as *Apistonema* spp., *Pleurochrysis carterae* and the orange *Chrysotila lamellosa*, but other genera and species of Chrysophyceae, Haptophyceae and Prasinophyceae are likely to be present as well. Species such as *Entodesmis maritima* and *Thallochrysis littoralis* and the filamentous green alga *Epicladia perforans* are often associated with *Apistonema* spp. and the latter can form a green layer beneath the *Apistonema* spp. Associated with this splash zone algal community is an assemblage of animals of terrestrial origin, with red mites, insects and centipedes commonly found. These species descend into the community as the tide falls and retreat as the tide rises. The most common truly 'marine' species is the small winkle *Melarhaphe neritoides*.

Situation

This description is partly based on a Thanet intertidal survey (Tittley & Spurrier 2001). More information is needed to identify the species composition and dominant species of this biotope.

Temporal variation

During summer the gelatinous growth dries and often peels off.

Similar biotopes

LR.FLR.CvOv.AudPil	Golden brown velvety growths of the brown algae *Pilinia maritima* occurring in mats with the red alga *Audouinella purpurea* on cave walls and upper littoral levels of cliffs.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Entodesmsis maritima				
Thallochrysis litoralis				
Apistonema carterae				
Melarhaphe neritoides				
Entocladia perforans				

LR.FLR.CvOv.GCv Green algal films on upper and mid-shore cave walls and ceilings

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	
Substratum:	Bedrock
Zone:	Supralittoral, Littoral fringe, Eulittoral - upper, Eulittoral - mid
Other features:	Moist, dark caves

Previous code

SUR.PilPse	96.7

Biotope description

The upper walls and ceilings of upper and mid-shore hard and soft rock (chalk) dominated by a band of green algal films (or 'stains'). Other encrusting algae including the non-calcified *Hildenbrandia rubra* may be present. In chalk caves, on the east and south-east coasts of England, a distinctive assemblage of species occurs, including the brown alga *Pilinia maritima* and the bright green algae *Pseudendoclonium submarinum* and *Entocladia perforans* that often covers the cave ceilings. Fauna is generally sparse and limited to limpets such as *Patella vulgata* and the winkle *Littorina saxatilis*. The species forming a green algal film that covers upper shore caves in Berwickshire were not identified. More information required to validate this biotope description.

Situation

This biotope is situated above the AudCla or VmucHil zone, extending to cover the upper walls and ceilings of caves. GCv can be found at the entrances to caves and through to the darkest areas at the back and is often found above a zone of AudPil. In hard rock caves however, the green and brown algae (AudPil) or Haptophyceae (ChrHap) occur as separate zones or GCv may occur on its own.

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Patella vulgata	••	Frequent	3	
Littorina saxatilis	••	Frequent	3	
Hildenbrandia rubra	••	Super-abundant	13	
CHLOROPHYCOTA	•••••	Super-abundant	70	

LR.FLR.CvOv.AudPil *Audouinella purpurea* and *Pilinia maritima* crusts on upper and mid-shore cave walls and ceilings

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	
Substratum:	Bedrock
Zone:	Littoral fringe - upper
Other features:	Moist, dark caves

Biotope description

Golden brown velvety growths of the brown algae *Pilinia maritima* occurring in mats with the red alga *Audouinella purpurea* forming on cave walls and upper littoral levels of cliffs. Fauna is sparse and limited to occasional individuals of the winkle *Littorina saxatilis* and spirorbid polychaetes. This assemblage is thought to be is widespread throughout Britain, although there are currently few records available. More information are needed to validate this description, which is based on information from the Thanet intertidal survey (Tittley & Spurrier 2001). Received after deadline: *A. purpurea* has changed name to *Rhodochorton purpurea* and *P. maritima* has changed name to *Pleurocladia lacustris*.

Situation

This biotope is found at the entrances and the inner reaches of caves between a band of AudCla and the GCv zone above.

Temporal variation

Some variation in the species composition of the individual caves must be expected depending on local conditions.

Similar biotopes

LR.FLR.CvOv.ChrHap	Occurs in chalk caves and on open vertical rock (chalk). Gelatinous orange and brown algae (non Phaeophyceae) including the Haptophyceae *Apistonema* spp., *Pleurochrysis carterae*, *Epicladia perforans* and the orange *Chrysotila lamellosa*, but other genera and species of Chrysophyceae, Haptophyceae and Prasinophyceae are likely to be involed.v

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Spirorbidae				
Littorina saxatilis				
Audouinella purpurea				
Pilinia maritima				

LR.FLR.CvOv.AudCla *Audouinella purpurea* and *Cladophora rupestris* on upper to mid-shore cave walls

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	
Substratum:	Bedrock
Zone:	Supralittoral, Littoral fringe, Eulittoral - upper, Eulittoral - mid
Other features:	Moist, dark caves; Chalk

Previous code

SUR.PilPse?	96.7
LRK.APP	6.95

Biotope description

Vertical and steeply-sloping upper walls at the entrances and inner reaches of upper to mid-shore caves that are partially sheltered from direct wave action characterised by a turf of the 'velvety' red seaweed *Audouinella purpurea*. Patches of green filamentous seaweed *Cladophora rupestris* can be present. The fauna is generally limited to limpets *Patella* spp., the winkle *Littorina saxatilis* and the barnacle *Semibalanus balanoides*, while they usually occur in low abundance. Filamentous or crust forming brown seaweeds may occur mixed with *A. purpurea*, often becoming a zone in its own right (AudPil) above the AudCla biotope. Other shade-tolerant red seaweed such as *Catenella caespitosa* and *Lomentaria articulata* may occur (but at lower abundance), and where freshwater seepage occurs, *Enteromorpha intestinalis* can form patches. Some variation in the species composition of the individual caves must be expected depending on local conditions. *A. purpurea* can be the only seaweed present in caves on the Thanet coast in south-east England. This biotope is known to occur in hard rock caves in north-east England and chalk caves in south-east England. Received after deadline: *A. purpurea* has changed name to *Rhodochorton purpurea*.

Situation

In hard rock caves, this biotope is generally found on the upper walls above the ScrFa and FaCr biotopes and beneath the biotopes dominated by green and/or brown crusts (GCv; AudPil). In chalk caves, AudCla may cover the lower and upper walls, while it is usually found below GCv and/or AudPil.

Temporal variation

Unknown.

Similar biotopes

LR.FLR.CvOv.VmucHil	The turf-forming red seaweed *Audouinella* spp. can be present though not at a high abundance. The red crust *Hildenbrandia rubra* is present.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	●●●	Frequent	3	
Patella	●●●	Frequent	11	
Littorina saxatilis	●●●●	Frequent	17	
Audouinella purpurea	●●●●●	Abundant	49	
Cladophora rupestris	●●●	Common	9	

LR.FLR.CvOv.VmucHil *Verrucaria mucosa* and/or *Hildenbrandia rubra* on upper to mid shore cave walls

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Bedrock
Zone:	Littoral fringe, Eulittoral - upper, Eulittoral - mid
Other features:	Moist, dark caves

Biotope description

The upper walls and ceilings of the entrances and inner reaches of upper shore caves affected by direct wave action (and therefore moistened by sea spray), characterised by a mosaic of the olive green lichen *Verrucaria mucosa* and the non-calcified encrusting red alga *Hildenbrandia rubra*. The black lichen *Verrucaria maura* and red coralline algae can be present, though not dominating. The fauna in these upper shore caves is generally limited, due to problems of desiccation. However, where conditions remain sufficiently moist, and particularly in crevices and fissures, the barnacle *Semibalanus balanoides*, the limpet *Patella vulgata* and winkles *Littorina saxatilis* may occur, particularly towards the rear of the cave. Although the characterising species of this biotope also occur on the shore, they do not generally occur in a distinct band other than in moist dark caves. The turf-forming red seaweed *Audouinella purpurea* may occasionally occur in low abundance (where *A. purpurea* covers an extensive area, generally on softer rock such as chalk, the biotope should be recorded as AudCla).

Situation

VmucHil generally occurs on upper walls and ceilings towards the rear of dark, moist caves, but can also occur at cave entrances that are directly affected by sea-spray. Where VmucHil occurs at cave entrances and to approximately 5 m into the cave, it is usually found above a zone of Sem and below GCv or AudCla. Further into the cave Sem is replaced completely by VmucHil. There are no records for VmucHil in soft rock caves.

Temporal variation

Unknown.

Similar biotopes

LR.FLR.CvOv.AudCla	Occurs in similar physical conditions, though mostly on vertical faces. The turf-forming red seaweed *Audouinella* spp. and *C. caespitosa* is more dense, while *H. rubra* is absent.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	••	Occasional	1	
Patella vulgata	••••	Common	13	
Littorina saxatilis	••	Occasional	1	
Audouinella purpurea	••	Frequent	1	
Hildenbrandia rubra	••••	Super-abundant	30	
Corallinaceae	••	Occasional	2	
Verrucaria maura	•••	Common	8	
Verrucaria mucosa	••••	Abundant	38	

LR.FLR.CvOv.SpR Sponges and shade-tolerant red seaweeds on overhanging lower eulittoral bedrock and in cave entrances

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	
Substratum:	Bedrock
Zone:	Eulittoral - mid, Eulittoral - lower, Sublittoral fringe
Other features:	Overhanging rock and cave entrances

Previous code

LR.SR	97.06
MLR.S.R	96.7
LRK.RSP	6.95

Biotope description

Overhanging shaded bedrock on the open lower shore and at the entrance to inner reaches of caves (where light availability permits), which is not subject to appreciable wave-surge, characterised by a shade-tolerant red seaweed community. It includes foliose species such as *Plumaria plumosa*, *Palmaria palmata*, *Mastocarpus stellatus*, *Membranoptera alata* and *Osmundea pinnatifida*, but *Lomentaria articulata* and coralline crusts are usually present as well. The foliose green seaweed *Ulva lactuca* can be present. The rock surface often supports dense populations of calcareous tube-forming polychaetes *Spirorbis* spp. and *Pomatoceros* spp., while sponges such as *Grantia compressa*, *Halichondria panicea* and *Hymeniacidon perleve* can be common. The hydroid *Dynamena pumila* (normally found on fucoids) hangs in distinct form from overhanging rock. Colonies of the ascidian *Botryllus schlosseri* can be found on the rock, along with the mussel *Mytilus edulis* and the barnacles *Semibalanus balanoides* and *Balanus perforatus* (the latter may occur at high densities in the south and west), while the anemone *Actinia equina* thrives in the permanently damp pits and crevices. The whelk *Nucella lapillus* can be found among the barnacles and mussels, preying on them. The long list of characterising species is partly due to the difference in the species composition and does not solely reflect a high species richness.

Situation

On overhangs, this biotope is generally found above the SByAs biotope, where there is more light available. In cave environments, SR may be found at the entrance to and inner reaches of the cave, extending from the lower walls (above the SByAs biotope) to the upper walls (depending on the height of the cave). Further into the cave where less light is available the ascidian *Dendrodoa grossularia* can be abundant (SR.Den).

Temporal variation

Unknown.

Similar biotopes

LR.FLR.CvOv.SpByAs	SR is distinguished from SByAs by its abundance of red algae; SByAs lacks the red algae, except for perhaps a few on the edge of the overhang.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Grantia compressa	••	Occasional	3	
Halichondria panicea	•••••	Frequent	15	
Hymeniacidon perleve	•••	Occasional	5	
Dynamena pumila	•••	Frequent	5	
Actinia equina	••	Occasional	2	
Pomatoceros	••	Occasional	2	
Spirorbidae	•••	Frequent	3	
Semibalanus balanoides	•••	Frequent	5	
Balanus perforatus	••	Frequent	2	
Nucella lapillus	••	Occasional	2	
Mytilus edulis	••	Occasional	2	
Umbonula littoralis	••	Occasional	1	
Palmaria palmata	•••	Occasional	4	
Corallinaceae	•••	Common	8	
Mastocarpus stellatus (Petrocelis)	••	Frequent	2	
Lomentaria articulata	••••	Common	9	
Plumaria plumosa	••••	Frequent	8	
Membranoptera alata	••	Occasional	2	
Osmundea pinnatifida	•••	Frequent	3	
Ulva lactuca	•••	Occasional	2	

LR.FLR.CvOv.SpR.Den Sponges, shade-tolerant red seaweeds and *Dendrodoa grossularia* on wave-surged overhanging lower eulittoral bedrock and caves

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	
Substratum:	Bedrock
Zone:	Eulittoral - lower
Other features:	Overhanging rock and caves

Previous code

MLR.S.R	96.7
LRK.RSP	6.95

Biotope description

Overhanging bedrock on the lower shore, at cave entrances, to and on inner walls of caves, subject to wave surge and low light levels, and characterised by a high density of small groups of the solitary ascidian *Dendrodoa grossularia*. The sponges *Grantia compressa*, *Halichondria panicea* and *Hymeniacidon perleve* are common on the rock surface, while the hydroid *Dynamena pumila* (normally found on fucoids) hangs in distinct form from overhanging rock. Found on the rock surface are the calcareous tube-forming polychaetes *Spirorbis* spp. and *Pomatoceros* spp. along with the barnacles *Semibalanus balanoides*. The anemone *Actinia equina* thrives in the permanently damp pits and crevices. Where sufficient light is available a sparse community of shade-tolerant red seaweeds. These include *Membranoptera alata, Lomentaria articulata, Audouinella* spp. and coralline crusts.

Situation

This biotope is found on lower shore overhangs and on the entrances and inner walls of lower shore caves, and usually dominates the available habitat. It is generally found above the BarCv biotope and may extend to the upper walls of caves.

Temporal variation

Some variation in the species composition of the individual caves must be expected depending on local conditions.

Similar biotopes

LR.FLR.CvOv.SpR	Occurs at localities with more available light. The ascidian *Dendrodoa grossularia* does not occur and red and brown seaweeds are usually present at higher frequency and at a higher abundance.
LR.FLR.CvOv.SpByAs	Occurs in similar physical conditions. SpByAs lacks the red seaweed community, except for a few individuals on the edge of overhangs.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Grantia compressa	••••	Occasional	10	
Halichondria panicea	•••••	Frequent	19	
Hymeniacidon perleve	•••	Occasional	2	
Dynamena pumila	•••	Frequent	4	
Actinia equina	•••	Occasional	2	
Spirorbidae	••	Common	2	
Semibalanus balanoides	•••	Common	4	
Dendrodoa grossularia	•••••	Abundant	34	
Audouinella	•••	Common	7	
Corallinaceae	•••	Occasional	5	
Lomentaria articulata	••	Occasional	2	
Membranoptera alata	•••	Rare	2	

LR.FLR.CvOv.SpByAs Sponges, bryozoans and ascidians on deeply overhanging lower shore bedrock or caves

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	
Substratum:	Bedrock
Zone:	Eulittoral - mid, Eulittoral - lower, Sublittoral fringe
Height band:	Lower shore
Other features:	Overhanging and shaded vertical rock; Lower shore caves

Previous code

LR.SByAs	97.06
MLR.S.ByAs	96.7
LRK.BAS	6.95

Biotope description

Overhanging, and shaded vertical, bedrock on the lower shore and in lower shore caves, which is not subject to appreciable wave-surge, characterised by crusts of bryozoans including *Umbonula littoralis*, sponges such as *Grantia compressa*, *Halichondria panicea*, *Scypha ciliata* and *Hymeniacidon perleve* and the ascidian *Botryllus schlosseri*. On overhangs, the hydroid *Dynamena pumila* hangs in distinct form from overhanging rock. The barnacles *Balanus crenatus*, *Balanus perforatus* (sometimes at high densities) and *Semibalanus balanoides*, and the calcareous tube-forming polychaetes *Spirorbis* spp. and *Pomatoceros triqueter* can be present as well. Certain species which are generally confined to the sublittoral, including the anemones *Metridium senile* and *Corynactis viridis*, may be found in the lower shore caves and overhangs. Littoral species such as *Actinia equina* are also present. The only algae present are coralline crusts. The list of characterising species partly reflects the variation in the species composition between individual overhangs and caves although this biotope can have a high species richness.

Situation

This biotope is found in the lower eulittoral and sublittoral fringe in less wave-surged conditions than that of SR.Den.

Temporal variation

Unknown.

Similar biotopes

LR.FLR.CvOv.SpR	SpByAs is distinguished from SR by its lack of shade-tolerant red algae, although some may occur on the edges of the overhangs.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Scypha ciliata	••	Rare	1	
Grantia compressa	••	Frequent	3	
Halichondria panicea	••••	Frequent	21	
Hymeniacidon perleve	•••	Occasional	10	
Dysidea fragilis	••	Frequent	1	
Porifera indet crusts	••	Occasional	2	
Dynamena pumila	•••	Frequent	9	
Actinia equina	••	Occasional	3	
Metridium senile	••	Occasional	1	
Corynactis viridis	••	Occasional	2	
Pomatoceros	••	Frequent	2	
Pomatoceros triqueter	••	Occasional	3	
Semibalanus balanoides	••	Frequent	3	
Balanus crenatus	••	Occasional	2	
Balanus perforatus	••	Occasional	2	
Umbonula littoralis	••	Frequent	5	
Bryozoa indet crusts	••	Frequent	1	
Dendrodoa grossularia	••	Rare	1	
Botryllus schlosseri	••	Rare	2	
Corallinaceae	••	Occasional	2	

LR.FLR.CvOv.FaCr Faunal crusts on wave-surged littoral cave walls

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	
Substratum:	Bedrock
Zone:	Eulittoral
Other features:	Moist, dark caves; Vertical faces; Ceilings

Biotope description

The inner walls of caves, predominantly in the mid shore in wave-surged conditions dominated by barnacles *Semibalanus balanoides*, and *Verruca stroemia*, with patches of encrusting sponges such as *Halichondria panicea* and *Grantia compressa* and occasional patches of the mussel *Mytilus edulis*. Increased moisture allows a denser faunal population than ScrFa to develop within the cave. The limpet *Patella vulgata* and spirorbid tube-forming polychaetes can be present. The hydroid *Dynamena pumila* and anemones such as *Metridium senile* and *Actinia equina* may occur towards the lower reaches of the cave. Where a dense faunal turf of barnacles or bryozoan crusts covers the cave walls, the biotope can also extend to cover the ceiling and may be accompanied by the bryozoan *Alcyonidium diaphanum*. Variations of this biotope may occur in mid and lower shore scoured caves in south Wales the rock is dominated by dense *Sabellaria alveolata*. In south-west England the rock can be completely covered by the barnacle *Balanus perforatus*. There may be a variation in the species composition from cave to cave, depending on local conditions.

Situation

This biotope usually occurs above the sand/pebble scoured ScrFa zone and may extend to the ceilings of the caves.

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Grantia compressa	••	Occasional	3	
Halichondria panicea	•••	Occasional	9	
Dynamena pumila	••	Frequent	3	
Actinia equina	••••	Frequent	27	
Metridium senile	••	Occasional	3	
Spirorbidae	••	Common	7	
Verruca stroemia	••	Common	6	
Semibalanus balanoides	•••	Occasional	11	
Balanus perforatus	••	Occasional	4	
Patella vulgata	•••	Rare	5	
Mytilus edulis	•••	Occasional	4	
Bryozoa indet crusts	••	Common	7	
Corallinaceae	••	Super-abundant	4	

LR.FLR.CvOv.ScrFa Sparse fauna (barnacles and spirorbids) on sand/pebble-scoured rock in upper littoral to lower shore caves

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	
Substratum:	Bedrock
Zone:	Eulittoral
Other features:	Moist, dark caves; Vertical faces

Biotope description

Upper to lower shore sand- or pebble-scoured cave walls characterised by an impoverished faunal assemblage which may include bryozoan crusts, scattered sponges *Halichondria panicea*, barnacles such as *Semibalanus balanoides* or often large *Balanus crenatus and* the limpet *Patella vulgata*. The isopod *Ligia oceanica* may seek refuge in crevices in the rock, and due to the decreased effect of desiccation in these damp caves, other species such as the anemone *Actinia equina* and spirorbid polychaetes are able to extend further up the shore than normally found on open rock. The lower section of the wall which is subject to greatest scour may be characterised by a band of *Pomatoceros triqueter* and spirorbid tube-forming polychaetes. In wave sheltered conditions, this biotope may extend to the cave ceiling. The rear of caves on the lower shore may support only sparse fauna consisting of spirorbid polychaetes and barnacles such as *Chthamalus montagui* with scattered *Pomatoceros* sp., scattered bryozoan and coralline crusts and in the south-west, occasional *Sabellaria alveolata*. Shade-tolerant red algae such as *Lomentaria articulata* may occasionally occur. Due to the low species abundance in this biotope, there may be a variation from cave to cave, depending on local conditions.

Situation

This biotope is found in caves between the barren (of macro-fauna or flora) or very species poor BarCv zone and the wave-surged, more densely populated FaCr zone. On the walls above the scour and near the cave entrance the community may grade into a red algal dominated community (AudCla).

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Halichondria panicea	●●●	Occasional	4	
Actinia equina	●●	Occasional	4	
Pomatoceros triqueter	●●●	Occasional	7	
Spirorbidae	●●●	Common	29	
Chthamalus montagui	●●	Common	4	
Semibalanus balanoides	●●●	Common	24	
Patella vulgata	●●●	Occasional	6	
Littorina arcana	●●	Occasional	3	
Corallinaceae	●●●	Common	12	

LR.FLR.CvOv.BarCv Barren and/or boulder-scoured littoral cave walls and floors

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Bedrock
Zone:	Supralittoral, Littoral fringe, Eulittoral - upper, Eulittoral - mid
Other features:	Dark, scoured caves

Biotope description

Mid and upper shore mobile boulders/cobbles on cave floors and the lower reaches of cave walls which are subject to scour are generally devoid of macro-fauna and flora. However, where light is available around the cave entrances, encrusting coralline algae may cover the rock and boulder surfaces. In some instances they may support sparse fauna such as the limpet *Patella* spp. and the winkle *Littorina saxatilis*.

Situation

This biotope is situated on the floor, or at the base of cave walls, often with a zone of ScrFa above (where the scouring effect of boulders is less). In areas of extreme wave exposure this zone will extend high up the sides of the cave and in less wave-exposed conditions where the effects of scouring are reduced, some fauna may be present. At the entrances and 2-3 metres into upper shore caves, a zone of Sem may occur above the BarCv, becoming a zone of VmucHil further into the cave. In mid shore caves, BarCv is above by a zone of ScrFa (sparse fauna), and in caves on the lower shore, the surge-tolerant SR.Den may occur above this zone.

Temporal variation

In calmer summer months cave mouths may have some ephemeral algae (e.g. *Enteromorpha intestinalis*) and a spat-fall of barnacles or limpets.

Similar biotopes

LR.FLR.CvOv.ScrFa	Occurs closer to the cave entrance or slightly higher on the cave wall. ScrFa is also a species impoverished biotope. It is distinguished from BarCv by the presence of a faunal assemblage which may include sponges, bryozoans, barnacles and spirorbid polychaetes.

LR.FLR.Eph Ephemeral green or red seaweeds (freshwater or sand-influenced)

Habitat (physical) description

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Bedrock; boulders
Zone:	Littoral fringe - lower, Eulittoral
Height band:	Upper shore, Mid shore, Lower shore

Previous code

MLR.Eph	97.06

Biotope description

Ephemeral seaweeds on disturbed littoral rock in the lower to upper shore. Dominant green seaweeds include *Enteromorpha intestinalis*, *Ulva lactuca* and the red seaweeds *Rhodothamniella floridula* and *Porphyra purpurea*. Winkles such as *Littorina littorea* and *Littorina saxatilis*, the limpet *Patella vulgata* and the barnacles *Semibalanus balanoides* can occur, though usually in low abundance. The crab *Carcinus maenas* can be found where boulders are present, while the barnacle *Elminius modestus* is usually present on sites subject to variable salinity. On moderately exposed shores, the biotope is *Enteromorpha* spp. on freshwater-influenced or unstable upper shore rock (Ent) or *P. purpurea* and/or *Enteromorpha* spp. on sand-scoured mid to lower eulittoral rock (EntPor). Eulittoral mixed substrata subject to variations in salinity and/or siltation characterised by dense blankets of ephemeral green and red seaweeds (EphX), or if the substratum is too mobile or disturbed to support a seaweed community (BLitX). These are biotopes with a low species diversity and the relatively high number of species in the characterising species list are due to a variation in the species composition from site to site, not to high species richness on individual sites.

Situation

This biotope complex occurs the splash zone, sometimes on cliff faces, and throughout the main intertidal zone.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Semibalanus balanoides	●●●	Occasional	3	
Elminius modestus	●●	Occasional	10	
Carcinus maenas	●●	Occasional	4	
Patella vulgata	●●	Occasional	4	
Littorina littorea	●●	Occasional	7	
Littorina saxatilis	●●	Occasional	5	
Porphyra purpurea	●	Present	1	
Rhodothamniella floridula	●	Present	1	
Fucus vesiculosus	●●	Occasional	2	
CHLOROPHYCEAE	●●	Abundant	5	
Enteromorpha intestinalis	●●●●	Common	37	
Ulva lactuca	●●	Occasional	3	

LR.FLR.Eph.Ent *Enteromorpha* spp. on freshwater-influenced and/or unstable upper eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed, Sheltered
Tidal streams:	
Substratum:	Chalk, firm mud, bedrock, boulders
Zone:	Littoral fringe - lower, Eulittoral - upper
Height band:	Upper shore
Other features:	Physical disturbance, (soft rock) or freshwater runoff

Previous code

MLR.Eph.Ent	97.06
MLR.Eph.Ent	96.7
LRK.ENT	6.95

Biotope description

Upper shore hard substratum that is relatively unstable (e.g. soft rock) or subject to considerable freshwater runoff is typically very species poor and characterised by a dense mat of *Enteromorpha* spp., though *Ulva lactuca* can occur as well. It occurs in a wider zone spanning from the supralittoral down to the upper eulittoral, across a wide range of wave exposures range. This biotope is generally devoid of fauna, except for occasional limpets *Patella vulgata*, winkles *Littorina littorea* or *Littorina saxatilis* and barnacles *Semibalanus balanoides*.

Situation

This band of green seaweeds is usually found above a zone dominated by a mixture *Enteromorpha* spp. and *Porphyra* spp. (EntPor) or a *Fucus spiralis* or *Fucus ceranoides* zone (Fspi; Fcer), and may replace the *Pelvetia canaliculata* zone (PelB). It can be found below a zone dominated by yellow and grey lichens. In very sheltered areas the seagrass *Ruppia maritima* can be found above this biotope while different wracks such as *Fucus* spp. can dominate the zone below (Rup; Asc; Fspi).

Temporal variation

Seasonal fluctuations in the abundance of the *Enteromorpha* spp. and the occurrence of the other green seaweeds species will occur.

Similar biotopes

LR.FLR.Eph.EntPor	Occurs in the lower to mid-eulitttoral zone in sand influenced habitats. It has a higher species richness, which include the red seaweed *Porphyra purpurea* and the occasional wracks such as *F. spiralis* or *Fucus vesiculosus*. The winkle *L. littorea* is usually present.
LR.FLR.Eph.EphX	Occurs in more estuarine conditions and on mixed substrata. The green seaweed *Ulva lactuca* may be present. A very similar biotope.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	••	Rare	4	
Patella vulgata	••	Occasional	3	
Littorina saxatilis	••	Occasional	2	
Enteromorpha	••••	Common	74	
Enteromorpha intestinalis	••	Present	2	
Enteromorpha prolifera	••	Present	2	
Ulva lactuca	•	Present	1	

LR.FLR.Eph.EntPor *Porphyra purpurea* and *Enteromorpha* spp. on sand-scoured mid or lower eulittoral rock

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	
Substratum:	Bedrock; boulders
Zone:	Eulittoral
Height band:	Mid shore
Other features:	Sand-scour

Previous code

MLR.Eph.EntPor	97.06
MLR.Eph.Por	96.7
LRK.EPH	6.95

Biotope description

Exposed and moderately exposed mid-shore bedrock and boulders occurring adjacent to areas of sand which significantly affects the rock. As a consequence of sand-abrasion, wracks such as *Fucus vesiculosus* or *Fucus spiralis* are scarce and the community is typically dominated by ephemeral red or green seaweeds, particularly the foliose red seaweed *Porphyra purpurea* and green seaweeds such as *Enteromorpha* spp. Under the blanket of ephemeral seaweeds, the barnacles *Semibalanus balanoides* or *Elminius modestus* and the limpet *Patella vulgata* may occur in the less scoured areas, along with the occasional winkles *Littorina littorea* and *Littorina saxatilis*. Few other species are present.

Situation

Usually found below the species impoverished biotope dominated by *Enteromorpha* spp. (Ent) and above the *F. spiralis* zone (Fspi). It may replace the zone dominated by the wrack *Pelvetia canaliculata* (PelB). In areas where sand abrasion is less severe, the sand-binding red alga *Rhodothamniella floridula* occurs with other sand-tolerant seaweeds and the wrack *Fucus serratus* (Rho), along with the mussel *Mytilus edulis*.

Temporal variation

Seasonal fluctuations in the abundance of the *Enteromorpha* spp. and the *P. purpurea* will occur, especially as a result of storm action.

Similar biotopes

LR.FLR.Eph.Ent	Occurs from the mid eulittoral to the supralittoral zone, often in freshwater influenced habitats. It has a lower species richness and the red seaweed *P. purpurea* and the wracks *F. spiralis* or *F. vesiculosus* are usually not present. The winkle *L. littorea* is also absent.
LR.FLR.Eph.EphX	Occurs in more estuarine conditions and on mixed substrata. A very similar biotope.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	●●●	Occasional	6	
Elminius modestus	●●	Occasional	2	
Patella vulgata	●●	Occasional	3	
Littorina littorea	●●●	Occasional	7	
Littorina saxatilis	●●	Occasional	3	
Mytilus edulis	●●	Frequent	2	
Porphyra	●●	Frequent	2	
Porphyra purpurea	●●●	Frequent	11	
Fucus vesiculosus	●●	Occasional	3	
Enteromorpha	●●●	Abundant	48	
Enteromorpha intestinalis	●●	Present	3	
Enteromorpha prolifera	●●	Present	2	
Ulva lactuca	●●	Frequent	2	

LR.FLR.Eph.EphX Ephemeral green and red seaweeds on variable salinity and/or disturbed eulittoral mixed substrata

Habitat (physical) description

Salinity:	Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Pebbles & cobbles on mud and sand
Zone:	Eulittoral
Height band:	Mid shore

Previous code

SLR.FX.EphX	97.06
LMXD.EPH	6.95

Biotope description

Eulittoral mixed substrata (pebbles and cobbles overlying sand or mud) that are subject to variations in salinity and/or siltation, characterised by dense blankets of ephemeral green and red seaweeds. The main species present are *Enteromorpha intestinalis*, *Ulva lactuca* and *Porphyra* spp., along with colonial diatoms covering the surface of the substratum. Small numbers of other species such as barnacles *Semibalanus balanoides* and *Elminius modestus* are confined to any larger cobbles and pebbles or on the shells of larger individuals of the mussel *Mytilus edulis*. The crab *Carcinus maenas* and the winkle *Littorina littorea* can be present among the boulders, cobbles and seaweeds, while gammarids can be found in patches underneath the cobbles. In common with the other biotopes found on mixed substrata, patches of sediment are typically characterised by infaunal species including bivalves, for example, *Cerastoderma edule* and the polychaete *Arenicola marina* and the polychaete *Lanice conchilega*.

Situation

This biotope is found primarily on enclosed (estuarine) stony shores sheltered from wave action (compare with Sem.LitX), with weak to moderate tidal streams and often subject to variable levels of salinity. It is found predominately in the mid shore zone above or at the same level as the biotope dominated by the barnacles *S. balanoides* and/or *E. modestus* and *Littorina* spp. (BLitX). If it is found in the upper shore region it can be backed by saltmarsh species such as *Salicornia* sp. and *Spartina* sp. Below are biotopes dominated by the wracks *Fucus serratus* or *Fucus vesiculosus* (Fserr.X; Fves.X) or by *M. edulis* (Myt.Myt) or by the polychaete *Hediste diversicolor* and the tellin *Macoma balthica* (HedMac) depending on the substratum. This is a biotope with a low species diversity and the 'high' number of species in the characterising species list is due to a variation in the species composition from site to site, not to high species richness at individual sites.

Temporal variation

This biotope may be a summer variation of BLitX, in which ephemeral algal growth has exceeded the capacity of the grazing molluscs.

Similar biotopes

LR.HLR.MusB.Sem.LitX	Occurs on boulders and cobbles on moderately exposed shores. It has a high abundance of *S. balanoides*, the limpet *Patella vulgata* and the whelk *Gibbula cineraria* and it has a higher diversity of red seaweeds.
LR.FLR.Eph.BLitX	Occurs on similar substrata and in similar wave exposure. It has a similar species composition, but a higher species diversity and abundance of the individual species. The winkles *L. littorea* and *Littorina saxatilis* are normally present along with the barnacles *S. balanoides* and *E. modestus*. See also temporal variation.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	••	Occasional	4	
Elminius modestus	••	Occasional	4	
GAMMARIDEA	••	Occasional	3	
Carcinus maenas	••	Occasional	3	
Littorina littorea	••	Occasional	2	
Mytilus edulis	••	Occasional	5	
Porphyra	••	Occasional	4	
Enteromorpha	••••	Frequent	56	
Enteromorpha intestinalis	••	Present	2	
Ulva lactuca	••	Frequent	6	

LR.FLR.Eph.BLitX Barnacles and *Littorina* spp. on unstable eulittoral mixed substrata

Habitat (physical) description

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	
Substratum:	Cobbles and pebbles on sand and gravel
Zone:	Eulittoral
Height band:	Mid shore

Previous code

BLit in part	97.06
LMXD.BLIT	6.95

Biotope description

The eulittoral zone, particularly the mid shore zone, of sheltered to extremely sheltered mixed substrata shores is often characterised by flat banks or scards of cobbles and pebbles (on sediment) which are either too small or unstable to support a seaweed community. The boulders and larger cobbles are usually colonised by the barnacles *Semibalanus balanoides* or in areas with variable salinity *Elminius modestus* and often dense aggregations of the winkles *Littorina littorea* and *Littorina saxatilis* are present as well. Between the cobbles and pebbles the mussel *Mytilus edulis* occasionally occurs, but always at low abundance. Juvenile crabs *Carcinus maenas* and gammarids may occur between and underneath the pebbles and cobbles. Brown seaweeds are rare, although the wrack *Fucus vesiculosus* may occasionally occur on larger cobbles and small boulders in the mid and upper shore zones. Ephemeral green seaweeds such as *Enteromorpha intestinalis* may also be present. Shallow pools and patches of standing water may occur in low-lying areas and may contain amphipods and filamentous green seaweeds. Due to the unstable nature of the substratum the diversity and density of flora and fauna is characteristically low.

Situation

This biotope is found primarily on enclosed (estuarine) stony shores in wave-sheltered conditions (compare with Sem.LitX) and may be subject to variable levels of salinity. It is found predominately in the mid shore zone below or at the same level as the biotope dominated by ephemeral green seaweeds (EphX). If it is found in the upper shore region it can be backed by salt marsh species such as *Salacornia* and *Spartina* sp. Below are biotopes dominated by the wracks *Fucus serratus* or *F. vesiculosus* (Fserr.X; Fves.X).

Temporal variation

Unknown.

Similar biotopes

LR.HLR.MusB.Sem.LitX	Found on more exposed, open coast sites, but with similar substrata. It is more species rich than BLitX, and red seaweeds including coralline crusts, *Mastocarpus stellatus* and *Chondrus crispus* are present. There is also a higher abundance of the limpet *Patella vulgata* and *S. balanoides.*
LR.FLR.Eph.EphX	Occurs in a wider exposure range and similar physical conditions. It has a higher abundance of green seaweeds such as *Enteromorpha* spp. and *Ulva lactuca* and a lower abundance and frequency of occurrence of barnacles. Very low species diversity.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Semibalanus balanoides	••••	Frequent	18	
Elminius modestus	•••	Frequent	15	
Carcinus maenas	•••	Occasional	7	
Littorina littorea	•••••	Frequent	25	
Littorina saxatilis	••••	Frequent	15	
Mytilus edulis	•••	Occasional	6	
Fucus vesiculosus	••	Occasional	3	
Enteromorpha intestinalis	••	Occasional	3	

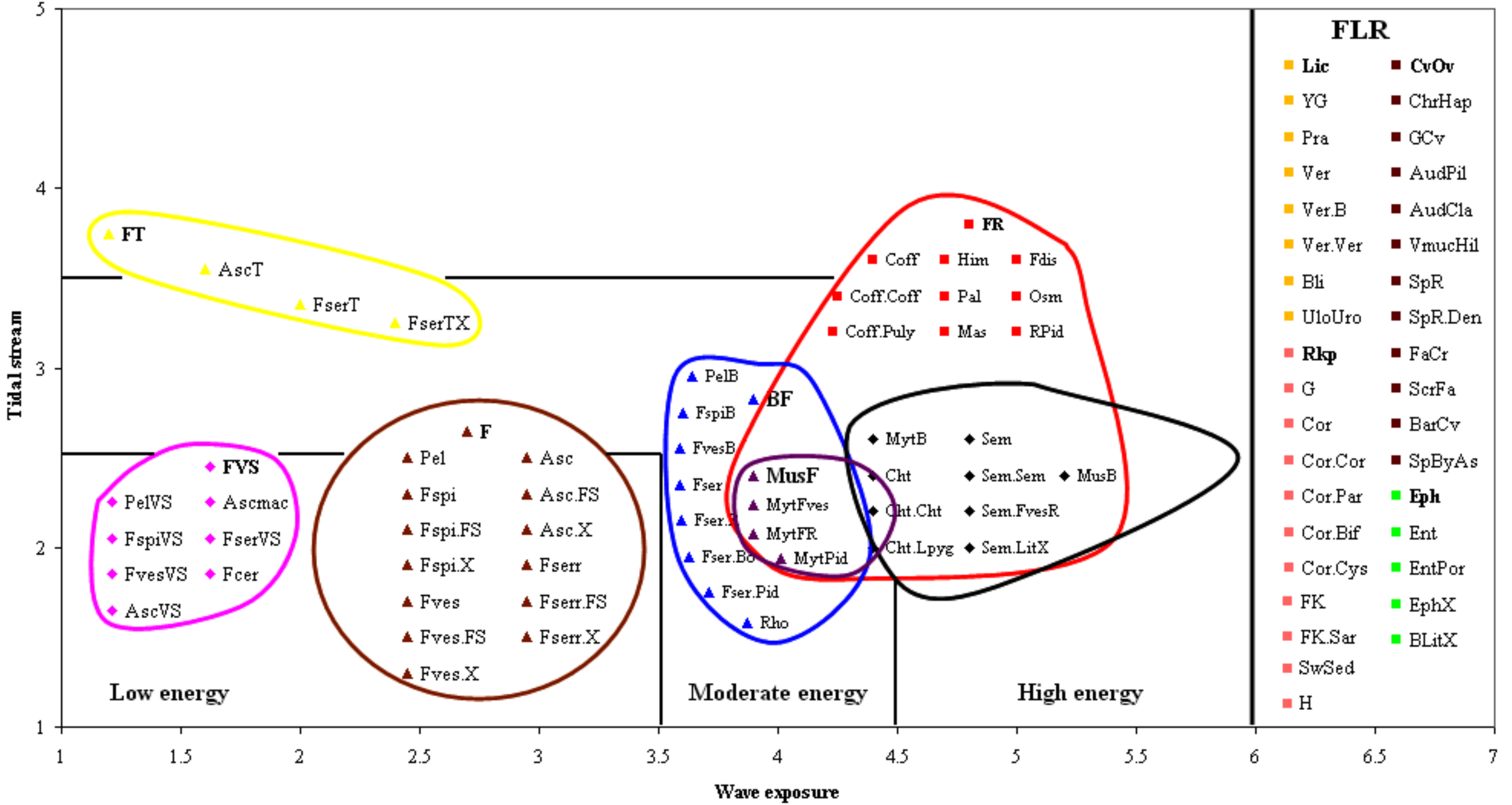
Hierarchy Structure Diagram for Littoral Rock

Littoral rock LR											
High energy littoral rock HLR			Moderate energy littoral rock MLR		Low energy littoral rock LLR		Features of littoral rock FLR				
Mussel and/or barnacle communities MusB	Robust fucoid and/or red seaweed communities FR	Fucoids in tide-swept conditions FT	Mussels and fucoids on moderately exposed shores MusF	Barnacles and fucoids on moderately exposed shores BF	Fucoids on sheltered marine shores F	Fucoids in variable salinity conditions FVS	Lichen or small green algal communities Lic	Rockpools Rkp	Littoral caves and overhangs CvOv	Ephemeral green or red seaweed communities Eph
MytB	Fdis	AscT	MytFves	PelB	Pel	PelVS	YG	G	ChrHap	Ent
Cht	Coff	FserT	MytFR	FspiB	Fspi	FspiVS	Pra	Cor	GCv	EntPor
Cht.Cht	Coff.Coff	FserTX	MytPid	FvesB	Fspi.FS	FvesVS	Ver	Cor.Cor	AudPil	EphX
Cht.Lpyg	Coff.Puly			Fser	Fspi.X	AscVS	Ver.B	Cor.Par	AudCla	BLitX
Sem	Him			Fser.R	Fves	Ascmac	Ver.Ver	Cor.Bif	VmucHil	
Sem.Sem	Pal			Fser.Bo	Fves.FS	FserVS	Bli	Cor.Cys	SpR	
Sem.FvesR	Mas			Fser.Pid	Fves.X	Fcer	UloUro	FK	SpR.Den	
Sem.LitX	Osm			Rho	Asc			FK.Sar	SpByAs	
	RPid				Asc.FS			SwSed	FaCr	
					Asc.X			H	ScrFa	
					Fserr				BarCv	
					Fserr.FS					
					Fserr.X					

Littoral rock

LR

High energy littoral rock HLR				Moderate energy littoral rock MLR			Low energy littoral rock LLR			Features of littoral rock FLR			
Mussel and/or barnacle communities MusB	Robust fucoid and/or red seaweed communities FR	Fucoids in tide swept conditions FT		Mussels and fucoids on moderately exposed shores MusF	Barnacles and fucoids on moderately exposed shores BF		Fucoids on sheltered marine shores F	Fucoids in variable salinity conditions FVS		Lichen or small green algal communities Lic	Rockpools Rkp	Littoral caves and overhangs CvOv	Ephemeral green or red seaweed communities Eph
MytB	Fdis	AscT		MytFves	PelB		Pel	PelVS		YG	G	ChrHap	Ent
Cht	Coff	FserT		MytFR	FspiB		Fspi	FspiVS		Pra	Cor	GCv	EntPor
Cht.Cht	Coff.Coff	FserTX		MytPid	FvesB		Fspi.FS	FvesVS		Ver	Cor.Cor	AudPil	EphX
Cht.Lpyg	Coff.Puly				Fser		Fspi.X	AscVS		Ver.B	Cor.Par	AudCla	BLitX
Sem	Him				Fser.R		Fves	Ascmac		Ver.Ver	Cor.Bif	VmucHil	
Sem.Sem	Pal				Fser.Bo		Fves.FS	FserVS		Bli	Cor.Cys	SpR	
Sem.FvesR	Mas				Fser.Pid		Fves.X	Fcer		UloUro	FK	SpR.Den	
Sem.LitX	Osm				Rho		Asc				FK.Sar	SpByAs	
	RPid						Asc.FS				SwSed	FaCr	
							Asc.X				H	ScrFa	
							Fserr					BarCv	
							Fserr.FS						
							Fserr.X						


Tidal stream
Wave exposure
5
4
3
2
1
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
FT
AscT
FserT
FserTX
FVS
PelVS
Ascmac
FspiVS
FserVS
FvesVS
Fcer
AscVS
F
Pel
Asc
Fspi
Asc.FS
Fspi.FS
Asc.X
Fspi.X
Fserr
Fves
Fserr.FS
Fves.FS
Fserr.X
Fves.X
PelB
FspiB
FvesB
Fser
Fser.Bo
Fser.Pid
Rho
BF
MusF
MytFves
MytFR
MytPid
FR
Coff
Him
Fdis
Coff.Coff
Pal
Osm
Coff.Puly
Mas
RPid
MytB
Sem
Cht
Sem.Sem
MusB
Cht.Cht
Sem.FvesR
Cht.Lpyg
Sem.LitX
Low energy
Moderate energy
High energy
FLR
Lic
CvOv
YG
ChrHap
Pra
GCv
Ver
AudPil
Ver.B
AudCla
Ver.Ver
VmucHil
Bli
SpR
UloUro
SpR.Den
Rkp
FaCr
G
ScrFa
Cor
BarCv
Cor.Cor
SpByAs
Cor.Par
Eph
Cor.Bif
Ent
Cor.Cys
EntPor
FK
EphX
FK.Sar
BLitX
SwSed
H

The Marine Habitat Classification for Britain and Ireland. Version 04.05

Infralittoral Rock Section

This document is an extract from:

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www.jncc.gov.uk/MarineHabitatClassification

Table of Contents

IR Infralittoral rock (and other hard substrata)

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt), Reduced/low (0.5-30ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Very strong, Strong, Moderately strong, Weak, Very weak
Substratum:	Bedrock; boulders, cobbles; mixed substrata
Zone:	Sublittoral fringe, Infralittoral
Height band:	Lower shore
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m

Previous code

SR in part	96.7

Biotope description

Infralittoral rock includes habitats of bedrock, boulders and cobbles which occur in the shallow subtidal zone and typically support seaweed communities. The upper limit is marked by the top of the kelp zone whilst the lower limit is marked by the lower limit of kelp growth or the lower limit of dense seaweed growth. Infralittoral rock typically has an upper zone of dense kelp (forest) and a lower zone of sparse kelp (park), both with an understorey of erect seaweeds. In exposed conditions the kelp is *Laminaria hyperborea* whilst in more sheltered habitats it is usually *Laminaria saccharina*; other kelp species may dominate under certain conditions. On the extreme lower shore and in the very shallow subtidal (sublittoral fringe) there is usually a narrow band of dabberlocks *Alaria esculenta* (exposed coasts) or the kelps *Laminaria digitata* (moderately exposed) or *L. saccharina* (very sheltered). Areas of mixed ground, lacking stable rock, may lack kelps but support seaweed communities. In estuaries and other turbid-water areas the shallow subtidal may be dominated by animal communities, with only poorly developed seaweed communities.

IR.HIR High energy infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock & boulders
Zone:	Sublittoral fringe, Infralittoral
Height band:	Lower shore
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Rocky habitats in the infralittoral zone subject to exposed to extremely exposed wave action or strong tidal streams. Typically the rock supports a community of kelp *Laminaria hyperborea* with foliose seaweeds and animals, the latter tending to become more prominent in areas of strongest water movement. The depth to which the kelp extends varies according to water clarity, exceptionally (e.g. St Kilda) reaching 45 m. The sublittoral fringe is characterised by dabberlocks *Alaria esculenta*. Surge gullies and caves typically lack kelp, and in reduced light conditions lack red seaweeds and are dominated by communities of sponges, ascidians, bryozoans, mussels and barnacles.

IR.HIR.KFaR Kelp with cushion fauna, foliose red seaweeds or coralline crusts.

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock; stable boulders
Zone:	Sublittoral fringe, Infralittoral
Height band:	Lower shore
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m

Biotope description

Rocky habitats in the infralittoral zone subject to exposed to extremely exposed wave action or strong tidal streams. Typically the rock supports a community of kelp *Laminaria hyperborea* with foliose seaweeds and animals, the latter tending to become more prominent in areas of strongest water movement (LhypFa, LhypR and LhypR.Pk). In areas where *L. hyperborea* is removed by seasonal disturbance (such as winter storms) a mixed kelp forest of fast-growing opportunistic help *Saccorhiza polyschides* and *Laminaria saccharina* may occur (LsacSac). The depth to which the kelp extends varies according to water clarity, exceptionally (e.g. St Kilda) reaching 45 m. In some areas, there may be a band of dense foliose seaweeds (reds or browns) below the main kelp zone (FoR). The sublitttoral fringe is characterised by dabberlocks *Alaria esculenta* (Ala biotopes) or occasionally by the kelp *S. polyschides* (Sac). In very strong wave action the sublittoral fringe *A. esculenta* zone extends to 5 to 10 m depth, whilst at Rockall *A. esculenta* replaces *L. hyperborea* as the dominant kelp in the infralittoral zone (AlaAnCrSp).

Characterising species

	% Frequency	*Abundance (SACFOR)*
Alcyonium digitatum	••	Occasional
Urticina felina	••	Occasional
Sagartia elegans	••	Occasional
Corynactis viridis	••	Frequent
Pomatoceros triqueter	••	Occasional
Calliostoma zizyphinum	••	Occasional
Asterias rubens	•••	Occasional
Echinus esculentus	••	Occasional
Botryllus schlosseri	••	Occasional
Callophyllis laciniata	••	Occasional
Corallinaceae	••••	Common
Corallina officinalis	••	Frequent
Plocamium cartilagineum	•••	Frequent
Cryptopleura ramosa	•••	Frequent
Delesseria sanguinea	•••	Frequent
Dictyota dichotoma	•••	Frequent
Laminaria hyperborea	•••	Common
Alaria esculenta	•••	Common

IR.HIR.KFaR.Ala *Alaria esculenta* on exposed sublittoral fringe bedrock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed
Tidal streams:	Very strong, Strong, Moderately strong, Weak
Substratum:	Bedrock; very large boulders
Zone:	Sublittoral fringe
Height band:	Lower shore
Depth band:	0-5 m

Biotope description

Exposed sublittoral fringe bedrock with an *Alaria esculenta* forest and an encrusting fauna of the mussel *Mytilus edulis* and barnacles such as *Semibalanus balanoides*. The kelp *Laminaria digitata* can be part of the canopy. Underneath the canopy are red seaweeds such as *Mastocarpus* stellatus and *Palmaria palmata*, while encrusting coralline red algae such as *Lithothamnion graciale* covers the rock surface. The limpet *Patella vulgata* can be found grazing the rock surface, while the whelk Nucella lapillus is preying on the limpets, barnacles and mussels. Two variants of this biotope are described. In more wave exposed conditions *Laminaria digitata* is absent and the rock surface is often characterised by dense patches of mussels (Ala.Myt). In slightly less exposed sites the *A. esculenta* is mixed with *L. digitata* (Ala.Ldig).

Situation

This biotope is found in the sublittoral fringe on exposed shores, typically occupying the extreme lower shore down to 1 or 2 m depth, although it can also extend down to 15 m depth on very exposed coasts. It is generally found below the mussel-barnacle zone of the lower shore (MytB) or a narrow band of the seaweed-dominated biotopes featuring dense *Himanthalia elongata* or red seaweeds (Him, Mas). Below the *A. esculenta* zone, the upper infralittoral rock generally supports a *Laminaria hyperborea* kelp community (LhypFa, LhypR.Ft or Lhyp.Ft).

Temporal variation

Unknown

Similar biotopes

IR.HIR.KFaR.AlaAnCrSp	Occur on very exposed bedrock shores. Dense anthozoans including *Corynactis viridis* and *Phellia gausapata* and sponges such as *Haliclona urceolus* and *Myxilla fimbriata* can be present.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Semibalanus balanoides	●●●	Frequent	4
Patella vulgata	●●●	Common	8
Nucella lapillus	●●	Occasional	1
Mytilus edulis	●●●●	Common	14
Palmaria palmata	●●	Occasional	1
Corallinaceae	●●●	Abundant	6
Corallina officinalis	●●●●	Frequent	11
Lithothamnion glaciale	●●	Abundant	6
Mastocarpus stellatus	●●●	Frequent	2
Laminaria digitata	●●●	Common	5
Alaria esculenta	●●●●●	Abundant	32

IR.HIR.KFaR.Ala.Myt *Alaria esculenta*, *Mytilus edulis* and coralline crusts on very exposed sublittoral fringe bedrock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock
Zone:	Sublittoral fringe
Height band:	Lower shore
Depth band:	0-5 m

Previous code

LRK.AL	6.95

Biotope description

Very exposed sublittoral fringe bedrock characterised by the kelp *Alaria esculenta* and dense patches of small individuals of the mussel *Mytilus edulis*, both of which grow over a dense cover of encrusting coralline algae. Foliose red seaweeds may also be present, but the species composition and their abundance vary between sites. Species such as *Corallina officinalis* occur widely. The kelp *Laminaria digitata* is usually absent, although stunted plants may be present at a few sites. The limpet *Patella vulgata* and the barnacle *Semibalanus balanoides* are often common. Patches of anthozoans and the hydroid *Tubularia* spp. occur in more wave-surged areas. In extremely exposed areas the *A. esculenta* zone can extend as deep as 15 m, where it has less *S. balanoides*, *M. edulis* and greater densities of *Tubularia* spp. (e.g. Barra and shallow areas of Rockall).

Situation

This biotope is most commonly found beneath the mussel-barnacle zone (MytB) of very exposed shores and above the upper infralittoral *Laminaria hyperborea* forest (LhypR or LhypFa). It is at the extremely wave-surged sites, such as St Kilda, that LhypFa occurs below Ala.Myt. Occasionally, the *A. esculenta* zone occurs below a narrow but dense band of red seaweeds: typically *Mastocarpus stellatus* and/or *Palmaria palmata* and *Corallina officinalis* (Mas) or very occasionally *Himanthalia elongata* (Him). A dense turf of *C. officinalis* (Coff) occurs above the *A. esculenta* zone at a few extremely exposed sites, particularly on steep or vertical rock. On less exposed shores, however, an *A. esculenta* dominated zone may lie immediately above a narrow *L. digitata* zone (Ldig). Ala.Myt can also occur on less exposed steep or vertical shores, where wave-surge restricts the growth of *L. digitata* which generally dominates the sublittoral fringe rock on moderately exposed shores. On seasonally unstable boulders or sites subject to disturbance by strong wave-action, a mixed kelp canopy that characterises LsacSac may occur beneath the Ala.Myt zone instead of the ubiquitous *L. hyperborea* forest; this is most common on the Shetland Isles.

Temporal variation

At very exposed sites, *A. esculenta* may have been so wave-battered during the season as to be reduced to a tattered midrib with no blades, altering the general appearance of the biotope. Where Ala.Myt occurs on boulders and/or sites subject to disturbance during severe weather conditions, rock that is scoured clean may then be rapidly colonised by fast-growing green algae such as *Enteromorpha* spp. An assemblage of rapidly colonising species that characterise the disturbed Sac biotope may also develop in the sublittoral fringe. A species that can fluctuate in huge numbers at these sites is the starfish *Asterias rubens*, sometimes forming dense aggregations across the narrow *A. esculenta* band whilst feeding on the mussels.

Similar biotopes

IR.HIR.KFaR.Ala.Ldig	Occurs on less exposed shores. *A. esculenta* and *M. edulis* occurs at a lower abundance and *Lithothamnion* spp. is not usually present. *L. digitata* is

	present in high abundance and the diversity of red seaweeds are high.
IR.HIR.KFaR.AlaAnCrSp	Occur on very exposed bedrock shores. Dense anthozoans including *Corynactis viridis* and *Phellia gausapata* and sponges such as *Haliclona urceolus* and *Myxilla fimbriata* can be present. Ala.Myt is distinguished from the deep *A. esculenta* forest found on Rockall by its lack of short turf forming hydroids.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Semibalanus balanoides	●●●	Frequent	5
Patella vulgata	●●●●	Common	10
Mytilus edulis	●●●●	Abundant	19
Corallinaceae	●●	Abundant	3
Corallina officinalis	●●●●	Frequent	10
Lithothamnion	●●●●	Abundant	9
Alaria esculenta	●●●●●	Abundant	34

IR.HIR.KFaR.Ala.Ldig *Alaria esculenta* and *Laminaria digitata* on exposed sublittoral fringe bedrock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock
Zone:	Sublittoral fringe
Height band:	Lower shore
Depth band:	0-5 m
Other features:	On vertical and very steep rock, on moderately exposed shores

Previous code

LRK.LDIG.AL	6.95

Biotope description

Exposed sublittoral fringe bedrock characterised by a mixture of the kelps *Laminaria digitata* and *Alaria esculenta* with an understorey of red seaweeds including *Palmaria palmata* and *Corallina officinalis* with encrusting coralline algal on the rock surface. Anthozoans such as *Halichondria panicea*, the mussel *Mytilus edulis* and the barnacle *Semibalanus balanoides* can be found attached in cracks and crevices. The limpets *Patella vulgata* or on southern shores *Patella ulyssiponensis* can be found in their characteristic "scars" grazing the biofilm/algal crusts on the rock surface, while the limpet *Helcion pellucidum* is restricted to grazing the kelp fronds. Colonies of the bryozoan *Electra pilosa* can cover the red seaweeds *Mastocarpus stellatus* and *Chondrus crispus* or the rock surface.

Situation

Ala.Ldig represents an intermediate on the wave exposure gradient, with pure stands of *A. esculenta* (Ala.Myt) being found on more exposed shores and pure *L. digitata* (Ldig) on more sheltered shores. This biotope usually occurs immediately above a sublittoral *Laminaria hyperborea* forest (LhypR or Lhyp), although a narrow band of *L. digitata* (Ldig) may occur between these two zones, particularly on less exposed shores. In southwest England a zone of mixed kelp forest *L. hyperborea* and *Laminaria ochroleuca* may occur below the *A. esculenta* (Lhyp.Loch). A number of different biotopes can occur above Ala.Ldig; most commonly these are the mussel-barnacle zone (MytB), *Himanthalia elongata* (Him), a red algal turf or a *Fucus serratus*-red algal mosaic (Fser.R) on the less exposed shores. This biotope also occurs on steep and vertical shores of moderately exposed coasts where a localised increase in wave action restricts the growth of *L. digitata*. As a result of this increased wave action the *L. digitata* plants are usually small and often show signs of damage.

Temporal variation

There may be seasonal changes in the amount of ephemeral seaweeds due to disturbance caused by winter storms.

Similar biotopes

IR.HIR.KFaR.Ala.Myt	Occurs on more exposed shores. *A. esculenta* and *M. edulis* is abundant and *Lithothamnion* spp. is the dominant coralline crust. *L. digitata* is absent and the diversity of red seaweeds are lower.
IR.MIR.KR.Ldig.Ldig	Occurs on less exposed shores. *L. digitata* is the dominant kelp (Abundant), while the abundance of *A. esculenta* is low (Occasional).

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution*

			to similarity
Halichondria panicea	●●●	Occasional	2
Semibalanus balanoides	●●	Occasional	2
Patella ulyssiponensis	●●	Frequent	1
Patella vulgata	●●●	Frequent	2
Helcion pellucidum	●●●	Frequent	2
Mytilus edulis	●●●	Frequent	4
Umbonula littoralis	●●	Frequent	2
Electra pilosa	●●●	Frequent	1
Palmaria palmata	●●●	Frequent	3
Corallinaceae	●●●●	Abundant	10
Corallina officinalis	●●●●	Common	8
Mastocarpus stellatus	●●●	Frequent	4
Chondrus crispus	●●●	Occasional	2
Laminaria digitata	●●●●●	Abundant	22
Alaria esculenta	●●●●●	Common	20

IR.HIR.KFaR.AlaAnCrSp *Alaria esculenta* forest with dense anemones and crustose sponges on extremely exposed infralittoral bedrock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed
Tidal streams:	Weak
Substratum:	Bedrock
Zone:	Infralittoral
Depth band:	10-20 m, 20-30 m, 30-50 m
Other features:	Vertical, very steep rock and, upper faces

Previous code

EIR.AlaAnSC	97.06
EIR.AlaRAn	96.7
EIR.RAn	96.7

Biotope description

This biotope has only been recorded from Rockall, where *Alaria esculenta* appears to replace *Laminaria hyperborea* as the dominant kelp forest species on the extremely wave-exposed steep and vertical rock, a zone that extends from 14 m down to 35 m. Beneath the *A. esculenta* canopy, the rock surface is covered by a dense turf of anthozoans such as *Sagartia elegans*, *Phellia gausapata* and *Corynactis viridis*, encrusting sponges and coralline algae. The gastropod *Margarites helicinus* can be found grazing on the kelp fronds, whereas the crab *Cancer pagurus* can be found among the kelp stipes. The bryozoan *Tubularia indivisa* also occur, but it does not form such a dense turf as in more shallow waters, while the sea squirt *Botryllus leachi* is found encrusting the large brown seaweeds. *Cryptopleura ramosa* is the dominant red seaweed on horizontal surfaces. The kelp *Laminaria digitata* is reported to occur mixed with *A. esculenta* on the nearby Helen's reef.

Situation

Above the AlaAnSC zone (about 5 m to 13 m) *A. esculenta* still dominates, but it resembles more closely the typical sublittoral fringe *A. esculenta* biotope (Ala.Myt), though it has a very dense turf of small hydroids and few foliose algae. Towards the lower part of this *A. esculenta* forest (30 m to 35 m), the density of *A. esculenta* is reduced and the rock surface is characterised by a dense turf of red algae (FoR).

Temporal variation

Unknown

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Porifera indet crusts	●●●	Present	2
Tubularia indivisa	●●●●●	Frequent	8
Sagartia elegans	●●●●●	Frequent	11
Phellia gausapata	●●●●●	Frequent	10
Corynactis viridis	●●●●●	Common	15
AMPHIPODA	●●●●	Present	2
Cancer pagurus	●●●●	Occasional	5
Margarites helicinus	●●●●	Frequent	3
Didemnidae	●●●●	Present	4
Botrylloides leachi	●●●●	Frequent	6
Corallinaceae	●●●●	Present	3
Cryptopleura ramosa	●●●●	Frequent	7
Alaria esculenta	●●●●●	Abundant	14

IR.HIR.KFaR.LhypFa *Laminaria hyperborea* forest with a faunal cushion (sponges and polyclinids) and foliose red seaweeds on very exposed upper infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock; massive boulders
Zone:	Infralittoral - upper
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

EIR.LhypFa.Ft	96.7

Biotope description

Very exposed and exposed, but wave-surged, upper infralittoral bedrock and massive boulders characterised by a dense forest of the kelp *Laminaria hyperborea* with a high diversity of seaweeds and invertebrates. The shallowest kelp plants are often short or stunted, while deeper plants are taller with heavily epiphytised stipes with foliose red seaweeds such as *Delesseria sanguinea*, *Cryptopleura ramosa* or *Plocamium cartilagineum* or even the brown seaweed *Dictyota dichotoma*. Also found on the stipes or on the rock below the canopy are red seaweeds including *Phycodrys rubens*, *Kallymenia reniformis*, *Callophyllis laciniata*, *Caryophyllia smithii*, and *Corallina officinalis*, while encrusting coralline algae can cover any bare patches of rock. At some sites the red seaweeds can be virtually mono-specific, while at other sites show considerable variation containing a dense mixed turf of a large variety of species. The red seaweed *Odonthalia dentata* can be present in the north. The faunal and floral under-storey is generally rich in species due, in part, to the relatively low urchin-grazing pressure in such shallow exposed conditions. The faunal composition of this biotope varies markedly between sites, but commonly occurring are the soft coral *Alcyonium digitatum* and the anthozoans *Sagartia elegans* and *Corynactis viridis*. Sponges form a prominent part of the community with variable amounts of the sponges *Halichondria panicea* and *Pachymatisma johnstonia* and several other species. The crab *Cancer pagurus* and the starfish *Asterias rubens* are normally present in small numbers foraging beneath the canopy, while the sea urchins *Echinus esculentus* and *Urticina felina* graze on the seaweeds. The hydroid Obelia geniculata, the ascidian Botryllus schlosseri and the bryozoan Membranipora membranacea compete for space on the kelp, whereas the bryozoan Electra pilosa also can be found on foliose red seaweeds.

Situation

This kelp forest most commonly occurs beneath a zone of *Alaria esculenta* and *Mytilus edulis* (Ala.Myt) and may contain small patches of *A. esculenta*. As the force of the wave-surge diminishes with increased depth, density of the faunal turf reduces and the kelp forest or park changes to one characterised by kelp and dense red seaweeds (LhypR.Ft or LhypR.Pk). In some areas of Shetland and St Kilda the lower infralittoral zone is characterised by a park of the kelp *Laminaria saccharina* and/or *Saccorhiza polyschides* (LsacSac). Where the *L. hyperborea* forest continues to depths of 15 m or greater it may give way to a zone of dense foliose red algae (FoR or For.Dic).

Temporal variation

Unknown.

Similar biotopes

IR.HIR.KFaR.LhypR.Ft	*L. hyperborea* kelp forest with very dense foliose red seaweeds. Although encrusting fauna are present it is less conspicuous than in LhypFa.
IR.MIR.KR.Lhyp.Pk	*L. hyperborea* kelp park with dense foliose red seaweeds; usually found beneath the kelp forest (LhypR.Ft) but can occur beneath LhypFa where

wave surge is reduced. Lacks the dense faunal turf of LhypFa.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pachymatisma johnstonia	●●●	Occasional	1
Obelia geniculata	●●●	Frequent	2
Alcyonium digitatum	●●●●●	Occasional	4
Urticina felina	●●●●	Occasional	2
Sagartia elegans	●●●●	Frequent	4
Corynactis viridis	●●●●	Common	4
Caryophyllia smithii	●●●	Occasional	1
Cancer pagurus	●●●	Occasional	1
Necora puber	●●●	Occasional	1
Calliostoma zizyphinum	●●●●	Occasional	3
Membranipora membranacea	●●●	Frequent	2
Electra pilosa	●●●	Frequent	1
Asterias rubens	●●●●●	Occasional	4
Echinus esculentus	●●●●	Occasional	3
Botryllus schlosseri	●●●	Occasional	2
Callophyllis laciniata	●●●●	Occasional	3
Kallymenia reniformis	●●●	Occasional	2
Corallinaceae	●●●●●	Frequent	5
Corallina officinalis	●●●	Occasional	1
Plocamium cartilagineum	●●●●	Frequent	3
Cryptopleura ramosa	●●●●	Frequent	3
Delesseria sanguinea	●●●●●	Frequent	5
Phycodrys rubens	●●●	Frequent	2
Dictyota dichotoma	●●●●	Frequent	3
Laminaria hyperborea	●●●●●	Abundant	12

IR.HIR.KFaR.LhypPar Sparse *Laminaria hyperborea* and dense *Paracentrotus lividus* on exposed infralittoral limestone

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed
Tidal streams:	Very weak
Substratum:	Bedrock
Zone:	Infralittoral - upper
Depth band:	0-5 m, 5-10 m
Other features:	Limestone platforms

Previous code

EIR.LhypFa.Par	96.7

Biotope description

This biotope is known from only one location, the Aran Islands, Co. Galway. Here, a limestone platform between 3 m and 6 m of depth is dominated by a dense population of the urchin *Paracentrotus lividus*, which heavily graze and burrow into the soft limestone. So intense is the grazing pressure that the rock appears completely bare, except for a coralline algal crust and occasional *Laminaria hyperborea* and *Saccorhiza polyschides*. The anthozoans *Sagartia elegans* and *Corynactis viridis* are also present, though at low abundance. The grazed kelp also extends deeper to 20 to 25 m further offshore. (Only one CB record within this biotope, hence contribution to similarity not applicable at present).

Situation

This rare biotope has only been recorded from one location and the neighbouring biotopes were not fully surveyed. In deeper water (30-40m) there is PhaAxi.

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Cliona celata	●●●●●	Occasional	N/a
Anemonia viridis	●●●●●	Frequent	N/a
Urticina felina	●●●●●	Rare	N/a
Sagartia elegans	●●●●●	Frequent	N/a
Corynactis viridis	●●●●●	Occasional	N/a
Paracentrotus lividus	●●●●●	Super-abundant	N/a
Laminaria hyperborea	●●●●●	Occasional	N/a
Saccorhiza polyschides	●●●●●	Occasional	N/a

IR.HIR.KFaR.LhypR *Laminaria hyperborea* with dense foliose red seaweeds on exposed infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed
Tidal streams:	Strong, Moderately strong, Weak, Very weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m

Biotope description

Very exposed to exposed infralittoral bedrock or large boulders characterised by the kelp *Laminaria hyperborea*, beneath which is a dense turf of foliose red seaweeds. Three variations of this biotope are described: the upper infralittoral kelp forest (LhypR.Ft), the kelp park below (LhypR.Pk) and a third type of kelp forest, confined to southern England, that is characterised by a mixture of *L. hyperborea* and *Laminaria ochroleuca* (LhypR.Loch). The fauna of these biotopes is markedly less abundant than kelp forests in areas of greater wave surge (LhypFa); sponges, anthozoans and polyclinid ascidians may be present, though never at high abundance. Beneath the under-storey of red seaweeds, the rock surface is generally covered with encrusting coralline algae.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	●●●	Frequent	1
Alcyonium digitatum	●●●	Occasional	2
Urticina felina	●●●	Occasional	1
Corynactis viridis	●●●	Frequent	2
Caryophyllia smithii	●●●	Occasional	1
Pomatoceros triqueter	●●●	Occasional	1
Gibbula cineraria	●●●	Occasional	1
Calliostoma zizyphinum	●●●	Occasional	2
Membranipora membranacea	●●●	Frequent	2
Electra pilosa	●●	Frequent	1
Asterias rubens	●●●	Occasional	3
Echinus esculentus	●●●●	Frequent	4
Botryllus schlosseri	●●●	Occasional	2
Callophyllis laciniata	●●●●	Frequent	3
Kallymenia reniformis	●●●	Occasional	2
Corallinaceae	●●●●	Frequent	5
Plocamium cartilagineum	●●●●	Frequent	4
Cryptopleura ramosa	●●●●	Frequent	5
Delesseria sanguinea	●●●●●	Frequent	7
Hypoglossum hypoglossoides	●●●	Occasional	1
Membranoptera alata	●●	Occasional	1
Heterosiphonia plumosa	●●●	Frequent	1
Dictyota dichotoma	●●●●	Frequent	5
Laminaria hyperborea	●●●●●	Abundant	15

IR.HIR.KFaR.LhypR.Ft *Laminaria hyperborea* forest with dense foliose red seaweeds on exposed upper infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock; large boulders
Zone:	Infralittoral - upper
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Very exposed to exposed upper infralittoral bedrock or large boulders characterised by a dense forest of the kelp *Laminaria hyperborea*. On the rock surface beneath the kelp canopy is a dense turf of red foliose seaweeds including *Cryptopleura ramosa*, *Plocamium cartilagineum*, *Phycodrys rubens* and *Callophyllis laciniata* as well as encrusting coralline algae and the foliose brown seaweed *Dictyota dichotoma*. The red algal turf can be virtually mono-specific, dominated by stands of *P. cartilagineum*, *C. ramosa* or *Heterosiphonia plumosa*, *Kallymenia reniformis* or in the north, *Odonthalia dentata*. Other sites may contain a dense mixed turf of these and other species. The dense turf is due, in part, to the relatively low grazing pressure from the urchin *Echinus esculentus* in such shallow exposed conditions. The shallowest kelp plants are often short or stunted, while deeper plants are taller and the stipes are heavily epiphytised by red seaweeds such as *Delesseria sanguinea* and *Membranoptera alata*. The bryozoan *Electra pilosa* can form colonies on the foliose red seaweeds, while the bryozoan *Membranipora membranacea* more often can be found on the *L. hyperborea* fronds along with the ascidian *Botryllus schlosseri* and the hydroid *Obelia geniculata*. The gastropods *Gibbula cineraria* and *Calliostoma zizyphinum* are found grazing among the kelp holdfasts, while a few individuals of the barnacle *Balanus crenatus* can present along with the white calcareous tubes of the polychaete *Pomatoceros triqueter*, where substratum is available. The starfish *Asterias rubens* can be found predating on polychaetes, mussels and small crustaceans. The soft coral *Alcyonium digitatum* can be present covering the rock surface as well as the anthozoan *Urticina felina*.

Situation

This kelp forest biotope most commonly occurs beneath a zone of *Alaria esculenta/Mytilus edulis* (Ala.Myt) and above a *L. hyperborea* park (LhypR.Pk). At very exposed sites, such as some areas of Shetland and St Kilda, the lower infralittoral zone is often characterised by a park of *Laminaria saccharina* and/or *Saccorhiza polyschides* (LsacSac). This zone presumably develops due to the mobility of nearby cobbles, boulders and sediment during winter storms, removing the slower growing *L. hyperborea*. Occasionally, a band of dense foliose seaweeds, with no kelp, occurs below the kelp forest (FoR or FoR.Dic).

Temporal variation

Unknown.

Similar biotopes

IR.HIR.KFaR.LhypFa	Occurs in areas with more wave-surge. The cushion fauna in this biotope is markedly more abundant than kelp forests in areas with less wave surge.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	••	Frequent	1
Alcyonium digitatum	•••	Occasional	1
Urticina felina	•••	Occasional	1
Pomatoceros triqueter	••••	Frequent	1
Balanus crenatus	••	Frequent	1
Gibbula cineraria	•••	Occasional	1
Calliostoma zizyphinum	•••	Occasional	1
Membranipora membranacea	•••	Frequent	2
Electra pilosa	•••	Frequent	2
Asterias rubens	•••	Occasional	2
Echinus esculentus	•••	Frequent	2
Botryllus schlosseri	•••	Occasional	2
Callophyllis laciniata	••••	Frequent	3
Kallymenia reniformis	••••	Occasional	1
Corallinaceae	••••	Frequent	5
Plocamium cartilagineum	••••	Frequent	5
Cryptopleura ramosa	••••	Frequent	6
Delesseria sanguinea	•••••	Frequent	6
Hypoglossum hypoglossoides	•••	Occasional	1
Membranoptera alata	•••	Occasional	2
Phycodrys rubens	••••	Frequent	4
Heterosiphonia plumosa	•••	Frequent	1
Dictyota dichotoma	••••	Frequent	4
Laminaria hyperborea	•••••	Abundant	18

IR.HIR.KFaR.LhypR.Pk *Laminaria hyperborea* park with dense foliose red seaweeds on exposed lower infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock; large boulders
Zone:	Infralittoral - lower
Depth band:	10-20 m, 20-30 m, 30-50 m

Previous code

EIR.LhypFa.Pk	96.7

Biotope description

Very exposed to exposed lower infralittoral bedrock or large boulders characterised by a kelp park of *Laminaria hyperborea* with a dense turf of foliose red seaweeds and encrusting coralline algae. These red seaweeds dominate kelp stipes and bedrock in a similar abundance and composition to the upper infralittoral kelp forest, the most commonly occurring species being *Callophyllis laciniata*, *Cryptopleura ramosa*, *Plocamium cartilagineum*, *Kallymenia reniformis*, *Delesseria sanguinea*, *Phycodrys rubens*, *Hypoglossum hypoglossoides*, *Heterosiphonia plumosa* and *Bonnemaisonia asparagoides*. In addition, moderate to high abundance of foliose brown seaweeds, such as *Dictyota dichotoma* are more common than in the kelp forest above. More upper circalittoral fauna occur in the park than in the kelp forest, such as the cup-coral *Caryophyllia smithii*. Some species more often present in the kelp park than the forest include the anthozoan *Alcyonium digitatum* and the featherstar *Antedon bifida*. The urchin *Echinus esculentus*, the gastropods *Gibbula cineraria* and *Calliostoma zizyphinum* and the starfish *Asterias rubens* are normally present underneath the canopy along with the anthozoans *Urticina felina* and *Corynactis viridis*. The sponge *Cliona celata* is also present often found boring into shells or soft rock where available. The bryozoan *Membranipora membranacea* can be found on the *L. hyperborea* fronds along with the hydroid *Obelia geniculata* and the ascidian *Botryllus schlosseri.* The polychaete *Pomatoceros* sp. is present on the rock surface.

Situation

This biotope usually occurs below the exposed kelp forests (LhypFa and LhypR.Ft). At some sites, a dense band of *D. dichotoma* may form a separate zone below (FoR). Where seasonally unstable cobbles and/or boulders are present adjacent to and/or below the bedrock supporting the *L. hyperborea* LsacSac may occur.

Temporal variation

In the late summer both the kelp and the foliose seaweeds can become heavily encrusted with the bryozoan crusts *Electra pilosa* and *Membranipora membranacea*. Temporal variation within the community structure is unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Cliona celata	●●●	Occasional	2
Obelia geniculata	●●●	Frequent	2
Alcyonium digitatum	●●●●	Occasional	4
Urticina felina	●●●	Occasional	2
Corynactis viridis	●●●	Frequent	4
Caryophyllia smithii	●●●●	Occasional	3
Pomatoceros triqueter	●●●	Occasional	2
Gibbula cineraria	●●●	Occasional	2

Calliostoma zizyphinum	●●●●	Occasional	3
Membranipora membranacea	●●●	Occasional	1
Antedon bifida	●●●	Frequent	2
Asterias rubens	●●●●	Occasional	4
Echinus esculentus	●●●●	Frequent	4
Botryllus schlosseri	●●●	Occasional	1
Bonnemaisonia asparagoides	●●●	Occasional	1
Callophyllis laciniata	●●●●	Frequent	3
Kallymenia reniformis	●●●●	Occasional	2
Corallinaceae	●●●●	Frequent	5
Plocamium cartilagineum	●●●●	Occasional	3
Acrosorium venulosum	●●●	Frequent	1
Cryptopleura ramosa	●●●●	Frequent	4
Delesseria sanguinea	●●●●●	Frequent	6
Hypoglossum hypoglossoides	●●●	Occasional	1
Phycodrys rubens	●●●	Frequent	1
Heterosiphonia plumosa	●●●	Frequent	1
Dictyota dichotoma	●●●●	Frequent	5
Laminaria hyperborea	●●●●●	Frequent	8

IR.HIR.KFaR.LhypR.Loch Mixed *Laminaria hyperborea* and *Laminaria ochroleuca* forest on exposed infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral
Depth band:	5-10 m, 10-20 m

Previous code

EIR.LhypFa.Loch	96.7

Biotope description

Mixed *Laminaria hyperborea* and *Laminaria ochroleuca* forests on upper infralittoral exposed rock with a dense community of foliose red seaweeds such as *Cryptopleura ramosa*, and *Plocamium cartilagineum* as well as small filamentous red seaweeds including *Bonnemaisonia asparagoides*, *Heterosiphonia plumosa*, *Pterosiphonia parasitica* and *Brongniartella byssoides*. *L. hyperborea* has a rough stipe which allow dense assemblages of epiphytic red seaweeds to form including the foliose *Callophyllis laciniata*, *Delesseria sanguinea* and *Hypoglossum hypoglossoides*. Unlike *L. hyperborea*, however, *L. ochroleuca* has a smooth stipe and so it lacks dense assemblages of epiphytic seaweeds *L. ochroleuca* has a smooth stipe. Encrusting coralline algae often cover much of the rock surface along with a few brown seaweeds including *Dictyota dichotoma*, *Dictyopteris polypodioides* and *Desmarestia aculeata* present as well. In mixed kelp forest *L. ochroleuca* may predominate with *L. hyperborea* more common at shallower depths. Whilst foliose red seaweeds dominate the upward-facing rock beneath the kelp canopy, much of the fauna is restricted to crevices or vertical faces, possibly due to grazing pressure. Echinoderms are often common in this biotope, in particular the sea urchin *Echinus esculentus* and the starfish *Asterias rubens* and *Marthasterias glacialis*. Verticals are colonised by anthozoans including the anthozoans *Corynactis viridis*, *Caryophyllia smithii*, *Actinothoe sphyrodeta* and *Alcyonium digitatum*, while the bryozoan *Membranipora membranacea* colonise the *Laminaria* sp. fronds. This biotope is restricted to the coast of Cornwall and the Isles of Scilly. *L. ochroleuca* occurs at low abundance in other kelp biotopes (sheltered through to exposed) from Dorset to Lundy Island. In such cases, records should be treated as regional variations of these biotopes. Records should only be assigned to the LhypR.Loch biotope when the canopy is dominated by *L. ochroleuca* alone, or (more usually) by a mixture of both *L. hyperborea* and *L. ochroleuca* (at similar abundance). Both this biotope and Lhyp.Loch are common on the Brittany and Normandy coasts.

Situation

Since *L. ochroleuca* is less tolerant of wave action than *L. hyperborea* this biotope commonly occurs below exposed kelp forests (LhypR.Ft). On occasion it is found below *Alaria esculenta* in the sublittoral fringe (Ala.Myt or Ala.Ldig). At some sites a band of dense foliose seaweeds, with no kelp, occurs below the kelp forest (FoR or For.Dic) whilst at other sites *L. hyperborea* kelp park occurs below (LhypR.Pk).

Temporal variation

Unknown.

Similar biotopes

IR.HIR.KFaR.LhypR.Ft	Occur at a similar wave exposure. Superficially, this widespread *L. hyperborea* biotope looks similar to the *L. ochroleuca* forest (LhypR.Loch), containing a similar suite of dense foliose red seaweeds such as *Phycodrys rubens*, *Plocamium cartilagineum*, *Callophyllis laciniata* and *Delesseria sanguinea* beneath the kelp canopy. *L. ochroleuca* is only present at low

	abundance, if present at all.
IR.LIR.KFaR.LhypLoch	Occur on sheltered to moderately exposed shores. *L. hyperborea* is less abundant (Occasional) due to the lower wave exposure and *Laminaria saccharina* is usually present (Frequent).

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Actinothoe sphyrodeta	●●●	Frequent	2
Corynactis viridis	●●	Frequent	1
Caryophyllia smithii	●●●	Occasional	2
Pomatoceros	●●	Occasional	1
Membranipora membranacea	●●●	Frequent	2
Asterias rubens	●●	Frequent	1
Marthasterias glacialis	●●●●	Occasional	2
Echinus esculentus	●●●●●	Occasional	7
Bonnemaisonia asparagoides	●●●	Frequent	2
Callophyllis laciniata	●●●●	Frequent	3
Kallymenia reniformis	●●●	Frequent	3
Corallinaceae	●●●	Common	4
Plocamium cartilagineum	●●●●	Frequent	3
Cryptopleura ramosa	●●●●	Frequent	3
Delesseria sanguinea	●●●●	Frequent	4
Hypoglossum hypoglossoides	●●●	Frequent	2
Erythroglossum laciniatum	●●	Common	1
Heterosiphonia plumosa	●●●	Present	1
Brongniartella byssoides	●●●	Occasional	2
Pterosiphonia parasitica	●●●	Frequent	1
Dictyopteris membranacea	●●●●	Frequent	3
Dictyota dichotoma	●●●●●	Common	6
Desmarestia aculeata	●●●	Occasional	1
Laminaria hyperborea	●●●●●	Abundant	13
Laminaria ochroleuca	●●●●●	Common	10

IR.HIR.KFaR.FoR Foliose red seaweeds on exposed lower infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock; large boulders
Zone:	Infralittoral - lower
Depth band:	5-10 m, 10-20 m, 20-30 m

Previous code

MIR.FoR	96.7
EIR.FoR	97.06

Biotope description

A dense turf of foliose red seaweeds on exposed or moderately exposed lower infralittoral rock, generally, at or below the lower limit of the kelp. Most of the red seaweeds are common to the kelp zone above, while the faunal component of the biotope is made up of species that are found either in the kelp zone or the animal-dominated upper circalittoral below. Foliose species commonly present include *Dilsea carnosa*, *Hypoglossum hypoglossoides*, *Schottera nicaeensis*, *Cryptopleura ramosa* and *Delesseria sanguinea*. The red seaweed species composition varies considerably; at some sites a single species may dominate (particularly *Plocamium cartilagineum*). Small filamentous red seaweeds can be found here as well. These include species such as *Heterosiphonia plumosa*, *Brongniartella byssoides.* As well as a varied red seaweed component, this biotope may also contain occasional kelp plants and patches of the brown foliose seaweed *Dictyota dichotoma*. Coralline crusts covers the bedrock beneath the seaweeds. The fauna generally comprises low-encrusting forms such as the tubeworms *Pomatoceros* spp., anthozoans including *Alcyonium digitatum*, *Urticina felina* and *Caryophyllia smithii*) and occasional sponge crusts such as *Cliona celata*, *Esperiopsis fucorum*, *Scypha ciliata* and *Dysidea fragilis*. More mobile fauna include the gastropod *Calliostoma zizyphinum*, the echinoderms *Echinus esculentus* as well as the starfish *Asterias rubens* and *Marthasterias glacialis* and lastly, the crab *Cancer pagurus*. Bryozoan crusts such as *Electra pilosa* can be found fronds on the foliose red seaweeds while scattered hydroids such as *Nemertesia antennina* form colonies on shells, cobbles and available rock. At some sites erect bryozoans *Crisia* spp. and *Bugula* spp. are present. Ascidians such as *Clavelina lepadiformis* and *Clavelina lepadiformis* may also be common. In the north the foliose red seaweed *Callophyllis laciniata* may occur.

Situation

This biotope is generally found at or below the lower limit of the kelp, below either kelp forest or park (LhypR.Ft and LhypR.Pk).

Temporal variation

Many of the red seaweeds, which occur in this biotope, have annual fronds, which tend to die back in the autumn and regenerate again in the spring. This produces a seasonal change in the density of the seaweed cover, which is substantially reduced over winter months and reaches its most dense between April to September.

Similar biotopes

IR.HIR.KFaR.FoR.Dic	This biotope occurs in similar depth and conditions as FoR but is confined to SW coasts. The abundance of the brown seaweeds *Dictyopteris membranacea* (Frequent) and *D. dichotoma* is higher (Common) with the Occasional presence of the kelps *Laminaria hyperborea* and *Laminaria saccharina*.
IR.MIR.KR.XFoR	This biotope occurs on shallow, silted infralittoral bedrock and boulders in areas of turbid water dominated by dense red seaweeds, with the notable absence of kelp. Individual species of red seaweeds such as *Plocamium cartilagineum* or *Calliblepharis ciliata* often dominate. The fauna is both less

	diverse and has a lower abundance.
IR.HIR.KFaR.EphR	This biotope occurs on mixed, mobile substrata and is characterised by red seaweeds such as *Halarachnion ligulatum*, *Lomentaria orcadensis*, *Naccaria wiggii* and *Compsothamnion thuyoides* which thrive in these conditions.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Scypha ciliata	••	Occasional	1
Cliona celata	•••	Occasional	2
Esperiopsis fucorum	••	Occasional	1
Dysidea fragilis	••	Occasional	1
Nemertesia antennina	•••	Occasional	2
Alcyonium digitatum	•••	Occasional	3
Urticina felina	•••	Occasional	2
Caryophyllia smithii	••	Occasional	1
Pomatoceros triqueter	••	Occasional	3
Cancer pagurus	•••	Rare	1
Calliostoma zizyphinum	•••	Occasional	2
Electra pilosa	••	Frequent	1
Asterias rubens	••••	Frequent	7
Marthasterias glacialis	•••	Occasional	2
Echinus esculentus	•••	Occasional	3
Clavelina lepadiformis	••	Occasional	1
Dilsea carnosa	••	Occasional	1
Callophyllis laciniata	••	Occasional	1
Corallinaceae	••••	Frequent	7
Schottera nicaeensis	••	Frequent	1
Plocamium cartilagineum	••••	Frequent	8
Cryptopleura ramosa	•••	Frequent	2
Delesseria sanguinea	••••	Frequent	10
Hypoglossum hypoglossoides	•••	Occasional	2
Heterosiphonia plumosa	•••	Frequent	2
Brongniartella byssoides	•••	Frequent	1
Dictyota dichotoma	•••	Frequent	3

IR.HIR.KFaR.FoR.Dic Foliose red seaweeds with dense *Dictyota dichotoma* and/or *Dictyopteris membranacea* on exposed lower infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock; large boulders
Zone:	Infralittoral - lower
Depth band:	10-20 m, 20-30 m

Previous code

EIR.Dic	96.7

Biotope description

A dense turf of foliose red seaweeds mixed with a dense turf of the foliose brown seaweeds *Dictyota dichotoma* and/or *Dictyopteris membranacea* on exposed and moderately exposed lower infralittoral rock, generally at or below the lower limit of the kelp zone. In some areas the lower infralittoral is subject to a moderate amount of scour from nearby sand. *D. dichotoma* is relatively tolerant of such scour and in such areas a zone forms with other sand-tolerant seaweeds. *D. membranacea* is confined to south-western coasts. Typically brown seaweeds dominate the seabed or are at least in equal abundance to the red seaweeds, some of which may also form dense stands such as *Plocamium cartilagineum, Calliblepharis ciliata, Cryptopleura ramosa, Bonnemaisonia asparagoides, Heterosiphonia plumosa, Delesseria sanguinea* and *Brongniartella byssoides*. The urchin *Echinus esculentus* can be found grazing the rock surface which can be covered in coralline algae. The anthozoans *Caryophyllia smithii* and *Alcyonium digitatum* are usually present in this biotope along with the tube-building worm *Pomatoceros* sp. which is more common in sand-scoured areas. The starfish *Asterias rubens* and *Henricia* sp. and sponge crusts including *Cliona celata* can also be found here. *D. dichotoma* also occurs in the kelp park, and records should only be assigned to this biotope where kelp such as *Laminaria hyperborea* is sparse or absent and a relatively high density of *D. dichotoma* and/or *D. membranacea* is present.

Situation

This biotope usually occurs at or below the lower limit of kelp *L. hyperborea* (LhypR.Pk or Lhyp). In south-west England a zone of mixed kelp forest *L. hyperborea* and *Laminaria ochroleuca* may occur above the dense foliose algae (LhypR.Loch). FoR.Dic marks the lower limit of the lower infralittoral zone.

Temporal variation

Like many of the red seaweeds found in this biotope the dominant brown seaweeds *D. membranacea* and *D. dichotoma* have annual fronds which tend to die back in the autumn and regenerate again in the spring. This produces a seasonal change in the density of the seaweed cover, which is substantially reduced over winter months and reaches its most dense between April and September.

Similar biotopes

IR.HIR.KFaR.FoR	This biotope occurs at similar depth and conditions as FoR.Dic. The abundance of the brown seaweeds *Dictyopteris membranacea* (Occasional) and *D. dichotoma* is higher (Frequent) without the presence of the kelps *Laminaria hyperborea* and *Laminaria saccharina*.
IR.MIR.KR.XFoR	This biotope occurs on shallow, silted infralittoral bedrock and boulders in areas of turbid water dominated by dense red seaweeds, with the notable absence of kelp. Individual species of red seaweeds such as *Plocamium cartilagineum* or *Calliblepharis ciliata* often dominate. The fauna is both less

	diverse and at lower abundance.
IR.HIR.KSed.EphR	This biotope occurs on mixed, mobile substrata and is characterised by red seaweeds such as *Halarachnion ligulatum*, *Lomentaria orcadensis*, *Naccaria wiggii* and *Compsothamnion thuyoides* which thrive in these conditions.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Cliona celata	●●●	Occasional	2
Alcyonium digitatum	●●	Occasional	3
Caryophyllia smithii	●●●●	Occasional	2
Pomatoceros triqueter	●●	Occasional	1
Henricia oculata	●●●	Occasional	2
Asterias rubens	●●●●	Occasional	4
Echinus esculentus	●●●	Occasional	2
Bonnemaisonia asparagoides	●●	Occasional	1
Corallinaceae	●●●	Frequent	2
Plocamium cartilagineum	●●●●	Frequent	5
Calliblepharis ciliata	●●	Occasional	2
Cryptopleura ramosa	●●●	Frequent	2
Delesseria sanguinea	●●●●●	Frequent	7
Heterosiphonia plumosa	●●●●	Frequent	6
Brongniartella byssoides	●●●●	Frequent	6
Dictyopteris membranacea	●●●●●	Frequent	11
Dictyota dichotoma	●●●●●	Common	15
Laminaria hyperborea	●●●	Occasional	

IR.HIR.KFaR.LhypRVt *Laminaria hyperborea* and red seaweeds on exposed vertical rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Vertical rock.

Previous code

SCAs.ByH in part	97.06
CorMetAlc in part	97.06

Biotope description

On exposed coasts with moderately strong to weak tidal currents generally at depths of 0-10m, vertical rock communities dominated by frequent *Laminaria hyperborea* and its commonly associated red seaweeds *Delesseria sanguinea*, *Cryptopleura ramosa* and *Plocamium cartilagineum* can be found. Within this biotope the jewel anemone *Corynactis viridis* is frequently found in dense aggregations attached to the vertical rock surface. This biotope contains 5 sub-biotopes, distinguished by their biogeography. On the west coast of Scotland, the Northern Isles and the Isle of Man on extremely exposed coasts a variant of this biotope characterised by frequent *Metridium senile* and occasional *Sagartia elegans* can be found. Further south on the west coast of Ireland, southern Scotland, Wales, and south west England a second variant characterised by frequent *Alcyonium digitatum* and occasional *Cliona celata* can be distinguished. A third variant has been recorded from Northern Ireland characterised by the red seaweeds *Lithophyllum* and *Ptilota gunneri*, the sea squirt *Dendrodoa grossularia* and the bryozoan *Membranipora membranacea*. South from the Isle of Man, on the Welsh Coast, and on the south west and southern English coasts a fourth variant of this biotope is found, which is characterised by the barnacle *Balanus crenatus*, which may be more frequent in this sub-biotope, and the rarity of *Alcyonium digitatum*, a species which is more frequent in other variants. This variant has mainly been recorded in shallow water (0-5m). The final biogeographic variant of this biotope is, as with the previous variant, found on the coasts of Wales and south west England. It can be distinguished from the previous variant by the frequent *Diplosoma listerianum* and occasional *Lissoclinum perforatum*, although these species are not always present.

Situation

Open rocky coasts of the south-west, west and north-west.

Temporal variation

No temporal data available

Similar biotopes

MIR.LhypVt	Much more species poor, with red algae sparse or absent.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Pachymatisma johnstonia	●●●	Occasional	1	
Halichondria panicea	●●	Occasional	1	
Esperiopsis fucorum	●●	Occasional	1	
Dysidea fragilis	●●●	Occasional	2	
Alcyonium digitatum	●●●	Occasional	3	
Sagartia elegans	●●●	Occasional	2	
Corynactis viridis	●●●●	Frequent	5	
Caryophyllia smithii	●●●	Occasional	3	
Cancer pagurus	●●●	Rare	2	
Calliostoma zizyphinum	●●●	Occasional	1	
Crisiidae	●●	Frequent	1	
Asterias rubens	●●●	Occasional	2	
Marthasterias glacialis	●●●	Occasional	1	
Echinus esculentus	●●	Occasional	1	
Clavelina lepadiformis	●●●	Occasional	2	
Botryllus schlosseri	●●●	Occasional	2	
Callophyllis laciniata	●●●	Occasional	2	
Kallymenia reniformis	●●●	Occasional	1	
Corallinaceae	●●●	Frequent	2	
Corallina officinalis	●●	Occasional	1	
Phyllophora crispa	●●	Occasional	1	
Plocamium cartilagineum	●●●●	Occasional	5	
Cryptopleura ramosa	●●●●	Frequent	4	
Delesseria sanguinea	●●●●	Frequent	5	
Hypoglossum hypoglossoides	●●●	Occasional	2	
Erythroglossum laciniatum	●●	Frequent	1	
Dictyota dichotoma	●●●	Frequent	3	
Laminaria hyperborea	●●●●	Frequent	5	

IR.HIR.KSed Sand or gravel-affected or disturbed kelp and seaweed communities

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock; unstable boulders and cobbles: often nearby coarse sediment
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Disturbed or sediment-affected

Previous code

SedK	97.06

Biotope description

Infralittoral rock habitats, subject to disturbance through mobility of the substratum (boulders or cobbles) or abrasion/covering by nearby coarse sediments or suspended particulate matter (sand). The associated communities can be quite variable in character, depending on the particular conditions, which prevail. The typical *Laminaria hyperborea* and red seaweed communities of stable open coast rocky habitats (IR.MIR.KR) are replaced by those, which include more ephemeral species or those tolerant of sand and gravel abrasion. As such *Laminaria saccharina*, *Saccorhiza polyschides* or *Halidrys siliquosa* may be prominant components of the community.

Characterising species

	% Frequency	*Abundance (SACFOR)*
Alcyonium digitatum	••	Occasional
Urticina felina	•••	Occasional
Pomatoceros triqueter	•••	Frequent
Balanus crenatus	••	Frequent
Cancer pagurus	••	Occasional
Gibbula cineraria	•••	Occasional
Electra pilosa	••	Frequent
Asterias rubens	•••	Occasional
Clavelina lepadiformis	••	Occasional
Botryllus schlosseri	•••	Occasional
Dilsea carnosa	•••	Occasional
Corallinaceae	•••	Frequent
Corallina officinalis	••	Occasional
Chondrus crispus	•••	Occasional
Plocamium cartilagineum	••••	Frequent
Halarachnion ligulatum	••	Occasional
Cryptopleura ramosa	•••	Occasional
Delesseria sanguinea	•••	Occasional
Hypoglossum hypoglossoides	•••	Occasional
Phycodrys rubens	••	Occasional
Heterosiphonia plumosa	•••	Frequent
Brongniartella byssoides	•••	Frequent
Rhodomela confervoides	••	Occasional
Dictyota dichotoma	•••	Occasional
Desmarestia aculeata	••	Occasional
Laminaria hyperborea	•••	Frequent
Laminaria saccharina	•••	Frequent
Halidrys siliquosa	•••	Frequent

IR.HIR.KSed.Sac *Saccorhiza polyschides* and other opportunistic kelps on disturbed sublittoral fringe rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock; boulders
Zone:	Sublittoral fringe, Infralittoral - upper
Height band:	Lower shore
Depth band:	0-5 m
Other features:	Disturbed (by storms or sand scour)

Previous code

MIR.Spol	96.7
LRK.SPOL	6.95

Biotope description

Exposed low-lying reefs in the sublittoral fringe or upper infralittoral (generally above 5m depth), mainly in the southwest and west, dominated by the kelp *Saccorhiza polyschides*. This opportunistic coloniser replaces *Laminaria digitata* or *Laminaria hyperborea* as the dominant kelp, following 'disturbance' of the canopy. This may be the result of storms, when loose sediment and even cobbles or boulders are mobilised, scouring most seaweeds and animals from the surrounding rock. As *S. polyschides* is essentially a summer annual (occasionally it lasts into a second year), it is also particularly common close to rock/sand interfaces which become too scoured during winter months to prevent the longer-living kelps from surviving. As a result of the transient nature of this biotope, its composition is varied; it may contain several other kelp species, including *L. digitata*, *Laminaria saccharina* and *Alaria esculenta*, at varying abundances. *Laminaria* spp. sporelings can also be a prominent feature of the site. Beneath the kelp, (scour-tolerant) red seaweeds including *Corallina officinalis*, *Kallymenia reniformis*, *Plocamium cartilagineum*, *Chondrus crispus*, *Dilsea carnosa* and encrusting coralline algae are often present. Foliose red seaweeds such as *Callophyllis laciniata*, *Cryptopleura ramosa* and *Palmaria palmata* also occur in this biotope. *P. palmata* and *Delesseria sanguinea* often occur as epiphytes on the stipes of *L. hyperborea*, when it is present. The foliose green seaweed *Ulva* spp. is fast to colonise newly cleared areas of rock and is often present along with the foliose brown seaweed *Dictyota dichotoma*. Due to the disturbed nature of this biotope, fauna are generally sparse, being confined to encrusting bryozoans and/or sponges, such as *Halichondria panicea* and the gastropod *Gibbula cineraria*.

Situation

On some shores (for example in Cornwall and south-west Ireland), *S. polyschides* competes so effectively with the other laminarians that it forms a well-defined zone in shallow water, between the *L. digitata* (Ldig) and *L. hyperborea* zones (LhypR and Lhyp). Elsewhere, it is found at sites that have been physically disturbed, removing areas of established kelp (*L. hyperborea*) thus allowing this opportunistic biotope to develop over a short space of time.

Temporal variation

There may be significant variations in this biotope over time, as by its very nature, it is dominated by many fast-growing annual seaweeds. The foliose green seaweed *Ulva* sp. is fast to colonise newly cleared areas of rock and can be present as a dense growth on the rock around the *Saccorhiza polyschides*. Similarly, large patches of *Laminaria* spp. sporelings may be present at times.

Similar biotopes

IR.HIR.KFaR.LsacSac	This biotope occurs in deeper water and often forms a mixed kelp canopy of *L. saccharina*, *L. hyperborea* and *S. polyschides*. Although *S. polyschides* can occur in equal abundance to the other kelps it may be absent altogether from

some sites. It supports a slightly richer faunal community of species commonly found in deeper water, such as *Alcyonium digitatum*, *Caryophyllia smithii* and encrusting bryozoans.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	••	Occasional	1
Gibbula cineraria	•••	Frequent	3
Palmaria palmata	••	Frequent	2
Dilsea carnosa	••	Frequent	2
Callophyllis laciniata	••	Frequent	1
Kallymenia reniformis	••	Frequent	1
Corallinaceae	••••	Frequent	10
Corallina officinalis	••	Frequent	2
Plocamium cartilagineum	•••	Occasional	3
Cryptopleura ramosa	•••	Frequent	4
Delesseria sanguinea	••	Frequent	1
Dictyota dichotoma	••	Frequent	2
Laminaria digitata	••	Common	3
Laminaria hyperborea	••	Common	3
Laminaria saccharina	•••	Frequent	4
Saccorhiza polyschides	•••••	Abundant	30
Alaria esculenta	••	Occasional	2
Ulva lactuca	••	Frequent	2

IR.HIR.KSed.LsacSac *Laminaria saccharina* and/or *Saccorhiza polyschides* on exposed infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock; boulders and cobbles
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m
Other features:	Often (but not always) disturbance due to scour or seasonal instability of substratum

Previous code

EIR.LsacSpol	96.7

Biotope description

A forest or park of the fast-growing, opportunistic kelps *Laminaria saccharina* and/or *Saccorhiza polyschides* often occurs on seasonally unstable boulders or sand/pebble scoured infralittoral rock. The substratum varies from large boulders in exposed areas to smaller boulders and cobbles in areas of moderate wave exposure or nearby bedrock. In these cases, movement of the substratum during winter storms prevents a longer-lived forest of *Laminaria hyperborea* from becoming established. This biotope also develops on bedrock where it is affected by its close proximity to unstable substrata. Other fast-growing brown seaweeds such as *Desmarestia viridis*, *Desmarestia aculeata*, *Cutleria multifida* and *Dictyota dichotoma* are often present. Some *L. hyperborea* plants may occur in this biotope, but they are typically small since the plants do not survive many years. The kelp stipes are usually epiphytised by red seaweeds such as *Delesseria sanguinea* and *Phycodrys rubens*. Other red seaweeds present beneath the kelp canopy include *Plocamium cartilagineum*, *Nitophyllum punctatum*, *Callophyllis laciniata* and *Cryptopleura ramosa*. Encrusting algae often form a prominent cover on the rock surfaces, including red, brown and coralline crusts. Faunal richness and diversity is generally low compared to the more stable *L. hyperborea* kelp forest and park communities (LhypR). Where some protection is afforded the anthozoan *Alcyonium digitata* can occur in addition to the more robust species such as the tube-building worm *Pomatoceros triqueter*. Mobile species include the to shell *Gibbula cineraria* and *Calliostoma zizyphinum* and the sea urchin *Echinus esculentus*. The hydroid *Obelia geniculata* and the bryozoan *Membranipora membranacea* can often be found colonising the kelp fronds.

Situation

This biotope can be found below the *L. hyperborea* zone (LhypFa or LhypR), especially where close to a rock/ sand interface (where it is subject to sand/pebble scour in winter). Where this biotope occurs on bedrock, not scoured by mobile sediment, it is thought to occur as a result of intense wave action in winter storms which is too severe to allow *L. hyperborea* to develop and remain in shallow water.

Temporal variation

Due to the disturbed nature of this biotope there can be significant changes in the structure of the community. Coralline and brown algal crusts with sparse kelp plants generally dominate areas that have been recently disturbed. Diversity is low and a few species of fast-growing seaweeds can dominate the seabed. A longer established community will have larger, mixed kelp plants and a greater diversity of red seaweeds.

Similar biotopes

IR.HIR.KFaR.DesFilR	Occurs at similar conditions but at slightly less exposed coasts. The brown seaweed *Desmarestia aculeata* has a higher abundance (Abundant) than in LsacSac, while the kelp *L. saccharina* has a lower abundance (Occasional).

The kelp *S. polyschides* rarely occurs.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	••	Frequent	2
Alcyonium digitatum	•••	Occasional	2
Pomatoceros triqueter	••	Frequent	2
Gibbula cineraria	•••	Occasional	4
Calliostoma zizyphinum	•••	Occasional	2
Membranipora membranacea	••	Frequent	2
Asterias rubens	••••	Occasional	5
Echinus esculentus	••••	Occasional	8
Callophyllis laciniata	•••	Frequent	2
Corallinaceae	•••••	Common	12
Plocamium cartilagineum	•••	Frequent	2
Cryptopleura ramosa	•••	Frequent	2
Delesseria sanguinea	••••	Occasional	5
Nitophyllum punctatum	•••	Occasional	1
Phycodrys rubens	•••	Occasional	2
Cutleria multifida	••	Frequent	2
Dictyota dichotoma	•••	Frequent	2
Desmarestia aculeata	••	Occasional	1
Desmarestia viridis	••	Occasional	1
Laminaria hyperborea	•••	Common	15
Laminaria saccharina	•••••	Common	5
Saccorhiza polyschides	••••	Common	4

IR.HIR.KSed.LsacChoR *Laminaria saccharina*, *Chorda filum* and dense red seaweeds on shallow unstable infralittoral boulders or cobbles

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Moderately strong
Substratum:	Boulders, cobbles, pebbles and gravel
Zone:	Infralittoral - upper
Depth band:	0-5 m
Other features:	Shallow, seasonally unstable substrata

Biotope description

Seasonally disturbed unstable boulders and cobbles in very shallow water dominated by the fast-growing brown seaweed *Chorda filum* together with the kelp *Laminaria saccharina*. The brown seaweed *Desmarestia aculeata* is also typical of this disturbed environment as well encrusting coralline algae and brown crusts. Beneath the prolific growth of *C. filum*, red and brown seaweeds densely cover many of the boulders, cobbles and pebbles. Other sediment-tolerant seaweeds such as species from the Ectocarpales (brown filamentous seaweeds) and the red seaweeds *Chondrus crispus*, *Phyllophora pseudoceranoides*, *Dilsea carnosa* and *Corallina officinalis* is normally present. Other red seaweeds which can be found here include *Chondria dasyphylla*, *Brongniartella byssoides*, *Polysiphonia elongata*, *Ceramium nodolosum*, *Cystoclonium purpureum*, *Heterosiphonia plumosa*, *Rhodomela confervoides* and *Plocamium cartilagineum*. The brown seaweeds *Punctaria* sp. and *Cladostephus spongiosus* are generally present. The faunal component of this biotope is typically sparse - the starfish *Asterias rubens* and the crabs *Pagurus bernhardus* and *Necora puber* are amongst the most conspicuous animals. The bryozoan crust *Electra pilosa* colonise many of the algae along with the ascidian *Botryllus schlosseri*. Occasional the polychaete *Lanice conchilega* may occur in the sand between pebbles, and the anthozoan *Urticina felina* may be found amongst pockets of gravel along with the gastropod *Gibbula cineraria*. At some sites the rock beneath the algae can be occupied by the tube-building polychaete *Pomatoceros triqueter*. This biotope is also present at other open coast sites around the UK where suitable shallow, seasonally stable boulders, cobbles and pebbles occur. Typical examples of this biotope occur on the shallowest areas of the Sarns in Cardigan Bay, Wales, where reef crests are formed by embedded and mobile boulders, together with cobbles and pebbles in between (typically at 2-3m depth).

Situation

This biotope occurs in shallow water, often on the crest of an infralittoral boulder/cobble bank and as such will not have any biotope 'above' it. More mobile areas of smaller boulders, cobbles and pebbles nearby may support dense ephemeral red seaweeds (EphR) or robust scour-tolerant red seaweeds on sand-covered rock (ProtAhn). The *Halidrys siliquosa* biotope XKHal also thrives under similar conditions, extending deeper than the shallow LsacChoR biotope. Deeper still in the circalittoral zone encrusting fauna is found on highly mobile mixed substrata (PomB). At a few sites, this biotope can occur within more extensive maerl beds (SS.SMP.Mrl) but more commonly is surrounded by sandy sediments (SS.SSa).

Temporal variation

This biotope will change markedly with the seasons. During the winter months boulders and cobbles will be storm battered and overturned and much of the biota dislodged from the rocks. During more stable conditions in the late spring and summer months the fast-growing seaweeds that characterise this biotope (*C. filum* and *L. saccharina* in particular) will be quick to re-establish, growing at a

phenomenal rate. The seasonal disturbance of the substratum prevents a stable *Laminaria hyperborea* forest from developing.

Similar biotopes

IR.HIR.KSed.XKHal	Tide-swept biotope dominated by *H. siliquosa* (>Common) with mixed kelp species. Although *C. filum* may occur it is generally only Occasional.
IR.HIR.KSed.EphR	Lacks the larger kelp and dense *C. filum* associated with LsacChoR and is generally found in deeper water (below 10m depth compared to LsacChoR usually above 5m depth).
IR.MIR.KT.XKTX	Typically occurs on boulders, cobbles and pebbles in sheltered but tide-swept shallow water (such as found in tidal-rapids). *L. saccharina* is the dominant kelp, although *L. hyperborea* does occurs (Frequent). *C. filum*, when present is less dense (Common).

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Urticina felina	●●●	Occasional	1
Lanice conchilega	●●●	Occasional	2
Pagurus bernhardus	●●	Frequent	1
Gibbula cineraria	●●●	Occasional	2
Electra pilosa	●●●	Frequent	1
Electra pilosa	●●●	Frequent	2
Asterias rubens	●●●●	Frequent	6
Botryllus schlosseri	●●●	Occasional	1
Dilsea carnosa	●●●	Occasional	2
Corallinaceae	●●●	Occasional	2
Corallina officinalis	●●	Occasional	1
Phyllophora pseudoceranoides	●●●	Frequent	2
Chondrus crispus	●●●	Frequent	3
Plocamium cartilagineum	●●●●	Frequent	3
Cystoclonium purpureum	●●●	Frequent	4
Heterosiphonia plumosa	●●●	Occasional	2
Brongniartella byssoides	●●●●	Frequent	6
Chondria dasyphylla	●●●	Occasional	2
Polysiphonia elongata	●●●	Frequent	1
Rhodomela confervoides	●●●	Frequent	3
Ectocarpaceae	●●●	Frequent	3
Cladostephus spongiosus	●●●	Frequent	2
Desmarestia aculeata	●●	Frequent	3
Punctaria	●●	Frequent	1
Chorda filum	●●●●●	Abundant	17
Laminaria saccharina	●●●	Common	5

IR.HIR.KSed.DesFilR Dense *Desmarestia* spp. with filamentous red seaweeds on exposed infralittoral cobbles, pebbles and bedrock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock & boulders
Zone:	Sublittoral fringe, Infralittoral - upper
Depth band:	5-10 m

Biotope description

Wave-exposed seasonally mobile substrata (pebbles, cobbles) dominated by dense stands of the brown seaweed *Desmarestia aculeata* and/or *Desmarestia ligulata*. Infralittoral pebbles and cobbles that are scoured through mobility during storms, but become stable in the summer allowing the growth of such algae as *Desmarestia* spp. Filamentous red seaweeds such *as Bonnemaisonia asparagoides* and *Brongniartella byssoides* are usually present. Stunted individuals of the kelp such as *Laminaria hyperborea* and *Laminaria saccharina* may be present where bedrock is available. A variety of foliose red seaweeds such as *Cryptopleura ramosa, Chondrus crispus, Plocamium cartilagineum, Hypoglossum hypoglossoides* and *Nitophyllum punctatum* may on occasion be present underneath the kelp canopy. Other red algae including *Corallina officinalis, Rhodomela confervoides* and coralline crusts including *Lithothamnion* spp. may be present as well as well as the foliose brown seaweed *Dictyota dichotoma* and the green *Enteromorpha intestinalis*. Due to the nature of this biotope the faunal component is very impoverished though the gastropod *Gibbula cineraria* can be found among the cobbles.

Situation

Often a narrow zone on mixed substrata below a stable zone of kelp on bedrock. Where seasonally mobile substrata affect nearby bedrock this biotope may occur in place of kelp forest.

Temporal variation

See biotope description

Similar biotopes

IR.HIR.KFaR.Sac	Occurs on bedrock at slightly more exposed coasts. The kelp *Saccorhiza polyschides* has a higher abundance (Abundant), while the brown seaweed *D. aculeata* has a lower abundance (Occasional) than in DesFilR.
IR.HIR.KFaR.LsacSac	Occurs at similar conditions but at slightly more exposed coasts. The two kelps *Laminaria saccharina* and *S. polyschides* has a higher abundance (both Common), while the brown seaweed *D. aculeata* has a lower abundance (Occasional) than in DesFilR.
IR.FIR.SG.CC.Mo	Occurs in similar conditions as DesFilR but has a very low species diversity and lacks the brown seaweed *D. aculeata*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Urticina felina	••	Occasional	3
Pomatoceros triqueter	••	Occasional	3
Gibbula cineraria	•••	Frequent	2

RHODOPHYCOTA	••	Frequent	2
Bonnemaisonia asparagoides	••	Occasional	9
Corallinaceae	••	Frequent	2
Corallina officinalis	••	Occasional	2
Lithothamnion	••	Common	3
Chondrus crispus	•••	Frequent	1
Plocamium cartilagineum	•••	Frequent	4
Cryptopleura ramosa	••	Occasional	3
Delesseria sanguinea	••	Rare	1
Hypoglossum hypoglossoides	•••	Rare	3
Nitophyllum punctatum	••	Occasional	1
Brongniartella byssoides	••••	Frequent	9
Rhodomela confervoides	••	Occasional	1
Dictyota dichotoma	•••	Frequent	6
Desmarestia aculeata	•••••	Common	24
Desmarestia ligulata	••	Frequent	3
Laminaria	••	Frequent	3
Laminaria hyperborea	••	Occasional	1
Laminaria saccharina	•••	Occasional	4
Enteromorpha	••	Occasional	1

IR.HIR.KSed.XKScrR Mixed kelps with scour-tolerant and opportunistic foliose red seaweeds on scoured or sand-covered infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Close proximity to sand

Previous code

MIR.LsacScrR	96.7
MIR.XK	96.7

Biotope description

Bedrock and boulders, often in tide-swept areas, that are subject to scouring or periodic burial by sand, characterised by a canopy of mixed kelps such as *Laminaria saccharina*, *Laminaria hyperborea* and *Saccorhiza polyschides* and the brown seaweed *Desmarestia aculeata*; there may also be an understorey of foliose seaweeds that can withstand scour such as *Plocamium cartilagineum, Chondrus crispus, Dilsea carnosa, Callophyllis laciniata* as well as the filamentous *Heterosiphonia plumosa* and the foliose brown seaweed *Dictyota dichotoma*. The perennial red seaweed *Brongniartella byssoides* re-grows in the summer months. The *L. hyperborea* stipes often support a growth of epiphytes, such as *Delesseria sanguinea*, *Phycodrys rubens* and *Cryptopleura ramosa*. The scour can reduce the rock surface to bare coralline crusts at times; sponge crusts and the colonial ascidian *Botryllus schlosseri* can also grow on the stipes and holdfasts. The faunal diversity on the rock is usually low and restricted to robust, low-profile animals such as the tube-building polychaete *Pomatoceros triqueter*, the barnacle *Balanus crenatus*, encrusting bryozoans such as *Membranipora membranacea*, the anthozoan *Urticina felina*, the starfish *Asterias rubens* and the urchin *Echinus esculentus*. Deeper sites support more hydroids and bryozoans, particularly *Bugula* spp. Where this biotope occurs in very shallow water *Laminaria digitata* may be found in combination with the other kelp species. Other species present only in shallow water include the red algae *Corallina officinalis* and the sand-binding alga *Rhodothamniella floridula*.

Situation

This biotope often occurs below a *L. hyperborea* forest (LhypR.Ft, Lhyp.Ft or LhypT.Ft), close to a rock-sediment boundary. It is also found on low-lying rock outcrops surrounded by sand or mixed sediment and nearby biotopes on mixed substrata may include EphR, ProtAhn or in very shallow water LsacChoR. A *Flustra foliacea* community (FluCoAs) often dominates deeper sand-scoured circalittoral rock.

Temporal variation

During late autumn and winter seaweeds are sparse, leaving predominantly kelp and encrusting coralline algae. This is due in part to periods of intense scouring during stormy months, which may strip off all but the most tenacious seaweeds. In addition there will be the natural die back of many of the seaweeds such as *B. byssoides* and *C. ciliata* during the winter months which become conspicuous again during the summer months.

Similar biotopes

IR.HIR.KSed.XKHal	A tide-swept biotope dominated by *Halidrys siliquosa* (typically greater than Common) with mixed kelp species that is subject to greater scour than XKScrR.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Urticina felina	●●●	Occasional	1
Pomatoceros triqueter	●●●	Frequent	2
Balanus crenatus	●●	Frequent	2
Gibbula cineraria	●●●	Frequent	3
Membranipora membranacea	●●	Frequent	2
Asterias rubens	●●●	Occasional	3
Echinus esculentus	●●	Occasional	1
Botryllus schlosseri	●●	Occasional	1
Dilsea carnosa	●●●	Occasional	3
Callophyllis laciniata	●●●	Occasional	2
Corallinaceae	●●●	Frequent	5
Corallina officinalis	●●	Occasional	1
Chondrus crispus	●●●	Occasional	1
Plocamium cartilagineum	●●●●	Frequent	6
Cryptopleura ramosa	●●●	Frequent	4
Delesseria sanguinea	●●●	Occasional	3
Phycodrys rubens	●●●	Frequent	2
Heterosiphonia plumosa	●●●	Frequent	2
Brongniartella byssoides	●●●	Occasional	2
Dictyota dichotoma	●●●	Frequent	3
Desmarestia aculeata	●●	Occasional	1
Laminaria hyperborea	●●●●	Common	10
Laminaria saccharina	●●●●	Frequent	9
Saccorhiza polyschides	●●●	Frequent	2

IR.HIR.KSed.XKHal *Halidrys siliquosa* and mixed kelps on tide-swept infralittoral rock with coarse sediment

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock, boulders or cobbles with coarse sediment
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Sediment abrasion

Previous code

MIR.HalXK	97.06
MIR.HalXK.Ft	96.7
MIR.HalXK.Pk	96.7

Biotope description

Tide-swept boulders and cobbles, often with a mobile component to the substrata (pebbles, gravel and sand), characterised by dense stands of the brown seaweed *Halidrys siliquosa*. It is can be mixed with the foliose brown seaweed *Dictyota dichotoma* and kelp such as *Laminaria saccharina* and *Laminaria hyperborea*. Below the canopy is an undergrowth of red seaweeds that are tolerant of sand-scour such as *Phyllophora crispa*, *Phyllophora pseudoceranoides*, *Rhodomela confervoides*, *Corallina officinalis* and *Chondrus crispus*. Other red seaweeds such as *Plocamium cartilagineum*, *Calliblepharis ciliata*, *Cryptopleura ramosa*, *Delesseria sanguinea*, *Heterosiphonia plumosa*, *Dilsea carnosa*, *Hypoglossum hypoglossoides* and *Brongniartella byssoides* may be locally abundant, particularly in the summer months. There may be a rich epibiota on *H. siliquosa*, including the hydroid *Aglaophenia pluma*, ascidians such as *Botryllus schlosseri*. There is generally a sparse faunal component colonising the boulders and cobbles, comprising the tube-building polychaete *Pomatoceros triqueter*, the crab *Cancer pagurus*, the starfish *Asterias rubens*, the gastropod *Gibbula cineraria* and the sea anthozoan *Urticina felina*. The bryozoan *Electra pilosa* can form colonies on the kelp.

Situation

XKHal can occur below the tide-swept *Laminaria digitata* zone of the sublittoral fringe bedrock or boulders (LdigT). Less stable substrata of boulders, cobbles or pebbles may support kelp and *Chorda filum* in the shallows (LsacChoR) or dense ephemeral seaweeds (EphR). Sand-influenced rocky outcrops in deeper water may support a *Flustra foliacea* community (FluCoAs). This biotope is widespread and is found on the open coast in Wales, the south-west and the English Channel as well as more sheltered tidal rapids in the Scottish sealochs. It can form extensive forests or parks in certain areas (Dorset, Sarns). In Wales, the south-west and west of England the red seaweeds *Spyridia filamentosa* and *Halarachnion ligulatum* and brown seaweeds *Dictyopteris membranacea* and *Taonia atomaria* are frequent. In Scotland, kelp occur at a greater proportion of sites, solitary ascidians such as *Ascidiella* spp. are more common and the featherstar *Antedon bifida* and brittlestars *Ophiothrix fragilis* are found.

Temporal variation

Higher diversity of red seaweeds during the summer.

Similar biotopes

IR.HIR.KSed.XKScrR	This biotope is distinguished from XKHal by its greater scour.
IR.MIR.KT.XKT	This biotope is distinguished from XKHal by occurring at more sheltered shores and by the occurrence of species like the urchin *Echinus esculentus*, the brittlestar *Ophiothrix fragilis* and the crab *Carcinus maenas* (all typical abundance of Occasional).
IR.MIR.KT.XKTX	Usually at more sheltered shores with a mixed substratum, variable salinity and stronger tidal streams. Species like the urchin *E. esculentus*, the brittlestar *Ophiothrix fragilis* and the crab *C. maenas* and encrusting red algae *Lithothamnion graciale* (Frequent) occurs in this biotope.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Aglaophenia pluma	••	Frequent	1
Urticina felina	•••	Occasional	1
Pomatoceros triqueter	••••	Frequent	3
Cancer pagurus	•••	Occasional	1
Gibbula cineraria	•••	Occasional	2
Electra pilosa	•••	Frequent	2
Asterias rubens	••••	Frequent	3
Botryllus schlosseri	••••	Frequent	3
Dilsea carnosa	••••	Occasional	2
Corallinaceae	•••	Frequent	3
Corallina officinalis	•••	Occasional	1
Phyllophora crispa	•••	Occasional	1
Phyllophora pseudoceranoides	•••	Frequent	2
Chondrus crispus	•••	Occasional	2
Plocamium cartilagineum	••••	Frequent	4
Calliblepharis ciliata	•••	Occasional	2
Cryptopleura ramosa	•••	Occasional	2
Hypoglossum hypoglossoides	•••	Occasional	1
Heterosiphonia plumosa	••••	Frequent	3
Brongniartella byssoides	••••	Frequent	3
Rhodomela confervoides	•••	Occasional	2
Dictyota dichotoma	••••	Frequent	4
Laminaria hyperborea	••	Frequent	1
Laminaria saccharina	•••	Occasional	2
Halidrys siliquosa	•••••	Common	15

IR.HIR.KSed.ProtAhn *Polyides rotundus*, *Ahnfeltia plicata* and *Chondrus crispus* on sand-covered infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock, cobbles and pebbles with mobile sand
Zone:	Infralittoral
Depth band:	5-10 m
Other features:	Sand-covered rock

Previous code

MIR.PolAhn	97.06

Biotope description

Low-lying rock surrounded by mobile sand and often subject to burying by the sand, with a turf of resilient red seaweeds *Chondrus crispus, Polyides rotundus* and *Ahnfeltia plicata* typically protruding through the sand on the upper surfaces of the rock. Other scour-tolerant seaweeds include *Rhodomela confervoides*, *Phyllophora pseudoceranoides*, *Phyllophora crispa*, *Furcellaria lumbricalis*, *Gracilaria gracilis, Ceramium rubrum, Plocamium cartilagineum, Heterosiphonia plumosa, Cryptopleura ramosa* and *Dilsea carnosa*. Coralline crusts typically cover the rock, while scattered individuals of the brown seaweeds *Halidrys siliquosa, Cladostephus spongiosus, Dictyota dichotoma* and *Laminaria saccharina* can be present. The large anthozoan *Urticina felina* can occur in this biotope but there are few other conspicuous animals.

Situation

This biotope occurs on shallow sand-covered rock, often below bedrock and boulders supporting kelp forest, which is above the effect of, sand scour (Lhyp) or abutting sand-scoured kelp on bedrock (XKScrR). It may also be found adjacent to the shallow kelp and *Chorda filum* biotope (LsacChoR) and similarly can be surrounded by a variety of sediment biotopes.

Temporal variation

Unknown.

Similar biotopes

IR.HIR.KSed.XKHal	Lack of large boulders or prominent bedrock in ProtAhn prevents dominance by *H. siliquosa* or kelps.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Urticina felina	••	Occasional	1
Dilsea carnosa	•••	Occasional	6
Corallinaceae	••••	Frequent	9
Gracilaria gracilis	••	Frequent	1
Ahnfeltia plicata	•••	Frequent	6
Phyllophora crispa	•••	Occasional	3
Phyllophora pseudoceranoides	•••	Frequent	3
Chondrus crispus	•••••	Frequent	15
Polyides rotundus	••••	Frequent	10
Plocamium cartilagineum	•••	Occasional	2
Furcellaria lumbricalis	•••	Occasional	4
Ceramium nodulosum	••	Frequent	1
Cryptopleura ramosa	•••	Occasional	3
Heterosiphonia plumosa	•••	Frequent	3
Rhodomela confervoides	•••	Frequent	3
Cladostephus spongiosus	••	Occasional	1
Dictyota dichotoma	••	Occasional	2
Laminaria saccharina	•••	Occasional	4
Halidrys siliquosa	••	Occasional	1
Ulva	••	Occasional	1

IR.MIR Moderate energy infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock and stable boulders
Zone:	Sublittoral fringe, Infralittoral
Height band:	Lower shore
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

This habitat complex occurs on predominantly moderately wave-exposed bedrock and boulders, subject to moderately strong to weak tidal streams. On the bedrock and stable boulders there is typically a narrow band of kelp *Laminaria digitata* in the sublittoral fringe which lies above a *Laminaria hyperborea* forest and park. Associated with the kelp are communities of seaweeds, predominantly reds and including a greater variety of more delicate filamentous types than found on more exposed coasts (KFaR).

IR.MIR.KR Kelp with red seaweeds (moderate energy infralittoral rock)

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock & boulders
Zone:	Sublittoral fringe, Infralittoral
Height band:	Lower shore
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Infralittoral rock subject to moderate wave exposure, or moderately strong tidal streams on more sheltered coasts. On bedrock and stable boulders there is typically a narrow band of kelp *Laminaria digitata* in the sublittoral fringe which lies above a *Laminaria hyperborea* forest and park. Associated with the kelp are communities of seaweeds, predominantly reds and including a greater variety of more delicate filamentous types than found on more exposed coasts (KFaR). The faunal component of the understorey is also less prominant than in KFaR.

Characterising species

	% Frequency	*Abundance (SACFOR)*
Scypha ciliata	•	Occasional
Halichondria panicea	••	Occasional
Obelia geniculata	••	Frequent
Alcyonium digitatum	••	Occasional
Urticina felina	•••	Occasional
Sagartia elegans	••	Occasional
Caryophyllia smithii	••	Occasional
Pomatoceros triqueter	•••	Occasional
Balanus crenatus	••	Frequent
Pagurus bernhardus	••	Occasional
Cancer pagurus	••	Rare
Necora puber	••	Occasional
Gibbula cineraria	•••	Occasional
Calliostoma zizyphinum	••	Occasional
Membranipora membranacea	••	Frequent
Electra pilosa	••	Frequent
Bryozoa indet crusts	••	Frequent
Antedon bifida	•	Occasional
Asterias rubens	•••	Occasional
Ophiothrix fragilis	••	Occasional
Echinus esculentus	•••	Frequent
Clavelina lepadiformis	••	Occasional
Botryllus schlosseri	••	Occasional
Palmaria palmata	••	Frequent
Dilsea carnosa	••	Occasional
Callophyllis laciniata	••	Occasional
Corallinaceae	•••	Common
Corallina officinalis	••	Frequent
Chondrus crispus	••	Occasional
Plocamium cartilagineum	•••	Frequent
Cryptopleura ramosa	••	Frequent
Delesseria sanguinea	•••	Frequent
Hypoglossum hypoglossoides	••	Occasional

Membranoptera alata	••	Occasional
Phycodrys rubens	•••	Frequent
Dictyota dichotoma	••	Frequent
Laminaria digitata	•••	Abundant
Laminaria hyperborea	••••	Common
Laminaria saccharina	••	Occasional

IR.MIR.KR.Ldig *Laminaria digitata* on moderately exposed sublittoral fringe rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock; boulders
Zone:	Sublittoral fringe
Height band:	Lower shore
Depth band:	0-5 m

Previous code

LRK.LDIG	6.95

Biotope description

Exposed to moderately exposed sublittoral fringe rock characterised by the kelp *Laminaria digitata* with coralline crusts covering the rock beneath the kelp canopy. Foliose red seaweeds such as *Palmaria palmata*, *Membranoptera alata*, *Chondrus crispus* and *Mastocarpus stellatus* are often present along with the calcareous *Corallina officinalis*. The brown seaweed *Fucus serratus* and the green seaweeds *Cladophora rupestris* and *Ulva lactuca* can be present as well. The sponge *Halichondria panicea* can be found among the kelp holdfasts or underneath overhangs. Also present on the rock are the tube-building polychaete *Pomatoceros triqueter*, the gastropods *Patella vulgata* and *Gibbula cineraria*. The bryozoan *Electra pilosa* can form colonies on especially *C. crispus*, *M. stellatus* and *F. serratus* while the hydroid *Dynanema pumila* are more common on the kelp. Three variants of this biotope are described: *L. digitata* forest on rocky shores (Ldig.Ldig). *L. digitata* on boulder shores (Ldig.Bo) and soft rock supporting *L. digitata*, such as the chalk found in south-east England (Ldig.Pid). For *L. digitata* in sheltered, tide-swept conditions see LdigT.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	●●●	Occasional	3
Dynamena pumila	●●	Occasional	1
Pomatoceros triqueter	●●●	Occasional	2
Patella vulgata	●●	Occasional	1
Gibbula cineraria	●●●	Frequent	2
Electra pilosa	●●●	Occasional	3
Palmaria palmata	●●●●	Frequent	5
Corallinaceae	●●●●	Abundant	12
Corallina officinalis	●●●	Occasional	3
Mastocarpus stellatus	●●●	Frequent	4
Chondrus crispus	●●●●	Frequent	5
Lomentaria articulata	●●	Occasional	1
Membranoptera alata	●●●	Occasional	2
Laminaria digitata	●●●●●	Abundant	27
Fucus serratus	●●●	Occasional	3
Ulva lactuca	●●	Occasional	1
Cladophora rupestris	●●	Occasional	1

IR.MIR.KR.Ldig.Ldig *Laminaria digitata* on moderately exposed sublittoral fringe rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock; boulders
Zone:	Sublittoral fringe
Height band:	Lower shore
Depth band:	0-5 m

Previous code

LRK.LDIG.LDIG	6.95

Biotope description

Exposed to sheltered sublittoral fringe bedrock or boulders dominated by a dense canopy of *Laminaria digitata* often with a wide range of filamentous and foliose red seaweeds beneath. The most frequently occurring red seaweeds are *Palmaria palmata*, *Corallina officinalis*, *Mastocarpus stellatus*, *Chondrus crispus*, *Lomentaria articulata* and *Membranoptera alata*. Generally the rocky substratum is covered by encrusting coralline algae, on which occasional limpets *Patella vulgata* and topshells *Gibbula cineraria* graze. A wide variety of fauna occurs, some of the most commonly occurring species being the sponge *Halichondria panicea*, the tube-building polychaete *Pomatoceros triqueter* and occasional . Kelp holdfasts provide a refuge for a varied assemblage of species such as sponges and the limpet *Helcion pellucidum*, while encrusting bryozoans such as *Electra pilosa* more often are found on the fronds of foliose red seaweeds. Solitary ascidians may be locally abundant where overhanging or vertical rock occurs, while the hydroid *Dynamena pumila* can be abundant on *Fucus serratus* and *Laminaria* sp. fronds. On exposed, wave-surged shores, the robust red seaweeds *M. stellatus*, *C. crispus* and *C. officinalis* can form a dense turf beneath the kelp along with the occasional green seaweed *Ulva lactuca*. Similarly on such shores the mussel *Mytilus edulis* can occur in extremely dense aggregations on the rock, beneath the kelp canopy.

Situation

This biotope is usually found on the extreme low shore below the *Fucus serratus* zone (Fser) and above the truly sublittoral *Laminaria hyperborea* zone (Lhyp).

Temporal variation

Unknown

Similar biotopes

IR.HIR.KFaR.Ala.Ldig	*Alaria esculenta* is generally at least Common in this biotope and/or of similar abundance to *L. digitata*, with dense mussels and barnacles overgrowing coralline-encrusted rock.
IR.MIR.KR.Ldig.Bo	*L. digitata* on moderately exposed boulder shores and occasionally on exposed or sheltered shores. Other canopy-forming kelps such as *A. esculenta* and *Laminaria saccharina* are not present in this biotope.
IR.MIR.KR.Ldig.Pid	*L. digitata* and rock-boring animals such as piddocks (*Barnea candida*, *Pholas dactylus* and *Petricola pholadiformis*), the bivalve *Hiatella arctica* and worms *Polydora* spp. on soft littoral fringe rock.
IR.MIR.KR.Ldig.Ldig	*L. saccharina* and *L. digitata* generally occur in equal abundance on silted, sheltered rock. Kelps often 'cape-form'. Fewer faunal species and fewer red seaweeds is present, but *Chorda filum* often present.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	●●●	Occasional	3
Dynamena pumila	●●	Occasional	1
Pomatoceros triqueter	●●●	Occasional	1
Patella vulgata	●●	Occasional	2
Helcion pellucidum	●●	Occasional	1
Gibbula cineraria	●●●	Occasional	2
Mytilus edulis	●●	Occasional	1
Electra pilosa	●●●	Occasional	3
Palmaria palmata	●●●●	Frequent	5
Corallinaceae	●●●●	Abundant	13
Corallina officinalis	●●●	Occasional	4
Mastocarpus stellatus	●●●	Frequent	4
Chondrus crispus	●●●●	Frequent	4
Lomentaria articulata	●●	Occasional	1
Membranoptera alata	●●●	Occasional	2
Laminaria digitata	●●●●●	Abundant	29
Fucus serratus	●●●	Occasional	3
Ulva lactuca	●●	Occasional	1

IR.MIR.KR.Ldig.Bo *Laminaria digitata* and under-boulder fauna on sublittoral fringe boulders

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Boulders
Zone:	Sublittoral fringe
Height band:	Lower shore
Depth band:	0-5 m
Other features:	Under-boulder habitats

Previous code

MIR.Ldig.Bo	96.7
LRK.BSP in part	6.95
MIR.Ldig.Ldig.Bo	97.06

Biotope description

This *Laminaria digitata* biotope is found predominantly on moderately exposed boulder shores and occasionally also on exposed or sheltered shores. Upper surfaces of the boulders are colonised by dense *L. digitata* though other kelp such as *Laminaria hyperborea* and *Laminaria saccharina* or the wrack *Fucus serratus* can be present at lower abundance. The kelp fronds can be colonised by the bryozoan *Membranipora membranacea*. Beneath the kelp canopy are a variety of red seaweeds such as *Mastocarpus stellatus, Chondrus crispus, Palmaria palmata, Membranoptera alata, Corallina officinalis* and coralline crusts. Green seaweeds include *Cladophora rupestris* and *Ulva lactuca*. Where space is available beneath the boulders (i.e. they are not buried in sediment) there may be a rich assemblage of animals. Characteristic species include the crabs *Porcellana platycheles, Pisidia longicornis* and juvenile *Cancer pagurus*. Also present beneath the boulders are often high densities of the barnacle *Balanus crenatus*, the tube-building polychaete *Pomatoceros triqueter*, spirorbid worms, the polychaete *Harmotho‰* sp., gammarid amphipods and a few gastropods such as *Gibbula cineraria*. The encrusting bryozoans *Electra pilosa* and *Umbonula littoralis* and encrusting colonies of the sponges *Halichondria panicea* and *Halisarca dujardini* are also typical of this habitat. The richest examples also contain a variety of echinoderms such as *Asterias rubens*, colonial ascidians such as *Botryllus schlosseri* and small hydroids.

Situation

This biotope is found in a similar situation to Ldig.Ldig, usually beneath the *Fucus serratus* zone (Fser.Bo or Fser.R) and above the *Laminaria hyperborea* zone (Lhyp). Many of the animals found under boulders in the lower shore in Fser.Bo are also found under boulders in the sublittoral fringe (Ldig.Bo), particularly the sponges and crabs. Similarly, many of the seaweeds present on the lower shore are also present in the shallow sublittoral fringe.

Temporal variation

Unknown

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	●●●●●	Occasional	5
Halisarca dujardini	●●●	Occasional	1
Harmothoe	●●●	Occasional	1
Pomatoceros triqueter	●●●●	Occasional	4
Spirorbidae	●●●	Frequent	2
Balanus crenatus	●●●	Frequent	2
Pisidia longicornis	●●	Occasional	1
Porcellana platycheles	●●	Occasional	1

Cancer pagurus	●●●	Rare	1
Gibbula cineraria	●●●●	Occasional	3
Umbonula littoralis	●●	Frequent	1
Membranipora membranacea	●●●	Occasional	1
Electra pilosa	●●●●	Occasional	4
Asterias rubens	●●●	Occasional	1
Botryllus schlosseri	●●●	Occasional	2
Palmaria palmata	●●●●	Frequent	4
Corallinaceae	●●●●●	Common	10
Corallina officinalis	●●●●	Occasional	2
Mastocarpus stellatus	●●●	Frequent	2
Chondrus crispus	●●●●●	Frequent	6
Membranoptera alata	●●●	Occasional	1
Laminaria digitata	●●●●●	Abundant	15
Laminaria hyperborea	●●●	Occasional	1
Laminaria saccharina	●●●	Occasional	1
Fucus serratus	●●●●	Occasional	2
Ulva lactuca	●●●	Occasional	1
Cladophora rupestris	●●●	Frequent	2

IR.MIR.KR.Ldig.Pid *Laminaria digitata* and piddocks on sublittoral fringe soft rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock
Zone:	Sublittoral fringe
Height band:	Lower shore
Other features:	Soft rock such as chalk and limestone

Previous code

LRK.LDIG.PID	6.95

Biotope description

Soft rock, such as chalk, in the sublittoral fringe characterised by *Laminaria digitata* and rock-boring animals such as piddocks *Barnea candida* and *Pholas dactylus*, the bivalve *Hiatella arctica* and worms *Polydora* spp. Beneath the kelp forest, a wide variety of foliose red seaweeds occur such as *Palmaria palmata*, *Chondrus crispus*, *Membranoptera alata* and *Halurus flosculosus*. Filamentous red seaweeds often present are *Polysiphonia fucoides* and *Ceramium nodulosum*, while coralline crusts cover available rock surface. The bryozoan *Membranipora membranacea* and the hydroid *Dynanema pumila* can form colonies on the kelp fronds, while the bryozoan *Electra pilosa* more often occur on the foliose red seaweeds. Empty piddock burrows are often colonised by the polychaete *Sabellaria spinulosa* or in more shaded areas the sponges *Halichondria panicea* and *Hymeniacidon perleve*. The undersides of small chalk boulders are colonised by encrusting bryozoans, colonial ascidians and the tube-building polychaete *Pomatoceros lamarcki*. The boulders and any crevices within the chalk provide a refuge for small crustaceans such as *Carcinus maenas*, the mussel *Mytilus edulis* or the barnacle *Semibalanus balanoides*. The echinoderm *Asterias rubens* is present as well.

Situation

This biotope occurs on moderately exposed soft rock where Ldig.Ldig would normally occur. Above it may lie a zone of *Fucus serratus* on similarly bored soft rock (Fser.Pid) or a variant of one of the *F. serratus* biotopes (Fser.R or Fser.Fser). Lower shore sites influenced by sand may have more *Mytilus edulis* beneath the seaweed canopy (MytFR) or the sand-binding red seaweed *Rhodothamniella floridula* (Rho). Below the Ldig.Pid biotope a variety of biotopes can occur such as LsacChoR on unstable infralittoral cobbles and boulders or even MCR.Pid in the turbid waters of south-east England where the kelp generally extends to less than 4m BCD.

Temporal variation

The under-storey of foliose and filamentous seaweeds will diminish towards the autumn and regrow in the spring. Since the soft rock does not provide a strong hold for the seaweeds they are easily dislodged during storm periods. After such an event the green seaweeds *Enteromorpha* spp. and *Ulva* spp. and/or the red seaweed *P. palmata* may temporarily cover much of the rock. Eventually a more diverse range of seaweeds and associated animals will re-establish on the rock.

Similar biotopes

IR.MIR.KR.Ldig.Ldig	Dense canopy of *L. digitata* on exposed to sheltered sublittoral fringe bedrock or boulders often with a wide range of filamentous and foliose red seaweeds beneath. Without the rock-boring fauna such as piddocks *B. candida*, *P. dactylus* and *P. pholadiformis*, the bivalve *H. arctica* and worms *Polydora* spp. associated soft rock biotopes.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	••••	Occasional	3
Hymeniacidon perleve	••••	Occasional	2
Dynamena pumila	••••	Occasional	4
Polydora	•••••	Abundant	9
Sabellaria spinulosa	•••	Common	1
Pomatoceros lamarcki	••••	Occasional	1
Semibalanus balanoides	••••	Occasional	2
AMPHIPODA	••••	Common	3
Carcinus maenas	•••	Occasional	1
Mytilus edulis	••••	Occasional	2
Hiatella arctica	•••••	Frequent	5
Pholas dactylus	••••	Common	5
Barnea	•••	Common	1
Membranipora membranacea	•••	Occasional	2
Electra pilosa	•••••	Common	7
Asterias rubens	••••	Occasional	1
Palmaria palmata	••••	Common	4
Corallinaceae	•••	Abundant	2
Corallina officinalis	•••	Common	2
Chondrus crispus	••••	Common	3
Ceramium nodulosum	••	Common	1
Polysiphonia fucoides	••••	Frequent	3
Laminaria digitata	•••••	Abundant	14

IR.MIR.KR.LhypT *Laminaria hyperborea* on tide-swept, infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Strong, Moderately strong
Substratum:	Bedrock & boulders
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Wave exposed to moderately wave exposed, tide-swept bedrock and boulders with *Laminaria hyperborea*, characterised by a rich under-storey and stipe flora of foliose seaweeds including the brown seaweed *Dictyota dichotoma*. The kelp stipes support epiphytes such as *Cryptopleura ramosa* and *Phycodrys rubens*. At some sites, instead of being covered by red seaweeds, the kelp stipes are heavily encrusted by the ascidian *Botryllus schlosseri*. Epilithic seaweeds *Delesseria sanguinea*, *Plocamium cartilagineum Heterosiphonia plumosa*, *Hypoglossum hypoglossoides*, *Callophyllis laciniata*, *Kallymenia reniformis*, *Brongniartella byssoides* and crustose seaweeds commonly occur beneath the kelp. The kelp fronds are often covered with growth of the hydroid *Obelia geniculata* or the bryozoan *Membranipora membranacea*. On the rock surface, a rich fauna comprising the bryozoan *Electra pilosa*, the sponge *Pachymatisma johnstonia*, anthozoans such as *Alcyonium digitatum*, *Sagartia elegans* and *Urticina felina*, colonial ascidians such as *Clavelina lepadiformis*, the calcareous tubeworm *Pomatoceros triqueter* and the barnacle *Balanus crenatus* occur. More mobile species include the gastropod *Calliostoma zizyphinum*, the crab *Cancer pagurus* and the echinoderms *Asterias rubens* and *Echinus esculentus*. Two variants have been described: Tide-swept kelp forest (LhypT.Ft) and tide-swept kelp park (LhypT.Pk).

Situation

This biotope occurs below *Alaria esculenta* (Ala) at exposed sites or *L. digitata* (Ldig.Ldig) at moderately exposed locations. With increasing depth the kelp density diminishes to become tide-swept kelp park (LhypT.Pk).

Temporal variation

Unknown

Similar biotopes

HIR.LhypFa	On very exposed coasts subject to weaker tidal currents. The fauna turf is characterised by a higher abundance of anthozoans such as *Corynactis viridis* and *Sargartia elegans*, but topshells such *Calliostoma zizyphi*num and *Gibbula cineraria* are also common. Red seaweeds are present but less dense than LhypT.Ft.
MIR.LhypTX	Occurs under similar wave exposure and tidal stream conditions, but on mixed substrata.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pachymatisma johnstonia	●●●	Occasional	1
Obelia geniculata	●●	Frequent	1

Alcyonium digitatum	●●●	Occasional	2
Urticina felina	●●●	Occasional	1
Sagartia elegans	●●	Occasional	1
Pomatoceros triqueter	●●	Occasional	1
Balanus crenatus	●●●	Frequent	2
Cancer pagurus	●●●	Occasional	1
Calliostoma zizyphinum	●●●	Occasional	1
Membranipora membranacea	●●●	Frequent	2
Electra pilosa	●●	Frequent	1
Asterias rubens	●●●●	Occasional	3
Echinus esculentus	●●●	Occasional	2
Clavelina lepadiformis	●●●	Occasional	2
Botryllus schlosseri	●●●	Occasional	1
Callophyllis laciniata	●●●	Occasional	2
Kallymenia reniformis	●●●	Occasional	1
Corallinaceae	●●●●	Frequent	5
Plocamium cartilagineum	●●●●	Frequent	6
Cryptopleura ramosa	●●●●	Frequent	3
Delesseria sanguinea	●●●●	Frequent	6
Hypoglossum hypoglossoides	●●●	Occasional	2
Phycodrys rubens	●●●	Frequent	3
Heterosiphonia plumosa	●●●	Frequent	2
Brongniartella byssoides	●●●	Occasional	2
Dictyota dichotoma	●●●●	Frequent	3
Laminaria hyperborea	●●●●●	Common	13

IR.MIR.KR.LhypT.Ft *Laminaria hyperborea* forest, foliose red seaweeds and a diverse fauna on tide-swept upper infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Strong, Moderately strong
Substratum:	Bedrock; boulders
Zone:	Infralittoral - upper
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Exposed to moderately exposed, tide-swept bedrock and boulders, with dense *Laminaria hyperborea* forest, characterised by a rich under-storey and stipe flora of foliose seaweeds. The kelp stipes support epiphytes such as *Callophyllis laciniata*, *Corallina officinalis*, *Cryptopleura ramosa*, *Membranoptera alata*, and *Phycodrys rubens.* At some sites, instead of being covered by red seaweeds, the kelp stipes are heavily encrusted by the ascidians *Botryllus schlosseri* and in the south-west *Distomus variolosus.* Epilithic seaweeds (*Dilsea carnosa*, *Hypoglossum hypoglossoides*, *Delesseria sanguinea*, *Plocamium cartilagineum*, *Brongniartella byssoides*, and *Dictyota dichotoma*) and crustose seaweeds commonly occur beneath the kelp. The kelp fronds are often covered with growth of the hydroid *Obelia geniculata* or the bryozoan *Membranipora membranacea.* Although these species are also found in most kelp forests, in this biotope they are particularly dense. On the rock surface, a rich fauna comprising of the sponges *Pachymatisma johnstonia*, *Halichondria panicea*, *Esperiopsis fucorum* and *Dysidea fragilis*, anthozoans such as *Urticina felina*, *Alcyonium digitatum* and *Caryophilia smithii*, the barnacle *Balanus crenatus*, colonial ascidians such as *Clavelina lepadiformis*, and the gastropods *Calliostoma zizyphinum* and *Gibbula cineraria*, occur. Also found on the rock is the echinoderm *Asterias rubens* and the crab *Cancer pagurus*.

Situation

This biotope occurs below *Alaria esculenta* (Ala) at exposed sites or *L. digitata* (Ldig.Ldig) at moderately exposed locations. With increasing depth the kelp density diminishes to become tide-swept kelp park (LhypT.Pk).

Temporal variation

Unknown

Similar biotopes

HIR.LhypFa	On very exposed coasts subject to weaker tidal currents. The fauna turf is characterised by a higher abundance of anthozoans such as *Corynactis viridis* and *Sargartia elegans*, but topshells such *C. zizyphi*num and *Gibbula cineraria* are also common. Red seaweeds are present but less dense than LhypT.Ft.
MIR.LhypT.Pk	Found in similar tide-swept conditions, often forming a zone below the kelp forest (LhypT.Ft) in deeper water where the kelp is less dense and more upper circalittoral species occurs.
MIR.Lhyp.Ft	Found in areas similar wave exposure but not subject to accelerated tidal currents and lacks therefore a prominent filter feeder community. The large variety of sponges such as *H. panicea* and *Esperiopsis fucorum*, the bryozoans *A. diaphanum* and *Flustra foliacea* and the barnacle *Balanus balanus* are not found in great abundance in the kelp forest.
MIR.LhypTX.Ft	Found in similar tide swept conditions, but on mixed substrata.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pachymatisma johnstonia	●●●	Occasional	2
Halichondria panicea	●●	Occasional	1
Esperiopsis fucorum	●●	Occasional	1
Dysidea fragilis	●●	Occasional	2
Obelia geniculata	●●●	Frequent	1
Alcyonium digitatum	●●●	Occasional	2
Urticina felina	●●●	Occasional	1
Caryophyllia smithii	●●	Occasional	1
Balanus crenatus	●●	Occasional	1
Cancer pagurus	●●●	Present	1
Membranipora membranacea	●●●	Present	2
Asterias rubens	●●●●	Present	3
Clavelina lepadiformis	●●●	Occasional	2
Botryllus schlosseri	●●●	Occasional	3
Dilsea carnosa	●●●	Occasional	2
Callophyllis laciniata	●●●	Occasional	2
Corallinaceae	●●●●	Frequent	3
Corallina officinalis	●●	Occasional	1
Plocamium cartilagineum	●●●●	Frequent	6
Cryptopleura ramosa	●●●●	Frequent	3
Delesseria sanguinea	●●●●	Frequent	4
Hypoglossum hypoglossoides	●●	Frequent	1
Membranoptera alata	●●●	Occasional	1
Phycodrys rubens	●●●●	Frequent	3
Brongniartella byssoides	●●●	Occasional	2
Dictyota dichotoma	●●●	Frequent	2
Laminaria hyperborea	●●●●●	Abundant	10

IR.MIR.KR.LhypT.Pk *Laminaria hyperborea* park with hydroids, bryozoans and sponges on tide-swept lower infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Strong, Moderately strong
Substratum:	Bedrock and boulders
Zone:	Infralittoral - lower
Depth band:	5-10 m, 10-20 m

Biotope description

Exposed to moderately wave-exposed, strongly tide-swept, rock with *Laminaria hyperborea* park characterised by a rich under-storey and stipe flora of foliose seaweeds such as *Phycodrys rubens*, *Plocamium cartilagineum*, *Hypoglossum hypoglossoides*, *Kallymenia reniformis*, *Cryptopleura ramosa* and *Delesseria sanguinea*. The red seaweed *Heterosiphonia plumosa* can be present. The foliose brown seaweed *Dictyota dichotoma* and coralline crust are often present as well. Amongst the red seaweeds is a rich fauna comprising sponges (*Pachymatisma johnstonia*, *Stelligera rigida*, *Esperiopsis fucorum* and *Dysidea fragilis*), anthozoans (*Alcyonium digitatum* and *Caryophyllia smithii*), hydroids (*Aglaophenia pluma* and *Nemertesia antennina*), colonial ascidians (*Clavelina lepadiformis* and *Morchellium argus*) and bryozoans such as *Electra pilosa*. Both the flora and fauna of this biotope are similar to the wave exposed kelp park (LhypR.Pk), but LhypT.Pk has a greater faunal component including the barnacle *Balanus crenatus*, the echinoderm *Asterias rubens* and the crab *Necora puber*.

Situation

This biotope generally occurs below a tide-swept *L. hyperborea* kelp forest (LhypT.Ft). As this biotope occurs over such a range of wave exposures a variety of circalittoral biotopes can occur beneath it: for example, Exposed, tide-swept rock (FaT) or moderately exposed tide-swept rock (EcCr).

Temporal variation

Unknown

Similar biotopes

MIR.Lhyp.Pk	Found in areas of similar wave exposure but not subject to accelerated tidal currents. Although similar red seaweeds dominate these kelp forests the faunal component is more conspicuous in the tide-swept biotope (higher diversity of sponges, hydroids and anthozoans).
MIR.LhypT	Found in similar tide-swept conditions, often forming a zone above the kelp forest (LhypT.Ft) in shallower water with higher abundance of *L. hyperborea*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pachymatisma johnstonia	●●●	Occasional	3
Stelligera rigida	●●	Occasional	1
Esperiopsis fucorum	●●	Occasional	1

Dysidea fragilis	●●●	Occasional	3
Aglaophenia pluma	●●	Occasional	2
Nemertesia antennina	●●●	Occasional	2
Alcyonium digitatum	●●●	Occasional	1
Caryophyllia smithii	●●●	Occasional	1
Balanus crenatus	●●●	Common	2
Necora puber	●●	Occasional	2
Electra pilosa	●●	Frequent	1
Asterias rubens	●●●	Occasional	2
Clavelina lepadiformis	●●●	Occasional	1
Morchellium argus	●●	Frequent	1
Kallymenia reniformis	●●●	Occasional	2
Corallinaceae	●●●●●	Frequent	5
Plocamium cartilagineum	●●●●●	Frequent	5
Cryptopleura ramosa	●●●●	Frequent	3
Delesseria sanguinea	●●●●●	Frequent	6
Hypoglossum hypoglossoides	●●●	Occasional	2
Phycodrys rubens	●●●	Frequent	1
Heterosiphonia plumosa	●●●●	Frequent	3
Dictyota dichotoma	●●●●	Frequent	5
Laminaria hyperborea	●●●●●	Frequent	7

IR.MIR.KR.LhypTX *Laminaria hyperborea* on tide-swept, infralittoral mixed substrata.

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Boulders, cobbles, pebbles and gravel
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m

Biotope description

Wave-exposed through to wave-sheltered, tide-swept infralittoral mixed substrata with *Laminaria hyperborea* forest/park and other kelp species such as *Laminaria saccharina*. The rich under-storey and stipe flora is characterised by foliose seaweeds including the brown algae *Dictyota dichotoma*. The kelp stipes support epiphytes such as *Cryptopleura ramosa*, *Callophyllis laciniata* and *Phycodrys rubens*. At some sites, instead of being covered by red seaweeds, the kelp stipes are heavily encrusted by the ascidians *Botryllus schlosseri* and the bryozoan *Alcyonidium diaphanum*. Epilithic seaweeds such as *Desmerestia aculeata*, *Odonthalia dentate*, *Delesseria sanguinea*, *Plocamium cartilagineum*, *Callophyllis laciniata*, and crustose seaweeds commonly occur beneath the kelp. The kelp fronds are often covered with growths of the hydroid *Obelia geniculata* or the bryozoan *Membranipora membranacea*. On the rock surface, a rich fauna comprising anthozoans such as *Alcyonium digitatum* and *Urticina felina*, colonial ascidians such as *Clavelina lepadiformis* and the calcareous tubeworm *Pomatoceros triqueter* occurs. More mobile species include the gastropods *Gibulla cineria* and *Calliostoma zizyphinum*, the crab *Cancer pagurus* and the echinoderms *Crossaster papposus*, *Henricia oculata*, *Asterias rubens* and *Echinus esculentus*. Two variants are described; tide-swept kelp forest on upper infralittoral mixed substrata (LhypTX.Ft) and tide-swept kelp park on lower infralittoral mixed substrata (LhypTX.Pk).

Similar biotopes

IR.MIR.KR.LhypT	Found under similar wave exposure and tidal stream conditions, but on bedrock and boulder substratum.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	••	Present	1
Alcyonium digitatum	•••	Present	1
Urticina felina	•••	Rare	1
Pomatoceros triqueter	•••	Present	2
Cancer pagurus	•••	Present	2
Gibbula cineraria	•••	Present	2
Calliostoma zizyphinum	••••	Present	4
Alcyonidium diaphanum	•••	Present	2
Membranipora membranacea	••	Present	1
Crossaster papposus	•••	Present	1
Henricia oculata	••	Present	1
Asterias rubens	••••	Present	4
Echinus esculentus	••••	Present	5
Clavelina lepadiformis	••	Present	1
Botryllus schlosseri	•••	Present	2

Callophyllis laciniata	●●●	Present	2
Lithophyllum	●●●	Present	2
Plocamium cartilagineum	●●●●	Present	4
Cryptopleura ramosa	●●●	Present	2
Delesseria sanguinea	●●●●	Present	4
Phycodrys rubens	●●●●	Present	3
Odonthalia dentata	●●●	Present	2
Dictyota dichotoma	●●●	Present	2
Desmarestia aculeata	●●	Present	1
Laminaria hyperborea	●●●●●	Present	6

IR.MIR.KR.LhypTX.Ft *Laminaria hyperborea* forest and foliose red seaweeds on tide-swept, upper infralittoral mixed substrata.

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	Strong, Moderately strong, Weak, Very weak
Substratum:	Bedrock, boulders, cobbles, pebbles and gravel
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Moderately wave-exposed to wave sheltered, tide-swept mixed substrata, with dense *Laminaria hyperborea* forest and sparser *Laminaria saccharina*, characterised by an under-storey and stipe flora of foliose seaweeds. The kelp stipes support epiphytes such as *Palmaria palmata Callophyllis laciniata, Cryptopleura ramosa, Membranoptera alata*, and *Phycodrys rubens.* At some sites, instead of being covered by red seaweeds, the kelp stipes are heavily encrusted by the ascidians *Botryllus schlosseri* and in the south-west *Distomus variolosus.* Epilithic seaweeds (*Delesseria sanguinea, Plocamium cartilagineum, Odonthalia dentata, Dictyota dichotoma* and *Desmarestia aculeata*) and crustose seaweeds commonly occur beneath the kelp. The kelp fronds are often covered with growth of the hydroid *Obelia geniculata* or the bryozoan *Membranipora membranacea.* Although these species are also found in most kelp forests, in this biotope they are particularly dense. On the rock surface, a rich fauna comprising anthozoans such as *Urticina felina*, the barnacle *Balanus crenatus*, the calcareous tubeworm *Pomatoceros triqueter*, colonial ascidians such as *Clavelina lepadiformis*, the gastropods *Calliostoma zizyphinum* and *Gibbula cineraria*, and the bryozoans *Electra pilosa* and *Alcyonidium diaphanum* occur. Also found on the rock are the echinoderms *Echinus esculentus, Asterias rubens and Ophiothrix fragilis*, and the crabs *Cancer pagurus, Pagurus bernhardus* and *Necora puber*.

Similar biotopes

MIR.LhypTX.Pk	Found in more tide-swept conditions, often forming a zone below the kelp forest (LhypTX.Ft) in deeper water where the kelp is less dense and more upper circalittoral species occurs.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	●●●	Present	2
Urticina felina	●●●	Present	2
Pomatoceros triqueter	●●●	Present	2
Balanus crenatus	●●	Occasional	1
Pagurus bernhardus	●●	Present	1
Cancer pagurus	●●●	Present	3
Necora puber	●●●	Present	2
Gibbula cineraria	●●●●	Present	3
Calliostoma zizyphinum	●●●●	Present	4
Alcyonidium diaphanum	●●●	Present	1
Membranipora membranacea	●●●	Present	2
Electra pilosa	●●●	Present	2
Asterias rubens	●●●●	Present	5
Ophiothrix fragilis	●●	Present	1

Echinus esculentus	●●●●	Present	5
Clavelina lepadiformis	●●●	Present	2
Botryllus schlosseri	●●●	Present	2
Palmaria palmata	●●●	Present	1
Callophyllis laciniata	●●●	Present	2
Lithophyllum	●●●	Present	1
Plocamium cartilagineum	●●●●	Present	3
Cryptopleura ramosa	●●●	Present	2
Delesseria sanguinea	●●●●	Present	3
Membranoptera alata	●●●	Present	2
Phycodrys rubens	●●●●	Present	3
Odonthalia dentata	●●●	Present	3
Dictyota dichotoma	●●●	Present	1
Desmarestia aculeata	●●●	Present	3
Laminaria hyperborea	●●●●●	Present	5
Laminaria saccharina	●●●●	Present	4

IR.MIR.KR.LhypTX.Pk *Laminaria hyperborea* park and foliose red seaweeds on tide-swept, lower infralittoral mixed substrata.

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Very strong, Strong, Moderately strong
Substratum:	Boulders, cobbles, pebbles & gravel
Zone:	Infralittoral - lower
Depth band:	10-20 m, 20-30 m

Biotope description

Exposed to moderately wave-exposed, tide-swept, Infralittoral mixed substrata with *Laminaria hyperborea* park characterised by an under-storey and stipe flora of foliose seaweeds such as *Phycodrys rubens*, *Plocamium cartilagineum*, *Hypoglossum hypoglossoides*, *Kallymenia reniformis*, *Cryptopleura ramosa* and *Delesseria sanguinea*. Epilithic seaweeds (*Bonnemaisonia asparagoides*, *Callophyllis laciniata*, *Lomentaria orcadensis* and *Brongniartella byssoides*) and crustose seaweeds commonly occur beneath the kelp. The foliose brown seaweed *Dictyota dichotoma* is often present as well. Amongst the red seaweeds is a fairly diverse fauna comprising sponges (*Scypha ciliate*), anthozoans (*Alcyonium digitatum*, *Urticina felina* and *Caryophyllia smithii*), hydroids (*Tubularia indivisa*, *Halecium halecinum*, *Sertularia argentea* and *Nemertesia antennina*), colonial ascidians (*Botryllus schlosseri*) and bryozoans such as *Alcyonium diaphanum*. On the rock surface, the calcareous tubeworm *Pomatoceros triqueter*, the crab *Cancer pagurus* and the gastropods *Gibbula cineraria* and *Calliostoma zizyphinum* may be found. A diverse range of echinoderms are also found in this biotope: *Crossaster papposus*, *Henricia oculata*, *Asterias rubens*, *Echinus esculentus* and *Ophiothrix fragilis*.

Similar biotopes

MIR.LhypT.Pk	Occurs over similar range of tidal streams but found on bedrock and boulders.
MIR.LhypTX.Ft	Occurs on similar substrata but in shallower water depths in the upper infralittoral kelp forest zone.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Scypha ciliata	●●●	Present	1
Tubularia indivisa	●●●	Present	1
Halecium halecinum	●●●	Present	1
Nemertesia antennina	●●●	Present	2
Sertularia argentea	●●●	Present	1
Alcyonium digitatum	●●●	Present	3
Urticina felina	●●	Rare	1
Caryophyllia smithii	●●●	Present	2
Pomatoceros triqueter	●●●	Present	2
Cancer pagurus	●●●	Present	2
Gibbula cineraria	●●●	Rare	2
Calliostoma zizyphinum	●●●●	Present	4
Alcyonidium diaphanum	●●●	Present	2
Crossaster papposus	●●●	Present	2
Henricia oculata	●●●	Present	1
Asterias rubens	●●●●	Present	4

Ophiothrix fragilis	●●●	Present	1
Echinus esculentus	●●●●●	Present	6
Botryllus schlosseri	●●	Present	1
Bonnemaisonia asparagoides	●●	Present	1
Callophyllis laciniata	●●●●	Present	2
Kallymenia reniformis	●●●	Present	1
Plocamium cartilagineum	●●●●	Present	4
Lomentaria orcadensis	●●●	Present	1
Cryptopleura ramosa	●●●	Present	2
Delesseria sanguinea	●●●●	Present	4
Hypoglossum hypoglossoides	●●●	Present	1
Phycodrys rubens	●●●	Present	2
Brongniartella byssoides	●●●	Present	1
Dictyota dichotoma	●●●	Present	1
Laminaria hyperborea	●●●●●	Present	6

IR.MIR.KR.Lhyp *Laminaria hyperborea* and foliose red seaweeds on moderately exposed infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Moderately exposed infralittoral bedrock and boulders characterised by a canopy of the kelp *Laminaria hyperborea* beneath which is an under-storey of foliose red seaweeds and coralline crusts. Some red seaweeds can be found as epiphytes on the kelp stipes and include *Delesseria sanguinea* and *Phycodrys rubens*. Other red seaweeds present include the *Plocamium cartilagineum*, *Callophyllis laciniata*, *Cryptopleura ramosa* and the brown seaweeds *Dictyota dichotoma* and *Cutleria multifida*. The kelp fronds can be colonised by the hydroid *Obelia geniculata* or the bryozoans *Membranipora membranacea*. The echinoderm *Antedon bifida*, the ascidian *Clavelina lepadiformis*, the tube-building polychaete *Pomatoceros triqueter*, the anthozoans *Alcyonium digitatum* and *Urticina felina* can be found on the rock beneath the canopy. Mobile species often present include the gastropods *Gibbula cineraria* and *Calliostoma zizyphinum* and the echinoderms *Echinus esculentus* and *Asterias rubens*. Five variants has been described: Kelp forest (Lhyp.Ft), kelp park (Lhyp.Pk), grazed kelp forest (Lhyp.GzFt), grazed kelp park (Lhyp.GzPk) and kelp with *Sabellaria spinulosa* reefs (Lhyp.Sab). This suite of biotopes differs from the wave exposed *L. hyperborea* biotopes (KFaR) by having a lower diversity of cushion-forming faunal species. The foliose red seaweed component of the two suites of biotopes may also differ in composition with a tendency for Lhyp to include some more delicate filamentous species.

Temporal variation

Not known

Similar biotopes

IR.HIR.KFaR.LhypFa	*L. hyperborea* forest with a faunal cushion (sponges and polyclinids) and foliose red seaweeds on very exposed upper infralittoral rock. Both have dense red algae communities, but Lhyp lacks the dense cushion forming fauna associated with the more exposed biotopes.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	••	Frequent	1
Alcyonium digitatum	•••	Occasional	2
Pomatoceros triqueter	•••	Frequent	3
Gibbula cineraria	•••	Occasional	3
Membranipora membranacea	••	Frequent	1
Antedon bifida	••	Frequent	1
Asterias rubens	••••	Occasional	5
Echinus esculentus	••••	Frequent	6
Clavelina lepadiformis	••	Occasional	1
Callophyllis laciniata	•••	Occasional	2

Corallinaceae	●●●●	Common	9
Plocamium cartilagineum	●●●	Frequent	4
Delesseria sanguinea	●●●	Frequent	4
Phycodrys rubens	●●●	Frequent	4
Cutleria multifida	●●	Frequent	1
Dictyota dichotoma	●●●	Frequent	2
Laminaria hyperborea	●●●●●	Abundant	19

IR.MIR.KR.Lhyp.Ft *Laminaria hyperborea* forest and foliose red seaweeds on moderately exposed upper infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock; large boulders
Zone:	Infralittoral - upper
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Moderately exposed upper infralittoral bedrock and boulders characterised by a dense forest of *Laminaria hyperborea* with dense foliose red seaweeds beneath the canopy. These include *Callophyllis laciniata, Plocamium cartilagineum, Cryptopleura ramosa* and *Delesseria sanguinea*. Kelp stipes are usually covered in a rich mixture of red seaweeds of which *Palmaria palmata, Phycodrys rubens* and *Membranoptera alata* are often present. Small kelp plants can also be found on the larger kelp stipes. Kelp fronds may be covered with a hydroid growth of *Obelia geniculata* or the bryozoans *Membranipora membranacea* and *Electra pilosa*. The kelp holdfasts can be colonised by bryozoans *Scrupocellaria* spp. and/or crisiids and colonial ascidians such as *Botryllus schlosseri*. The rock surface between the kelp plants is generally covered by encrusting coralline algae, often with sponge crusts *Halichondria panicea.* Small vertical surfaces within the kelp forest generally lack kelp plants, instead being characterised by foliose red seaweeds such as *Dictyota dichotoma*, the anthozoans *Alcyonium digitatum, Urticina felina* and *Caryophyllia smithii*, the tube-building polychaete *Pomatoceros triqueter* and gastropods including *Calliostoma zizyphinum* and *Gibbula cineraria*. Many grazers are found in the kelp forest, the most commonly occurring being the gastropods *Gibbula cineraria* and *Calliostoma zizyphinum* and the echinoderm *Echinus esculentus*. Other echinoderms present include *Asterias rubens* and *Antedon bifida* which can be locally abundant, particularly in the north-west.

Situation

This biotope occurs over a wide geographic area and is generally found below the sublittoral fringe *Laminaria digitata* zone (Ldig) and above the *L. hyperborea* park (Lhyp.Pk). In the north, Shetland in particular, LsacSac can occur in the lower infralittoral; where grazing influence is present the abundance of red seaweeds may be much reduced (Lhyp.GzPk). In turbid water kelp park is often absent and dense foliose seaweed cover may occur instead (XFoR). In areas affected by scour, such as the rock-sediment interface at the base of bedrock slopes, a mixed kelp canopy can develop below the kelp forest (XKScrR).

Temporal variation

The under-storey of foliose and filamentous seaweeds will diminish towards the autumn and regrow in the spring. Otherwise this biotope is not known to vary markedly over time. Certain areas are prone to urchin grazing and this can substantially alter the community structure of the biotope, such that any site subject to intensive urchin grazing should be recorded as Lhyp.GzFt.

Similar biotopes

IR.LIR.K.LhypCape	Occurs in very and extremely sheltered silted sites. Ascidians such as *Ascidia mentula, Ascidiella aspersa, Ascidiella scabra* and *Clavelina lepadiformi* are more common and foliose red seaweeds such as *Callophyllis laciniata, Plocamium cartilagineum, Cryptopleura ramosa* and *Delesseria sanguinea* form a silted understorey on the rock. The filamentous red seaweed

Bonnemaisonia hamifera may carpet the seabed.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	••	Frequent	2
Urticina felina	•••	Occasional	2
Pomatoceros triqueter	•••	Frequent	3
Gibbula cineraria	••••	Frequent	4
Calliostoma zizyphinum	•••	Occasional	1
Membranipora membranacea	•••	Frequent	2
Electra pilosa	••	Frequent	1
Asterias rubens	••••	Occasional	3
Echinus esculentus	•••	Occasional	3
Botryllus schlosseri	•••	Occasional	3
Palmaria palmata	••	Frequent	1
Callophyllis laciniata	•••	Occasional	2
Corallinaceae	••••	Common	6
Plocamium cartilagineum	••••	Frequent	5
Cryptopleura ramosa	•••	Frequent	3
Delesseria sanguinea	••••	Frequent	5
Membranoptera alata	•••	Occasional	2
Phycodrys rubens	••••	Frequent	4
Dictyota dichotoma	•••	Frequent	2
Laminaria hyperborea	•••••	Abundant	22

IR.MIR.KR.Lhyp.Pk *Laminaria hyperborea* park and foliose red seaweeds on moderately exposed lower infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral - lower
Depth band:	5-10 m, 10-20 m

Biotope description

Below the dense kelp forest (Lhyp.Ft) on moderately exposed lower infralittoral bedrock and boulders, the kelp thins out to form a park. Beneath the kelp, the rock and kelp stipes are covered by an often dense turf of foliose red seaweeds such as *Callophyllis laciniata*, *Plocamium cartilagineum*, *Delesseria sanguinea*, *Hypoglossum hypoglossoides*, *Cryptopleura ramosa*, *Callophyllis laciniata* and *Phycodrys rubens*. Coralline crusts are often present on the rock surface. Many species of red seaweed found in this biotope occur at greater abundance in the shallower kelp forest. Other seaweeds, such as the red seaweeds *Bonnemaisonia asparagoides* and *Hypoglossum hypoglossoides* as well as the brown seaweed *Dictyota dichotoma* are more abundant in this zone than the upper infralittoral. The faunal component of this biotope is similar to that found below the kelp in the upper infralittoral zone and include the hydroid *Obelia geniculata*, the ascidian *Clavelina lepadiformis*, the anthozoans *Urticina felina*, *Alcyonium digitatum* and *Caryophyllia smithii*, the tube-building polychaete *Pomatoceros triqueter* and the gastropods *Calliostoma zizyphinum* and *Gibbula cineraria*. The gastropods *Gibbula cineraria* and *Calliostoma zizyphinum* and the echinoderm *Echinus esculentus* can be found grazing on the rock. Other echinoderms present include *Asterias rubens* and *Antedon bifida* which can be locally abundant, particularly in the north-west.

Situation

This biotope generally occurs below *L. hyperborea* forest (Lhyp.Ft) and marks the lower limit of the infralittoral rock. Occasionally a narrow band of foliose seaweeds (FoR) may occur below the kelp park but generally circalittoral biotopes are found.

Temporal variation

The under-storey of foliose and filamentous seaweeds will diminish towards the autumn and regrow in the spring. When grazing urchins (predominantly *E. esculentus*) reach a large number in the kelp park their voracious grazing can substantially alter the community structure of the biotope, removing most of the seaweeds and leaving only coralline crusts on the rock. This is common around the coast of Scotland, particularly in Shetland and such sites should be recorded as Lhyp.GzFt.

Similar biotopes

IR.HIR.KFaR.LhypR.Pk	Found in areas of greater wave exposure and has a greater faunal component (cushion sponges, anthozoans: *Sagartia elegans*, *Corynactis viridis* and *Actinothoe sphyrodeta*, more bryozoans such as *Crisia* spp. and epilithic bryozoan crusts).
IR.MIR.KR.Lhyp.Ft	Found above the kelp park and has a greater abundance of kelps but similar species composition.
IR.MIR.KR.LhypT.Pk	Occurs in sites subject to accelerated tidal currents, generally with a more prominent filter feeder community. A larger variety of sponges such as *Halichondria panicea* and *Esperiopsis fucorum*, the bryozoans *Alcyonidium diaphanum* and *Flustra foliacea* and the barnacle *Balanus balanus* are found

	in greater abundance in the tide-swept kelp park.
IR.MIR.KR.Lhyp.GzPk	Lacks the dense understorey of red seaweeds beneath the kelp canopy with the brown seaweeds *D. dichotoma* and *Desmarestia* spp. more prominent on the rock. The kelp stipes may still be covered with dense seaweeds but can also be bare from grazing.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	••	Frequent	2
Alcyonium digitatum	•••	Occasional	2
Urticina felina	•••	Occasional	1
Caryophyllia smithii	•••	Occasional	2
Pomatoceros triqueter	••••	Frequent	4
Gibbula cineraria	•••	Occasional	2
Antedon bifida	•••	Frequent	2
Asterias rubens	••••	Occasional	5
Echinus esculentus	••••	Occasional	5
Clavelina lepadiformis	•••	Occasional	2
Bonnemaisonia asparagoides	•••	Occasional	2
Callophyllis laciniata	•••	Occasional	2
Corallinaceae	••••	Frequent	7
Plocamium cartilagineum	••••	Frequent	5
Cryptopleura ramosa	••	Occasional	1
Delesseria sanguinea	•••••	Frequent	8
Hypoglossum hypoglossoides	•••	Occasional	1
Phycodrys rubens	••••	Frequent	4
Dictyota dichotoma	••••	Frequent	5
Laminaria hyperborea	•••••	Frequent	12

IR.MIR.KR.Lhyp.GzFt Grazed *Laminaria hyperborea* forest with coralline crusts on upper infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock; large boulders
Zone:	Infralittoral - upper
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Urchin grazing

Biotope description

Exposed to moderately exposed *Laminaria hyperborea* forest is in some areas intensely grazed by the urchin *Echinus esculentus*. The rock surface lacks a significant turf of foliose seaweeds and generally looks bare, though encrusting algae cover the rock. In addition to these encrusting coralline algae, non-calcareous crusts such as *Cruoria pellita* and brown algal crusts also occur. The kelp stipes may or may not be grazed; in the most extremely grazed areas, the stipes are also devoid of seaweeds. More usually, however, the stipes offers a refuge from grazing, and are characterised by dense turfs of red seaweeds, especially *Phycodrys rubens, Callophyllis laciniata, Plocamium cartilagineum* and *Delesseria sanguinea*. The hydroid *Obelia geniculata* and the bryozoan *Membranipora membranacea* colonise the kelp fronds. On the rock itself certain brown seaweeds such as *Cutleria multifida* may persist in this grazed environment. Fast-growing species such as the kelp *Laminaria saccharina* may be present at sites recovering from grazing, opportunistically colonising the rock surfaces that have been cleared by grazing. The fauna within a grazed kelp forest is also relatively sparse and is mostly confined to cracks, crevices and under-boulders. Species such as the ascidian *Clavelina lepadiformis* can often be found on vertical rock. Also found on the rock surface are the anthozoans *Urticina felina* and *Alcyonium digitatum*. Encrusting species such as the tube-building polychaete *Pomatoceros triqueter* are resistant to grazing and may occur in abundance. The grazers present include the echinoderm *Echinus esculentus* and the gastropods *Calliostoma zizyphinum* and *Gibbula cineraria*. Other echinoderms present include *Asterias rubens* and *Antedon bifida* which can be abundant in the north-west. Moderate grazing occurs within many kelp forests; records should only be assigned to this biotope where the community has been intensively grazed leaving algal-encrusted rock with very few epilithic algae.

Situation

With increasing depth, the kelp forest grades into a grazed kelp park (Lhyp.GzPk), the lower limit of which is often abrupt, representing the balance point between urchin-grazing pressure and kelp growth capabilities. In wave-exposed steep rocky areas, the shallowest water may be characterised by a forest of kelp with red seaweeds (LhypR.Ft), with a grazed kelp forest beneath. This effect may be a result of the increased wave action in shallower water, which regularly dislodges the urchins thereby reducing their grazing impact. Lhyp.GzFt is prevalent in the north of the UK where *E. esculentus* populations reach high densities. Although *E. esculentus* is widely distributed around the UK it occurs in greatest abundance in Scotland and north-east England where urchin grazing can substantially affect infralittoral communities.

Temporal variation

Fluctuations in *E. esculentus* numbers may give foliose seaweeds a chance to re-grow periodically. Further information is required on the temporal variation within these grazed forests and the changes in community structure when grazing pressure decreases.

Similar biotopes

IR.MIR.KR.Lhyp.GzPk	Found beneath the kelp forest and has a lower abundance of kelps but similar species composition to kelp forest.
IR.HIR.KSed.XKScrR	Bare rock surfaces beneath the kelp canopy may also be caused by sand-scour and should not be confused with the barren appearance of a community decimated (reduced) by grazing.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	••	Frequent	1
Alcyonium digitatum	•••	Occasional	2
Urticina felina	•••	Occasional	1
Pomatoceros triqueter	•••	Frequent	5
Gibbula cineraria	•••	Occasional	2
Calliostoma zizyphinum	•••	Occasional	2
Membranipora membranacea	••	Frequent	1
Antedon bifida	••	Occasional	1
Asterias rubens	••••	Occasional	5
Echinus esculentus	•••••	Common	15
Corallinaceae	••••	Abundant	12
Plocamium cartilagineum	••	Frequent	1
Delesseria sanguinea	•••	Occasional	1
Phycodrys rubens	••••	Frequent	4
Cutleria multifida	••	Common	3
Laminaria hyperborea	•••••	Abundant	20

IR.MIR.KR.Lhyp.GzPk Grazed *Laminaria hyperborea* park with coralline crusts on lower infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral - lower
Depth band:	10-20 m
Other features:	Urchin grazing

Biotope description

Exposed to moderately exposed *Laminaria hyperborea* kelp park in some areas is intensively grazed by the urchin *Echinus esculentus*. The rock surface lacks a significant turf of foliose seaweeds and generally looks bare, though coralline algal crusts and some grazing-resistant animals such as the tube-building polychaete *Pomatoceros triqueter* cover it. The kelp stipes may or may not be grazed; in the most extremely grazed areas, the stipes are also devoid of seaweeds. More usually, however, the stipes offers a refuge from grazing, and are characterised by dense turfs of red seaweeds, especially *Phycodrys rubens* and *Delesseria sanguinea*. Brown seaweeds present include *Cutleria multifida*, *Laminaria saccharina* and *Dictyota dichotoma*. The fauna within a grazed kelp park is also relatively sparse, though some species will survive in cracks and crevices or under boulders including the ascidian *Clavelina lepadiformis*. The encrusting bryozoan *Parasmittina trispinosa* and the anthozoans *Alcyonium digitatum*, *Urticina felina* and *Caryophyllia smithii* often characterise vertical or overhanging rock. Mobile species include the gastropods *Gibbula cineraria* and *Calliostoma zizyphinum* and the hermit crab *Pagurus bernhardus* The echinoderms *Ophiocomina nigra*, *Ophiothrix fragilis* and *Crossaster papposus*, generally absent from the kelp forest, can be found in these kelp parks along with *Asterias rubens* and *Antedon bifida*.

Situation

This biotope generally occurs below a grazed kelp forest (Lhyp.GzFt) but can also occur below ungrazed kelp forests on exposed sites where wave action can dislodge urchins from shallow rock. The grazed circalittoral biotope FaAlCr often occurs on the bedrock or boulders below.

Temporal variation

Fluctuations in the numbers of *E. esculentus* may give foliose seaweeds a chance to re-grow periodically. Further information is required on the temporal variation within these grazed kelp parks and the changes in community structure when grazing pressure decreases.

Similar biotopes

IR.MIR.KR.Lhyp.GzFt	Found above the kelp park and has a higher abundance of kelps but similar species composition to the park (Lhyp.GzPk).
IR.HIR.KSed.XKScrR	Bare rock surfaces beneath the kelp canopy may also be caused by sand-scour and should not be confused with the barren appearance of a community decimated (reduced) by grazing.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Alcyonium digitatum	••••	Occasional	3
Urticina felina	•••	Occasional	2
Caryophyllia smithii	•••	Occasional	1
Pomatoceros triqueter	••••	Frequent	5
Pagurus bernhardus	••	Occasional	1
Gibbula cineraria	••••	Occasional	4
Calliostoma zizyphinum	•••	Occasional	3
Parasmittina trispinosa	•••	Occasional	1
Antedon bifida	•••	Occasional	3
Crossaster papposus	•••	Rare	1
Asterias rubens	••••	Occasional	5
Ophiothrix fragilis	•••	Occasional	2
Ophiocomina nigra	••	Occasional	2
Echinus esculentus	•••••	Common	14
Clavelina lepadiformis	•••	Occasional	2
Corallinaceae	•••••	Abundant	12
Delesseria sanguinea	•••	Occasional	1
Phycodrys rubens	•••	Occasional	3
Cutleria multifida	••	Frequent	4
Dictyota dichotoma	•••	Occasional	2
Laminaria hyperborea	•••••	Frequent	9
Laminaria saccharina	••	Occasional	1

IR.MIR.KR.Lhyp.Sab *Sabellaria spinulosa* with kelp and red seaweeds on sand-influenced infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m
Other features:	Sand-scoured

Previous code

MIR.SabKR	97.06
MIR.SabR	96.7

Biotope description

Laminaria hyperborea kelp forest on shallow infralittoral bedrock and boulders characterised by encrustations of *Sabellaria spinulosa* tubes which cover much of the rock, together with sand-tolerant red seaweeds such as *Phyllophora pseudoceranoides*, *Dilsea carnosa* and *Polysiphonia elongata* and *Polysiphonia fucoides*. Red seaweeds such as *Plocamium cartilagineum* and *Delesseria sanguinea* may also be found beneath the kelp canopy, although typically low in abundance. They can be colonised by the ascidian *Botryllus schlosseri*. The cowrie *Trivia arctica* can also be found here. Much of the available rock is covered with encrusting coralline algae together with patches of the encrusting sponge *Halichondria panicea* and the anthozoan *Urticina felina.* More mobile fauna include the echinoderms *Asterias rubens, Henricia sanguinolenta*, *Echinus esculentus*, and *Ophiothrix fragilis,* the gastropod *Gibbula cineraria* and the hermit crab *Pagurus bernhardus*. The scouring effect of mobile sand adjacent to the rock maintains a reduced underflora and fauna compared to the association of species found in non-scoured kelp forests (Lhyp.Ft). Scour-resistant fauna such as the barnacle *Balanus crenatus* can be locally abundant on the rock, while the bivalve *Pododesmus patelliformis* can be found seeking shelter underneath the cobbles. Above the effect of scour, kelp stipes may be densely colonised by red seaweeds such as *Phycodrys rubens*, *Palmaria palmata* and *Membranoptera alata*, together with some sponges and ascidians.

Situation

This biotope is found in the sand-laden waters of north-east England in conditions in which *S. spinulosa* is able to thrive. Nearby circalittoral rock is often also dominated by *S. spinulosa* (Sspi) but lacks the kelp and red seaweeds. As this biotope is not commonly recorded in the UK there is a scarcity of information relating to the surrounding biotopes.

Temporal variation

Unknown.

Similar biotopes

CR.MCR.CSab.Sspi	A similar biotope is found in the circalittoral zone, where it lacks the algal component.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	●●●	Common	2
Urticina felina	●●●●	Frequent	4
Sabellaria spinulosa	●●●●●	Abundant	20
Balanus crenatus	●●	Occasional	1
Pagurus bernhardus	●●●●	Occasional	3
Gibbula cineraria	●●●●	Frequent	4
Trivia arctica	●●●	Occasional	2
Pododesmus patelliformis	●●	Frequent	1
Electra pilosa	●●●	Frequent	1
Henricia sanguinolenta	●●●	Occasional	2
Asterias rubens	●●●●●	Frequent	6
Ophiothrix fragilis	●●●	Occasional	2
Echinus esculentus	●●●●	Occasional	3
Botryllus schlosseri	●●●	Frequent	1
Dilsea carnosa	●●●	Occasional	1
Corallinaceae	●●●●	Frequent	3
Phyllophora pseudoceranoides	●●	Frequent	1
Plocamium cartilagineum	●●●●●	Frequent	6
Delesseria sanguinea	●●●	Frequent	3
Polysiphonia elongata	●●●	Common	3
Polysiphonia fucoides	●●	Occasional	1
Laminaria hyperborea	●●●●●	Abundant	15

IR.MIR.KR.XFoR Dense foliose red seaweeds on moderately exposed, silted, stable infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Moderately strong
Substratum:	Bedrock; boulders & cobbles
Zone:	Infralittoral
Depth band:	5-10 m, 10-20 m
Other features:	In turbid conditions

Biotope description

Upward-facing surfaces of shallow, infralittoral bedrock and boulders in areas of turbid water dominated by dense red seaweeds, with the notable absence of kelp. The stable rock, which can be cobbles or boulders but is more typically bedrock, is usually silted. Individual species of foliose red seaweeds such as *Plocamium cartilagineum* or *Calliblepharis ciliata* often dominate. Other red seaweeds likely to be present include *Phyllophora crispa*, *Rhodymenia holmesii*, *Halurus flosculosus*, *Cryptopleura ramosa*, *Hypoglossum hypoglossoides*, *Heterosiphonia plumosa* and coralline crusts. The brown seaweed *Dictyota dichotoma* is sometimes present, although never abundant. This biotope does not generally occur below kelp park but rather occurs on shallow, silted rock on which kelp would normally grow in less turbid conditions. The fauna can be variable but is generally typified by the presence of silt-tolerant animals such as encrusting sponges, particularly *Dysidea fragilis* and *Halichondria panicea*, the hydroid *Tubularia indivisa*, bryozoan crusts and scattered *Sabellaria spinulosa* and *Balanus crenatus*. In the summer months the seaweeds can become heavily encrusted with the bryozoan *Electra pilosa* and the ascidian *Molgula manhattensis* which can also form dense mats on the rock. The polychaete *Lanice conchilega* can be present, where sandy and muddy patches occur. Where this biotope occurs on chalk bedrock, such as off the Sussex coast, the piddock *Pholas dactylus* is often found bored into the rock. This biotope is recorded from the English Channel, off Kent, Sussex and the Isle of Wight. Please notice that individual sites of this biotope can vary significantly in the species composition.

Situation

This biotope generally occurs on discrete bedrock outcrops surrounded by areas of mixed sediment or mobile sand. Off Sussex, it occurs on the horizontal chalk bedrock forming the tops of cliffs (2-3m in height).

Temporal variation

The seaweeds die back in late autumn and summer leaving, silted, coralline-encrusted rock with a sparse fauna of sponges, *S. spinulosa* and occasional hydroids and bryozoans. The bryozoan *Amathia lendigera* can also become abundant amongst the seaweeds during the summer months.

Similar biotopes

IR.HIR.KFaR.FoR	This biotope occurs in deeper water below the kelp park with a higher diversity of sponges like *H. panicea* and *D. fragilis*.
IR.HIR.KFaR.FoR.Dic	This biotope occurs in deeper water below the kelp park with a high abundance of the brown seaweeds *Dictyopteris membranacea* (Frequent) and *D. dichotoma* (Common). It also has a higher diversity of sponges like *H. panicea* and *D. fragilis*.
IR.HIR.KSed.EphR	This biotope occurs on mixed, mobile substrata and is characterised by red seaweeds such as *Halarachnion ligulatum*, *Lomentaria orcadensis*, *Naccaria wiggii* and *Compsothamnion thuyoides* that thrive in these conditions.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Porifera indet crusts	••	Rare	4
Tubularia indivisa	••	Rare	2
Lanice conchilega	••	Occasional	3
AMPHIPODA	••	Abundant	4
Caprellidae	••	Common	2
Mytilus edulis	••	Present	1
Electra pilosa	•••	Frequent	15
Molgula manhattensis	••	Rare	1
Corallinaceae	••	Occasional	4
Phyllophora crispa	••	Occasional	3
Plocamium cartilagineum	•••	Frequent	14
Calliblepharis ciliata	••	Common	2
Halurus flosculosus	•••	Frequent	11
Cryptopleura ramosa	••	Common	3
Hypoglossum hypoglossoides	•••	Occasional	9
Heterosiphonia plumosa	••	Frequent	3
Foliose red algae	•••	Abundant	5
Dictyota dichotoma	••	Occasional	1

IR.MIR.KR.LhypVt *Laminaria hyperborea* on moderately exposed vertical rock.

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Vertical rock.

Previous code

CorMetAlc in part	97.06
AlcByH in part	97.06

Biotope description

LhypVt is found on moderately exposed coasts in moderately strong to weak tidal streams generally in 0-20m water depth. It is characterised by the kelp *Laminaria hyperborea*, the soft coral *Alcyonium digitatum* and crinoid *Antedon bifida*. This biotope is relatively species poor when compared to similar biotopes in more exposed environments e.g. LhypRVt. The urchin *Echinus esculentus may be frequently observed grazing the vertical rock face. This biotope may have 2 sub-biotopes. One is characterised by the frequent occurrence of the sea squirt* Clavelina lepadiformis *and the red seaweeds* Phycodrys rubens *and* Cryptopleura ramosa. *The brown seaweed* Dictyota dichotoma *may also be frequent in this sub-biotope. The second sub-biotope is more species poor than the previous one and is characterised by the common occurrence of* Alcyonium digitatum, *which is only occasional in the other variant.*

Situation

Open rocky coasts in northern Britain, particularly North Sea coasts.

Temporal variation

No temporal data avialable

Similar biotopes

HIR.LhypRVt	Much richer; red seaweeds component usually denser.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Alcyonium digitatum	••••	Frequent	8
Urticina felina	•••	Occasional	3
Sagartia elegans	••	Occasional	1
Caryophyllia smithii	•••	Occasional	2
Pomatoceros triqueter	•••	Frequent	4
Cancer pagurus	••	Rare	1
Necora puber	••	Occasional	1
Gibbula cineraria	•••	Occasional	2
Calliostoma zizyphinum	•••	Occasional	2
Antedon bifida	•••	Frequent	3
Henricia	•••	Occasional	1
Asterias rubens	••••	Occasional	8
Echinus esculentus	•••••	Frequent	10
Clavelina lepadiformis	••••	Occasional	4
Botryllus schlosseri	••	Occasional	1
Corallinaceae	•••	Common	5
Plocamium cartilagineum	••	Occasional	2
Cryptopleura ramosa	•••	Frequent	2
Delesseria sanguinea	••	Occasional	2
Phycodrys rubens	•••	Frequent	2
Dictyota dichotoma	••	Frequent	2
Laminaria hyperborea	••••	Frequent	9

IR.MIR.KR.HiaSw *Hiatella arctica* with seaweeds on vertical limestone / chalk.

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Vertical limestone.

Previous code

AlcByH.Hia in part	97.06

Biotope description

This biotope is found in the infralittoral zone on moderately exposed vertical limestone/chalk surfaces in weak tidal streams, and has been recorded most frequently between 0-10m. This biotope is characterised by abundant *Hiatella arctica* and a rich sponge community including *Cliona celata*, *Dysidea fragilis* and *Pachymatisma johnstonia*. Other species that may be frequent in this biotope are the crab *Necora puber*, the sea squirt *Clavelina lepadiformis*, and the top shell *Calliostoma zizyphinum*, although these species are found in other vertical rock biotopes, however in lesser abundance.

Situation

Shallow rocky coasts with vertical limestone faces.

Temporal variation

No temporal data available

Similar biotopes

MCR.Hia	Similar vertical limestone/chalk habitat, but lacks seaweed component.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Dercitus bucklandi	••••	Frequent	1
Pachymatisma johnstonia	••••	Frequent	2
Tethya aurantium	••••	Frequent	1
Cliona celata	•••••	Common	4
Halichondria panicea	•••	Frequent	1
Esperiopsis fucorum	•••	Frequent	1
Dysidea fragilis	•••••	Frequent	4
HYDROZOA	•••	Common	2
Alcyonium digitatum	•••••	Abundant	4
Urticina felina	••••	Frequent	2
Sagartia elegans	•••	Frequent	1
Corynactis viridis	••••	Occasional	1
Caryophyllia smithii	••••	Frequent	2
POLYCHAETA	••••	Common	2
Pomatoceros triqueter	•••	Common	1
Balanus crenatus	•••	Common	1
Maja squinado	•••••	Occasional	2
Cancer pagurus	•••••	Occasional	3
Necora puber	•••••	Frequent	3

Calliostoma zizyphinum	●●●●●	Frequent	3
Mytilus edulis	●●●	Occasional	1
Hiatella arctica	●●●●	Abundant	3
Membranipora membranacea	●●●	Frequent	1
Bugula	●●●●	Frequent	2
Bryozoa indet crusts	●●●●	Common	2
Asterias rubens	●●●●	Occasional	1
Aslia lefevrei	●●●●	Frequent	2
Clavelina lepadiformis	●●●●●	Frequent	4
Morchellium argus	●●●●	Frequent	2
Aplidium punctum	●●●●	Occasional	1
Didemnidae	●●●●	Frequent	1
Polycarpa scuba	●●●	Abundant	1
Botryllus schlosseri	●●●●	Frequent	2
Corallinaceae	●●●●	Occasional	1
Phyllophora crispa	●●●	Abundant	2
Cryptopleura ramosa	●●●●	Common	2
Brongniartella byssoides	●●●	Common	1
Laminaria hyperborea	●●●	Common	1

IR.MIR.KT Tide-swept kelp and seaweed communities (sheltered infralittoral rock)

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Bedrock, boulders and cobbles
Zone:	Sublittoral fringe, Infralittoral
Height band:	Lower shore
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Sheltered infralittoral rock exposed to strong tidal streams. In the sublittoral fringe dense *Laminaria digitata* is found together with erect seaweeds, sponges, ascidians and bryozoans (LdigT). Below this, on bedrock and stable boulders a canopy of mixed kelp (primarily *Laminaria hyperborea* and *Laminaria saccharina*) occurs with foliose red seaweeds, sponges and ascidians (XKT). This biotope is typically found in the sheltered narrows and sills of Scottish sealochs. Mixed substrata of boulders, cobbles, pebbles and gravel, that also occurs in the tidal rapids of Scottish sealochs, supports a reduced kelp canopy (*L. hyperborea* and *L. saccharina*; typically Frequent), with a rich red seaweed component and maerl at some sites (XKTX). In south-west Britain, sheltered, tide-swept rock is restricted to estuarine conditions where variable salinity and increased turbidity of the water have a significant effect on the biota, limiting the infralittoral zone to very shallow depths. Unlike the tide-swept channels in sealochs, the rock in these estuaries is characterised by a relatively low abundance of *L. saccharina* (< Common) with foliose red seaweeds, sponges and ascidians (LsacT). *L. hyperborea* is rarely present. Mixed substrata in these conditions is also colonised by *L. saccharina* (typically Frequent) with a range of seaweeds characteristic of scoured/mobile conditions and interspersed with infaunal species (LsacTX).

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	●●●	Frequent	6
Anemonia viridis	●●	Occasional	1
Urticina felina	●●	Occasional	1
Pomatoceros triqueter	●●●	Frequent	4
Balanus crenatus	●●	Frequent	2
Carcinus maenas	●●●	Occasional	4
Gibbula cineraria	●●●	Occasional	2
Asterias rubens	●●●	Occasional	3
Ophiothrix fragilis	●●	Occasional	1
Echinus esculentus	●●	Occasional	2
Clavelina lepadiformis	●●	Occasional	1
Botryllus schlosseri	●●●	Occasional	2
Corallinaceae	●●●	Frequent	4
Corallina officinalis	●●	Occasional	1
Lithothamnion glaciale	●●	Frequent	1
Chondrus crispus	●●●	Occasional	2
Hypoglossum hypoglossoides	●●	Frequent	1
Dictyota dichotoma	●●	Occasional	2
Laminaria digitata	●●	Common	2
Laminaria hyperborea	●●●	Common	4
Laminaria saccharina	●●●●	Frequent	7
Halidrys siliquosa	●●●	Occasional	2

Ulva lactuca	●●●	Occasional	3

IR.MIR.KT.LdigT *Laminaria digitata*, ascidians and bryozoans on tide-swept sublittoral fringe rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Very strong, Strong, Moderately strong
Substratum:	Bedrock; boulders and cobbles
Zone:	Sublittoral fringe
Height band:	Lower shore
Depth band:	0-5 m

Previous code

LRK.LDIG.T	6.95

Biotope description

Sheltered bedrock, boulders and cobbles that are subject to moderate to strong tidal water movement characterised by dense *Laminaria digitata*, coralline crusts and sponges such as *Halichondria panicea*. Other seaweeds present include the foliose red *seaweeds Chondrus crispus, Palmaria palmata, Cryptopleura ramosa* and *Mastocarpus stellatus* as well as the calcareous *Corallina officinalis*. Green seaweeds present include *Ulva lactuca, Enteromorpha intestinalis* and *Cladophora rupestris*. The increased water movement encourages several filter-feeding faunal groups to occur. The sponges *Leucosolenia* spp., *Scypha ciliata* and *Hymeniacidon perleve* frequently occur on steep and overhanging rock faces. The bryozoans *Electra pilosa*, *Membranoptera membranipora* and *Alcyonidium hirsutum* encrust the kelp and other foliose seaweeds. In addition, ascidians such as *Ascidiella scabra*, *Dendrodoa grossularia* and colonial ascidians *Botryllus byssoides* and *Botryllus leachi* often thrive in this environment encrusting both the rock and the seaweeds. The tube-building polychaete *Pomatoceros triqueter* can be found on the rock and on the kelp holdfasts along with the barnacle *Balanus crenatus*. More mobile species such as the gastropods *Gibbula cineraria* and *Calliostoma zizyphinum*, the crab *Carcinus maenas* and the starfish *Asterias rubens* are also common. Areas where increased tidal movement influences this community can be found in the narrows and/or intertidal sills of sealochs.

Situation

This biotope often occurs immediately below the tide-swept *Fucus serratus* biotope (SLR.Fserr.T) consequently, some *F. serratus* may occur in this biotope (typically only Occasional). The sublittoral fringe of similarly sheltered shores that are not tide-swept are generally characterised by mixed *Laminaria saccharina* and *L. digitata* (Lsac.Ldig) or *L. saccharina* (Lsac). Below LdigT, at these sheltered, tide-swept sites, a canopy of mixed kelp species often occurs (see XKT and XKTX).

Temporal variation

Unknown.

Similar biotopes

IR.MIR.KR.Ldig	Occur in non tide-swept areas and lacks the characteristic community of filter-feeders, though the individual species may be present.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	••••	Frequent	5
Dynamena pumila	•••	Occasional	2
Pomatoceros triqueter	••••	Occasional	3

Spirorbidae	●●●	Frequent	2
Balanus crenatus	●●	Occasional	1
Carcinus maenas	●●●●	Rare	2
Gibbula cineraria	●●●	Occasional	2
Calliostoma zizyphinum	●●●	Rare	1
Alcyonidium hirsutum	●●●	Frequent	2
Membranipora membranacea	●●●	Occasional	2
Bryozoa indet crusts	●●●	Frequent	2
Asterias rubens	●●●	Occasional	1
Ascidiella scabra	●●	Frequent	1
Dendrodoa grossularia	●●●	Occasional	1
Botryllus schlosseri	●●●●	Occasional	3
Botrylloides leachi	●●	Rare	1
Palmaria palmata	●●●	Occasional	3
Corallinaceae	●●●●	Common	8
Corallina officinalis	●●●	Occasional	2
Mastocarpus stellatus	●●	Occasional	1
Chondrus crispus	●●●	Occasional	3
Cryptopleura ramosa	●●●	Occasional	1
Laminaria digitata	●●●●●	Abundant	20
Fucus serratus	●●●	Occasional	3
Enteromorpha	●●●	Occasional	1
Ulva lactuca	●●●●	Occasional	3
Cladophora rupestris	●●	Frequent	1

IR.MIR.KT.XKT Mixed kelp with foliose red seaweeds, sponges and ascidians on sheltered, tide-swept infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Very strong, Strong, Moderately strong
Substratum:	Bedrock, boulders and cobbles
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m

Previous code

Lsac.T (in part)	97.06

Biotope description

Stable, tide-swept rock characterised by dense kelp *Laminaria hyperborea* and/or *Laminaria saccharina* forest on scoured, coralline-encrusted rock. This biotope occurs in the sheltered narrows and sills of Scottish sealochs, where there is an increase in tidal flow. Although *L. hyperborea* (typically Common) generally occurs in greater abundance than *L. saccharina* (Frequent), either kelp may dominate, sometimes to the exclusion of the other. (This biotope should not be confused with sheltered, but silted LhypLsac). Large stands of the brown seaweed *Halidrys siliquosa* may also occur amongst the kelp along with *Dictyota dichotoma* on bedrock and boulders. In contrast to the scoured rock surface the kelp stipes themselves often support prolific growths of foliose red seaweeds such as *Phycodrys rubens, Membranoptera alata, Delesseria sanguinea* and *Plocamium cartilagineum*. Other foliose seaweeds may be present among the kelp holdfasts include *Chondrus crispus and Dilsea carnosa*. The scoured rock surface is characterised by encrusting coralline algae, barnacles *Balanus crenatus* and the tube-building polychaete *Pomatoceros triqueter*. The sponge *Halichondria panicea*, anthozoans *Urticina felina*, *Anemonia viridis* and *Sagartia elegans* can also occur on the scoured rock. Sponges, particularly *Halichondria panicea* and colonial and solitary ascidians *Botryllus schlosseri* and *Ascidiella aspersa* encrust the stipes, whilst hydroid growth of *Obelia geniculata* and seamats *Membranoptera membranacea* can cover the fronds, optimising the increased tidal flow. Mobile species such as the gastropod *Gibbula cineraria* can often be found on and around the kelp. The echinoderms *Asterias rubens*, *Ophiothrix fragilis* and *Echinus esculentus* can be found underneath the kelp canopy on the rock along with the crab *Carcinus maenas*. Where some protection is afforded from the scour anthozoans may occur on the rock such as *Alcyonium digitatum* or *Metridium senile*.

Situation

This biotope may be fringed by tide-swept kelp *Laminaria digitata* in shallower water (LdigT). Where mixed substrata occurs adjacent to the stable bedrock and boulders the kelp will usually diminish in density (typically Frequent), but a greater diversity of species will be found compared to the scoured bedrock, in particular there is an increase in red seaweeds and a greater infaunal component (XKTX). Maerl rhodoliths may be present amongst the bedrock and boulders of XKT in small amounts, and at some sites may form extensive beds surrounding the bedrock outcrops (Phy.R and Lgla).

Temporal variation

Unknown.

Similar biotopes

IR.MIR.KR.LhypT.Ft	Tide-swept rock on the open coast supports a similar community of *L. hyperborea* kelp forest. LhypT.Ft generally occurs at a greater depth (6-10m below chart datum compared to the shallow XKT, which is generally above 5m chart datum). The kelp composition in XKT is generally mixed compared to the dense monospecific *L. hyperborea* canopy of LhypT.Ft. The faunal composition differs with a higher diversity of sponges and anthozoans in the

	open coast sites, which lack the often dense aggregations of solitary ascidians that occur at the sheltered, shallow sites of XKT.
IR.MIR.KT.XKTX	Tidal rapids with a higher percentage of mixed substrata which support a higher abundance of red algae like *Lithothamnion* spp. and *L. graciale* but also the brown seaweed *Chorda filum* is present. Filterfeeders like the sponge *Halichondria panicea*, hydroids (*Obelia geniculata*) and anthozoans like *Urticina felina* and *Sargartia elegans* are usually absent due to the more unstable substrata of this biotope compared to XKT.
IR.HIR.KSed.XKHal	Occurs on the open, more exposed coast and is not tide-swept.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	••••	Frequent	4
Obelia geniculata	•••	Frequent	2
Anemonia viridis	••	Occasional	1
Urticina felina	•••	Occasional	1
Sagartia elegans	••	Occasional	1
Pomatoceros triqueter	••••	Frequent	4
Balanus crenatus	••	Frequent	1
Carcinus maenas	•••	Occasional	3
Gibbula cineraria	•••	Frequent	2
Asterias rubens	••••	Occasional	4
Ophiothrix fragilis	•••	Occasional	1
Echinus esculentus	••••	Occasional	3
Ascidiella aspersa	••	Occasional	1
Botryllus schlosseri	•••	Occasional	2
Dilsea carnosa	•••	Occasional	1
Corallinaceae	••••	Common	5
Chondrus crispus	•••	Occasional	2
Plocamium cartilagineum	•••	Occasional	1
Delesseria sanguinea	•••	Frequent	2
Membranoptera alata	•••	Occasional	1
Phycodrys rubens	•••	Frequent	1
Dictyota dichotoma	•••	Occasional	2
Laminaria hyperborea	••••	Common	10
Laminaria saccharina	••••	Frequent	6
Halidrys siliquosa	••••	Occasional	4

IR.MIR.KT.XKTX Mixed kelp and red seaweeds on infralittoral boulders, cobbles and gravel in tidal rapids

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Very strong, Strong, Moderately strong
Substratum:	Boulders, cobbles and gravel
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m

Previous code

Lsac.T (in part)

Biotope description

Mixed substrata of boulders, cobbles, pebbles and gravel, typically found in tidal rapids with kelp *Laminaria saccharina* and *Laminaria hyperborea* and red seaweeds. *L. saccharina* usually dominates this habitat although *L. hyperborea* may occur in equal abundance at some sites. The kelp in these tidal rapids does not form the same dense canopies associated with stable tide-swept bedrock, but generally occurs at lower abundance (Frequent). Other brown seaweeds occur in significant amounts in these tidal rapids including *Dictyota dichotoma*, *Halidrys siliquosa* and *Chorda filum*. These mixed substrata support a greater diversity of species than scoured bedrock narrows (XKT). In particular, there is an increase in red algal species such as *Corallina officinalis, Bonnemaisonia hamifera* and *Ceramium nodulosum*, although none occur in any great abundance. Red seaweeds common to both XKT and this biotope include *Chondrus crispus, Delesseria sanguinea, Plocamium cartilagineum* and *Phycodrys rubens*. Good examples of this biotope often have maerl gravel (*Lithothamnion* sp.) or rhodoliths between cobbles and boulders. Where maerl dominates, the biotope should be recorded as a maerl bed (SS.SMP.Mrl). The sponges associated with more stable, tide-swept conditions are generally absent, but the anthozoan *Anemonia viridis* might be present. Cobbles and pebbles are encrusted by the ubiquitous polychaete *Pomatoceros triqueter* and provide shelter for scavenging crabs such as *Carcinus maenas* and the hermit crab *Pagurus bernhardus*, gastropods such as *Gibbula cineraria* and echinoderms such as *Echinus esculentus, Asterias rubens, Ophiocomina nigra* and *Ophiothrix fragilis* which favour these sites of increased water movement. Additional infaunal species, inhabiting the sediment pockets, include *Lanice conchilega* and *Sabella pavonina*, which can be locally abundant.

Situation

Where stable rock fringes the shallows the tide-swept *Laminaria digitata* biotope often occurs (LdigT). Adjacent areas of stable bedrock or boulders in these sheltered, tide-swept narrows can support a similar kelp community, often with a greater percentage of *L. hyperborea* (XKT). Maerl fragments are often found amongst the mixed substrata of XKTX and this biotope may abut more extensive areas of maerl bed (Phy & Lgla).

Temporal variation

Unknown.

Similar biotopes

IR.HIR.KSed.XKHal	This biotope occurs on the open coast in deeper water.
IR.MIR.KT.XKT	Stable, tide-swept rock in the sheltered narrows and sills of Scottish sealochs, characterised by a dense kelp forest of *L. hyperborea* (Common) and/or *Laminaria saccharina* (Frequent) on scoured, coralline-encrusted rock. The brown seaweed *Chorda filum* is not present. Filterfeeders like the sponge *Halichondria panicea*, hydroids (*Obelia geniculata*) and anthozoans like *Urticina felina* and *Sargartia elegans* are present (Frequent-Occasional) due

to the more stable substrata of this biotope compared to XKTX.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Anemonia viridis	●●●	Occasional	2
Pomatoceros triqueter	●●●●	Frequent	10
Pagurus bernhardus	●●●	Occasional	3
Carcinus maenas	●●●	Frequent	5
Gibbula cineraria	●●●	Frequent	1
Asterias rubens	●●●●	Occasional	6
Ophiothrix fragilis	●●	Occasional	1
Ophiocomina nigra	●●●	Common	4
Echinus esculentus	●●●	Occasional	2
Bonnemaisonia hamifera	●●	Frequent	2
Corallinaceae	●●●	Frequent	3
Corallina officinalis	●●●	Occasional	2
Lithothamnion	●●●●●	Common	9
Chondrus crispus	●●●●	Rare	3
Ceramium nodulosum	●●●	Rare	2
Delesseria sanguinea	●●●	Occasional	1
Phycodrys rubens	●●●	Occasional	3
Rhodophycota indet.(non-calc.crusts)	●●	Frequent	1
Dictyota dichotoma	●●●	Frequent	3
Laminaria hyperborea	●●	Frequent	1
Laminaria saccharina	●●●●●	Frequent	11
Halidrys siliquosa	●●	Occasional	1
Ulva lactuca	●●●	Occasional	4

IR.MIR.KT.LsacT *Laminaria saccharina* with foliose red seaweeds and ascidians on sheltered, tide-swept infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Strong, Moderately strong
Substratum:	Boulders, bedrock and gravel
Zone:	Infralittoral - upper
Depth band:	0-5 m

Previous code

Lsac.T (in part)	97.06

Biotope description

Sheltered, tide-swept rock in south-western Britain tends to be restricted to estuarine conditions, where variable salinity and increased turbidity have a significant effect on the biota. Due to the turbidity of the water, the infralittoral zone is restricted to very shallow depths. Unlike the tide-swept channels in sealochs, which support a mixed kelp canopy, the rock in these estuaries is characterised by *Laminaria saccharina* occurring in relatively low abundance (Frequent). The brown alga *Desmarestia ligulata* can occur in this biotope, though never dense, along with the non-native brown seaweed *Sargassum muticum*. Beneath the sparse kelp, cobbles and boulders, often surrounded by sediment, are encrusted by fauna and often a dense turf of red seaweed. The foliose red seaweeds associated with this biotope include *Callophyllis laciniata*, *Nitophyllum punctatum*, *Kallymenia reniformis*, *Gracilaria gracilis*, *Gymnogongrus crenulatus*, *Hypoglossum hypoglossoides*, *Rhodophyllis divaricata*, *Chylocladia verticillata*, *Cryptopleura ramosa* and *Erythroglossum laciniatum* as well as the filamentous *Ceramium nodulosum* and *Pterothamnion plumula*. Green seaweeds *Ulva lactuca*, *Bryopsis plumosa* and *Cladophora* spp. may be locally abundant. The dominating faunal species vary from site to site but include sponges such as *Halichondria panicea*, *Esperiopsis fucorum*, *Dysidea fragilis* and *Hymeniacidon perleve* as well as ascidians, particularly *Dendrodoa grossularia* and *Morchellium argus*, which can cover the rocks. Also present is the anthozoan *Anemonia viridis*, the barnacle *Balanus crenatus* and the tube-building polychaete *Pomatoceros triqueter*. The hydroid Plumularia setacea can cover rocks and seaweed fronds The range of solitary ascidians found in the north-west are limited to *Ascidiella aspersa* in these south-western inlets. There is also a general absence of echinoderms. Where soft rock allows, such as the limestone in Plymouth Sound, rock-boring organisms such as *Polydora* spp. may be locally abundant. Sheltered, tide-swept rock is generally restricted to the narrows or tidal rapids of marine inlets. The clear tide-swept waters of Scottish sealochs are considerably different to the marine inlets of south-west Britain. This biotope deals with the latter.

Situation

This biotope generally occurs on rocky outcrops interspersed by sediment areas. Where the rock extends into deeper water, beyond the limit of kelp, sponges and ascidians tend to dominate these sheltered, tide-swept circalittoral sites (CuSpH); also *Alcyonium digitatum* with sponges and *Nemertesia antennina* (ByErSp).

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	●●●	Occasional	3
Hymeniacidon perleve	●●●	Frequent	3
Dysidea fragilis	●●	Occasional	1
Plumularia setacea	●●	Occasional	2
Anemonia viridis	●●	Occasional	1
Pomatoceros triqueter	●●	Occasional	2
Balanus crenatus	●●	Occasional	2
Morchellium argus	●●	Frequent	1
Dendrodoa grossularia	●●●	Abundant	4
Callophyllis laciniata	●●	Occasional	2
Kallymenia reniformis	●●	Occasional	2
Gracilaria gracilis	●●	Occasional	1
Rhodophyllis divaricata	●●●	Occasional	3
Chylocladia verticillata	●●	Rare	1
Ceramium nodulosum	●●●	Frequent	4
Pterothamnion plumula	●●	Occasional	1
Cryptopleura ramosa	●●	Frequent	3
Hypoglossum hypoglossoides	●●●	Occasional	3
Nitophyllum punctatum	●●●	Occasional	3
Desmarestia ligulata	●●	Rare	1
Laminaria saccharina	●●●●●	Frequent	23
Sargassum muticum	●●	Occasional	2
Ulva lactuca	●●●	Frequent	5
Bryopsis plumosa	●●	Occasional	1

IR.MIR.KT.FilRVS Filamentous red seaweeds, sponges and *Balanus crenatus* on tide-swept variable-salinity infralittoral rock

Habitat classification

Salinity:	Variable (18-35ppt)
Wave exposure:	Extremely sheltered
Tidal streams:	Moderately strong
Substratum:	Bedrock; boulders
Zone:	Infralittoral
Depth band:	0-5 m
Other features:	Heavily silted / turbid water

Previous code

SIR.Lsac.FiR	96.7

Biotope description

Tide-swept infralittoral rock subject to variable salinity and turbid waters occurs in the mid to upper reaches of the rias of south-west Britain, where riverine freshwater input reduces the salinity. Very shallow rock under these conditions is characterised by a covering of filamentous red seaweed such as *Callithamnion* spp., *Antithamnion* spp., *Ceramium* spp., *Griffithsia devoniensis*, *Pterothamnion plumula* and *Polysiphonia fucoides* as well as the filamentous green seaweed *Cladophora* spp. Foliose red seaweeds such as *Hypoglossum hypoglossoides*, *Cryptopleura ramosa* and *Erythroglossum laciniatum* commonly occur, as does the foliose green seaweed *Ulva lactuca*. Although *Laminaria saccharina* is often present it is usually in low abundance (Occasional). The fluctuating salinity limits the number of species able to exist in this habitat. The animal community is dominated by the sponges *Halichondria panicea* and *Hymeniacidon perleve* and the barnacle *Balanus crenatus*. The ascidians *Clavelina lepadiformis* and *Dendrodoa grossularia* can be locally abundant at some sites. The crab *Carcinus maenas* is usually present along with the bivalve *Mytilus edulis*. The bryozoan *Bugula plumosa* can occur attached to the rock.

Situation

This biotope is usually found amidst sediment or rock and as such there is no defined zonation of the surrounding biotopes. Shallow sediments nearby may support seagrass beds (*Zostera* spp.) or infaunal-dominated sediments (SS.SCS.ICS). Nearby, deeper tide-swept rock may support circalittoral communities dominated by sponges, hydroids and ascidians on stable rock (CuSpH.As) or dense bryozoans on mixed substrata (SpNemAdia & FluHocu).

Temporal variation

Unknown.

Similar biotopes

IR.MIR.KT.LsacT	This biotope occurs at similar conditions as FilRVS. The species diversity is also similar between the to biotopes, but LsacT have a higher abundance of the kelp *L. saccharina* (Common) and of the ascidian *Dendrodoa grossularia* (Abundant). FilRVS have a higher abundance of the sponge *H. panicea.*

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	••••	Common	8
Hymeniacidon perleve	•••	Frequent	4
Balanus crenatus	••••	Occasional	3
Carcinus maenas	•••	Occasional	4

Mytilus edulis	••	Occasional	2
Bugula plumosa	••	Occasional	1
Clavelina lepadiformis	••	Frequent	1
Dendrodoa grossularia	••	Occasional	1
Antithamnion	••	Occasional	2
Callithamnion	•••	Frequent	6
Ceramium nodulosum	••	Occasional	1
Griffithsia devoniensis	••	Frequent	2
Pterothamnion plumula	••••	Frequent	14
Cryptopleura ramosa	••	Common	1
Hypoglossum hypoglossoides	•••••	Frequent	18
Erythroglossum laciniatum	•••	Frequent	8
Polysiphonia fucoides	••	Occasional	3
Laminaria saccharina	••	Occasional	1
Ulva lactuca	••	Occasional	2
Cladophora	••	Occasional	2

IR.LIR Low energy infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered, Ultra sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock, boulders and cobbles
Zone:	Sublittoral fringe, Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Infralittoral rock in wave and tide-sheltered conditions, supporting silty communities with *Laminaria hyperborea* and/or *Laminaria saccharina* (K). Associated seaweeds are typically silt-tolerant and include a high proportion of delicate filamentous types. In turbid-water estuarine areas, the kelp and seaweeds (KVS) may be replaced by animal-dominated communities (FaVS) whilst stable hard substrata in lagoons support distinctive communities (Lag).

IR.LIR.K Silted kelp (stable rock)

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock, boulders, cobbles and mixed substrata
Zone:	Sublittoral fringe, Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Infralittoral rock in wave and tide-sheltered conditions, supporting silty communities with *Laminaria hyperborea* and/or *Laminaria saccharina*. Associated seaweeds are typically silt-tolerant and include a high proportion of delicate filamentous types. Some areas, particularly in the lower infralittoral zone, are subject to intense grazing by urchins and chitons and may have poorly developed seaweed communities.

IR.LIR.K.LhypLoch Mixed *Laminaria hyperborea* and *Laminaria ochroleuca* forest on moderately exposed or sheltered infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	Weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral - upper
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Mixed *Laminaria hyperborea* and *Laminaria ochroleuca* forest on upper infralittoral moderately exposed or sheltered rock is restricted to the coast of Cornwall and the Isles of Scilly. Unlike *L. hyperborea*, however, *L. ochroleuca* has a smooth stipe and it lacks the epiphytic growth of seaweeds. The bryozoan *Membranipora membranacea* may encrust the very lower part of the stipe but the rest of the stipe is characteristically bare. The fronds too are generally free of encrusting hydroids, bryozoans and grazing gastropods as compared to *L. hyperborea*. *L. ochroleuca* holdfasts, however, are often encrusted with sponges and colonial ascidians. A large variety of foliose and filamentous red seaweeds are often present underneath the canopy. These include *Callophyllis laciniata, Plocamium cartilagineum, Cryptopleura ramosa, Delesseria sanguinea, Dilsea carnosa Bonnemaisonia asparagoides, Erythroglossum laciniatum, Sphaerococcus coronopifolius, Polyneura bonnemaisonii* and *Corallina officinalis*. The foliose brown seaweed *Dictyota dichotoma* is frequently found in this biotope along with the occasional kelp such as *Saccorhiza polyschides* and *Laminaria saccharina*. The faunal composition of the biotope as a whole is often sparse. The anthozoans *Corynactis viridis* and *Caryophyllia smithii* are common on vertical surfaces with scattered bryozoan turf species such as Crisiidae. Grazers such as the gastropod *Gibbula cineraria* and the urchin *Echinus esculentus* are often present. *L. ochroleuca* occurs across a wide range of wave exposures (in common with *L. hyperborea*) and consequently it occurs at low abundance in other kelp biotopes (sheltered through to exposed) that occur in the South-West between Dorset to Lundy. In such cases, records should be considered as regional variations of the usual kelp biotopes. Records should only be assigned to this biotope when the canopy is dominated by *L. ochroleuca* alone, or by a mixture of both *L. hyperborea* and *L. ochroleuca* (though the latter is usually at greater abundance). *L. ochroleuca* commonly occurs on the Brittany and Normandy coasts.

Situation

On moderately exposed to sheltered rock *Laminaria ochroleuca* can form a dense forest below the *L. hyperborea* forest (Lhyp.Ft). At other sites *L. hyperborea* park (Lhyp.Pk) occurs below Lhyp.Loch. A band of dense foliose seaweeds can also dominate the lower infralittoral zone below the kelp zone (FoR or FoR.Dic). More data is required to establish further trends in neighbouring biotopes.

Temporal variation

The under-storey of foliose and filamentous seaweeds will diminish towards the autumn and regrow in the spring. Otherwise, this biotope is not known to change significantly over time.

Similar biotopes

IR.HIR.KFaR.LhypR.Loch	This biotope is similar to the mixed *L. hyperborea* and *L. ochroleuca* biotope found on exposed coasts (LhypR.Loch), though the latter generally occurs in slightly deeper water (often below the *L. hyperborea*-forest LhypR.Ft) as *L. ochroleuca* is less tolerant of strong wave action at its northern limit of distribution.

IR.MIR.KR.Lhyp

Superficially, the *L. ochroleuca* biotope looks similar to a moderately exposed *L. hyperborea* forest, containing a similar suite of foliose and filamentous red seaweeds beneath the canopy. *L. ochroleuca* is not usually present in this biotope.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Corynactis viridis	●●●	Occasional	2
Caryophyllia smithii	●●●	Frequent	2
Gibbula cineraria	●●	Occasional	1
Crisiidae	●●	Frequent	1
Echinus esculentus	●●●	Occasional	1
Bonnemaisonia asparagoides	●●	Occasional	1
Dilsea carnosa	●●●	Occasional	2
Callophyllis laciniata	●●●●	Frequent	4
Corallinaceae	●●●●	Frequent	5
Corallina officinalis	●●	Frequent	1
Chondrus crispus	●●●	Occasional	1
Plocamium cartilagineum	●●●	Occasional	2
Sphaerococcus coronopifolius	●●●	Occasional	1
Cryptopleura ramosa	●●●	Frequent	3
Delesseria sanguinea	●●●	Occasional	3
Polyneura bonnemaisonii	●●●	Frequent	3
Erythroglossum laciniatum	●●●	Frequent	2
Dictyota dichotoma	●●●●	Frequent	4
Laminaria hyperborea	●●●●●	Occasional	10
Laminaria ochroleuca	●●●●●	Abundant	26
Laminaria saccharina	●●●	Frequent	3
Saccorhiza polyschides	●●●	Frequent	2

IR.LIR.K.LhypLsac Mixed *Laminaria hyperborea* and *Laminaria saccharina* on sheltered infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Mixed *Laminaria hyperborea* and *Laminaria saccharina* on bedrock and boulders in sheltered infralittoral habitats. Typically subject to weak tidal streams and rather silty conditions. Beneath the kelp is an associated under-storey flora of foliose red seaweeds including *Plocamium cartilagineum, Cryptopleura ramosa* and *Callophyllis laciniata* as well as the brown seaweeds *Dictyota dichotoma, Cutleria multifida* and *Desmarestia aculeata*. The stipes of *L. hyperborea* may be densely covered with red seaweeds such as *Phycodrys rubens* and *Delesseria sanguinea* as well as the solitary ascidian *Clavelina lepadiformis* and the featherstar *Antedon bifida*. The fronds are often epiphytised by the hydroid *Obelia geniculata* and the bryozoan *Membranipora membranacea*. Beneath the kelp canopy, the faunal component is generally less diverse than the more exposed kelp forests, dominated by the echinoderms *Echinus esculentus* and *Asterias rubens*, but the tops shells *Gibbula cineraria* and *Calliostoma zizyphinum* can be common as well. The crab *Necora puber* and the brittlestar *Ophiothrix fragilis* can be found in cracks and crevices, while the tube-building polychaete *Pomatoceros triqueter* and coralline crusts are present on the rock surface. Although there is a reduced number of species by comparison to the more exposed *L. hyperborea* forests (Lhyp.Ft), there are considerably more algae species than occur in the more sheltered *L. saccharina* forests (Lsac.Ft). This biotope is predominately found in the shelter of fjordic sealochs in Scotland. Where it does occur in south-west Britain the mixed kelp forest may also include the southern kelp *Laminaria ochroleuca*. Three variants has been described: The kelp forest in the upper infralittoral (LhypLsac.Ft), grading to a kelp park with increasing depth (LhypLsac.Pk) as well as a grazed variant (LhypLsac.Gz).

Temporal variation

Unknown

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	●●●	Occasional	2
Pomatoceros triqueter	●●●●	Frequent	6
Necora puber	●●●	Occasional	1
Gibbula cineraria	●●●●	Frequent	5
Calliostoma zizyphinum	●●●	Occasional	2
Membranipora membranacea	●●	Occasional	1
Asterias rubens	●●●●	Occasional	4
Ophiothrix fragilis	●●	Occasional	1
Echinus esculentus	●●●●	Occasional	5
Clavelina lepadiformis	●●●	Occasional	2
Callophyllis laciniata	●●●	Occasional	1
Corallinaceae	●●●●	Common	6
Plocamium cartilagineum	●●●	Occasional	3
Cryptopleura ramosa	●●●	Occasional	1

Delesseria sanguinea	●●●	Occasional	3
Phycodrys rubens	●●●	Frequent	3
Cutleria multifida	●●	Frequent	1
Dictyota dichotoma	●●●	Occasional	1
Desmarestia aculeata	●●	Occasional	1
Laminaria hyperborea	●●●●●	Common	15
Laminaria saccharina	●●●●●	Frequent	10

IR.LIR.K.LhypLsac.Ft **Mixed** *Laminaria hyperborea* **and** *Laminaria saccharina* **forest on sheltered upper infralittoral rock**

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral - upper
Depth band:	0-5 m, 5-10 m
Other features:	Siltation

Biotope description

Sheltered, often silted, upper infralittoral bedrock and boulder slopes with mixed kelps *Laminaria hyperborea* and *Laminaria saccharina* and red seaweeds beneath. The kelp at these sheltered sites often has large `cape-form' fronds, which form a dense canopy over the seabed and are often epiphytised by the hydroid *Obelia geniculata* and the bryozoan *Membranipora membranacea*. Beneath the kelp, red seaweeds such as *Delesseria sanguinea* and *Cryptopleura ramosa* occur on top of encrusting coralline algae. Often, a dense algal turf of *Bonnemaisonia hamifera* (tetrasporophyte) carpets the rock. The stipes of *L. hyperborea* may be densely covered with seaweeds such as *Phycodrys rubens*, *Plocamium cartilagineum* and *Porphyropsis coccinea*. There can also be a prominent faunal component on the stipes including the solitary ascidian *Clavelina lepadiformis* and the colonial ascidian *Botryllus schlosseri*. Brown seaweeds, occurring here in low abundance, include *Dictyota dichotoma*. The kelp *Saccorhiza polyschides* may also occur but rarely in equal abundance to *L. hyperborea* or *L. saccharina*. Beneath the kelp canopy, the faunal component is generally less diverse than the more exposed kelp forests (Lhyp). The silted rock supports a sparse fauna of gastropods *Gibbula cineraria* and *Calliostoma zizyphinum*, the tube-building polychaete *Pomatoceros triqueter* and occasional starfish *Asterias rubens* and the urchin *Echinus esculentus*. Steeper, less silted rock, may have the anthozoans *Caryophyllia smithii* and *Alcyonium digitatum*.Sheltered, often silted, upper infralittoral bedrock and boulder slopes with mixed kelps *Laminaria hyperborea* and *Laminaria saccharina* and red seaweeds beneath. The kelp at these sheltered sites often has large `cape-form' fronds, which form a dense canopy over the seabed and are often epiphytised by the hydroid *Obelia geniculata* and the bryozoan *Membranipora membranacea*. Beneath the kelp, red seaweeds such as *Delesseria sanguinea* and *Cryptopleura ramosa* occur on top of encrusting coralline algae. Often, a dense algal turf of *Bonnemaisonia hamifera* (tetrasporophyte) carpets the rock. The stipes of *L. hyperborea* may be densely covered with seaweeds such as *Phycodrys rubens*, *Plocamium cartilagineum* and *Porphyropsis coccinea*. There can also be a prominent faunal component on the stipes including the solitary ascidian *Clavelina lepadiformis* and the colonial ascidian *Botryllus schlosseri*. Brown seaweeds, occurring here in low abundance, include *Dictyota dichotoma*. The kelp *Saccorhiza polyschides* may also occur but rarely in equal abundance to *L. hyperborea* or *L. saccharina*. Beneath the kelp canopy, the faunal component is generally less diverse than the more exposed kelp forests (Lhyp). The silted rock supports a sparse fauna of gastropods *Gibbula cineraria* and *Calliostoma zizyphinum*, the tube-building polychaete *Pomatoceros triqueter* and occasional starfish *Asterias rubens* and the urchin *Echinus esculentus*. Steeper, less silted rock, may have the anthozoans *Caryophyllia smithii* and *Alcyonium digitatum*.

Situation

This biotope occurs below *Laminaria digitata* on the sheltered sublittoral fringe (Ldig.Ldig) or a mix of *L. saccharina* and *L. digitata* in very sheltered conditions (Lsac.Ldig). It can also be found on isolated rock exposures amid a sediment seabed (VirOphPmax or PhiVir). Where suitable substrata allow, the kelp thins out with increased depth to form a park below the forest (LhypLsac.Pk).

Temporal variation

Unknown.

Similar biotopes

IR.LIR.K.LhypLsac.Pk	Found in deeper water below the kelp forest and has a lower abundance of kelp and red seaweeds. The abundance of *Laminaria* spp. in the kelp park is typically only Frequent. The fauna remains much the same as the forest, unless there is a greater fraction of mixed substrata in the deeper park, in which case there may be an increase in infaunal species, brittlestars and starfish. The assemblage of red seaweeds does not differ greatly from that of the forest.
IR.LIR.K.Lsac.Ft	Generally occurs in more sheltered, siltier conditions and lacks *L. hyperborea*.
IR.LIR.K.LhypLsac.Gz	A greater number of grazing echinoderms reduce the abundance of foliose red seaweeds and kelp (Common-Frequent).
IR.LIR.K.LhypCape	Cape-form of *L. hyperborea* on very silted rock (particularly in extremely sheltered sealochs of western Scotland). *L. saccharina* can be present but does not co-dominant as in LhypLsac.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	●●●	Occasional	2
Alcyonium digitatum	●●	Occasional	1
Caryophyllia smithii	●●	Occasional	1
Pomatoceros triqueter	●●●●	Frequent	5
Necora puber	●●●	Occasional	1
Gibbula cineraria	●●●●	Frequent	5
Calliostoma zizyphinum	●●●	Occasional	1
Membranipora membranacea	●●●	Occasional	2
Asterias rubens	●●●●	Occasional	3
Echinus esculentus	●●●●	Occasional	3
Clavelina lepadiformis	●●●	Occasional	1
Botryllus schlosseri	●●●	Occasional	1
Bonnemaisonia hamifera	●●	Occasional	1
Callophyllis laciniata	●●●	Occasional	1
Corallinaceae	●●●●	Common	7
Plocamium cartilagineum	●●●●	Frequent	4
Cryptopleura ramosa	●●●	Occasional	1
Delesseria sanguinea	●●●●	Occasional	3
Phycodrys rubens	●●●	Occasional	3
Rhodophycota indet.(non-calc.crusts)	●●	Frequent	1
Dictyota dichotoma	●●●	Occasional	2
Laminaria hyperborea	●●●●●	Common	15
Laminaria saccharina	●●●●●	Common	13

IR.LIR.K.LhypLsac.Pk Mixed *Laminaria hyperborea* and *Laminaria saccharina* park on sheltered lower infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered
Tidal streams:	Weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral - lower
Depth band:	5-10 m, 10-20 m
Other features:	Siltation

Biotope description

Sheltered silted, bedrock and boulders with a park of mixed *Laminaria hyperborea* and *Laminaria saccharina*. Both kelp species are sparse in the park (Frequent). Beneath the often 'cape-form' kelp canopy, foliose red seaweeds such as *Delesseria sanguinea*, *Cryptopleura ramosa*, *Heterosiphonia plumosa* and *Brongniartella byssoides* are often present at high densities on the silted rock. Other red seaweeds such as encrusting coralline algae, *Phycodrys rubens*, *Callophyllis laciniata*, *Bonnemaisonia asparagoides* and *Plocamium cartilagineum* can be present. Other brown seaweeds include *Dictyota dichotoma* and *Desmarestia aculeata*. The animal component of this biotope is generally richer than the upper infralittoral mixed kelp forest (LhypLsac.Ft). A variety of hydroids such as *Obelia geniculata* grow epiphytically on the kelp fronds along with the bryozoan *Membranipora membranacea*. The echinoderm *Antedon bifida* and ascidians such as *Clavelina lepadiformis* attach to the kelp stipes, above the silted rock. The rock itself supports anthozoans such as *Caryophyllia smithii* and *Urticina felina* as well as the tube-building polychaete *Pomatoceros triqueter* and the crap *Necora puber*. Grazers include the prominent echinoderm *Echinus esculentus* and the gastropods *Gibbula cineraria* and *Calliostoma zizyphinum*. Where pockets of sediment occur, there may be an increase in infaunal species such as the burrowing anthozoan *Cerianthus lloydii*, the brittlestar *Ophiura albida*, and starfish *Asterias rubens*. Although there is a decrease in the number of algal species in the kelp park, the abundance remains relatively high.

Situation

These mixed kelp parks are generally found below the mixed kelp forest (LhypLsac.Ft) where there is a continuation of suitable hard substrata present. These sheltered kelps are also frequently found on bedrock or boulder exposures (XFa) adjacent to sediment seabed characterised by infaunal species. Where silted, circalittoral rock occurs below the kelp park a variety of biotopes may be found characterised by varying amounts of featherstars, anthozoans, solitary ascidians and sponge communities (e.g. AntAsH, LgAsSp, AmenCio, NeoPro and ModHAs).

Temporal variation

Unknown.

Similar biotopes

IR.LIR.K.LhypLsac.Ft	Found in shallower water, above the kelp park where both kelp species and red seaweeds occur in greater abundance. The fauna is generally less diverse in the forest than in the park.
IR.LIR.K.LhypLsac.Gz	Found in shallower water above the kelp park, but this biotope has a lower abundance of foliose red seaweeds due to the presence of more grazing echinoderms. The kelps *L. hyperborea* and *L. saccharina* has a typically abundance of Common.
IR.LIR.K.Lsac.Pk	Generally occurs in more sheltered, siltier conditions and lacks *L.*

hyperborea

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	●●●	Frequent	2
Urticina felina	●●	Occasional	1
Caryophyllia smithii	●●●	Occasional	1
Pomatoceros triqueter	●●●	Frequent	4
Necora puber	●●●	Occasional	2
Gibbula cineraria	●●●	Frequent	3
Calliostoma zizyphinum	●●●	Occasional	2
Membranipora membranacea	●●	Frequent	1
Antedon bifida	●●	Frequent	1
Asterias rubens	●●●●	Occasional	5
Echinus esculentus	●●●●	Frequent	7
Clavelina lepadiformis	●●●	Occasional	1
Bonnemaisonia asparagoides	●●●	Occasional	2
Callophyllis laciniata	●●●	Occasional	2
Corallinaceae	●●●	Frequent	3
Plocamium cartilagineum	●●●●	Occasional	4
Rhodophyllis divaricata	●●	Occasional	1
Cryptopleura ramosa	●●●	Occasional	1
Delesseria sanguinea	●●●●	Occasional	5
Phycodrys rubens	●●	Occasional	1
Heterosiphonia plumosa	●●●	Occasional	2
Brongniartella byssoides	●●	Frequent	1
Dictyota dichotoma	●●●●	Frequent	3
Desmarestia aculeata	●●●	Occasional	2
Laminaria hyperborea	●●●●●	Frequent	14
Laminaria saccharina	●●●●	Frequent	6

IR.LIR.K.LhypLsac.Gz Grazed, mixed *Laminaria hyperborea* and *Laminaria saccharina* on sheltered infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock & boulders
Zone:	Infralittoral - upper
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Silted infralittoral rock with mixed *Laminaria hyperborea* and *Laminaria saccharina* kelp forest, intensively grazed by the echinoderm *Echinus esculentus* and the gastropods *Gibbula cineraria* and *Calliostoma zizyphinum*. Although both kelp species can occur in equal abundance (Common), *L. hyperborea* usually dominates. The grazing-resistant brown seaweed *Desmarestia aculeata* and *Cutleria multifida* may be present. A similar variety of red seaweeds to those found in the ungrazed kelp forest (LhypLsac.Ft) may occur beneath the kelp canopy, but in much lower abundance. As grazing intensity increases the seaweed cover decreases - and some sites are reduced to the bare appearance of encrusting brown and coralline algae beneath the kelp canopy. The *L. hyperborea* stipes generally support more seaweeds than the rock beneath, including *Cryptopleura ramosa*, *Delesseria sanguinea*, *Phycodrys rubens* and *Bonnemaisonia hamifera*. The stipes may also support sometimes dense ascidians *Clavelina lepadiformis* and *Ciona intestinalis* and the echinoderm *Antedon bifida*. The kelp fronds are often densely covered by the hydroid *Obelia geniculata*. At the most intensively grazed sites even the kelp stipes are bare. Although the rock appears bare, between boulders and in crevices there are often the brittlestar *Ophiothrix fragilis* and the crabs *Necora puber* and *Pagurus bernhardus*. The tube-building *Pomatoceros triqueter* and bryozoan crusts are commonly found on any vertical surfaces.

Situation

This biotope can be found in similar conditions as LhypLsac.Ft and LhypLsac.Pk but where the numbers of grazers present are in high enough numbers to cause substantially community impoverishment through grazing. Generally occurs on isolated rock, surrounded by sediment biotopes. Although it has been recorded from sites astride the ungrazed kelp biotopes (LhypLsac.Ft and LhypLsac.Pk) it is more usually found on bedrock or boulder exposures (XFa) adjacent to sediment seabed characterised by infaunal species.

Temporal variation

If the grazing pressure is reduced (i.e. a decrease in the number of grazing echinoderms present) the community will eventually re-establish itself as a mixed kelp forest or park (LhypLsac).

Similar biotopes

IR.MIR.KR.Lhyp.GzFt	Found in more wave-exposed conditions, it has a greater range of sponges, hydroids and colonial ascidians. *L. hyperborea* is typically dense (Abundant) with L. *saccharina* (Occasional). NB notice the few records for this biotope.
IR.LIR.K.LhypLsac.Ft	Has a greater abundance of foliose red seaweeds and fewer grazing echinoderms with a high abundance of the kelp *L. hyperborea* (Abundant) and *L. saccharina* (Abundant).

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	●●●	Occasional	1
Pomatoceros triqueter	●●●●	Frequent	7
Pagurus bernhardus	●●●	Occasional	2
Necora puber	●●●	Occasional	1
Gibbula cineraria	●●●●	Frequent	5
Calliostoma zizyphinum	●●●	Occasional	2
Antedon bifida	●●	Occasional	1
Asterias rubens	●●●●	Occasional	6
Ophiothrix fragilis	●●●	Occasional	2
Echinus esculentus	●●●●●	Frequent	10
Clavelina lepadiformis	●●●	Occasional	1
Bonnemaisonia hamifera	●●	Occasional	1
Corallinaceae	●●●●	Abundant	7
Cryptopleura ramosa	●●	Frequent	1
Delesseria sanguinea	●●●	Occasional	2
Phycodrys rubens	●●●	Frequent	2
Cutleria multifida	●●●	Frequent	4
Desmarestia aculeata	●●●	Frequent	2
Laminaria hyperborea	●●●●●	Common	14
Laminaria saccharina	●●●●	Common	7

IR.LIR.K.Lsac *Laminaria saccharina* on very sheltered infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Very sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m
Other features:	Silty

Biotope description

Very sheltered infralittoral rock dominated by the kelp *Laminaria saccharina*. Typically very silty and often with few associated seaweeds due to siltation, grazing or shading from the dense kelp canopy. The most commonly occurring red seaweeds are *Delesseria sanguinea*, *Phycodrys rubens*, *Bonnemaisonia hamifera* and coralline crusts. In addition to the kelp the brown seaweed *Chorda filum* and Ectocarpaceae are often present. As well as lacking *Laminaria hyperborea*, the Lsac biotopes have fewer foliose and filamentous red seaweed species by comparison to LhypLsac biotopes. A depauperate assemblage of animals is present (by comparison to Lhyp.Ft and Lhyp.Pk) predominantly consisting of the encrusting polychaetes *Pomatoceros triqueter*, the crabs *Carcinus maenas* and *Pagurus bernhardus* and the ubiquitous gastropod *Gibbula cineraria*. The echinoderms *Antedon bifida*, starfish *Asterias rubens*, brittlestar *Ophiothrix fragilis* and urchin *Echinus esculentus* occur in low abundance. Ascidians are commonly found in all the Lsac biotopes, but the large solitary ascidian *Ascidia mentula* are most prolific in very sheltered conditions of *L. saccharina* forests (Lsac.Ft). This biotope is most commonly associated with the sheltered fjordic sealochs of Scotland where sublittoral hard substrata can be found at the sheltered head of the lochs. Similarly the sheltered loughs of Ireland (Lough Hyne, Strangford Lough and Carlingford Lough). It is also found where suitable hard substrata exist in the sheltered inlets of south-west Britain, such as Milford Haven or Plymouth Sound. 4 variants has been described: A mixture of *L. saccharina* and *Laminaria digitata* (Lsac.Ldig), dense *L. saccharina* forest in the upper infralittoral (Lsac.Ft), sparse *L. saccharina* in the lower infralittoral (Lsac.Pk) and urchin-grazed (Lsac.Gz).

Temporal variation

Unknown

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pomatoceros triqueter	●●●	Frequent	4
Pagurus bernhardus	●●	Occasional	2
Carcinus maenas	●●	Occasional	2
Gibbula cineraria	●●●	Occasional	4
Asterias rubens	●●●	Occasional	5
Ophiothrix fragilis	●●	Occasional	1
Echinus esculentus	●●●	Occasional	4
Clavelina lepadiformis	●●	Occasional	1
Ascidia mentula	●●	Occasional	2
Bonnemaisonia hamifera	●●	Frequent	1
Corallinaceae	●●●	Frequent	8
Delesseria sanguinea	●●	Occasional	1
Phycodrys rubens	●●	Frequent	3
Ectocarpaceae	●●	Frequent	1

Chorda filum	●●●	Occasional	3
Laminaria saccharina	●●●●●	Common	30
Ulva lactuca	●●	Occasional	1

IR.LIR.K.Lsac.Ldig *Laminaria saccharina* and *Laminaria digitata* on sheltered sublittoral fringe rock

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders and cobbles
Zone:	Sublittoral fringe
Height band:	Lower shore
Depth band:	0-5 m

Previous code

LRK.LDIG.LSAC	6.95

Biotope description

Sheltered bedrock and boulders in the sublittoral fringe characterised by a mixed canopy of the kelp *Laminaria digitata* (usually in its broad-fronded cape-form) and *Laminaria saccharina* - both species are generally Frequent or greater. Beneath the kelp canopy, the understorey of red seaweeds often includes *Chondrus crispus*, *Dumontia contorta*, *Bonnemaisonia hamifera* and *Plocamium cartilagineum*. The surface of the rock is usually covered with encrusting coralline algae as well as non-calcified red crusts and the tube-building polychaete *Pomatoceros triqueter*. The brown seaweeds *Chorda filum*, Ectocarpaceae and *Fucus serratus* can be present along with the green seaweeds *Ulva lactuca* and *Enteromorpha intestinalis*. Patches of the sponge *Halichondria panicea* can frequently be found in cracks and crevices. Beneath and between boulders a variety of mobile crustaceans such as *Carcinus maenas*, the gastropod *Gibbula cineraria* and the starfish *Asterias rubens* are common.

Situation

Where hard substrata occur on the shore, this biotope will be found below the *F. serratus* zone (Fser.Fser, Fser or FserX on mixed substrata). With such sheltered shores, the transition between sublittoral fringe and the true sublittoral zone may not be distinct; this biotope therefore extends into the shallow sublittoral kelp forest below (LhypLsac.Ft, Lsac.Ft or LhypCape).

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	••	Occasional	2
Pomatoceros triqueter	•••	Frequent	3
Carcinus maenas	•••	Rare	1
Gibbula cineraria	••••	Occasional	5
Asterias rubens	•••	Occasional	2
Bonnemaisonia hamifera	••	Frequent	1
Dumontia contorta	••	Occasional	1
Corallinaceae	•••	Frequent	6
Chondrus crispus	•••	Frequent	4
Plocamium cartilagineum	••	Occasional	1
Rhodophycota indet.(non-calc.crusts)	••	Frequent	2
Ectocarpaceae	•••	Frequent	2
Chorda filum	•••	Occasional	2
Laminaria digitata	•••••	Common	19
Laminaria saccharina	•••••	Frequent	19
Fucus serratus	•••	Occasional	2

Enteromorpha intestinalis	••	Frequent	2
Ulva lactuca	•••	Frequent	4

IR.LIR.K.Lsac.Ft *Laminaria saccharina* forest on very sheltered upper infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders and cobbles
Zone:	Sublittoral fringe, Infralittoral - upper
Height band:	Lower shore
Depth band:	0-5 m

Previous code

LRK.LSAC	6.95

Biotope description

Sheltered to extremely sheltered sublittoral fringe and infralittoral bedrock, boulders and cobbles characterised by a dense canopy of the kelp *Laminaria saccharina*. In such sheltered conditions, a distinct sublittoral fringe is not always apparent and this biotope often extends from below the *Fucus serratus* zone (Fserr) into the upper infralittoral zone, though there may be a mixed *L. saccharina* and *Laminaria digitata* zone (Lsac.Ldig) in between. There is a relatively low species diversity and species density due to a combination of heavy siltation of the habitat and the lack of light penetrating through the dense kelp canopy. Only a few species of red seaweeds are present compared with Lsac.Ldig or LhypLsac. The most commonly occurring red seaweeds are *Delesseria sanguinea*, *Phycodrys rubens*, *Bonnemaisonia hamifera* and coralline crusts. Brown seaweeds are also sparse and generally comprise *Chorda filum* and Ectocarpaceae. At extremely sheltered sites, where there is a heavy silt cover on the rock and the kelp fronds, the sub-flora is reduced to a few specialised species able to tolerate these conditions such as the cartilaginous seaweeds *Polyides rotundus* and *Chondrus crispus*. Ascidians such as *Clavelina lepadiformis*, *Ascidiella aspersa* and *Ascidia mentula* can remain prominent in such conditions, often occurring on steeper rock subject to less siltation. The variety of red seaweeds is further reduced where grazers such as the urchin *Echinus esculentus* and the top shell *Gibbula cineraria* are present. The tube-building polychaete *Pomatoceros triqueter*, the crab *Carcinus maenas* and the hermit crab *Pagurus bernhardus* can be present. Geographical variations: Northern sites: In sheltered sealochs the most conspicuous fauna in these forests are the large solitary ascidians *Ciona intestinalis*, *Ascidiella* spp. and *A. mentula* which occur in greater abundance than in the mixed kelp forests (LhypLsac). In common with mixed forests, echinoderms are consistently present in low abundance: the featherstar *Antedon bifida*, common starfish *Asterias rubens*, the brittlestar *Ophiothrix fragilis* and the urchin *Echinus esculentus* are typically present. Oysters *Pododesmus patelliformis* and chitons *Tonicella marmorea* may occur in high abundance at some sites. The anthozoan *Anemonia viridis* is often more prevalent at the extremely sheltered sites. The communities of the sheltered voes and sounds of Shetland and Orkney are similar to those present in the mainland sealochs. Southern sites: Sheltered infralittoral rock is not commonly found outside of the fjordic sealochs. In south-west Britain, where sublittoral rock does occur in shallow marine inlets, the waters are more turbid than in the sealochs, generally limiting kelp to the sublittoral fringe. Echinoderms are rare or absent from the south-western *L. saccharina* forests. A far greater diversity of red seaweeds is associated with the south-western sites: *Palmaria palmata*, *Gracilaria gracilis*, *Phyllophora pseudoceranoides*, *Cystoclonium purpureum*, *Rhodophyllis divaricata*, *Ceramium nodulosum* and *Polyneura bonnemaisonii* typically occur.

Situation

Although this biotope may occur below a mixed kelp canopy that occupies the sublittoral fringe (Lsac.Ldig or Ldig.Ldig) at some sites it extends directly into the sublittoral fringe and abuts the *F. serratus* zone (Fser.Fser, Fserr or FserX on mixed substrata). Where suitable hard substrata are available, the *L. saccharina* diminishes in abundance (typically Frequent) with increasing depth to form kelp park (Lsac.Pk).

Temporal variation

Unknown

Similar biotopes

IR.LIR.K.Lsac.Pk	*L. saccharina* is sparse (Occasional) and far fewer red seaweeds occur, also in low abundance.
IR.LIR.K.LhypLsac.Ft	This biotope occurs in similar conditions as Lsac.Ft, but is generally less silted. It is dominated by the kelp *L. hyperborea* (Abundant) and has a lower abundance of *L. saccharina* (Common) than Lsac.Ft. There tends to be a greater variety of species, particularly more red seaweeds in LhypLsac.Ft.
IR.LIR.K.Lsac.Gz	The variety of red seaweeds is reduced where grazers such as the urchin *E. esculentus* (Frequent) and the brittlestar *Ophiothrix fragilis* (Occasional) are present in high numbers. Grazing pressure can reduce the rock beneath the kelp canopy to coralline encrusted rock, with only a few tufts of foliose seaweeds present.
IR.LIR.KVS.LsacPsaVS	This biotope occurs at slightly more sheltered shores (Very to Extremely sheltered) with reduced salinity. The depauperate coralline-encrusted rock supports few foliose red seaweeds due to the high numbers of the urchins *E. esculentus* and *Psammechinus miliaris.*
IR.LIR.KVS.LsacPhyVS	Reduced salinity with filamentous green seaweeds.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pomatoceros triqueter	●●●	Frequent	3
Pagurus bernhardus	●●	Occasional	1
Carcinus maenas	●●●	Occasional	2
Gibbula cineraria	●●●	Frequent	4
Asterias rubens	●●●	Occasional	4
Echinus esculentus	●●●	Occasional	3
Clavelina lepadiformis	●●	Occasional	2
Ascidiella aspersa	●●	Occasional	1
Ascidia mentula	●●	Occasional	2
Bonnemaisonia hamifera	●●	Frequent	1
Corallinaceae	●●●	Frequent	6
Delesseria sanguinea	●●	Frequent	1
Phycodrys rubens	●●	Frequent	2
Ectocarpaceae	●●	Frequent	1
Chorda filum	●●●	Occasional	5
Laminaria saccharina	●●●●●	Abundant	36
Ulva lactuca	●●	Occasional	1

IR.LIR.K.Lsac.Pk *Laminaria saccharina* park on very sheltered lower infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders and cobbles
Zone:	Infralittoral - lower
Depth band:	5-10 m, 10-20 m

Biotope description

Silty bedrock or boulders with a *Laminaria saccharina* park (often the cape-form). Beneath the canopy, the rock is covered by encrusting coralline algae, and the urchin *Echinus esculentus* is often present. Due to the amount of silt cover on the rock and the reduced light intensity beneath the broad-fronded kelp, only a few red seaweeds are present, the most common species being *Phycodrys rubens, Delesseria sanguinea, Bonnemaisonia spp.* and *Brongniartella byssoides*. The brown seaweeds *Dictyota dichotoma* and *Cutleria multifida* may be present in low abundance. Compared to the sheltered kelp forest (Lsac.Ft) both the kelp and other seaweeds are sparse (Occasional). The most conspicuous animals in this biotope are large solitary ascidians, particularly *Ascidia mentula*, *Ciona intestinalis* and *Clavelina lepadiformis*. In general, the faunal component of this biotope is similar to many of the other sheltered kelp biotopes and includes a variety of mobile crustaceans such *Carcinus maenas* and *Pagurus bernhardus*), tube worms such as *Pomatoceros* spp. and Terebellidae, echinoderms *Asterias rubens, Ophiothrix fragilis* and the featherstar *Antedon bifida*. The hydroid *Kirchenpauria pinnata*, although only rare is often found in the kelp park along with the top shell Gibbula cineraria and the barnacle *Balanus crenatus*.

Situation

L. saccharina park can be found below a similar forest (Lsac.Ft) where suitable hard substrata exist or on isolated rock exposures surrounded by sediment communities. It may also occur below a zone of mixed *Laminaria hyperborea* and *L. saccharina* forest (LhypLsac). *L. saccharina* can also form a band below *L. hyperborea* forest (Lhyp.Ft) where some shelter from wave-action is afforded with depth (*L. saccharina* is not tolerant of surge), or more likely where *L. hyperborea* has been grazed out (below Lhyp.GzFt) since *L. saccharina* grows far quicker than *L. hyperborea*. Where such a narrow band occurs it is generally less silted than that found below Lsac.Ft in much more sheltered conditions. A range of sheltered circalittoral biotopes may occur on any deeper rock below (e.g. AntAsH, AmenCio and ModHAs).

Temporal variation

Unknown.

Similar biotopes

IR.LIR.K.LhypLsac.Pk	*L. saccharina* and *L. hyperborea* co-dominantes this biotope (both Frequent). Generally less silted than Lsac.Pk and there tends to be a greater variety of species, particularly more red seaweeds.
IR.LIR.K.Lsac.Ft	Occurs in shallower water where *L. saccharina* is typically Abundant and there is a greater variety and higher abundance of red seaweeds.
IR.LIR.K.Lsac.Gz	This biotope is very impoverished even compared to Lsac.Pk and the kelp may be absent altogether. The diversity of red seaweeds are much lower than in the park with a dominance of Corallinacea (Common) even though small turf of foliose red seaweeds and brown seaweeds like *Desmarestia* spp. and

Chorda filum may occur. *Halichondria panicea* (Rare) is the likely to be only sponge present compared to Lsac.Pk, which have a higher diversity of sponges (Porifera).

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Kirchenpaueria pinnata	••	Occasional	1
Caryophyllia smithii	••	Occasional	1
Terebellidae	••	Occasional	1
Pomatoceros triqueter	•••	Frequent	3
Balanus crenatus	••	Frequent	1
Pagurus bernhardus	•••	Occasional	4
Carcinus maenas	••	Occasional	1
Gibbula cineraria	•••	Occasional	2
Antedon bifida	••	Occasional	2
Asterias rubens	••••	Occasional	6
Ophiothrix fragilis	•••	Occasional	2
Echinus esculentus	••••	Occasional	8
Clavelina lepadiformis	••	Occasional	2
Ciona intestinalis	••	Occasional	1
Ascidia mentula	•••	Occasional	5
Bonnemaisonia asparagoides	••	Occasional	1
Bonnemaisonia hamifera	••	Common	2
Corallinaceae	••••	Frequent	9
Delesseria sanguinea	••	Occasional	2
Phycodrys rubens	••	Frequent	2
Brongniartella byssoides	••	Occasional	2
Cutleria multifida	••	Frequent	1
Dictyota dichotoma	••	Occasional	2
Laminaria saccharina	•••••	Occasional	18

IR.LIR.K.Lsac.Gz Grazed *Laminaria saccharina* with *Echinus*, brittlestars and coralline crusts on sheltered infralittoral rock

Habitat classification

Salinity:	Variable (18-35ppt)
Wave exposure:	Very sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock & boulders
Zone:	Sublittoral fringe, Infralittoral - upper
Depth band:	0-5 m, 5-10 m

Biotope description

Coralline encrusted rock with scattered tufts of red seaweed and a relatively high abundance of grazing echinoderms which typically include the urchin *Echinus esculentus* and/or the brittlestars *Ophiothrix fragilis* or *Ophiocomina nigra*. The rock often looks bare, with few conspicuous species present although *Laminaria saccharina* may occur it is generally in low abundance (Rare or Occasional). The red seaweeds, reduced to small tufts through grazing, include *Phycodrys rubens*, *Delesseria sanguinea* and *Brongniartella byssoides* and although these seaweeds also occur in Lsac.Pk they are far less frequent in this biotope. Brown seaweeds, such as *Desmarestia viridis*, *Chorda filum* and *Cutleria multifida*, may be present. Grazing molluscs, such as *Gibbula cineraria* and can be common. Under-boulder habitats can harbour the crabs Necora puber and *Pagurus bernhardus*, terebellid polychaetes and the polychaete *Pomatoceros* spp. with ascidians *Ascidia mentula*. and *Clavelina lepadiformis* on the open rock along with the echinoderm *Asterias rubens* and the hydroids *Kirchenpauria pinnata* and *Obelia dichotoma*.

Situation

This biotope generally occurs on rock below a dense kelp forest of *L. saccharina* (Lsac.Ft) or mixed kelp (LhypLsac.Ft).

Temporal variation

If the grazing pressure is reduced (i.e. a decrease in the number of grazing echinoderms present) a richer kelp community may develop (Lsac.Pk or LhypLsac.Pk).

Similar biotopes

IR.LIR.K.Lsac.Pk	This biotope a higher diversity and abundance of red seaweeds. Lsac.Pk also have a notable presence of sponges (Porifera), which are usually absent in Lsac.Gz.
CR.MCR.EcCr.FaAlCr	Occurs in deeper more exposed sites and has a similar grazed crustose appearance but lacks the red and brown seaweeds of Lsac.Gz.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Kirchenpaueria pinnata	●●●	Present	3
Obelia dichotoma	●●	Present	2
Terebellidae	●●●	Rare	1
Pomatoceros	●●●	Frequent	9
Pagurus bernhardus	●●●	Occasional	3
Necora puber	●●●	Rare	2
Gibbula cineraria	●●●	Occasional	5

Asterias rubens	●●●●	Occasional	6
Ophiothrix fragilis	●●●	Rare	4
Ophiocomina nigra	●●●	Present	3
Echinus esculentus	●●●●●	Occasional	11
Ascidia mentula	●●●	Present	3
Corallinaceae	●●●●	Common	12
Delesseria sanguinea	●●	Present	2
Phycodrys rubens	●●●	Rare	4
Brongniartella byssoides	●●	Present	2
Filamentous red algae	●●	Present	1
Cutleria multifida	●●	Frequent	1
Desmarestia viridis	●●	Occasional	1
Chorda filum	●●●	Present	2
Laminaria saccharina	●●●●●	Occasional	12

IR.LIR.K.LhypCape Silted, cape-form *Laminaria hyperborea* on very sheltered, infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock & boulders
Zone:	Infralittoral - upper
Depth band:	0-5 m, 5-10 m

Biotope description

Cape-form of the kelp *Laminaria hyperborea* on very silted rock, particularly in extremely sheltered sealochs of western Scotland. Below the huge kelp fronds (which often trail onto the seabed) foliose seaweeds form a silted understorey on the rock including *Phycodrys rubens, Delesseria sanguinea, Cryptopleura ramosa* and *Plocamium cartilagineum* as well as coralline crusts. At some sites the filamentous red seaweed *Bonnemaisonia hamifera, Heterosiphonia plumosa* and *Brongniartella byssoides* may carpet the seabed. Ascidians, particularly *Ascidiella aspersa, Ascidia mentula, Ciona intestinalis* and *Clavelina lepadiformis* thrive well in these conditions. The echinoderms *Antedon bifida, Echinus esculentus* and *Asterias rubens* are often present along with the gastropod *Gibbula cineraria*. An abundant growth of the hydroid *Obelia geniculata* can cover the silted kelp fronds along with the bryozoan *Membranipora membranacea*. The anthozoan *Caryophyllia smithii* can be present among the kelp holdfasts. The tube-building polychaete *Pomatoceros triqueter* can be present on the rock surface along with the crab *Necora puber*. This biotope generally occurs on shallow bedrock or boulder slopes or isolated rocks protruding through muddy sediment.

Situation

This biotope is often present on rocky outcrops surrounded by muddy sediments (such as VirOphPmax). Deeper, nearby rock, beyond the limit of foliose seaweeds, is often dominated by solitary ascidians (AmenCio).

Temporal variation

Unknown.

Similar biotopes

IR.MIR.KR.Lhyp.Ft	Occurs on moderately exposed rock and supports a dense understorey of foliose red seaweeds beneath the kelp canopy. *L. hyperborea* is not found in cape-form. A more diverse range of fauna such as sponges and anthozoans are also present in Lhyp.Ft.
IR.LIR.K.LhypLsac.Ft	*L. saccharina* and *L. hyperborea* generally occur together in predominantly "sheltered" sites. Large solitary ascidians (*Ascidiella* spp.) are more prevalent in LhypCape.
IR.LIR.K.Lsac.Ft	Occurs in similar sheltered conditions but there are fewer species present in Lsac.Ft, particularly fewer red seaweeds and no *L. hyperborea*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	●●●	Frequent	2
Caryophyllia smithii	●●●	Occasional	2

Pomatoceros triqueter	••••	Frequent	3
Necora puber	•••	Rare	1
Gibbula cineraria	••••	Occasional	4
Membranipora membranacea	••	Occasional	1
Antedon bifida	•••	Occasional	3
Asterias rubens	••••	Occasional	4
Echinus esculentus	••••	Occasional	4
Clavelina lepadiformis	••••	Frequent	4
Ciona intestinalis	•••	Occasional	1
Ascidiella aspersa	•••	Occasional	3
Ascidia mentula	•••••	Frequent	6
Bonnemaisonia asparagoides	•••	Occasional	2
Corallinaceae	•••	Common	3
Plocamium cartilagineum	•••	Frequent	1
Cryptopleura ramosa	••	Occasional	1
Delesseria sanguinea	••••	Occasional	3
Phycodrys rubens	••••	Occasional	5
Heterosiphonia plumosa	••	Occasional	1
Brongniartella byssoides	••	Frequent	1
Dictyota dichotoma	•••	Occasional	2
Desmarestia aculeata	••	Occasional	1
Laminaria hyperborea	•••••	Abundant	18

IR.LIR.K.Sar *Sargassum muticum* on shallow slightly tide-swept infralittoral mixed substrata

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong
Substratum:	Mixed substrata
Zone:	Sublittoral fringe, Infralittoral - upper
Depth band:	0-5 m

Biotope description

Mixed substrata from the sublittoral fringe to 5m below chart datum dominated by the brown seaweed *Sargassum muticum*. This invasive non-native brown seaweed can form a dense canopy on areas of mixed substrata (typically 0-10% bedrock on 90-100% sandy sediment). The substrate on which this *S. muticum*-dominated community is able to develop is highly variable, but particularly prevalent on broken rock and pebbles anchored in sandy sediment. The pebbles, cobbles and broken bedrock provide a substrate for alga such as the kelp *Laminaria saccharina*. During the spring, *S. muticum* has large quantities of epiphytic ectocarpales and may also support some epifauna e.g. the hydroid *Obelia geniculata* commonly found on kelp. The brown seaweed *Chorda filum*, which thrives well on these mixed substrata, is also commonly found with *S. muticum* during the summer months. In Strangford Lough, where this biotope occurs, the amphipod *Dexamine spinosa* has been recorded to dominate the epiphytic fauna (this is known to be commonly found in *Zostera* spp. beds). *S. muticum* is also found on hard, bedrock substrates within *L. saccharina* canopies. *S. muticum* plants on hard substrate area, under a dense *L. saccharina* canopy, are typically smaller and at a much lower density, especially where a lush, under-storey exists with red seaweeds such as *Ceramium nodolosum, Gracilaria gracilis, Chylocladia verticillata, Pterosiphonia plumula* and *Polysiphonia elongata* and the green seaweeds *Cladophora sp., Ulva lactuca* and *Bryopsis plumosa*. The anthozoan *Anemonia viridis* and the crab *Necora puber* can be present. More information is necessary to validate this description.

Situation

Where there is a greater proportion of bedrock or boulders (15-100%) *L. saccharina* will typically dominate the canopy. Areas with pebble cover on a hard substrate are colonised by *S. muticum*, but individuals quickly become peripatetic and are lost.

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Cliona celata	••	Present	1
Anemonia viridis	•••	Rare	3
Necora puber	••	Occasional	1
Gracilaria gracilis	••••	Frequent	13
Chylocladia verticillata	•••	Occasional	4
Ceramium nodulosum	••••	Occasional	9
Pterothamnion plumula	••	Occasional	1
Polysiphonia elongata	••	Rare	1
Chorda filum	••	Occasional	2
Laminaria saccharina	••••	Frequent	13
Sargassum muticum	•••••	Common	33

Cystoseira baccata	••	Occasional	1
Ulva lactuca	•••	Frequent	3
Cladophora	••	Occasional	1
Bryopsis plumosa	••	Occasional	2

IR.LIR.KVS Kelp in variable salinity conditions

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt), Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered, Ultra sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock, boulders & cobbles
Zone:	Sublittoral fringe, Infralittoral
Depth band:	0-5 m, 5-10 m

Biotope description

Very wave-sheltered bedrock, boulders and cobbles subject to only weak tidal streams in the sublittoral fringe and infralittoral zone, in areas of variable/low salinity. This biotope complex is characterised by the kelp *Laminaria saccharina* and coralline crusts such as *Lithothamnion glaciale*. Grazers such as the urchins *Psammechinus miliaris* and *Echinus esculentus*, and the gastropods *Gibbula cineraria* and *Buccinum undatum* may be recorded. The tube-dwelling polychaete *Pomatoceros triqueter*, the tunicates *Ciona intestinalis*, *Corella parallelogramma* and *Ascidiella scabra*, the barnacle *Balanus crenatus*, the starfish *Asterias rubens* and the brittlestar *Ophiothrix fragilis* may also be recorded. Red algal communities are composed primarily of *Phycodrys rubens*. The crabs *Carcinus maenas* and *Pagurus bernhardus*, and the bivalve *Modiolus modiolus* may also be observed.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pomatoceros triqueter	••••	Frequent	10
Balanus crenatus	••	Occasional	1
Pagurus bernhardus	•••	Occasional	3
Carcinus maenas	••••	Occasional	4
Gibbula cineraria	••	Frequent	2
Buccinum undatum	•••	Occasional	2
Modiolus modiolus	••	Occasional	1
Asterias rubens	••••	Frequent	7
Ophiothrix fragilis	••	Frequent	2
Psammechinus miliaris	••••	Frequent	12
Echinus esculentus	••	Occasional	2
Ciona intestinalis	•••	Occasional	2
Corella parallelogramma	••	Occasional	2
Ascidiella scabra	••	Occasional	1
Corallinaceae	•••	Common	7
Lithothamnion glaciale	••	Common	3
Phycodrys rubens	•••	Occasional	4
Laminaria saccharina	•••••	Common	20

IR.LIR.KVS.Cod *Codium* spp. with red seaweeds and sparse *Laminaria saccharina* on shallow, heavily-silted, very sheltered infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Boulders, cobbles, bedrock
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m
Other features:	Heavy siltation

Previous code

SIR.Lsac.CodR	96.7

Biotope description

Very shallow, heavily-silted infralittoral rock characterised by dense stands of *Codium* spp. with silt-tolerant red seaweeds, the green seaweed *Ulva* spp. and often sparse kelp *Laminaria saccharina*. This biotope appears to have a restricted distribution, being recorded to date from only the sheltered voes of Shetland and the harbours of south-west England. Dense *Codium* spp. can occur at very sheltered sites, on cobbles or boulders, often in dense patches interspersed with filamentous red seaweeds *Bonnemaisonia hamifera, Antithamnionella spirographidis* and *Ceramium spp.* Where sediment is present the red seaweed *Polyides rotundus* is commonly found along the rock-sediment interface, and the sponge *Dysidea fragilis* often occurs on the rock. Other red seaweeds that may be present include *Chondrus crispus, Callophyllis laciniata, Gelidium latifolium, Corallina officinalis* and coralline crusts. The brown seaweeds *Halidrys siliquosa, Desmarestia viridis* or *Chorda filum* may be present in high abundance and although kelp *L. saccharina* may occur, it is usually sparse. There are no conspicuous fauna that typify this biotope, through polychaetes such as Terebellidae and Spirorbidae may occur. The opisthobranch *Elysia viridis* may be locally abundant on the seaweeds and is known to favour *Codium fragilis* in particular. In south-west England, Cod has only been recorded from Portland Harbour, Dorset. Large stands of *Codium* sp. (generally Common abundance) are accompanied by red seaweeds such as *G. latifolium, C. laciniata* and *A. spirographidis* on the rock beneath. Cod has been reported to occur in the shallows of The Fleet, Bembridge Ledges, Pagham Harbour and Jersey (Tittley et al. 1985). In Ireland, species-poor shallow, silted bedrock in the North Water of Mulroy Bay, Co. Donegal, is characterised by *Griffithsia corallinoides* (Common) and *Codium tomentosum* (Frequent) forming a narrow band below the kelp zone (Lsac.Ft). Cod has not been described from any other sites in Ireland. If *Codium* spp. is less than Common amongst dense *L. saccharina* and *Chorda filum*, it should not be recorded as Cod.

Situation

This biotope occurs on bedrock below a sublittoral fringe of mixed kelp *L. saccharina* and *Laminaria digitata* (Lsac.Ldig) or below a *L. saccharina* forest (Lsac.Ft) or else on isolated boulders on sediment. Further information on which species of *Codium* is present and on fauna is required on Cod.

Temporal variation

Unknown.

Similar biotopes

IR.LIR.K.Lsac.Ft	In Cod *L. saccharina* is replaced in abundance by *Codium* spp.
IR.LIR.K.LsacPsaVS	Lower diversity of red and brown seaweeds.
IR.LIR.K.LsacPhyVS	Reduced salinity and lower diversity of red and brown seaweeds.
IR.LIR.Lag.FChoG	Dense *Codium* spp. can occur in the saline lagoons of Scotland amongst fucoids and *C. filum.*

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Terebellidae	••	Frequent	2
Spirorbidae	••	Occasional	2
Carcinus maenas	•••	Occasional	3
Bonnemaisonia hamifera	•••	Frequent	9
Gelidium latifolium	••	Frequent	2
Callophyllis laciniata	••	Occasional	2
Corallinaceae	•••	Frequent	4
Corallina officinalis	••	Occasional	2
Chondrus crispus	••	Frequent	1
Polyides rotundus	••	Occasional	1
Antithamnionella spirographidis	••	Frequent	1
Ceramium	••	Common	1
Ceramium nodulosum	••	Occasional	1
Ectocarpaceae	••	Occasional	1
Desmarestia viridis	••	Frequent	3
Chorda filum	•••	Frequent	3
Laminaria saccharina	•••	Abundant	4
Halidrys siliquosa	••	Occasional	1
Ulva lactuca	•••	Occasional	3
Cladophora	••	Occasional	1
Codium	•••••	Common	32

IR.LIR.KVS.LsacPsaVS *Laminaria saccharina* and *Psammechinus miliaris* on variable salinity grazed infralittoral rock

Habitat classification

Salinity:	Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders and cobbles
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m
Other features:	Heavily urchin-grazed

Previous code

SIR.LsacRS.Psa	97.06

Biotope description

Sheltered bedrock, boulders and cobbles, in areas of reduced salinity, with kelp *Laminaria saccharina*, and depauperate coralline-encrusted rock supporting few foliose seaweeds but many grazing urchins *Psammechinus miliaris* and *Echinus esculentus*. The coralline crusts are typically *Lithothamnion glaciale*, while the brown crusts can be *Pseudolithoderma extensum*. Encrusting polychaetes *Pomatoceros triqueter*, resistant to the grazing, are also present on most of the rock. The grazing fauna are a significant component of this biotope; large numbers of *P. miliaris* are typically present, although where absent the brittlestar *Ophiothrix fragilis* may occur. Other grazers prevalent on the rock include the chiton *Tonicella marmorea*, the limpet *Tectura testudinalis* and the gastropod *Gibbula cineraria*. A combination of grazing pressure and lowered salinity maintains a low diversity of species in this biotope, with foliose and filamentous seaweeds generally absent or reduced to small tufts by grazing. In stark contrast to the range of seaweeds present in the *L. saccharina* forests (Lsac.Ft) the only red seaweed consistently found in this biotope is *Phycodrys rubens*. The range of fauna is similarly low, with a conspicuous absence of hydroids and bryozoans. Bedrock and boulders provide a firm substrate on which ascidians *Ciona intestinalis* and *Ascidia mentula* and the bivalve *Modiolus modiolus* can attach. The crabs *Pagurus bernhardus* and *Carcinus maenas* can usually be found here, though *Necora puber* typically is absent due to the brackish conditions. The starfish *Asterias rubens* along with the whelk *Buccinum undatum* can be present. The substratum on which this biotope occurs varies from bedrock to boulders or cobbles on sediment. The kelp band is relatively narrow and shallow (upper 5 m) compared to Lsac.Ft, although the grazed coralline encrusted rock extends deeper. This depth limit becomes shallower towards the heads of the sealochs. Geographical distribution This biotope is restricted to the west coast of Scotland, usually near the head of fjordic sealochs, which are influenced by freshwater run-off.

Situation

Where circalittoral rock occurs below this biotope, it often supports a brachiopod/anthozoan community (NeoPro); where mixed substrata occurs below or adjacent, beds of *Modiolus modiolus* are common (ModHAs or ModHo).

Temporal variation

If the grazing pressure is reduced (i.e. a decrease in the number of grazing echinoderms present) there may be an increase in filamentous and foliose seaweeds although the diversity will remain low compared to full saline sites.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pomatoceros	●●●●●	Frequent	12
Pagurus bernhardus	●●●	Occasional	3

Carcinus maenas	●●●	Occasional	3
Tectura testudinalis	●●	Occasional	1
Gibbula cineraria	●●●	Frequent	2
Buccinum undatum	●●●	Occasional	2
Modiolus modiolus	●●●	Occasional	2
Asterias rubens	●●●●	Occasional	4
Ophiothrix fragilis	●●●	Occasional	2
Psammechinus miliaris	●●●●●	Frequent	18
Echinus esculentus	●●●	Occasional	2
Ciona intestinalis	●●●	Occasional	2
Corallinaceae	●●●	Common	7
Lithothamnion glaciale	●●●	Common	4
Phycodrys rubens	●●●	Occasional	2
Pseudolithoderma extensum	●●	Abundant	2
Laminaria saccharina	●●●●●	Common	18

IR.LIR.KVS.LsacPhyVS *Laminaria saccharina* with *Phyllophora* spp. and filamentous green seaweeds on variable or reduced salinity infralittoral rock

Habitat classification

Salinity:	Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Sheltered, Very sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders and cobbles
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m

Previous code

SIR.LsacRS.Phy	97.06

Biotope description

Shallow infralittoral bedrock or boulder slopes, in reduced or low salinity conditions, characterised by the kelp *Laminaria saccharina* with dense stands of silted filamentous green seaweeds and red seaweeds *Phyllophora crispa, Phyllophora pseudoceranoides* and *Phycodrys rubens*. The filamentous green seaweeds e.g. *Chaetomorpha melagonium* and *Cladophora* spp. can form a blanket cover amongst the *L. saccharina* in the upper zone, which is under greater influence of freshwater input. In deeper water the green seaweeds are replaced by red seaweed *Phyllophora* spp. or *Polysiphonia fucoides* which may form a distinct sub-zone in the biotope. Coralline crust can be present. The solitary ascidians *Corella parallelogramma* and *Ascidiella scabra* are often epiphytic on the seaweed (particularly *Phyllophora* spp.) and dominate the animal community along with the starfish *Asterias rubens*. The small ascidian *Dendrodoa grossularia*, the barnacle *Balanus crenatus* and the tube-building polychaete *Pomatoceros triqueter* occur on the rock surface. More mobile species include the crab *Carcinus maenas*, the hermit crab *Pagurus bernhardus* and the whelk *Buccinum undatum*. Bryozoans *Electra pilosa* and *Spirorbis* sp. may cover kelp fronds. The red seaweed *Odonthalia dentata* may be present in the north.

Situation

The ascidians found in LsacPhyVS may continue onto the circalittoral rock below where dense colonies of anthozoans and brachiopods can also be found (NeoPro.Den). Where tidal streams are increased, sponge and hydroid communities may occur below (HbowEud).

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pomatoceros triqueter	●●●	Occasional	2
Balanus crenatus	●●●	Occasional	3
Pagurus bernhardus	●●●	Occasional	3
Carcinus maenas	●●●●●	Occasional	8
Buccinum undatum	●●	Occasional	1
Eucratea loricata	●●●	Occasional	3
Electra pilosa	●●●	Common	3
Asterias rubens	●●●●●	Frequent	12
Corella parallelogramma	●●●●	Frequent	8
Ascidiella scabra	●●●	Frequent	5
Dendrodoa grossularia	●●	Occasional	1
Corallinaceae	●●	Common	2
Phyllophora crispa	●●●●	Frequent	6

Phyllophora pseudoceranoides	●●●●	Frequent	9
Phycodrys rubens	●●●●	Occasional	6
Odonthalia dentata	●●	Occasional	2
Polysiphonia fucoides	●●	Occasional	1
Laminaria saccharina	●●●●●	Frequent	12
Filamentous green algae	●●	Occasional	1

IR.LIR.IFaVS Estuarine faunal communities (shallow rock/mixed substrata)

Habitat classification

Salinity:	Variable (18-35ppt), Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Very sheltered, Extremely sheltered, Ultra sheltered
Tidal streams:	Strong, Moderately strong, Weak, Very weak
Substratum:	Bedrock, shells, mud, artificial and other
Zone:	Infralittoral
Depth band:	0-5 m

Previous code

SIR.EstFa	97.06

Biotope description

Shallow subtidal rocky habitats which support fauna-dominated communities, with seaweed communities only poorly developed or absent. In some sealochs dense mussel *Mytilus edulis* beds (MytRS) develop in tide-swept channels, whilst upper estuarine rocky habitats in the south-west coast rias may support particular brackish-water tolerant faunas (CcasEle; HarCon).

Temporal variation

Unknown

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	••	Common	3
Metridium senile	••	Frequent	2
Balanus crenatus	•••	Frequent	8
Carcinus maenas	•••	Occasional	6
Mytilus edulis	•••••	Abundant	65
Ascidiella aspersa	••	Occasional	1
Ectocarpaceae	••	Frequent	2

IR.LIR.IFaVS.MytRS *Mytilus edulis* beds on reduced salinity infralittoral rock

Habitat classification

Salinity:	Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Very sheltered, Extremely sheltered
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral
Depth band:	0-5 m
Other features:	May occur on vertical rock.

Biotope description

This biotope occur in shallow, often tide-swept, reduced salinity conditions. Dense beds of the mussel *Mytilus edulis* with the occasional barnacle *Balanus crenatus*. A wide variety of epifaunal colonisers on the mussel valves, including seaweeds, hydroids and bryozoans can be present. Predatory starfish *Asterias rubens* can be very common in this biotope. This biotope generally appears to lack large kelp plants, although transitional examples containing mussels and kelps plants may also occur. More information needed to validate this description.

Situation

Occurs in tide-swept entrance channels in very enclosed basins of sealochs where the basins are typically of lowered salinity. Also occurs in very sheltered subtidal rock (often vertical) in lagoons.

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Balanus crenatus	●●●●●	Common	85	
Mytilus edulis	●●●●●	Abundant	9	
Asterias rubens	●●●●●	Frequent	1	

IR.LIR.IFaVS.CcasEle *Cordylophora caspia* and *Electra crustulenta* on reduced salinity infralittoral rock

Habitat classification

Salinity:	Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Very sheltered, Extremely sheltered
Tidal streams:	Strong, Moderately strong
Substratum:	Boulders; cobbles
Zone:	Infralittoral
Depth band:	0-5 m

Previous code

SCR.HarCon in part	96.7

Biotope description

Shallow sublittoral rock in the upper estuary of one of the south-west inlets (Tamar) with very high turbidity and therefore no seaweeds. The brackish-water hydroid *Cordylophora caspia* and small colonies of the encrusting bryozoan *Electra crustulenta* and a few *Balanus crenatus* characterise this biotope. More information required to validate this description.

Situation

Insufficient information to describe neighbouring biotopes.

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Cordylophora caspia	●●●●●	Occasional	98
Balanus crenatus	●●●	Rare	1
Electra crustulenta	●●●	Frequent	1

IR.LIR.IFaVS.HarCon *Hartlaubella gelatinosa* and *Conopeum reticulum* on low salinity infralittoral mixed substrata

Habitat classification

Salinity:	Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong
Substratum:	Boulders, cobbles and mixed sediments
Zone:	Infralittoral
Depth band:	0-5 m

Previous code

SCR.HarCon in part	96.7

Biotope description

Upper estuarine mixed hard substrata colonised by very sparse communities of animals with low species richness and with a few seaweeds in very shallow water. In the Tamar estuary the hydroid *Hartlaubella gelatinosa* and bryozoan *Conopeum reticulum* are found on stones. In the River Dart the bryozoan *Bowerbankia imbricata* is most abundant. The mussel *Mytilus edulis*, the crab *Carcinus maenas* and the hydroid *Obelia dichotoma* can be present. A similar brackish-water rocky biotope is recorded from the Bann Estuary, Northern Ireland. There are considerable differences in species composition between sites, but all occur in brackish turbid-water conditions. More information required to validate this description.

Situation

Insufficient information to describe neighbouring biotopes.

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Hartlaubella gelatinosa	●●●●●	Frequent	33
Obelia dichotoma	●●●●●	Rare	22
Carcinus maenas	●●●●●	Occasional	11
Mytilus edulis	●●●●●	Rare	11
Bowerbankia imbricata	●●●●●	Present	11
Conopeum reticulum	●●●●●	Present	11

IR.LIR.Lag Submerged fucoids, green and red seaweeds (lagoonal rock)

Habitat classification

Salinity:	Full (30-35ppt), Low (<18ppt)
Wave exposure:	Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock, boulders, cobbles, pebbles
Zone:	Infralittoral
Depth band:	0-5 m

Biotope description

Very shallow submerged rocky habitats in lagoons, subject to variable or permanently reduced salinity conditions. These particular habitat conditions lead to a variety of seaweed-dominated communities, which include fucoids and green filamentous species. The fucoids, more typical of intertidal habitats, penetrate into the subtidal under the reduced salinity conditions, which are not tolerated by kelps.

Temporal variation

Unknown

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Mysidae	••	Frequent	5
Carcinus maenas	••	Occasional	4
Littorina littorea	••	Frequent	3
Mytilus edulis	••	Occasional	2
Corallinaceae	••	Occasional	2
Mastocarpus stellatus	••	Occasional	1
Chondrus crispus	••	Occasional	1
Polyides rotundus	••	Frequent	2
Ectocarpaceae	••	Frequent	8
Chorda filum	••	Frequent	3
Ascophyllum nodosum	••	Occasional	3
Fucus ceranoides	••	Common	14
Fucus serratus	•••	Common	13
Fucus vesiculosus	••	Frequent	7
Enteromorpha intestinalis	••••	Frequent	12
Cladophora rupestris	••	Frequent	3

IR.LIR.Lag.AscSpAs *Ascophyllum nodosum* with epiphytic sponges and ascidians on variable salinity infralittoral rock

Habitat classification

Salinity:	Variable (18-35ppt), Reduced/low (0.5-30ppt)
Wave exposure:	Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders and cobbles
Zone:	Infralittoral
Depth band:	0-5 m

Previous code

SLR.AscSAs

Biotope description

Dense subtidal stands of *Ascophyllum nodosum*, heavily epiphytised by sponges and ascidians in lagoon-like habitats. The wracks *Fucus vesiculosus* and *Fucus serratus* can be present along with the brown seaweed *Chorda filum* and the red seaweed *Polyides rotundus*. The crab *Carcinus maenas* can be present between the *A. nodosum* holdfasts along with the shrimps Mysidae.

Situation

Nearby rock often supports similar biotopes of submerged fucoids and green seaweeds (FChoG). Slightly deeper rock often supports *Laminaria saccharina* (Lsac.Ft), usually surrounded by more extensive areas of sediment. Seagrass beds thrive well in the muddy sand of these lagoons and often cover large areas. They include both *Ruppia maritima* and *Zostera marina* (Rup and Zmar).

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Mysidae	●●●	Occasional	3
Carcinus maenas	●●●●●	Occasional	21
Polyides rotundus	●●●	Frequent	7
Chorda filum	●●●	Frequent	4
Ascophyllum nodosum	●●●●●	Frequent	40
Fucus serratus	●●●	Frequent	4
Fucus vesiculosus	●●●●	Frequent	4

IR.LIR.Lag.FChoG Mixed fucoids, *Chorda filum* and green seaweeds on reduced salinity infralittoral rock

Habitat classification

Salinity:	Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Extremely sheltered
Tidal streams:	Very weak
Substratum:	Bedrock; boulders, cobbles and pebbles
Zone:	Infralittoral
Depth band:	0-5 m

Biotope description

Permanently submerged mixed fucoids on rock in lagoons. The main species are the wracks *Fucus serratus* and *Fucus vesiculosus*, but the brown seaweeds *Chorda filum*, *Ascophyllum nodosum* and Ectocarpaceae can be present as well. Red seaweeds are normally present and include *Mastocarpus stellatus*, *Polyides rotundus*, *Chondrus crispus*, *Ceramium* spp. and coralline crusts. A variety of green seaweeds is also present and include *Enteromorpha* spp., while dense patches of *Cladophora rupestris* may occur on vertical rock faces. The faunal component is restricted to the mussel *Mytilus edulis*, the polychaete *Arenicola marina* and the crab *Carcinus maenas*. Opossum shrimps Mysidae can be present as well. The kelp *Laminaria saccharina* is absent, possibly due to the low salinity conditions.

Situation

Nearby rock often supports similar biotopes of submerged fucoids (AscSpAs and FcerEnt) or where salinity is further reduced ProtFur can occur. Slightly deeper rock often supports *Laminaria saccharina* (Lsac.Ft), usually surrounded by more extensive areas of sediment. Seagrass beds thrive well in the muddy sediments of the lagoons and often cover large areas. They include both *Ruppia* spp. and *Zostera marina* and some locations in the Outer Hebrides support dense beds of the nationally rare stonewort *Lamprothamnion papulosum* (Rup and Zmar). The sublittoral mud, which abuts most of the submerged rock, can become anoxic and covered by a bacterial mat of *Beggiatoa* spp. (Beg).

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Arenicola marina	••	Occasional	2
Mysidae	••	Frequent	3
Carcinus maenas	••	Occasional	3
Littorina littorea	•••	Frequent	6
Mytilus edulis	••	Occasional	3
Corallinaceae	••	Occasional	2
Mastocarpus stellatus	••	Occasional	2
Chondrus crispus	••	Occasional	1
Polyides rotundus	••	Occasional	2
Ectocarpaceae	•••	Frequent	9
Chorda filum	••	Occasional	3
Ascophyllum nodosum	••	Occasional	3
Fucus serratus	••••	Common	30
Fucus vesiculosus	•••	Frequent	12
Enteromorpha	••	Occasional	2

Enteromorpha intestinalis	••	Frequent	3
Cladophora rupestris	••	Frequent	3

IR.LIR.Lag.ProtFur *Polyides rotundus* and/or *Furcellaria lumbricalis* on reduced salinity infralittoral rock

Habitat classification

Salinity:	Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Very sheltered, Extremely sheltered
Tidal streams:	Very weak
Substratum:	Bedrock; boulders, cobbles and pebbles
Zone:	Infralittoral
Depth band:	0-5 m

Previous code

SLR.PolFur	97.06

Biotope description

Bedrock and boulders characterised by a dense turf of the red seaweeds *Polyides rotundus* and/or *Furcellaria lumbricalis*, often with a dense mat of filamentous brown and green seaweeds including Ectocarpaceae and *Cladophora* spp. Other red seaweeds presents include *Chondrus crispus*, *Gracilaria gracilis* and coralline crusts as well as the odd brown seaweed *Chorda filum* or *Laminaria* spp. Associated with these seaweeds are a variety of ascidians including *Clavelina lepadiformis*, *Ascidiella aspersa*, *Ascidiella scabra* and *Ciona intestinalis* as well as the anemones *Anemonia viridis* and *Actinia equina* and the sponge *Halichondria panicea*. More mobile fauna include the starfish *Asterias rubens*, the crab *Carcinus maenas*, the hermit crab *Pagurus bernhardus*, the opossum shrimps Mysidae and the gastropod *Littorina littorea*. Attached to the rock or cobbles are spirorbid polychaetes and the mussel *Mytilus edulis*. Please notice that part of this diversity is due to large differences between sites.

Situation

Nearby rock (AscSpAs and FChoG) and seagrass *Ruppia maritima* dominating much of the surrounding muddy sediment (Rup). Mixed sediment supports filamentous green seaweeds e.g. *Cladophora* spp. and *Derbesia marina* on (FiG).

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	••	Occasional	1
Actinia equina	••	Occasional	2
Anemonia viridis	••	Frequent	2
Spirorbidae	••	Frequent	3
Mysidae	•••	Occasional	5
Pagurus bernhardus	••	Frequent	1
Carcinus maenas	•••	Frequent	6
Littorina littorea	••	Frequent	1
Mytilus edulis	••	Frequent	1
Asterias rubens	••••	Occasional	7
Clavelina lepadiformis	••	Frequent	2
Ciona intestinalis	•••	Frequent	5
Ascidiella aspersa	•••	Frequent	5
Ascidiella scabra	••	Occasional	1
Corallinaceae	••••	Occasional	6
Gracilaria gracilis	••	Frequent	1
Chondrus crispus	••	Occasional	2

Polyides rotundus	●●●	Common	10
Furcellaria lumbricalis	●●●	Common	11
Ectocarpaceae	●●	Occasional	3
Chorda filum	●●●	Frequent	5
Laminaria	●●	Frequent	1
Enteromorpha	●●●	Occasional	3
Cladophora	●●	Frequent	2
Cladophora rupestris	●●	Occasional	2

IR.LIR.Lag.FcerEnt *Fucus ceranoides* and *Enteromorpha* spp. on low salinity infralittoral rock

Habitat classification

Salinity:	Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Extremely sheltered
Tidal streams:	Very weak
Substratum:	Bedrock; boulders, cobbles and mixed sediment
Zone:	Infralittoral
Depth band:	0-5 m

Biotope description

Permanently submerged lagoon fringes with dense communities of the wrack *Fucus ceranoides* and the green seaweed *Enteromorpha* spp. There is typically a very limited associated biota due to low salinity conditions, and may include the opossum shrimps Mysidae and the freshwater/brackish gastropod *Potamopyrgus antipodarum*.

Situation

Insufficient information to describe neighbouring biotopes.

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Mysidae	••	Frequent	2
Potamopyrgus antipodarum	••	Common	4
Fucus ceranoides	•••••	Common	67
Enteromorpha	•••	Common	11
Enteromorpha intestinalis	••	Common	7

IR.FIR Features of infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock
Zone:	Sublittoral fringe, Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Two biotope complexes are currently found within the infralittoral rock features habitat complex: Surge Gulleys (SG) and Infralittoral Fouling communities (IFou). Surge Gulleys features are found throughout the infralittoral rock zone, and usually consist of vertical bedrock walls, occasionally with overhanging faces, and support communities, which reflect the degree of wave surge they are subject to and any scour from mobile substrata on the cave/gully floors. The larger cave and gully systems, such as found in Shetland, Orkney, the Western Isles and St Kilda, typically show a marked zonation from the entrance to the rear of the gully/cave as wave surge increases and light reduces. Infralittoral Fouling communities are found on wave-sheltered artificial substrata (usually steel wrecks), subject to weak tidal streams, in the upper infralittoral zone. Infralittoral fouling communities are characterised by filamentous and foliose algae.

IR.FIR.SG Robust faunal cushions and crusts (surge gullies and caves)

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock (boulders, cobbles, pebbles or coarse sediment in gully floors)
Zone:	Sublittoral fringe, Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Wave surge; vertical (and overhanging rock)

Previous code

EIR.SG	97.06

Biotope description

Infralittoral rocky habitats subject to strong wave surge conditions, as found in surge gullies and shallow caves, and typically colonised by faunal communities of encrusting or cushion sponges, colonial ascidians, short turf-forming bryozoans, anthozoans, barnacles and, where there is sufficient light, red seaweeds. These features usually consist of vertical bedrock walls, occasionally with overhanging faces, and support communities, which reflect the degree of wave surge they are subject to and any scour from mobile substrata on the cave/gully floors. The larger cave and gully systems, such as found in Shetland, Orkney, the Western Isles and St Kilda, typically show a marked zonation from the entrance to the rear of the gully/cave as wave surge increases and light reduces. This is reflected in communities of anthozoans, ascidians, bryozoans and red seaweeds near the entrance, leading to sponge crust-dominated communities and finally barnacle and spirorbid worm communities in the most severe surge conditions. Gully/cave floors usually have mobile boulders, cobbles, pebbles or coarse sediment. The mobile nature of the gully/cave floors leads to communities of encrusting species, tolerant of scour and abrasion or fast summer-growing ephemeral species. The lower zone of the gully side walls are also often scoured, and typically colonised by coralline crusts and barnacles.

Temporal variation

Not known

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Clathrina coriacea	●●●	Frequent	6
Pachymatisma johnstonia	●●	Occasional	2
Halichondria panicea	●●●	Frequent	5
Esperiopsis fucorum	●●	Occasional	1
Myxilla incrustans	●●	Occasional	1
Porifera indet crusts	●●	Occasional	2
Tubularia indivisa	●●	Occasional	3
Alcyonium digitatum	●●	Occasional	2
Urticina felina	●●●	Occasional	4
Metridium senile	●●	Frequent	1
Sagartia elegans	●●●	Occasional	5
Corynactis viridis	●●	Frequent	2
Pomatoceros triqueter	●●	Occasional	2
Balanus crenatus	●●●	Frequent	7
Cancer pagurus	●●●	Occasional	5
Calliostoma zizyphinum	●●	Occasional	1
Bryozoa indet crusts	●●	Frequent	1
Henricia	●●	Occasional	1

Asterias rubens	●●●	Occasional	3
Echinus esculentus	●●	Occasional	1
Polyclinum aurantium	●●	Frequent	1
Didemnidae	●●	Frequent	2
Dendrodoa grossularia	●●	Common	5
Botryllus schlosseri	●●	Occasional	2
Corallinaceae	●●●	Frequent	7

IR.FIR.SG.FoSwCC Foliose seaweeds and coralline crusts in surge gully entrances

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Boulder-scoured and wave-surged

Previous code

EIR.SG.FoSwCC	97.06

Biotope description

This biotope is found on steep wave-surged entrances to gullies and caves and on unstable boulders in the entrance to caves and gullies. The rock may be abraded by the movement of the boulders and cobbles in heavy surge and tends to be dominated by dense foliose seaweeds that grow rapidly in the calmer summer months. Beneath the foliose seaweeds the rock surface is typically covered with coralline crusts, which are longer-lived, and tolerant of abrasion. The flora of this biotope is relatively varied, depending upon the amount of light and degree of abrasion or rock mobility with red seaweeds such as *Cryptopleura ramosa*, *Plocamium cartilagineum*, *Odonthalia dentata*, *Callophyllis laciniata*, *Phycodrys rubens*, *Hypoglossum hypoglossoides*, *Phyllophora crispa* and *Corallina officinalis*. The brown seaweed *Dictyota dichotoma* also occurs in these conditions, since it is tolerant of some sand scour. During the summer months small fast-growing kelp plants can arise in this biotope, although the mobility of the substratum prevents the kelp from forming a kelp forest. Dense swathes of very young kelp such as *Laminaria hyperborea* are, however, not uncommon. The faunal community consist of the anemone *Urticina felina*, the sponge *Halichondria panicea* and the ascidian *Dendrodoa grossularia*. More mobile fauna include the echinoderms *Asterias rubens* and *Echinus esculentus*, the top shell *Gibbula cineraria* and the crab *Cancer pagurus*.

Situation

Further into the cave or gully, beyond the dense red seaweeds of FoSwCC, the vertical rock grades to either an ascidian and sponge dominated community or sponge crusts and anthozoans (CrSpAsAn/CrSpAsDenB). Further into the cave or gully the floor and any boulders or cobbles are generally scoured clean or may support coralline encrusting algae (CC.Mo). Above the red seaweeds, steep rock surfaces often support a kelp community (LhypR or Lhyp) or in shallower water *Alaria esculenta* is usually present (Ala.Myt).

Temporal variation

Unknown.

Similar biotopes

HIR.LsacSac	This biotope occurs in a similar depth and conditions as FoSwCC, though LsacSac often occurs further away from the cave / gully entrance on larger boulders. As such, the greater (relative) stability of the boulders allows the opportunistic kelps to survive long enough to form a forest.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Halichondria panicea	••	Occasional	2	
Urticina felina	•••	Occasional	5	
Cancer pagurus	••	Occasional	1	
Gibbula cineraria	•••	Frequent	3	
Asterias rubens	•••	Occasional	3	
Echinus esculentus	••	Occasional	1	
Dendrodoa grossularia	••	Frequent	3	
Callophyllis laciniata	•••	Occasional	3	
Corallinaceae	•••••	Abundant	21	
Corallina officinalis	••	Occasional	1	
Phyllophora crispa	••	Occasional	1	
Plocamium cartilagineum	•••	Frequent	8	
Cryptopleura ramosa	••••	Frequent	10	
Hypoglossum hypoglossoides	•••	Occasional	3	
Phycodrys rubens	••	Occasional	3	
Odonthalia dentata	•••	Occasional	5	
Dictyota dichotoma	••	Occasional	4	
Laminaria hyperborea	••	Occasional	1	

IR.FIR.SG.CrSpAsAn Anemones, including *Corynactis viridis*, crustose sponges and colonial ascidians on very exposed or wave surged vertical infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m
Other features:	Wave surged vertical rock; in surge gullies and caves.

Previous code

IR.FaSwV.CorMetAlc in part	97.06
EIR.SG.SCAs.ByH in part	97.06
EIR.SG.SCAn	97.06

Biotope description

Vertical very exposed and exposed bedrock gullies, tunnels and cave entrances subject to wave-surge dominated by sponge crusts such as *Clathrina coriacea*, *Myxilla incrustans*, *Pachymatisma johnstonia* and *Halichondria panicea* and anthozoans such as *Sagartia elegans*, *Urticina felina*, *Alcyonium digitatum*, *Corynactis viridis* and dwarf *Metridium senile* generally dominate the area; the anthozoans often appearing to protrude through the sponge layer. There may be dense aggregations of the hydroid *Tubularia indivisa*, the cup coral *Caryophyllia smithii* and the colonial ascidians *Botrylloides leachi* and *Polyclinum aurantium*. There may be a short crisiid turf, interspersed with *Scrupocellaria reptans*. Encrusting coralline algae may occur on well-illuminated rock faces. The echinoderms *Asterias rubens*, *Marthasterias glacialis*, *Echinus esculentus*, *Antedon bifida* and *Ophiothrix fragilis*, the topshell *Calliostona zizphinum* and the calcareous tubeworm *Pomatoceros triqueter* may also be present on the rock face. The crabs *Cancer pagurus* and *Necora puber* may also be recorded. Due to the wave-surged nature and vertical orientation of these biotopes, kelps are rare and certainly never dominate.

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Clathrina coriacea	••••	Occasional	3	
Pachymatisma johnstonia	••	Occasional	3	
Halichondria panicea	•••	Frequent	1	
Myxilla incrustans	•••	Frequent	2	
Porifera indet crusts	•••	Frequent	2	
Tubularia indivisa	••••	Frequent	4	
Alcyonium digitatum	••••	Occasional	5	
Urticina felina	•••	Occasional	1	
Metridium senile	•••	Frequent	4	
Sagartia elegans	••••	Frequent	5	
Corynactis viridis	•••••	Common	14	
Caryophyllia smithii	•••	Occasional	2	
Pomatoceros triqueter	••	Occasional	1	
Cancer pagurus	••••	Occasional	3	
Necora puber	•••	Occasional	1	
Calliostoma zizyphinum	••••	Occasional	4	

Crisiidae	●●●	Frequent	2
Scrupocellaria reptans	●●●	Common	2
Bryozoa indet crusts	●●●	Frequent	3
Antedon bifida	●●●	Occasional	1
Asterias rubens	●●●●	Occasional	4
Marthasterias glacialis	●●●	Occasional	1
Ophiothrix fragilis	●●	Occasional	1
Echinus esculentus	●●●	Occasional	2
Polyclinum aurantium	●●●	Frequent	1
Didemnidae	●●	Frequent	2
Botrylloides leachi	●●●	Occasional	2
Corallinaceae	●●●	Frequent	3

IR.FIR.SG.CrSpAsDenB Crustose sponges and colonial ascidians with *Dendrodoa grossularia* or barnacles on wave-surged infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Strong, Moderately strong, Weak, Very weak
Substratum:	Bedrock
Zone:	Sublittoral fringe, Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Surge gullies and caves

Previous code

EIR.SG.SCAs in part	97.06
EIR.SG.SCAs.ByH in part	97.06
EIR.SG.SCAn.Tub in part	97.06

Biotope description

Vertical and overhanging, exposed to moderately exposed bedrock gullies, tunnels and cave entrances subject to wave surge, and dominated by the crustose sponges *Halichondria panicea*, *Myxilla incrustans*, *Clathrina coriacea*, *Leucosolenia botryoides*, Esperiopsis fucorum *and* Grantia compressa. *There may also be dense aggregations of the anthozoan* Sagartia elegans, *dwarf* Metridium senile, Alcyonium digitatum, *and* Urticina felina, *and a dense covering of the barnacle* Balanus crenatus *on the bare rock face. Dense aggregations of the robust hydroid* Tubularia indivisa *may be recorded, growing through the sponge crust. Colonial ascidians such as* Polyclinum aurantium, Botryllus schlosseri, Botrylloides leachi, Aplidium nordmanni *and the solitary ascidian* Dendrodoa grossularia *may all be recorded. The echinoderms* Asterias rubens, Echinus esculentus, Henricia *sp., the crab* Cancer pagurus *and the calcareous tubeworm* Pomatoceros triqueter *may also be present on the rock face, along with encrusting coralline algae.*

Temporal variation

Unknown.

Similar biotopes

FIR.CrSpAsAn
FIR.DenCcor

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Clathrina coriacea	●●●	Frequent	3	
Leucosolenia botryoides	●●	Occasional	1	
Grantia compressa	●●	Frequent	1	
Halichondria panicea	●●●●	Frequent	6	
Esperiopsis fucorum	●●	Frequent	1	
Myxilla incrustans	●●●●	Occasional	4	
Tubularia indivisa	●●●	Frequent	5	
Alcyonium digitatum	●●●	Occasional	3	
Urticina felina	●●●	Occasional	2	
Metridium senile	●●●	Occasional	4	
Sagartia elegans	●●●●	Frequent	7	
Pomatoceros triqueter	●●●	Frequent	3	
Balanus crenatus	●●●●	Frequent	7	

CAPRELLIDEA	••	Common	2
Cancer pagurus	••••	Occasional	4
Bryozoa indet crusts	••	Frequent	1
Henricia	••	Occasional	1
Asterias rubens	•••	Occasional	3
Echinus esculentus	•••	Occasional	1
Polyclinum aurantium	•••	Frequent	5
Aplidium nordmanni	••	Occasional	2
Didemnidae	••	Frequent	1
Dendrodoa grossularia	•••	Frequent	2
Botryllus schlosseri	••••	Occasional	4
Botrylloides leachi	••	Occasional	4
Corallinaceae	•••	Frequent	3

IR.FIR.SG.DenCcor *Dendrodoa grossularia* and *Clathrina coriacea* on wave-surged vertical infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	Weak, Very weak
Substratum:	Bedrock
Zone:	Sublittoral fringe, Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Wave-surged gullies or caves;, vertical and overhanging rock

Previous code

EIR.SCAs.DenCla	97.06

Biotope description

Vertical or overhanging infralittoral rock subject to considerable wave-surge, especially in the middle or back of caves but also in gullies and tunnels, and dominated by dense sheets of the ascidian *Dendrodoa grossularia*, together with variable quantities of the sponge *Clathrina coriacea*. At some sites *D. grossularia* forms continuous sheets, with few other species present. Other sponges such as *Esperiopsis fucorum*, *Pachymatisma johnstonia*, *Leucosolenia botryoides*, *Scypha ciliata* and *Halichondria panicea* regularly occur in this biotope, though generally at low abundance. Other ascidians, especially *Polyclinum aurantium*, *Diplosoma* spp. and other didemnids may also occur, though only *P. aurantium* is ever as abundant as *D. grossularia*. Being characteristically found in the middle or towards the backs of the caves mean that there is generally insufficient light to support any foliose seaweeds, although encrusting coralline algae are not uncommon. More scoured areas may also contain the anemone *Urticina felina*, whilst *Sagartia elegans* is often present in low numbers. Mobile fauna are often limited to the starfish *Asterias rubens* and *Henricia* spp., the brittlestar *Ophiopholis aculeata* and crabs *Cancer pagurus* and *Necora puber*. The barnacle *Balanus crenatus* can occur, usually in low densities.

Situation

Where this biotope develops in a cave or tunnel it can occur anywhere from the entrance to the rear of the system. Typically, it will give way to sponge crust or barnacle and encrusting tubeworm communities at the rear of the cave, where surge forces are amplified (CrSp or CC.BalPom). The vertical rock below the DenCla zone, abutting the cave/gully floor, is likely to be severely scoured, colonised by the robust CC.BalPom biotope. The cave or gully floor is generally scoured clean by boulders and/or cobbles (CC.Mo). The cave or gully entrance has more available light for algal growth so dense foliose seaweeds usually dominate the rock walls at the entrance, abutting the *D. grossularia* - *C. coriacea* zone further into the cave (FoSwCC). This dense seaweed growth may also extend to the upward-facing surfaces of boulders around the entrance. Where DenCla occurs in a gully situation, the rock tends to be colonised by dense *Alaria esculenta* in the sublittoral fringe (Ala) or by *Laminaria hyperborea* forest in the shallow infralittoral (LhypR.Ft).

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Clathrina coriacea	●●●●●	Common	16	
Leucosolenia complicata	●●	Frequent	2	
Scypha ciliata	●●	Occasional	1	
Grantia compressa	●●	Occasional	1	

Pachymatisma johnstonia	●●●	Frequent	3
Halichondria panicea	●●●	Frequent	4
Porifera indet crusts	●●	Occasional	1
Urticina felina	●●●	Occasional	2
Sagartia elegans	●●	Occasional	2
Spirorbidae	●●	Frequent	1
Balanus crenatus	●●●●	Frequent	3
Cancer pagurus	●●●	Occasional	4
Necora puber	●●	Rare	1
Henricia	●●	Occasional	2
Asterias rubens	●●	Occasional	2
Ophiopholis aculeata	●●	Occasional	2
Polyclinum aurantium	●●	Occasional	1
Didemnidae	●●	Occasional	1
Dendrodoa grossularia	●●●●●	Abundant	32
Botryllus schlosseri	●●	Occasional	1
Corallinaceae	●●	Occasional	1

IR.FIR.SG.CrSp Sponge crusts on extremely wave-surged infralittoral cave or gully walls

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; massive boulders
Zone:	Sublittoral fringe, Infralittoral - upper
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Extreme wave surge and scour on, vertical and overhanging rock

Previous code

EIR.SC	97.06

Biotope description

Walls, or massive boulders, in caves or gullies that are subject to severe wave-surge and characterised by extensive thin crusts of the sponge *Halichondria panicea* with smaller patches of other sponges such as *Esperiopsis fucorum* or *Clathrina coriacea*. Small turfs of robust hydroids, such as *Diphasia rosacea* and *Ventromma halecioides*, and patches of the barnacle *Balanus crenatus*, coralline crusts and tube-building spirorbid polychaetes may be present. The starfish *Henricia* spp., the brittlestar *Ophiopholis aculeata* and the crabs *Cancer pagurus* and *Necora puber* can be present. The anemones *Sagartia elegans, Urticina* felina *and* Actinia equina *can be found in cracks and crevices or under boulders. The mussel* Mytilus edulis *may be present in low densities.*

Situation

This surge-tolerant biotope of low-growing fauna is typically confined to the mid or rear section of caves (or the narrowest part of gullies) where the wave-surge is intensified. It generally abuts the less surged ascidian-sponge communities (CrSpAsAn, DenCcor and CrSpAsDenB). A highly scoured zone of barnacles and calcareous tubeworms often form a zone below, abutting the cave/gully floor (CC.BalPom).

Temporal variation

Unknown.

Similar biotopes

FIR.CrSpAsAn
FIR.CrSpAsDenB

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Clathrina coriacea	●●●	Frequent	6	
Leuconia nivea	●●	Common	4	
Pachymatisma johnstonia	●●●	Occasional	5	
Halichondria panicea	●●●	Abundant	20	
Porifera indet crusts	●●	Occasional	4	
Actinia equina	●●	Occasional	2	
Urticina felina	●●	Occasional	3	
Sagartia elegans	●●	Frequent	2	
Spirorbidae	●●	Common	8	
Balanus crenatus	●●	Frequent	4	

Cancer pagurus	●●	Occasional	3
Necora puber	●●	Occasional	3
Henricia	●●	Occasional	7
Ophiopholis aculeata	●●	Frequent	3
Dendrodoa grossularia	●●	Occasional	3
Corallinaceae	●●●	Frequent	13

IR.FIR.SG.CC Coralline crust in surge gullies and scoured infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock
Zone:	Sublittoral fringe, Infralittoral - upper
Depth band:	0-5 m, 5-10 m

Biotope description

Scoured bedrock in wave-surged caves, tunnels or gullies often look bare, but are characterised by a limited scour-tolerant fauna of *Balanus crenatus* and/or *Pomatoceros triqueter* with spirorbid polychaetes. In areas where sufficient light is available, encrusting coralline algae and non-calcareous crusts cover the rock surface, giving a pink appearance. This biotope most commonly occurs at the bottom of walls in caves and gullies, where abrasion by cobbles and stones is severe, especially during winter. In some gullies, extreme scouring and abrasion produces a narrow band of bare coralline algal crust at the very bottom of the walls, with a band of *P. triqueter* and or *B. crenatus* immediately above. Other scour-tolerant species, such as encrusting bryozoans may also be common. Crevices and cracks in the rock provide a refuge for sponge crusts such as *Halichondria panicea* and occasional *Urticina felina* and *Sagartia elegans*. More mobile fauna is usually restricted to the echinoderms *Asterias rubens* and *Echinus esculentus* as well as the crab *Cancer pagurus*. Two variants has been identified: Wave-surged crusts with coralline crust, *B. crenatus* and *P. triqueter* (CC.BalPom) and coralline crusts on mobile boulders in severely scoured caves (CC.Mo).

Situation

Generally occurring at the base of walls in caves and gullies. Immediately above this zone a variety of biotopes may occur depending on the proximity to the cave/gully entrance. Typically sponge crusts and ascidians with a hydroid-bryozoan turf will occur in the outer to mid section (CrSpAsAn, CrSpAsDenB); sponge crusts and dense ascidians in the outer to rear section (DecCcor); and low-growing sponge crusts at the rear of caves (CrSp). At some sites, CC.BalPom can form a zone towards the rear of the cave, beyond the sponge crust zone.

Temporal variation

Unknown

Similar biotopes

IR.FIR.SG.FoSwCC	This biotope occurs in surge gully entrances on bedrock. It is less scoured which allows foliose seaweeds develop.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	••	Occasional	3
Porifera indet crusts	••	Occasional	2
Urticina felina	••	Frequent	6
Sagartia elegans	••	Occasional	4
Pomatoceros triqueter	•••	Frequent	13
Spirorbidae	••	Abundant	2
Balanus crenatus	•••	Common	17

Cancer pagurus	●●●	Occasional	7
Asterias rubens	●●	Occasional	5
Echinus esculentus	●●	Occasional	2
Corallinaceae	●●●	Abundant	17

IR.FIR.SG.CC.BalPom *Balanus crenatus* and/or *Pomatoceros triqueter* with spirorbid worms and coralline crusts on severely scoured vertical infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock
Zone:	Sublittoral fringe, Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Scoured vertical or overhanging, rock

Previous code

EIR.SG.CC.BalPom	97.06
EIR.CCPom	96.7
EIR.BcreSpi	96.7

Biotope description

Severely scoured bedrock in wave-surged caves, tunnels or gullies often looks rather bare, and may be characterised by a limited scour-tolerant fauna of *Balanus crenatus* and/or *Pomatoceros triqueter* with spirorbid polychaetes. In areas where sufficient light is available, encrusting coralline algae and non-calcareous crusts cover the rock surface, giving a pink appearance. This biotope most commonly occurs at the bottom of walls in caves and gullies, where abrasion by cobbles and stones is severe, especially during winter. In some gullies, extreme scouring and abrasion produces a narrow band of bare coralline algal crust at the very bottom of the walls, with a band of *P. triqueter* and or *B. crenatus* immediately above. In some caves extreme wave surge at the back of the cave leads to a zone of this biotope which may also be dominated solely by sprorbids or by the barnacle *Verruca stroemia*. Other scour-tolerant species, such as encrusting bryozoans may also be common. Crevices and cracks in the rock provide a refuge for sponge crusts, small *Mytilus edulis* and occasional *Actinia equina*, *Urticina felina* and *Sagartia elegans*. More mobile fauna is usually restricted to the echinoderm *Asterias rubens* and the crab *Cancer pagurus*. During periods of relative stability in the summer, small quantities of foliose red seaweeds and opportunistic kelps may occur where sufficient light is available; the seaweeds however do not dominate (compare with FoSwCC).

Situation

Generally occurs at the base of walls in caves and gullies, but in extreme surge may occur as a zone at the back of caves. Immediately above this zone a variety of biotopes may occur depending on the proximity to the cave/gully entrance. Typically sponge crusts and ascidians with a hydroid-bryozoan turf will occur in the outer to mid section (CrSpAsAn, CrSpAsDenB); sponge crusts and dense ascidians in the outer to rear section (DenCcor); and low-growing sponge crusts at the rear of caves (CrSp). At some sites, CC.BalPom can form a zone towards the rear of the cave, beyond the sponge crust zone.

Temporal variation

Unknown.

Similar biotopes

FIR.CC.Mo	Coralline crusts and crustaceans on mobile boulders or cobbles in surge gullies. Occurs on mobile boulders on gully/cave floors.
FIR.FoSwCC	This biotope occurs in surge gully entrances on bedrock. It is less scoured which allows foliose seaweeds develop.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Porifera indet crusts	••	Occasional	3	
Urticina felina	•••	Frequent	4	
Sagartia elegans	••	Occasional	3	
Pomatoceros triqueter	•••	Common	11	
Spirorbidae	•••	Abundant	5	
Balanus crenatus	••••	Abundant	33	
Cancer pagurus	•••	Occasional	6	
Bryozoa indet crusts	••	Common	2	
Asterias rubens	••	Occasional	3	
Corallinaceae	•••	Common	17	

IR.FIR.SG.CC.Mo Coralline crusts and crustaceans on mobile boulders or cobbles in surge gullies

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Boulders, cobbles, often with pebbles or gravel
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Mobile substrata

Previous code

EIR.SG.CC.Mob	97.06
EIR.Bcre	96.7

Biotope description

Highly mobile and scoured boulders and cobbles found on cave and gully floors and which often appear bare. Where there is sufficient light and stability, however, the boulders are encrusted by coralline algal crusts. Barnacles *Balanus crenatus* and keelworms *Pomatoceros triqueter* may survive in areas protected from severe abrasion. Crabs such as *Cancer pagurus* and *Carcinus maenas* may occur, often beneath and between the rocks, along with the gastropod *Calliostoma zizyphinum*. The anemone *Actinia equina* may be present in low numbers.

Situation

The slightly less-scoured walls often found above this biotope in caves and gullies are generally characterised by a similar, but richer community of scour-tolerant *Balanus crenatus*, *Pomatoceros triqueter*, coralline crusts and spirorbid worms (CC.BalPom). This impoverished biotope may form an intermediate between barren gravel and slightly more stable larger pebbles and cobbles which are covered by algae that are often found in the mouths of caves (FoSwCC).

Temporal variation

Winter storms periodically mobilise the boulders and cobbles, causing abrasion to any seasonal biota that may have developed over the calmer summer months.

Similar biotopes

HIR.DesFilR	Occurs in similar conditions as CC.Mob but has a higher species diversity and has a high abundance of the brown seaweed *Desmarestia aculeata*.
FIR.CC.BalPom	Severely scoured vertical infralittoral rock with *B. crenatus* and/or *P. triqueter* with spirorbid worms and coralline crusts. Often occurs on nearby vertical rock.
FIR.FoSwCC	This biotope occurs in surge gully entrances on bedrock. The less scoured, more stable substrata allow foliose seaweeds develop.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Urticina felina	••	Occasional	12	
Cancer pagurus	••	Occasional	11	
Carcinus maenas	••	Rare	23	
Calliostoma zizyphinum	••	Occasional	13	
Corallinaceae	••	Common	23	
Rhodophycota indet.(non-calc.crusts)	••	Frequent	18	

IR.FIR.IFou Infralittoral fouling communities

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered, Ultra sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Artificial
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Moderately exposed to wave-sheltered artificial substrata (such as steel wrecks/concrete pilings/cable debris etc) subject to moderately strong to weak tidal streams in the infralittoral zone. This biotope complex is characterised by a dense covering of filamentous and foliose algae on vertical as well as the upper faces of the substrata. Although there are no biotopes currently defined under this biotope, due to the low number of records, it is suspected that this has been highly 'under-recorded', and that additional records will be added in the near future, leading to the definition of biotopes.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Plocamium cartilagineum		Common		
Ceramium		Frequent		
Nitophyllum punctatum		Occasional		
Phycodrys rubens		Frequent		
Brongniartella byssoides		Frequent		
Polysiphonia		Frequent		
Pterosiphonia parasitica		Frequent		
Filamentous red algae		Abundant		
Foliose red algae		Abundant		
Eudesme virescens		Common		
Cutleria multifida		Rare		
Desmarestia viridis		Occasional		
Laminaria		Occasional		
Filamentous brown algae		Abundant		
Foliose brown algae		Abundant		
Filamentous green algae		Abundant		
Foliose green algae		Abundant		

Infralittoral Rock: Hierarchy Structure Diagram

Infralittoral Rock
IR

High energy Infralittoral Rock HIR		Moderate energy Infralittoral Rock MIR		Low energy Infralittoral Rock LIR				Features of Infralittoral Rock FIR	
Kelp with cushion fauna and/or foliose red seaweeds KFaR	Sediment-affected or disturbed kelp and seaweed communities KSed	Kelp and red seaweeds KR	Kelp and seaweed communities in tide-swept sheltered conditions KT	Kelp in silted conditions K	Kelp in variable or reduced salinity KVS	Infralittoral fauna in variable or reduced salinity IFaVS	Submerged fucoids, green or red seaweeds (low salinity infralittoral rock - lagoonal communities) Lag	Infralittoral surge gullies and caves SG	Infralittoral fouling communities IFou
Ala	Sac	Ldig	LdigT	LhypLoch	Cod	MytRS	AscSpAs	FoSwCC	
Ala.Myt	LsacSac	Ldig.Ldig	XKT	LhypLsac	LsacPsaVS	CcasEle	FChoG	CrSpAsAn	
Ala.Ldig	LsacChoR	Ldig.Bo	XKTX	LhypLsac.Ft	LsacPhyVS	HarCon	ProtFur	CrSpAsDenB	
AlaAnCrSp	DesFilR	Ldig.Pid	LsacT	LhypLsac.Pk			FcerEnt	DenCcor	
LhypFa	XKScrR	LhypT	FilRVS	LhypLsac.Gz				CrSp	
LhypPar	XKHal	LhypT.Ft		Lsac				CC	
LhypR	ProtAhn	LhypT.Pk		Lsac.Ldig				CC.BalPom	
LhypR.Ft		LhypTX		Lsac.Ft				CC.Mo	
LhypR.Pk		LhypTX.Ft		Lsac.Pk					
LhypR.Loch		LhypTX.Pk		Lsac.Gz					
FoR		Lhyp		LhypCape					
FoR.Dic		Lhyp.Ft		Sar					
LhypRVt		Lhyp.Pk							
		Lhyp.GzFt							
		Lhyp.GzPk							
		Lhyp.Sab							
		XFoR							
		LhypVt							
		HiaSw							

Infralittoral Rock

IR

High energy Infralittoral Rock
HIR

- Kelp with cushion fauna and/or foliose red seaweeds (KFaR)
  - Ala
  - Ala.Myt
  - Ala.Ldig
  - AlaAnCrSp
  - LhypFa
  - LhypPar
  - LhypR
  - LhypR.Ft
  - LhypR.Pk
  - LhypR.Loch
  - FoR
  - FoR.Dic
  - LhypRVt
- Sediment-affected or disturbed kelp and seaweed communities (KSed)
  - Sac
  - LsacSac
  - LsacChoR
  - DesFilR
  - XKScrR
  - XKHal
  - ProtAhn

Moderate energy Infralittoral Rock
MIR

- Kelp and red seaweeds (KR)
  - Ldig
  - Ldig.Ldig
  - Ldig.Bo
  - Ldig.Pid
  - LhypT
  - LhypT.Ft
  - LhypT.Pk
  - LhypTX
  - LhypTX.Ft
  - LhypTX.Pk
  - Lhyp
  - Lhyp.Ft
  - Lhyp.Pk
  - Lhyp.GzFt
  - Lhyp.GzPk
  - Lhyp.Sab
  - XFoR
  - LhypVt
  - HiaSw
- Kelp and seaweed communities in tide-swept sheltered conditions (KT)
  - LdigT
  - XKT
  - XKTX
  - LsacT
  - FilRVS

Low energy Infralittoral Rock
LIR

- Kelp in silted conditions (K)
  - LhypLoch
  - LhypLsac
  - LhypLsac.Ft
  - LhypLsac.Pk
  - LhypLsac.Gz
  - Lsac
  - Lsac.Ldig
  - Lsac.Ft
  - Lsac.Pk
  - Lsac.Gz
  - LhypCape
  - Sar
- Kelp in variable or reduced salinity (KVS)
  - Cod
  - LsacPsaVS
  - LsacPhyVS
- Infralittoral fauna in variable or reduced salinity (IFaVS)
  - MytRS
  - CcasEle
  - HarCon
- Submerged fucoids, green or red seaweeds (low salinity infralittoral rock - lagoonal communities) (Lag)
  - AscSpAs
  - FChoG
  - ProtFur
  - FcerEnt

Features of Infralittoral Rock
FIR

- Infralittoral surge gullies and caves (SG)
  - FoSwCC
  - CrSpAsAn
  - CrSpAsDenB
  - DenCcor
  - CrSp
  - CC
  - CC.BalPom
  - CC.Mo
- Infralittoral fouling communities (IFou)

HIR *(High Energy Infralittoral Rock)*

MIR *(Moderate Energy Infralittoral Rock)*

LIR *(Low Energy Infralittoral Rock)*

FIR *(Features of Infralittoral Rock)*

KT
- XKTX
- LdigT
- LsacT
- XKT
- FilRVS

KR
- HiaSw
- LhypVt
- Ldig.Ldig
- Lhyp.Pk
- Ldig.Bo
- LhypT.Pk
- Ldig.Pid
- LhypT.Ft
- Lhyp.Ft
- XFoR
- Lhyp.GzPk
- LhypTX.Ft
- Lhyp.Sab
- AdigByH.Hia
- Lhyp.GzFt
- LhypTX.Pk

KFaR
- Ala.Myt
- LhypR.Loch
- Ala.Ldig
- AlaAnCrSp
- FoR.Dic
- LhypFa
- LhypRVt
- LhypPar
- LhypR.Ft
- LhypR.Pk

KSed
- Sac
- LsacSac
- LsacChoR
- DesFilR
- ProtAhn
- XKScrR
- XKHal

SG
- FoSwCC
- CrSpAsAn
- CrSpAsDenB
- DenCcor
- CrSp
- CC.BalPom
- CC.Mob

IFou

IFaVS
- MytRS
- CcasEle
- HarCon

Lag
- AscSpAs
- FChoG
- ProtFur
- Fcerorot

K
- LhypLoch
- Lsac.Ldig
- Sar
- LhypLsac.Ft
- Lsac.Ft
- LhypLsac.Pk
- Lsac.Pk
- LhypLsac.Gz
- Lsac.Gz
- LhypCape

KVS
- Cod
- LsacPhyVS
- LsacPsaVS

Tidal stream

Wave exposure

KFaR | KSed | KT | KR | K | Lag | SG | KVS | IFou

The Marine Habitat Classification for Britain and Ireland. Version 04.05

Circalittoral Rock Section

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Table of Contents

CR Circalittoral rock (and other hard substrata)

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt), Reduced/low (0.5-30ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Very strong, Strong, Moderately strong, Weak, Very weak
Substratum:	Bedrock; boulders, cobbles, mixed substrata
Zone:	Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m, 30-50 m

Previous code

SR in part	96.7

Biotope description

Circalittoral rock is present all around the coast of the United Kingdom, and is characterised by animal dominated communities (a departure from the algae dominated communities in the infralittoral zone). The circalittoral zone can itself be split into two sub-zones; upper circalittoral (foliose red algae present) and lower circalittoral (foliose red algae absent). The depth at which the circalittoral zone begins is directly dependent on the intensity of light reaching the seabed; in highly turbid conditions, the circalittoral zone may begin just below water level at mean low water springs (MLWS). The biotopes identified in the field 'fall' into three energy levels: high, moderate and low energy circalittoral rock (used to define the habitat complex level). The character of the fauna varies enormously and is affected mainly by wave action, tidal stream strength, salinity, turbidity, the degree of scouring and rock topography. It is typical for the community not to be dominated by single species, as is common in shore and infralittoral habitats, but rather comprise a mosaic of species. This, coupled with the range of influencing factors, makes circalittoral rock a difficult area to satisfactorily classify; particular care should therefore be taken in matching species and habitat data to the classification.

CR.HCR High energy circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed
Tidal streams:	Very strong, Strong
Substratum:	Bedrock;boulders
Zone:	Circalittoral - upper, Circalittoral - lower
Depth band:	10-20 m, 20-30 m
Other features:	Tideswept

Biotope description

This habitat complex occurs on extremely wave-exposed to exposed circalittoral bedrock and boulders subject to very strong to strong tidal streams. Typically found in tidal straits and narrows. The high energy levels found within this habitat complex are reflected in the fauna recorded. Sponges such as *Pachymatisma johnstonia*, *Halichondria panicea*, *Esperiopsis fucorum* and *Myxilla incrustans* may all be recorded. Characteristic of this habitat complex is the dense 'carpet' of the hydroid *Tubularia indivisa*. The barnacle *Balanus crenatus* is recorded in high abundance on the rocky substrata. On rocky outcrops, *Alcyonium digitatum* is often present.

CR.HCR.FaT Very tide-swept faunal communities

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed
Tidal streams:	Very strong, Strong
Substratum:	Bedrock, boulders
Zone:	Circalittoral - upper, Circalittoral - lower
Depth band:	10-20 m, 20-30 m

Previous code

ECR.BS	97.06

Biotope description

This biotope complex occurs in wave-exposed, tide-swept narrows and straits on circalittoral bedrock and boulders. The biotopes within this complex are characterised by a high abundance of the robust hydroid *Tubularia indivisa*, the barnacle *Balanus crenatrus* is characteristic of BalTub, the cushion sponges *Halichondria panicea* and *Myxilla incrustans* are characteristic of CTub.CuSp and *Alcyonium digitatum* is characteristic of CTub.Adig. The anemones *Sagartia elegans*, *Actinothoe sphyrodeta*, *Urticina felina*, *Corynactis viridis* and *Metridium senile* are all found within this complex. Other species present in this high-energy complex are the sponges *Esperiopsis fucorum* and *Pachymatisma johnstonia*, the bryozoans *Alcyonidium diaphanum* and *Flustra foliacea*, *Cancer pagurus*, Sertularia argentea *and* Asterias rubens. Within this complex, two biotopes have been identified: BalTub and CTub.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
PORIFERA	••	Frequent	1
Pachymatisma johnstonia	•••	Occasional	2
Halichondria panicea	••	Frequent	2
Esperiopsis fucorum	•••	Frequent	3
Myxilla incrustans	•••	Frequent	2
Tubularia indivisa	•••••	Abundant	24
Sertularia argentea	•••	Occasional	2
Alcyonium digitatum	••••	Frequent	7
Urticina felina	•••	Frequent	3
Metridium senile	••	Frequent	1
Sagartia elegans	••••	Common	9
Actinothoe sphyrodeta	••	Common	2
Corynactis viridis	••	Frequent	2
Balanus crenatus	••••	Abundant	11
Cancer pagurus	•••	Occasional	2
Alcyonidium diaphanum	•••	Frequent	3
Flustra foliacea	••	Frequent	2
Asterias rubens	•••	Occasional	2

CR.HCR.FaT.BalTub *Balanus crenatus* and *Tubularia indivisa* on extremely tide-swept circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed, Sheltered, Very sheltered, Extremely sheltered, Ultra sheltered
Tidal streams:	Very strong, Strong
Substratum:	Bedrock, boulder, cobble
Zone:	Circalittoral - upper, Circalittoral - lower
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m

Previous code

CR.ECR.BS.BalTub 97.06

Biotope description

This biotope typically occurs on upward-facing, extremely tide-swept, circalittoral bedrock, boulders and cobbles found in a broad spectrum of different wave-exposures. It is characterised by a few species that are capable of maintaining a foothold in strong tides. These species either form a flat, adherent crust in the case of the barnacle *Balanus crenatus*, or have strong attachment points and are flexible, bending with the tide, such as the turf of the hydroid *Tubularia indivisa*. Other species able to tolerate these very strong tides, or just situated slightly out of the main force of the current, include the sponge *Halichondria panicea*, the robust hydroid *Sertularia argentea* and current-tolerant anemones such as *Sagartia elegans*, *Urticina felina* and *Metridium senile*. Mobile species such as the starfish *Asterias rubens*, the crab *Cancer pagurus* and the whelk *Nucella lapillus* may also be present.

Situation

This biotope is typically occurs in deep, very tide-swept straights, sounds and narrows with a bedrock/boulder/cobble slope. Kelp forest (LhypT) occurs in shallower water.

Temporal variation

Not known.

Similar biotopes

CR.HCR.FaT.CTub.CuSp	This biotope occurs under similar conditions to BalTub although it tends to be found more on steep and vertical faces. CTub.CuSp contains a more diverse range of sponges, bryozoans and ascidians than BalTub. They both contain dense carpets of the robust hydroid *T. indivisa*.
CR.HCR.FaT.CTub.Adig	This biotope occurs under similar wave-exposed conditions to BalTub, but is subject to slightly weaker tides, which is perhaps reflected in the greater abundance of *Alcyonium digitatum*. Both sub-biotopes have a similarly impoverished epifauna, although CTub.Adig has a slightly more diverse range of sponges.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	••	Common	1
Tubularia indivisa	•••••	Frequent	18
Sertularia argentea	•••	Frequent	5
Urticina felina	••••	Occasional	4
Metridium senile	•••	Occasional	3
Sagartia elegans	••••	Frequent	10
Balanus crenatus	•••••	Abundant	28
Cancer pagurus	••••	Occasional	5
Nucella lapillus	••	Common	1
BRYOZOA	•••	Occasional	2
Alcyonidium diaphanum	•••	Occasional	3
Flustra foliacea	•••	Occasional	2
Asterias rubens	••••	Occasional	7

CR.HCR.FaT.CTub *Tubularia indivisa* on tide-swept circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed
Tidal streams:	Very strong, Strong
Substratum:	Bedrock, boulder
Zone:	Circalittoral - upper, Circalittoral - lower
Depth band:	10-20 m, 20-30 m

Biotope description

This biotope is typically found on the vertical and upper faces of strongly tide-swept, wave-exposed circalittoral bedrock and boulders. It is characterised by a dense carpet of the robust hydroid *Tubularia indivisa*. The barnacle *Balanus crenatus*, where present, is recorded as common. The accompanying species in the community are determined by tidal stream strength. On the more sheltered sides of headlands, where tidal streams are accelerated, sponges such as *Pachymatisma johnstonia*, *Esperiopsis fucorum*, *Myxilla incrustans* and *Halichondria panicea* proliferate forming the CTub.CuSp sub-biotope. There may also be a scattered bryozoan turf, formed by criisid bryozoans. However, where tidal streams are slightly reduced, but on more wave-exposed coasts, anthozoans such as *Alcyonium digitatum* become more prominent forming the CTub.Adig biotope. Other species recorded in this biotope include the anemones *Sagartia elegans*, *Actinothoe sphyrodeta*, *Corynactis virdis* and *Urticina felina*. There may be scattered clumps of hydroids such as *Sertularia argentea* and *Nemertesia antennina*. Where `relative shelter' is afforded by the topography of the seabed, the bryozoans *Flustra foliacea*, *Alcyonidium diaphanum* and the crab *Cancer pagurus* may be found. More ubiqutous species such as *Asterias rubens* and *Calliostoma zizyphinum* may also be present.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
PORIFERA	••	Frequent	1
Pachymatisma johnstonia	••••	Occasional	4
Halichondria panicea	••	Frequent	2
Esperiopsis fucorum	•••	Frequent	4
Myxilla incrustans	•••	Frequent	2
Tubularia indivisa	•••••	Abundant	24
Nemertesia antennina	••	Frequent	2
Sertularia argentea	••	Occasional	1
Alcyonium digitatum	•••••	Frequent	11
Urticina felina	•••	Frequent	2
Sagartia elegans	••••	Common	7
Actinothoe sphyrodeta	•••	Common	4
Corynactis viridis	•••	Frequent	3
Balanus crenatus	•••	Common	6
Cancer pagurus	•••	Rare	1
Calliostoma zizyphinum	••	Occasional	1
Crisiidae	••	Common	1
Alcyonidium diaphanum	••	Frequent	2
Flustra foliacea	••	Frequent	1
Asterias rubens	••	Occasional	2

CR.HCR.FaT.CTub.CuSp *Tubularia indivisa* and cushion sponges on tide-swept turbid circalittoral bedrock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Very strong, Strong
Substratum:	Bedrock; boulders
Zone:	Circalittoral - upper, Circalittoral - lower
Depth band:	10-20 m, 20-30 m

Previous code

CR.ECR.BS.TubS	97.06

Biotope description

This variant is typically found on the vertical and upper faces of strongly tide-swept, exposed circalittoral bedrock and boulders. It is commonly associated with areas where turbidity levels are high for much of the year, for example, around Anglesey and the Lleyn Penisula. From afar, this variant appears as a dense 'carpet' of *Tubularia indivisa* covering tide-swept gully walls, floors and boulders. *T. indivisa* is frequently observed growing through sheets of sponges such as *Myxilla incrustans* and *Halichondria panicea* as well as through dense patches of the barnacle *Balanus crenatus* and tubes of the amphipod *Jassa*. Several other species of sponge appear to be tolerant of the high turbidity in areas where this variant occurs, many of which are common in other biotopes. These include *Esperiopsis fucorum*, *Pachymatisma johnstonia*, *Hemimycale columella*, *Dysidea fragilis* and *Clathrina coriacea*. Robust hydroids (other than *T. indivisa*) such as *Nemertesia antennina* and *Sertularia argentea* occur in patches. The anemones *Urticina felina*, *Actinothoe sphyrodeta* and *Sagartia elegans* are typically common. A short bryozoan turf consisting of crisiid bryozoans, *Alcyonidium diaphanum*, *Bicellariella ciliata*, *Bugula turbinata* and *Bugula flabellata* may be present. *Alcyonium digitatum* may occasionally be seen although it doesn't tend to be as dominant as in CTub.Adig. Individual *Corynactis virdis* may be seen scattered across the gully walls and boulders. The starfish *Henricia oculata* may be seen on boulders and gully floors whilst typical under-boulder fauna includes the crab *Cancer pagurus*.

Situation

Above this biotope, *Laminaria* forest (LhypR) may be found.

Temporal variation

Not known.

Similar biotopes

CR.HCR.FaT.BalTub	This biotope occurs under similar conditions to CTub.CuSp, although it occurs on a more mixed range of substrata than Tub.CuSp. Both biotopes are dominated by a dense carpet of *Tubularia indivisa*, although CTub.CuSp has a more diverse sponge and bryozoan turf associated with it.
CR.HCR.FaT.CTub.Adig	This biotope occurs under similar wave-exposures to Tub.CuSp although is subject to slightly weaker tidal streams than CTub.CuSp. Both biotopes are dominated by a dense carpet of *Tubularia indivisa*. CTub.Adig does not contain such as diverse range of sponges as CTub.CuSp although dead mans fingers *Alcyonium digitatum* are typically frequent.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
PORIFERA	●●●	Frequent	2
Clathrina coriacea	●●●	Frequent	1
Pachymatisma johnstonia	●●●●●	Occasional	4
Halichondria panicea	●●●	Frequent	2
Esperiopsis fucorum	●●●●	Frequent	4
Myxilla incrustans	●●●●	Frequent	5
Hemimycale columella	●●●●	Occasional	3
Dysidea fragilis	●●●	Occasional	1
Tubularia indivisa	●●●●●	Abundant	17
Nemertesia antennina	●●●	Frequent	2
Sertularia argentea	●●●	Occasional	1
Alcyonium digitatum	●●●●	Occasional	4
Urticina felina	●●●	Frequent	1
Sagartia elegans	●●●●	Common	7
Actinothoe sphyrodeta	●●●●	Common	6
Corynactis viridis	●●●	Occasional	2
Balanus crenatus	●●●●●	Common	10
Jassa	●●	Frequent	1
Cancer pagurus	●●●	Rare	1
Crisiidae	●●●	Common	3
Alcyonidium diaphanum	●●	Frequent	2
Bicellariella ciliata	●●●	Occasional	1
Bugula flabellata	●●●	Common	2
Bugula turbinata	●●●	Common	2
Henricia oculata	●●●	Occasional	2

CR.HCR.FaT.CTub.Adig *Alcyonium digitatum* with dense *Tubularia indivisa* and anemones on strongly tide-swept circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed
Tidal streams:	Very strong, Strong, Moderately strong
Substratum:	bedrock; boulders
Zone:	Circalittoral - upper, Circalittoral - lower
Depth band:	5-10 m, 10-20 m, 20-30 m

Previous code

CR.ECR.Alc.AlcTub 97.06

Biotope description

This variant is typically found on exposed circalittoral bedrock and boulders in sounds, narrows and around tide-swept promontories in accelerated tidal streams. It is dominated by aggregations of dead man's fingers *Alcyonium digitatum*, and dense clumps or continuous cover of the robust hydroid *Tubularia indivisa*, particularly on prominent ledges and ridges. Anemones such as *Sagartia elegans*, *Urticina felina*, *Metridium senile*, *Actinothoe sphyrodeta* and *Corynactis virdis* form a prominent component of the community. Occasionally, massive sponges such as *Pachymatisma johnstonia* and *Esperiopsis fucorum* may be present. Encrusting species such as the polychaete *Pomatoceros triqueter* and the barnacle *Balanus crenatus* may be dotted around the rocks, and the top shell *Calliostoma zizyphinum* may also be observed. Clumps of the bryozoan *Flustra foliacea* are occasionally seen. The starfish *Asterias rubens* may be seen amongst a patchy turf of *Crisia denticulata* and the bryozoan *Alcyonidium diaphanum*. This variant may also be found on tideswept wrecks and other artificial sustratum.

Situation

Above this biotope, it is usual to find well-developed kelp forest in the upper infralittoral, dominated by *Laminaria hyperborea* (LhypR). In the lower infralittoral, it is usual to find a tide-swept turf of hydroids and red algae.

Temporal variation

Not known.

Similar biotopes

CR.HCR.FaT.CTub.CuSp	This biotope occurs on slightly more wave-sheltered sites than CTub.Adig. However, they are both subject to generally similar, strong tidal streams. CTub.CuSp also tends to be found slightly deeper. Although a similar suite of hydroid species are found in both biotopes, CTub.CuSp has a more diverse range of sponges, ascidian and turf-forming bryozoans such as *Bugula* spp. In addition, dense colonies of *Alcyonium digitatum* are found in CTub.Adig.
CR.HCR.FaT.BalTub	This biotope tends to be found under a broader range of wave-exposures compared to CTub.Adig. However, they are both subject to similar tidal-streams. BalTub also tends to be found on a wider range of substratum types compared to CTub.Adig. BalTub has a 'bare' appearance, dominated by *Tubularia indivisa* and *Balanus crenatus*, whereas CTub.Adig has a more diverse range of sponge, ascidian and turf-forming bryozoans.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pachymatisma johnstonia	●●●	Occasional	3
Esperiopsis fucorum	●●	Frequent	2
Tubularia indivisa	●●●●●	Common	27
Alcyonium digitatum	●●●●●	Frequent	21
Urticina felina	●●●	Frequent	3
Metridium senile	●●	Frequent	2
Sagartia elegans	●●●●	Common	6
Actinothoe sphyrodeta	●●	Frequent	1
Corynactis viridis	●●	Common	3
Pomatoceros triqueter	●●	Frequent	2
Balanus crenatus	●●	Common	1
Calliostoma zizyphinum	●●●	Occasional	2
Crisia denticulata	●●	Occasional	1
Alcyonidium diaphanum	●●	Frequent	2
Flustra foliacea	●●●	Occasional	2
Asterias rubens	●●●●	Occasional	7

CR.HCR.DpSp Deep sponge communities

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock
Zone:	Circalittoral - upper, Circalittoral - lower
Depth band:	20-30 m, 30-50 m

Biotope description

This biotope complex typically occurs on deep (commonly below 30m depth), wave-exposed circalittoral rock subject to negligible tidal streams. The sponge component of this biotope is the most striking feature, with similar species to the bryozoan and erect sponge biotope complex (BrErSp) although in this case, the sponges *Phakellia ventilabrum*, *Axinella infundibuliformis*, *Axinella dissimilis* and *Stelligera stuposa* dominate. Other sponge species frequently found on exposed rocky coasts are also present in low to moderate abundance. These include *Cliona celata*, *Polymastia boletiformis*, *Haliclona viscosa*, *Pachymatisma johnstonia*, *Dysidea fragilis*, *Suberites carnosus*, *Stelligera rigida*, *Hemimycale columella* and *Tethya aurantium*. The cup coral *Caryophyllia smithii* and the anemone *Corynactis virdis* may be locally abundant in some areas, along with the holothurian *Holothuria forskali*. The soft corals *Alcyonium digitatum* and *Alcyonium glomeratum* are frequently observed. The bryozoans *Pentapora foliacea* and *Porella compressa* are also more frequently found in this deep-water biotope complex. Bryozoan crusts such as *Parasmittina trispinosa* are also occasionally recorded. Isolated clumps of large hydroids such as *Nemertesia antennina Nemertesia ramosa* and *Sertularella gayi* may be seen on the tops of boulders and rocky outcrops. Large echinoderms such as *Echinus esculentus*, *Luidia ciliaris*, *Marthasterias glacialis*, *Strichastrella rosea*, *Henricia oculata* and *Aslia lefevrei* may also be present. The sea fan *Eunicella verucosa* may be locally common but to a lesser extent than in ByErSp.Eun. The top shell *Calliostoma zizyphinum* is often recorded as present.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pachymatisma johnstonia	●●●●●	Occasional	3
Tethya aurantium	●●●●	Occasional	1
Suberites carnosus	●●●●	Occasional	2
Polymastia boletiformis	●●●●●	Frequent	3
Cliona celata	●●●●●	Frequent	4
Axinella infundibuliformis	●●●●●	Frequent	4
Axinella dissimilis	●●●●●	Occasional	2
Phakellia ventilabrum	●●●●	Frequent	2
Stelligera rigida	●●●●	Occasional	2
Stelligera stuposa	●●●●●	Frequent	3
Hemimycale columella	●●●●	Occasional	1
Haliclona viscosa	●●●●	Frequent	3
Dysidea fragilis	●●●●●	Occasional	3
Nemertesia antennina	●●●●	Occasional	2
Nemertesia ramosa	●●●●	Occasional	1
Sertularella gayi	●●●●	Occasional	2
Alcyonium digitatum	●●●●●	Frequent	3
Alcyonium glomeratum	●●●●●	Frequent	2
Eunicella verrucosa	●●●	Occasional	1
Corynactis viridis	●●●	Frequent	2

Caryophyllia smithii	●●●●●	Frequent	6
Calliostoma zizyphinum	●●●●●	Occasional	3
Pentapora foliacea	●●●●	Frequent	2
Parasmittina trispinosa	●●●	Frequent	2
Porella compressa	●●●●●	Frequent	4
Luidia ciliaris	●●●●	Occasional	2
Henricia oculata	●●●●●	Occasional	3
Stichastrella rosea	●●●	Occasional	1
Marthasterias glacialis	●●●●	Occasional	2
Echinus esculentus	●●●●●	Occasional	3
Holothuria forskali	●●●●●	Frequent	4
Aslia lefevrei	●●●	Occasional	1

CR.HCR.DpSp.PhaAxi *Phakellia ventilabrum* and Axinellid sponges on deep, wave- exposed circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock
Zone:	Circalittoral - upper, Circalittoral - lower
Depth band:	20-30 m, 30-50 m

Previous code

CR.MCR.XFa.PhaAxi 97.06

Biotope description

This biotope typically occurs on the upper faces of deep (commonly below 30m depth), wave-exposed circalittoral rock subject to negligible tidal streams. Although it occurs in exposed and very exposed conditions, at such depth, the turbulent wave action appears to have a much-attenuated effect on the fauna compared with shallower depths. As the majority of records are from depths between 30-50+ m, slightly deeper than the depths of most surveys, it is possible that this biotope is more widespread than the available dataset indicates. The sponge component of this biotope is the most striking feature, with similar species to the bryozoan and erect sponge biotope complex (BrErSp) although in this case, the sponges *Phakellia ventilabrum*, *Axinella infundibuliformis*, *Axinella dissimilis* and *Stelligera stuposa* dominate. Other sponge species frequently found on exposed rocky coasts are also present in low to moderate abundance. These include *Cliona celata*, *Polymastia boletiformis*, *Haliclona viscosa*, *Pachymatisma johnstonia*, *Dysidea fragilis*, *Suberites carnosus*, *Stelligera rigida*, *Hemimycale columnella* and *Tethya aurantium*. The cup coral *Caryophyllia smithii* and the anemone *Corynactis virdis* may be locally abundant in some areas, along with the holothurian *Holothuria forskali*. The soft corals *Alcyonium digitatum* and *Alcyonium glomeratum* are frequently observed. The bryozoans *Pentapora foliacea* and *Porella compressa* are also more frequently found in this deep-water biotope. Bryozoan crusts such as *Parasmittina trispinosa* are also occasionally recorded. Isolated clumps of large hydroids such as *Nemertesia antennina*, *Nemertesia ramosa* and *Sertularella gayi* may be seen on the tops of boulders and rocky outcrops. Large echinoderms such as *Echinus esculentus*, *Luidia ciliaris*, *Marthasterias glacialis*, *Strichastrella rosea*, *Henricia oculata* and *Aslia lefevrei* may also be present. The seafan *Eunicella verucosa* may be locally common but to a lesser extent than in ByErSp.Eun. The top shell *Calliostoma zizyphinum* is often recorded as present.

Situation

CarSp.PenPcom probably occurs above PhaAxi in shallower water where the exposure of the coast ensures that there is more water mixing due to wave action. Deeper down, this effect is attenuated, allowing PhaAxi biotope to develop.

Temporal variation

Axinella dissimilis tends to grow extremely slowly.

Similar biotopes

CR.MCR.EcCr.CarSp.PenPcom	This biotope occurs under similar conditions as PhaAxi, although it tends to be found over a shallower depth range. Although high abundances of *C. smithii* are recorded in both these biotopes, CarSp.PenPcom has a less diverse sponge fauna than PhaAxi. The latter in particular is characterised by a diverse range of erect branching sponges. *E. verrucosa* is also occasionally found in PhaAxi.
CR.HCR.XFa.ByErSp.Sag	This biotope occurs on extremely exposed to moderately exposed coasts, subject to moderately strong tides. ByErSp.Sag also occurs over a shallower

	depth band. ByErSp.Sag has a more restricted range of sponges compared to PhaAxi. However, there is usually a more diverse range of hydroid and bryozoan 'turf-forming' species in ByErSp.Sag. Both biotopes occur mainly around the west coast of Ireland.
CR.HCR.XFa.ByErSp.Eun	This biotope occurs under similar wave-exposure conditions as PhaAxi, but is found in sites subject to moderately strong tidal streams. ByErSp.Eun is found much shallower than the deeper PhaAxi, with a mean depth of 20m to 24m, although typically found on the same substratum. *E. verrucosa* is very abundant in this biotope, although it is still present in PhaAxi. It is the absence of significant numbers of erect sponges that distinguishes this biotope from PhaAxi.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pachymatisma johnstonia	●●●●●	Occasional	3
Tethya aurantium	●●●●	Occasional	1
Suberites carnosus	●●●●	Occasional	2
Polymastia boletiformis	●●●●●	Frequent	3
Cliona celata	●●●●●	Frequent	4
Axinella infundibuliformis	●●●●●	Frequent	4
Axinella dissimilis	●●●●●	Occasional	2
Phakellia ventilabrum	●●●●	Frequent	2
Stelligera rigida	●●●●	Occasional	2
Stelligera stuposa	●●●●●	Frequent	3
Hemimycale columella	●●●●	Occasional	1
Haliclona viscosa	●●●●	Frequent	3
Dysidea fragilis	●●●●●	Occasional	3
Nemertesia antennina	●●●●	Occasional	2
Nemertesia ramosa	●●●●	Occasional	1
Sertularella gayi	●●●●	Occasional	2
Alcyonium digitatum	●●●●●	Frequent	3
Alcyonium glomeratum	●●●●●	Frequent	2
Eunicella verrucosa	●●●	Occasional	1
Corynactis viridis	●●●	Frequent	2
Caryophyllia smithii	●●●●●	Frequent	6
Calliostoma zizyphinum	●●●●●	Occasional	3
Pentapora foliacea	●●●●	Frequent	2
Parasmittina trispinosa	●●●	Frequent	2
Porella compressa	●●●●●	Frequent	4
Luidia ciliaris	●●●●	Occasional	2
Henricia oculata	●●●●●	Occasional	3
Stichastrella rosea	●●●	Occasional	1
Marthasterias glacialis	●●●●	Occasional	2
Echinus esculentus	●●●●●	Occasional	3
Holothuria forskali	●●●●●	Frequent	4
Aslia lefevrei	●●●	Occasional	1

CR.HCR.XFa Mixed faunal turf communities

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Strong, Moderately strong
Substratum:	Bedrock, boulders
Zone:	Circalittoral - upper, Circalittoral - lower
Depth band:	5-10 m, 10-20 m, 20-30 m

Previous code

CR.MCR.XFa	97.06

Biotope description

This biotope complex occurs on wave-exposed, circalittoral bedrock, and boulders subject to strong to moderately strong tidal streams. This complex is characterised by its diverse range of hydroids (*Halecium halecinum*, *Nemertesia antennina* and *Nemertesia ramosa*), bryozoans (*Alcyonidium diaphanum*, *Flustra foliacea*, *Bugula flabellata* and *Bugula plumosa*) and sponges (*Scypha ciliata*, *Pachymatisma johnstonia*, *Cliona celeta*, *Raspalia ramosa*, *Esperiopsis fucorum*, *Hemimycale columella* and *Dysidea fragilis*) forming an often dense, mixed faunal turf. Other species found within this complex are *Alcyonium digitatum*, *Urticina felina*, *Sagartia elegans*, *Actinothoe sphyrodeta*, *Caryophyllia smithii*, *Pomatoceros triqueter*, *Balanus crenatus*, *Cancer pagurus*, *Necora puber*, *Asterias rubens*, *Echinus esculentus* and *Clavelina lepadiformis*. Nine biotopes have been identified within this complex: ByErSp, FluCoAs, FluHocu, CvirCri, SwiLgAs, Mol, SubCriTf , SpNemAdia and SpAnVt.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Scypha ciliata	●●●	Occasional	-
Pachymatisma johnstonia	●●●	Occasional	-
Cliona celata	●●●●	Occasional	-
Raspailia ramosa	●●●	Occasional	-
Esperiopsis fucorum	●●●	Occasional	-
Hemimycale columella	●●●	Occasional	-
Dysidea fragilis	●●●	Occasional	-
Halecium halecinum	●●●	Occasional	-
Nemertesia antennina	●●●●	Frequent	-
Nemertesia ramosa	●●●	Occasional	-
Alcyonium digitatum	●●●●●	Frequent	-
Urticina felina	●●●	Occasional	-
Sagartia elegans	●●●	Occasional	-
Actinothoe sphyrodeta	●●●	Occasional	-
Caryophyllia smithii	●●●	Frequent	-
Pomatoceros triqueter	●●●	Occasional	-
Balanus crenatus	●●●	Frequent	-
Cancer pagurus	●●●	Occasional	-
Necora puber	●●●	Occasional	-
Calliostoma zizyphinum	●●●	Occasional	-
Alcyonidium diaphanum	●●●●	Frequent	-
Flustra foliacea	●●●●	Frequent	-
Bugula flabellata	●●●	Occasional	-
Bugula plumosa	●●●	Frequent	-
Asterias rubens	●●●●●	Frequent	-
Echinus esculentus	●●●	Occasional	-
Clavelina lepadiformis	●●●	Occasional	-

CR.HCR.XFa.ByErSp Bryozoan turf and erect sponges on tide-swept circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Strong, Moderately strong
Substratum:	Bedrock; boulder
Zone:	Circalittoral - upper, Circalittoral - lower
Depth band:	10-20 m, 20-30 m

Biotope description

This biotope is typically found on wave-exposed circalittoral bedrock or boulders subject to moderately strong to strong tidal streams. It often has a thin layer of silt covering the seabed, and is characterised by a bryozoan/hydroid turf with erect sponges. Typical bryozoans to be found include crisiids, *Alcyonidium diaphanum*, *Flustra foliacea*, *Pentapora foliacea*, *Bugula plumosa* and *Bugula flabellata*, while typical hydroids include *Nemetesia antennina*, *Nemertesia ramosa* and *Halecium halecinum*. The soft coral *Alcyonium digitatum* is frequently recorded on the tops of boulders and rocky outcrops. Characteristic erect sponges include *Raspailia ramosa*, *Stelligera stuposa* and *Stelligera rigida*; other sponges present include *Cliona celata*, *Dysidea fragilis*, *Pachymatisma johnstonia*, *Polymastia boletiformis*, *Hemimycale columella*, *Esperiopsis fucorum*, *Polymastia mamillaris* and *Tethya aurantium*. Other species present include *Caryophylia smithii*, *Actinothoe sphyrodeta*, *Corynactis viridis*, *Urticina felina*, *Balanus crenatus*, *Asterias rubens*, *Marthasterias glacialis*, *Henricia oculata*, *Echinus esculentus*, *Clavelina lepadiformis*, *Calliostoma zizyphinum* and *Necora puber*. Three variants of this biotope have been described, but all are characterised by a bryozoan turf with erect sponges. ByErSp.Eun is found primarily on circalittoral bedrock and is dominated by the seafan *Eunicella verrucosa*. ByErSp.DysAct is found under slightly stronger tide-swept conditions, and is characterised particularly by the sponge *Dysidea fragilis* and the anemone *Actinothoe sphyrodeta*. Finally ByErSp.Sag is characterised by the anemone *Sagartia elegans*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pachymatisma johnstonia	••••	Occasional	2
Tethya aurantium	•••	Occasional	1
Polymastia boletiformis	••••	Frequent	2
Polymastia mamillaris	•••	Occasional	1
Cliona celata	•••••	Occasional	4
Stelligera rigida	•••	Occasional	1
Stelligera stuposa	•••	Occasional	2
Raspailia ramosa	••••	Occasional	2
Esperiopsis fucorum	•••	Frequent	2
Hemimycale columella	••••	Occasional	2
Dysidea fragilis	••••	Frequent	3
Halecium halecinum	•••	Frequent	1
Nemertesia antennina	•••••	Frequent	4
Nemertesia ramosa	••••	Occasional	2
Alcyonium digitatum	•••••	Frequent	5
Urticina felina	•••	Occasional	1
Actinothoe sphyrodeta	••••	Occasional	2
Corynactis viridis	•••	Frequent	2
Caryophyllia smithii	••••	Frequent	4

Balanus crenatus	••	Occasional	2
Necora puber	•••	Occasional	1
Calliostoma zizyphinum	•••	Occasional	2
Crisiidae	•••	Frequent	1
Alcyonidium diaphanum	••••	Frequent	3
Pentapora foliacea	•••	Occasional	1
Flustra foliacea	•••	Frequent	2
Bugula flabellata	•••	Occasional	1
Bugula plumosa	•••	Frequent	2
Henricia oculata	•••	Occasional	1
Asterias rubens	••••	Frequent	3
Marthasterias glacialis	•••	Occasional	1
Echinus esculentus	••••	Occasional	2
Clavelina lepadiformis	••••	Occasional	2

CR.HCR.XFa.ByErSp.Eun *Eunicella verrucosa* and *Pentapora foliacea* on wave-exposed circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong
Substratum:	Bedrock
Zone:	Circalittoral - upper, Circalittoral - lower
Depth band:	10-20 m, 20-30 m

Previous code

CR.MCR.XFa.ErSEun 97.06

Biotope description

This variant typically occurs on wave-exposed, steep, circalittoral bedrock and boulder slopes and outcrops, subject to varying tidal streams. This silty variant contains a diverse faunal community, dominated by the seafan *Eunicella verrucosa*, the bryozoan *Pentapora foliacea* and the cup coral *Caryophyllia smithii*. There are frequently numerous *Alcyonium digitatum*, and these may become locally abundant under more tide-swept conditions. *Alcyonium glomeratum* may also be present. A diverse sponge community is usually present, including numerous erect sponges; species present include *Cliona celata, Raspailia ramosa, Raspailia hispida, Axinella dissimilis, Stelligera stuposa, Dysidea fragilis* and *Polymastia boletiformis. Homaxinella subdola* may be present in the south west. A hydroid/bryozoan turf may develop in the understorey of this rich sponge assemblage, with species such as *Nemertesia antennina, Nemertesia ramosa*, crisiids, *Alcyonidium diaphanum* and *Bugula plumosa*. The sea cucumber *Holothuria forskali* may be locally abundant, feeding on the silty deposits on the rock surface. Other echinoderms encountered include the starfish *Marthasterias glacialis* and the urchin *Echinus esculentus*. Other fauna includes aggregations of colonial ascidians *Clavelina lepadiformis* and *Stolonica socialis*. Anemones such as *Actinothoe sphyrodeta* and *Parazoanthus axinellae* may be seen dotted across the rock surface. This biotope is present in south west England and Wales.

Situation

This biotope is commonly found on rocky outcrops, surrounded by coarse sediment. This may be in the form of shelly gravel or muddy gravel, supporting *Urticina felina, Cerianthus lloydi* and *Neopentadactyla mixta*. Above ByErSp.Eun, dense kelp forest containing *Saccorhiza polyschides* is usually found.

Temporal variation

Not known

Similar biotopes

CR.MCR.EcCr.CarSp.PenPcom	This biotope occurs under similar wave-exposure conditions as ByErSp.Eun but is found in sites subject to only very weak tidal streams. ByErSp.Eun has a more diverse array of sponges (including erect sponges) and 'turf-forming' bryozoans.
CR.HCR.XFa.ByErSp.Sag	This biotope occurs under similar conditions and depths as ByErSp.Eun. A diverse group of sponges, hydroids and bryozoans are found in both biotopes, but it is the absence of *E. verrucosa* and species such as *Parazoanthus axinellae* and *Isozoanthus sulcatus* that distinguishes ByErSp.Sag from ByErSp.Eun.
CR.HCR.DpSp.PhaAxi	This biotope occurs under similar wave-exposure conditions as ByErSp.Eun but is found in sites subject to only very weak tidal streams and much deeper with a mean depth range of 32m-37m. Although *E. verrucosa* is present in this biotope, it is not as abundant as in ByErSp.Eun. It is the presence of significant numbers of axinellid sponges that distinguishes this biotope.

CR.HCR.XFa.CvirCri	This biotope occurs under similar conditions as ByErSp.Eun, but may occur at slightly deeper water depths. CvirCri lacks *E. verrucosa* but has a similar bryozoan and hydroid turf to ByErSp.Eun. The latter does have a slightly more diverse range of sponges and ascidians than CvirCri.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
PORIFERA	●●●	Occasional	1
Polymastia boletiformis	●●●	Occasional	1
Cliona celata	●●●●●	Frequent	5
Axinella dissimilis	●●●●	Occasional	2
Stelligera stuposa	●●●	Occasional	2
Raspailia hispida	●●●●	Occasional	2
Raspailia ramosa	●●●●	Occasional	2
Dysidea fragilis	●●●	Occasional	1
Nemertesia antennina	●●●●●	Frequent	5
Nemertesia ramosa	●●●●	Occasional	4
Alcyonium digitatum	●●●●●	Frequent	6
Alcyonium glomeratum	●●●	Occasional	2
Eunicella verrucosa	●●●●●	Frequent	7
Parazoanthus axinellae	●●●	Occasional	1
Actinothoe sphyrodeta	●●●●	Occasional	2
Caryophyllia smithii	●●●●●	Common	7
Crisiidae	●●●	Occasional	1
Alcyonidium diaphanum	●●●●	Frequent	4
Pentapora foliacea	●●●●●	Frequent	7
Bugula plumosa	●●●	Common	1
Marthasterias glacialis	●●●●	Frequent	4
Echinus esculentus	●●●●	Occasional	3
Holothuria forskali	●●●	Frequent	3
Clavelina lepadiformis	●●●	Occasional	2
Stolonica socialis	●●●	Common	2

CR.HCR.XFa.ByErSp.DysActMixed turf of bryozoans and erect sponges with Dysidia fragilis and Actinothoe sphyrodeta on tide-swept, wave-exposed circalittoral rock

Habitat classification		Previous code
Salinity:	Full (30-35ppt)	CR.MCR.XFa.ErSPbolSH 97.06
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed	
Tidal streams:	Strong, Moderately strong	
Substratum:	Bedrock; boulder	
Zone:	Circalittoral - upper, Circalittoral - lower	
Depth band:	5-10 m, 10-20 m, 20-30 m	

Biotope description

This variant typically occurs on exposed and moderately wave-exposed bedrock and boulders subject to a variety of tidal regimes (from strong through to weak). It is found mainly in the 10-20m depth range and does not usually occur deeper than 30 m. It therefore often straddles the upper circalittoral and lower infralittoral. It often has a light covering of silt and sand may be in the vicinity. Sponges form a dominant part of this variant, although cover usually appears patchy, with no one species dominating. Species present include *Dysidea fragilis*, *Pachymatisma johnstonia*, *Esperiopsis fucorum*, *Hemimycale columella*, *Cliona celata*, *Stelligera rigida*, *Polymastia boletiformis*, *Stelligera stuposa*, *Raspailia ramosa*, *Tethya aurantium*, *Polymastia mamillaris* and *Axinella dissimilis*. Tufts of large hydroids such as *Nemertesia antennina*, frequently recorded on the tops of outcrops and boulders, stand out more clearly than the understorey of finer hydroid and bryozoan turf such as *Aglaophenia pluma*, *Bugula flabellata*, *Bugula plumosa*, crisiids, *Cellaria sinuosa* and *Bugula turbinata*. Other bryozoans such as *Alcyonidium diaphanum* and *Flustra foliacea* are also frequently recorded. Other more widespread species present include *Asterias rubens*, *Actinothoe sphyrodeta*, *Balanus crenatus*, *Caryophyllia smithii*, *Corynactis viridis*, *Necora puber* and *Clavelina lepadiformis*. This variant has been recorded off the south east coast of Ireland, the welsh coast and Lundy Island.

Situation

This biotope is typically found on exposed coasts, with exposed kelp forest in the infralittoral zone, characterised by species such as *Laminaria hyperborea* and *Saccorhiza polyschides*. The ByErSp.DysAct variant is usually found below ByErSp.Eun, with similar geographic range.

Temporal variation

Not known.

Similar biotopes

CR.HCR.XFa.ByErSp.Eun	This sub-biotope is found on very wave-exposed circalittoral bedrock with slightly weaker tidal streams than ByErSp.DysAct. ByErSp.Eun is also found slightly deeper than ByErSp.DysAct. *E. verrucosa* is absent from ByErSp.DysAct.
CR.HCR.XFa.ByErSp.Sag	This sub-biotope occurs under similar wave-exposure conditions but with weaker tides than ByErSp.DysAct. ByErSp.Sag is also found slightly deeper than ByErSp.DysAct. Both sub-biotopes have similar suites of species but distinct geographical distributions; ByErSp.DysAct only tends to be found off Wales and Lundy whereas ByErSp.Sag tends to be found off the west coast of Ireland.
CR.HCR.XFa.FluCoAs	This biotope occurs under similar wave-exposure conditions, but with slightly weaker tides than ByErSp.DysAct. Both tend to occur throughout

similar depth ranges and substratum. They also both tend to have a thin layer of silt overlying them. Sponges, hydroids and bryozoans are present in both biotopes; although *Flustra* is present in ByErSp.DysAct, it is not present to the same abundance as in FluCoAs, where it forms dense aggregations on the bedrock and boulders. In addition, species such as *Caryophyllia smithii* and *Corynactis viridis* are absent from FluCoAs.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pachymatisma johnstonia	●●●●●	Occasional	4
Tethya aurantium	●●●●	Occasional	1
Polymastia boletiformis	●●●	Frequent	2
Polymastia mamillaris	●●●●	Occasional	1
Cliona celata	●●●●	Occasional	2
Axinella dissimilis	●●●	Occasional	1
Stelligera rigida	●●●●	Occasional	2
Stelligera stuposa	●●●●	Occasional	2
Raspailia ramosa	●●●●	Occasional	2
Esperiopsis fucorum	●●●●●	Frequent	3
Hemimycale columella	●●●●	Occasional	2
Dysidea fragilis	●●●●●	Frequent	5
Aglaophenia pluma	●●●	Frequent	1
Nemertesia antennina	●●●●	Frequent	3
Alcyonium digitatum	●●●●	Occasional	3
Actinothoe sphyrodeta	●●●●●	Frequent	3
Corynactis viridis	●●●	Frequent	1
Caryophyllia smithii	●●●●	Frequent	3
Balanus crenatus	●●●●	Frequent	3
Necora puber	●●●●	Occasional	1
BRYOZOA	●●●	Frequent	1
Crisiidae	●●●	Common	2
Alcyonidium diaphanum	●●●●	Frequent	2
Flustra foliacea	●●●●	Frequent	3
Cellaria sinuosa	●●●	Frequent	1
Bugula flabellata	●●●●	Occasional	2
Bugula plumosa	●●●●	Frequent	2
Bugula turbinata	●●●	Frequent	1
Asterias rubens	●●●●●	Frequent	4
Clavelina lepadiformis	●●●	Occasional	1

CR.HCR.XFa.ByErSp.Sag Mixed turf of bryozoans and erect sponges with *Sagartia elegans* on tide-swept ciraclittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong
Substratum:	Bedrock; boulder
Zone:	Circalittoral - upper, Circalittoral - lower
Depth band:	10-20 m, 20-30 m, 30-50 m

Biotope description

This variant is typically found on wave-exposed circalittoral bedrock and boulders, on steep slopes and upper faces in moderate tidal streams. This species-rich biotope is characterised by a dense sponge, hydroid and bryozoan turf and frequent *Alcyonium digitatum*. There are frequently large growths of *Cliona celata* and *Pachymatisma johnstonia*. Other species present in this diverse sponge community include *Polymastia boletiformis*, *Haliclona viscosa*, *Polymastia mamilliaris*, *Scypha ciliata*, *Hemimycale columella* and *Dysidea fragilis*. Axinellid sponges such as *Stelligera stuposa* and *Raspailia ramosa* may be present in low abundance, and are usually more abundant in deeper water. A dense hydroid turf forms a significant part of this biotope, with tufts of large hydroids such as *Nemertesia antennina* and *Nemertesia ramosa* frequently recorded. Other hydroid turf component species include *Halecium halecinum*, *Aglaophenia tubulifera* and *Abietinaria abietina*. Anemones are also well represented, with species such as *Urticina felina*, *Sagartia elegans* and *Metridium senile* recorded. The cup coral *Caryophyllia smithii* and the anemone *Corynactis viridis* are also frequently seen. The bryozoan turf is composed predominantly of *Alcyonidium diaphanum* and *Flustra foliacea*, whilst crustose species such as *Parasmittina trispinosa* contribute to a lesser extent. The delicate *Bugula plumosa* may also be present. There is a significant echinoderm component in this biotope. Species such as the starfish *Asterias rubens*, *Henricia oculata*, *Marthasterias glacialis* and *Luidia ciliaris*, the sea urchin *Echinus esculentus* and the crinoid *Antedon bifida* are all regularly recorded. Other species which may be observed include the top shell *Calliostoma zizyphinium*, the colonial ascidian *Clavelina lepadiformis* and the barnacle *Balanus crenatus*. The crab *Cancer pagurus* is typically found under boulders. This variant has been recorded from from various sites including Pembrokeshire, the Calf of Man and the west coast of Ireland.

Situation

Dense kelp forests containing *L. hyperborea* and *S. polyschides* are typically found above ByErSp.Sag.

Temporal variation

Not known

Similar biotopes

CR.HCR.XFa.ByErSp.Eun	This biotope occurs under similar conditions and depths as ByErSp.Sag. A diverse group of sponges, hydroids and bryozoans are found in both biotopes, but it is the frequently recorded *Eunicella verrucosa* and the occasional presence of *Parazoanthus axinellae* and *Isozoanthus sulcatus* that distinguishes it from ByErSp.Sag.
CR.HCR.XFa.ByErSp.DysAct	This biotope occurs under similar wave-exposure conditions with stronger tides than ByErSp.Sag. ByErSp.DysAct is also found slightly shallower than ByErSp.Sag. Both biotopes have similar suites of species but distinct

	geographical distributions; ByErSp.DysAct only tends to be found off Wales and Lundy whereas ByErSp.Sag tends to be found off the west coast of Ireland.
CR.HCR.DpSp.PhaAxi	This biotope is found on extremely wave-exposed and wave-exposed coasts with very weak tides. It is found much deeper than ByErSp.Sag with mean depths of 32m-37m. PhaAxi has a very diverse sponge fauna with a wide range of axinellids at most sites. In addition, *Alcyonium glomeratum* and *Eunicella verrucosa* are often present. ByErSp.Sag has a wider range of hydroids including *T. indivisa*, *H. halecinum* and *Gymnangium montagui*, which are rarely found in PhaAxi.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Scypha ciliata	••••	Occasional	1
Pachymatisma johnstonia	••••	Occasional	1
Polymastia boletiformis	••••	Frequent	2
Polymastia mamillaris	•••	Frequent	1
Cliona celata	•••••	Frequent	4
Stelligera stuposa	•••	Occasional	1
Hemimycale columella	•••	Occasional	1
Haliclona viscosa	••••	Occasional	2
Dysidea fragilis	•••	Occasional	1
Halecium halecinum	••••	Frequent	2
Aglaophenia tubulifera	•••	Frequent	1
Nemertesia antennina	•••••	Frequent	5
Nemertesia ramosa	•••••	Frequent	3
Abietinaria abietina	•••	Occasional	1
Alcyonium digitatum	•••••	Frequent	6
Urticina felina	•••••	Occasional	3
Metridium senile	•••	Frequent	1
Sagartia elegans	••••	Frequent	2
Corynactis viridis	••••	Frequent	2
Caryophyllia smithii	•••••	Frequent	3
Balanus crenatus	••••	Frequent	2
Cancer pagurus	••••	Occasional	1
Calliostoma zizyphinum	•••••	Occasional	3
Alcyonidium diaphanum	••••	Occasional	2
Parasmittina trispinosa	•••	Frequent	1
Flustra foliacea	•••	Frequent	2
Bugula plumosa	•••	Occasional	1
Antedon bifida	••••	Frequent	2
Luidia ciliaris	••••	Occasional	2
Henricia oculata	•••••	Occasional	3
Asterias rubens	•••••	Occasional	3
Marthasterias glacialis	••••	Occasional	2
Echinus esculentus	•••••	Occasional	3
Clavelina lepadiformis	••••	Occasional	2

CR.HCR.XFa.CvirCri *Corynactis viridis* and a mixed turf of crisiids, *Bugula*, *Scrupocellaria*, and *Cellaria* on moderately tide-swept exposed circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	Strong, Moderately strong
Substratum:	Bedrock; very large boulders
Zone:	Circalittoral - upper, Circalittoral - lower
Depth band:	10-20 m, 20-30 m
Other features:	Often on vertical or steep rock

Previous code

CR.ECR.EFa.CorCri 97.06

Biotope description

This biotope typically occurs on wave-exposed, vertical or steep, circalittoral bedrock or large boulders, usually subject to moderate or strong tidal streams. It is characterised by dense aggregations of the anemone *Corynactis viridis* and the cup coral *Caryophyllia smithii* intermixed with a short bryozoan turf of one or more *Crisia* spp., *Scrupocellaria* spp., *Bugula* spp. and *Cellaria* spp. Occasionally, this turf obscures the underlying *C. virdis* and *C. smithii*. Cushion and encrusting sponges, particularly *Pachymatisma johnstonia*, *Cliona celata*, *Esperiopsis fucorum* and *Dysidea fragilis*, are present in moderate amounts at many sites. The Axinellid sponges *Stelligera* spp. and *Raspailia* spp. are less frequently recorded. Clumps of large hydroids such as *Nemertesia antennina* and *Nemertesia ramosa* as well as the soft coral *Alcyonium digitatum* and the bryozoan *Alcyonidium diaphanum* may be found covering the hard substratum. The anemones *Actinothoe sphyrodeta* and *Sagartia elegans* are typically present in low numbers, while the hard `coral' *Pentapora foliacea* is also occasionally observed. The most frequently recorded echinoderms are *Marthasterias glacialis* and *Asterias rubens*, although other species such as *Echinus esculentus* may also be seen. The rocky substratum may have a patchy covering of encrusting red seaweeds/algae. The crabs *Necora puber* and *Cancer pagurus* may be seen in crevices or under overhangs. This biotope is regularly recorded around south west England and Wales, often on vertical rock faces.

Situation

Due to its wave-exposed nature, kelp park and forest biotopes (LhypR and Ala) are commonly found in the infralittoral zone shallower than this biotope, and feature species such as *Laminaria hyperborea*, *Sacchoriza polyschides* and *Alaria esculenta*.

Temporal variation

Not known.

Similar biotopes

CR.HCR.XFa.ByErSp.Sag	This variant is found on slightly less exposed coasts and in slightly weaker tides than CvirCri. ByErSp.Sag is characterised by a greater diversity of sponges, hydroids and anemones and also has small amounts of polyclinid ascidians, which are rare in CvirCri. ByErSp.Sag may sometimes be found below CvirCri.
CR.MCR.EcCr.CarSp.PenPcom	This variant is subject to weaker tides than CvirCri, but is found on similar wave-exposed upward-facing bedrock. The general appearance of CarSp.PenPcom is of a fairly sparse but diverse fauna and it lacks the bryozoan turf of CvirCri, having larger amounts of brittle and encrusting bryozoans such as *Porella compressa* and *Parasmittina trispinosa*.
CR.HCR.XFa.ByErSp.Eun	This variant occurs under similar conditions as CvirCri. It is characterised by

	the presence of *Eunicella verrucosa* and *Alcyonium glomeratum*, in combination with diverse sponges and hydroids. It also contains a much wider range of ascidians than CvirCri.
CR.HCR.XFa.ByErSp.DysAct	This sub-biotope occurs on similar wave-exposed bedrock and boulders as CvirCri, but is found in slightly stronger tidal streams. The sponge *Dysidea fragilis* and the anemone *Actinothoe sphyrodeta* are present in much higher abundances than in CvirCri. A more diverse range of ascidians are present in ByErSp.DysAct.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
PORIFERA	●●●	Occasional	1
Pachymatisma johnstonia	●●●●	Occasional	2
Cliona celata	●●●●●	Occasional	5
Raspailia ramosa	●●●	Occasional	1
Esperiopsis fucorum	●●●	Occasional	1
Dysidea fragilis	●●●	Occasional	2
Nemertesia antennina	●●●●	Common	3
Nemertesia ramosa	●●●	Occasional	2
Alcyonium digitatum	●●●●●	Common	10
Sagartia elegans	●●●	Occasional	1
Actinothoe sphyrodeta	●●●●	Occasional	3
Corynactis viridis	●●●●●	Common	9
Caryophyllia smithii	●●●●●	Frequent	8
Cancer pagurus	●●●	Rare	1
Necora puber	●●●●	Occasional	2
BRYOZOA	●●●●	Frequent	3
Crisiidae	●●●●	Common	4
Alcyonidium diaphanum	●●●	Occasional	2
Pentapora foliacea	●●●	Occasional	2
Cellaria sinuosa	●●	Frequent	1
Scrupocellaria	●●	Common	1
Asterias rubens	●●●●	Frequent	4
Marthasterias glacialis	●●●●●	Frequent	4
Echinus esculentus	●●●●	Occasional	2
Corallinaceae	●●●	Occasional	1

CR.HCR.XFa.SwiLgAs Mixed turf of hydroids and large ascidians with *Swiftia pallida* and *Caryophyllia smithii* on weakly tide-swept circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock; boulder
Zone:	Circalittoral - upper, Circalittoral - lower
Depth band:	10-20 m, 20-30 m, 30-50 m

Previous code

CR.MCR.XFa.ErSSwi 97.06

Biotope description

This biotope typically occurs from exposed through to sheltered circalittoral bedrock or boulders subject to moderately strong to weak tidal streams. It is found in water depths ranging from 4m to 37m. This biotope is distinguished by frequently occurring *Swiftia pallida*, abundant *Caryophilia smithii* and a diverse range of ascidians including *Clavelina lepadiformis*, *Ascidia mentula*, *Polycarpa pomaria*, *Diazona violacea* and *Corella parallelogramma*. A sparse, yet diverse hydroid turf is often apparent, with species such as *Aglaophenia tubulifera*, *Nemertesia antennina*, *Polyplumaria frutescens*, *Halecium halecinum*, *Abietinaria abietina*, *Nemertesia ramosa* and *Halopteris catharina* often recorded. Spaces amongst the turf are usually colonised by the polychaete *Pomatoceros triqueter* and encrusting red algae. Crinoids such as *Antedon petasus*, *Antedon bifida* and *Leptometra celtica* may be seen filter feeding on the tops of outcrops and boulders, along with the soft coral *Alcyonium digitatum*. Other echinoderms such as *Echinus esculentus*, *Crossaster papposus* and *Asterias rubens* may also be recorded. There may also be a bryozoan componant to the sparse faunal turf. Species such as *Securiflustra securifrons* and *Eucratea loricata* as well as the crustose *Parasmittina trispinosa* are all usually present. There may be a few isolated growths of sponge, such as *Iophonopsis nigricans*, *Axinella infundibuliformis* and *Haliclona urceolus*. Other species that may be present include the brachiopod *Terebratulina retusa* and the top shell *Calliostoma zizyphinum*. The crustacean *Munida rugosa* may be visible in crevices. All records are from the west coast of Scotland (east coast of Lewis /Outer Hebrides).

Situation

Above this biotope, kelp forest and park are typically found in the infralittoral, with *Laminaria saccharina* and *Laminaria hyperborea*. This biotope is found in Scottish Sealochs and, in the most sheltered situations, may graduate into NeoPro at greater depths.

Temporal variation

Not known

Similar biotopes

CR.MCR.EcCr.CarSwi.LgAs	This biotope is found over a broad range of sites with different wave-exposures, subject to moderately strong to very weak tidal streams. Substratum is typically similar to SwiLgAs. This biotope is more impoverished than SwiLgAs, lacking the diverse range of sponges, hydroids and bryozoans but still with frequent *S. pallida*.
CR.MCR.EcCr.CarSwi.Aglo	This biotope occurs predominantly in the sheltered end of the wave-exposure spectrum, and is subject to only weak tidal streams. It is typically found across similar depth bands as SwiLgAs. This heavily silted biotope is characterised by *Swiftia pallida*, *Alcyonium glomeratum*, *Isozoanthus sulcatus* and the prominent *Holothuria forskali*, the latter two of which are

absent from SwiLgAs. This biotope is only present around the coast of Ireland.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Axinella infundibuliformis	••••	Occasional	2
Iophonopsis nigricans	••••	Occasional	2
Haliclona urceolus	•••	Occasional	1
Halecium halecinum	••••	Occasional	2
Aglaophenia tubulifera	••••	Frequent	4
Halopteris catharina	•••	Frequent	1
Nemertesia antennina	••••	Occasional	3
Nemertesia ramosa	•••	Occasional	1
Polyplumaria frutescens	••••	Occasional	2
Abietinaria abietina	•••	Frequent	2
Alcyonium digitatum	••••	Occasional	2
Swiftia pallida	•••••	Frequent	6
Caryophyllia smithii	•••••	Frequent	7
Pomatoceros triqueter	••••	Frequent	3
Munida rugosa	••••	Occasional	2
Calliostoma zizyphinum	•••	Occasional	1
Terebratulina retusa	•••	Occasional	1
Parasmittina trispinosa	••••	Occasional	2
Eucratea loricata	•••	Frequent	1
Securiflustra securifrons	••••	Frequent	2
Antedon bifida	••••	Frequent	3
Antedon petasus	•••	Frequent	2
Leptometra celtica	•••	Occasional	1
Crossaster papposus	••••	Rare	1
Asterias rubens	•••	Occasional	1
Echinus esculentus	••••	Occasional	3
Clavelina lepadiformis	•••••	Occasional	4
Diazona violacea	••••	Occasional	2
Corella parallelogramma	••••	Occasional	2
Ascidia mentula	••••	Frequent	4
Polycarpa pomaria	••••	Occasional	2
Corallinaceae	•••	Frequent	1

CR.HCR.XFa.FluCoAs *Flustra foliacea* and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Bedrock; boulder; cobble
Zone:	Circalittoral - upper, Circalittoral - lower
Depth band:	5-10 m, 10-20 m

Biotope description

This biotope typically occurs on the upper faces of moderately tide-swept, moderately wave-exposed circalittoral bedrock or boulders (although a variant is found on mixed substrata). It most frequently occurs between 10-20m water depth. The biotope is exposed to varying amounts of scour (due to nearby patches of sediment) and, as a consequence, is characteristically dominated by dense *Flustra folicaea*, a range of colonial ascidians and a variety of other scour/silt-tolerant species. In addition to *Flustra*, other bryozoans present in this biotope include *Alcyonidium diaphanum*, *Bugula flabellata* and *Bugula plumosa*. Varying amounts of the soft coral *Alcyonium digitatum* may be recorded, depending on the amount of scouring which may vary locally. Where scour is a major factor, species such as the scour-tolerant *Urticina felina* are frequently observed. Hydroids present in this biotope include *Nemertesia antennina*, *Halecium halecium*, *Tubularia indivisa* and *Hydrallmania falcata*. Other species present include the silt-tolerant sponges such as *Scypha ciliata*, *Cliona celata*, *Leucosolenia botryoides*, and the ascidians *Clavelina lepadiformis* and *Botryllus schlosseri*. *Balanus crenatus* may be recorded occasionally on the boulder/rock surface, and the crab *Cancer pagurus* may be observed finding refuge in crevices and under boulders. More ubiquitous species present include *Asterias rubens*, *Crossaster papposus*, *Ophiothrix fragilis* and *Pagurus bernhardus*. Three variants of this biotope have been defined. FluCoAs.SmAs tends to have a high abundance of barnacles, which populate the rocky seabed. The second variant (FluCoAs.Paur) is characterised by abundant *Polyclinum aurantium* in addition to *F. foliacea*, which often incorporates sand grains into itself, giving the crustose appearance of sandy rock nodules. Finally, FluCoAs.X is found on mixed substrata and is characterised by a dense hydroid turf growing alongside *F. foliacea* and other scour-tolerant species.

Temporal variation

Not known

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Leucosolenia botryoides	••	Frequent	1
Scypha ciliata	••••	Frequent	4
Cliona celata	••••	Occasional	3
Tubularia indivisa	•••	Occasional	2
Halecium halecinum	•••	Frequent	2
Nemertesia antennina	••••	Frequent	3
Hydrallmania falcata	•••	Occasional	1
Alcyonium digitatum	•••••	Occasional	4
Urticina felina	••••	Frequent	4
Balanus crenatus	•••	Frequent	1
Pagurus bernhardus	•••	Occasional	1

Cancer pagurus	●●●●	Occasional	3
Alcyonidium diaphanum	●●●●●	Frequent	6
Flustra foliacea	●●●●●	Frequent	7
Bugula flabellata	●●●●	Occasional	3
Bugula plumosa	●●●	Frequent	2
Crossaster papposus	●●●●	Occasional	3
Asterias rubens	●●●●●	Frequent	8
Ophiothrix fragilis	●●●	Frequent	2
Clavelina lepadiformis	●●●●	Frequent	3
Polyclinum aurantium	●●●	Frequent	3
Botryllus schlosseri	●●●●	Occasional	2

HCR.XFa.FluCoAs.Paur *Polyclinum aurantium* and *Flustra foliacea* on sand-scoured tide-swept moderately wave-exposed circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Bedrock; boulder; cobble
Zone:	Circalittoral - upper, Circalittoral - lower
Depth band:	5-10 m, 10-20 m, 20-30 m
Other features:	Occurs mainly on upper-faces.

Previous code

CR.MCR.As.StoPaur 97.06

Biotope description

This variant is typically found on the upper faces of moderately exposed, moderately tide-swept, circalittoral bedrock or boulders. Sand and silt are periodically re-suspended in the water column, resulting in scour-tolerant species being characteristic of these areas. There is a dense covering of the scour-resistant bryozoan *Flustra foliacea* attached to the bedrock plains and boulders. The colonial ascidian *Polyclinum aurantium* commonly covers the rock surface at most locations within this biotope - itself incorporating sand grains into its surface to give it the appearance of sandy rock nodules. Other ascidians that may occur in this 'crust' are the flat, encrusting colonial *Botrylloides leachi*, *Botryllus schlosseri* and the colonial ascidian *Clavelina lepadiformis*, although in varying quantities at each location. A short turf of other bryozoans such as *Alcyonidium diaphanum*, *Bugula plumosa* and *Bugula flabellata* occur amongst the ascidians. Other species found in this biotope are the sponges *Cliona celata*, *Leucosolenia botryoides* and *Scypha ciliata*, the hydroids *Tubularia indivisa*, *Nemertesia antennina*, *Halecium halecinum* and the anthozoans *Alcyonium digitatum* and *Urticina felina*. Echinoderms which may be present include the starfish *Asterias rubens*, *Crossaster papposus* and the brittlestar *Ophiothrix fragilis*. Crustaceans such as the crab *Cancer pagurus*, the hermit crab *Pagurus bernhardus* and the lobster *Homarus gammarus* may be observed in crevices and under boulders. The palps of the polychaete *Polydora* may be observed whilst the nudibranch *Janolus cristatus* may be seen preying on the hydroid/bryozoan turf. This variant is commonly found on the Northumberland coast, Flamborough Head and the Lleyn Peninsula.

Situation

As FluCoAs.Paur tends to occur in waters with a sediment load, the resulting light penetration is reduced, meaning that kelp forests such as Lhyp, normally found shallower than FluCoAs.Paur in the infralittoral zone, are present over a narrower depth range.

Temporal variation

Not known

Similar biotopes

CR.HCR.XFa.Mol	This biotope occurs on more heterogeneous substrata, composed of bedrock ridges with cobbles and sand plains, rather than predominantly bedrock in the case of FluCoAs.Paur. Both biotopes contain *Flustra* and a similar hydroid turf, but Mol lacks the diversity of sponges and the dense polyclinid ascidians. It is the dense aggregations of *Molgula* which distinguish this biotope from others.
CR.HCR.XFa.FluCoAs.SmAs	This variant occurs on slightly more wave-exposed sites but subject to similar tidal streams. Both biotopes are found similarly on the upper faces of circalittoral bedrock/boulder. Although both biotopes feature *Flustra* as a

	dominant feature of their fauna, FluCoAs.SmAs has a much more diverse associated sponge fauna and lacks the abundant sheets of the colonial ascidian *Polyclinum aurantium*.
HCR.FluCoAs.X	This variant occurs on slightly more wave-exposed sites but subject to similar tidal streams. While FluCoAs.Paur is found on circalittoral bedrock or boulders, FluCoAs.Mx occurs on mixed substrata (boulders, cobble, pebble and gravel). Although both biotopes feature *Flustra* as a dominant feature of their fauna, FluCoAs.Mx has a much more diverse associated fauna and lacks the abundant sheets of the colonial ascidian *Polyclinum aurantium*.
MCR.FaAlCr.Flu	This biotope is found under similar exposure and tidal stream regimes as FluCoAs.Paur but occurs in slightly deeper water depths. FaAlCr.Flu is also found on similar rocky substrata as FluCoAs.Paur. While *F. foliacea* is the dominant bryozoan present in both, it is the presence of dense aggregations of *Polyclinium aurantium* which distinguish FluCoAs.Paur from this biotope.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Leucosolenia botryoides	••••	Frequent	5
Scypha ciliata	•••••	Frequent	4
Cliona celata	•••••	Common	6
Tubularia indivisa	•••	Occasional	1
Halecium halecinum	•••	Common	2
Nemertesia antennina	••••	Occasional	2
Alcyonium digitatum	•••••	Common	4
Urticina felina	•••••	Frequent	3
Polydora	•••	Frequent	2
Homarus gammarus	••••	Present	1
Pagurus bernhardus	••••	Present	1
Cancer pagurus	••••	Occasional	3
Janolus cristatus	••••	Occasional	2
Alcyonidium diaphanum	•••••	Frequent	5
Flustra foliacea	•••••	Common	10
Bugula flabellata	••••	Occasional	3
Bugula plumosa	••••	Common	4
Crossaster papposus	•••••	Occasional	4
Asterias rubens	•••••	Common	6
Ophiothrix fragilis	•••••	Frequent	3
Clavelina lepadiformis	••••	Common	3
Polyclinum aurantium	•••••	Common	8
Botryllus schlosseri	••••	Occasional	1
Botrylloides leachi	••••	Occasional	1

CR.HCR.XFa.FluCoAs.SmAs *Flustra foliacea*, small solitary and colonial ascidians on tide-swept circalittoral bedrock or boulders

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Strong, Moderately strong
Substratum:	Bedrock; boulder
Zone:	Circalittoral - upper, Circalittoral - lower
Depth band:	5-10 m, 10-20 m

Biotope description

This sub-biotope is typically found on the upper faces of exposed to moderately exposed, tide-swept, scoured, circalittoral bedrock or boulders. It most frequently occurs between 10-20m water depth. The biotope is characteristically dominated by dense *Flustra foliacea* with a variety of slightly scour/silt-tolerant species forming a dense turf. This turf is primarily composed of bryozoans (*Alcyonidium diaphanum*, *Bugula flabellata*, *Bugula plumosa*, *Bicellariella ciliata*) and hydroids (*Tubularia indivisa*, *Nemertesia antennina*, *Sertularia argentea*, *Hydrallmania falcata*, *Abietinaria abietina*). Where space permits, barnacles such as *Balanus crenatus* may be found encrusting on the rock surface. There may also be occasional crusts formed by the polychaete *Sabellaria spinulosa*, especially where the rock is most influenced by sand. Anthozoans which may be observed include *Urticina felina*, *Sagartia elegans*, whilst the soft coral *Alcyonium digitatum* may be recorded on the tops of boulders and bedrock ridges. A range of small solitary and colonial ascidians may be seen, including *Polycarpa scuba*, *Dendrodoa grossularia*, *Molgula manhattensis*, *Botryllus schlosseri*, *Clavelina lepadiformis* and polyclinids. Sponges found include *Scypha ciliata*, *Cliona celata*, *Esperiopsis fucorum* and *Dysidea fragilis*. Echinoderms such as *Asterias rubens*, *Henricia oculata* and *Crossaster papposus* may be seen on the rock surface. Other species found include the top shell *Calliostoma zizyphinum*, the crabs *Cancer pagurus* and *Necora puber*.

Situation

Above this variant, exposed kelp forest supporting *Laminaria hyperborea* is commonly found (LhypR). At locations where wave-exposure and/or tidal streams are less, this biotope may be replaced by *Alcyonium digitatum* and *Securiflustra securifrons* (FaAlC.Sec). Where the substrata changes to a less stable mixed substrata, then this biotope will be replaced by the sub-biotope FluCoAs.Mx, with more `sediment' species such as *Cerianthus lloydii* and *Chaetopterus variopedatus*.

Temporal variation

Not known

Similar biotopes

CR.HCR.XFa.FluCoAs.Paur	This variant occurs on moderately wave-exposed sites but subject to similar tidal streams as FluCoAs.SmAs. Although both sub-biotopes are dominated by *Flustra*, FluCoAs.SmAs has a much more diverse associated sponge fauna and lacks the abundant sheets of the colonial ascidian *Polyclinum aurantium*.
CR.HCR.XFa.FluCoAs.X	This variant occurs under slightly more wave-exposed conditions but subject to similar tidal streams, but is found on mixed substrata (boulders, cobbles, pebbles and gravel) whereas FluCoAs.SmAs is found on bedrock and boulders. FluCoAs.Mx does not tend to have such a diverse range of sponges, and species found on more mixed sediment tend to be more prevalent (*Cerianthus lloydii*, *Chaetopterus variopedatus* and *Chlamys varia*).
CR.HCR.XFa.ByErSp.DysAct	This sub-biotope occurs under more wave-exposed conditions, with slightly

stronger tides than FluCoAs.SmAs. They also both tend to have a thin layer of silt overlying them. Sponges, hydroids and bryozoans are present in both biotopes; although *Flustra* is present in ByErSp.DysAct, it is not present to the same abundance as in FluCoAs.SmAs, where it forms dense aggregations on the bedrock and boulders. In addition, species such as *Caryophyllia smithii* and *Corynactis viridis* are absent from FluCoAs.SmAs.

CR.MCR.EcCr.FaAlCr.Flu

This sub-biotope occurs over a similar range of wave-exposures but tends to occur in sites subject to moderately strong to weak tidal streams. This biotope is found deeper than FluCoAs.SmAs, with a mean depth range of 20m to 21m. Both sub-biotopes tend to occupy the same type of substrata (bedrock, boulder, cobble and sand influenced). This sub-biotope has a much more impoverished fauna (especially sponge fauna) when compared to FluCoAs.SmAs. Key species which are absent in FaAlCr.Flu but present in FluCoAs.SmAs include *Sertularia argentea*, *Balanus crenatus*, *Bugula plumosa* and *Scypha ciliata*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Scypha ciliata	••••	Frequent	3
Cliona celata	••••	Occasional	1
Esperiopsis fucorum	•••	Frequent	1
Dysidea fragilis	•••	Occasional	1
Tubularia indivisa	•••	Occasional	1
Nemertesia antennina	••••	Frequent	2
Abietinaria abietina	•••	Occasional	1
Hydrallmania falcata	••••	Frequent	2
Sertularia argentea	••••	Frequent	2
Alcyonium digitatum	••••	Occasional	3
Urticina felina	•••••	Frequent	4
Sagartia elegans	••••	Occasional	2
Sabellaria spinulosa	•••	Frequent	2
Balanus crenatus	••••	Common	4
Cancer pagurus	••••	Occasional	2
Necora puber	••••	Occasional	2
Calliostoma zizyphinum	•••	Occasional	1
Alcyonidium diaphanum	•••••	Frequent	6
Flustra foliacea	•••••	Frequent	6
Bicellariella ciliata	•••	Occasional	1
Bugula flabellata	••••	Occasional	3
Bugula plumosa	••••	Frequent	2
Crossaster papposus	••••	Occasional	2
Henricia	•••	Occasional	3
Asterias rubens	•••••	Frequent	6
Clavelina lepadiformis	•••	Occasional	1
Polyclinum aurantium	•••	Frequent	1
Polycarpa scuba	•••	Frequent	2
Dendrodoa grossularia	•••	Frequent	2
Botryllus schlosseri	•••	Occasional	1
Molgula manhattensis	•••	Frequent	2

CR.HCR.XFa.FluCoAs.X Flustra foliacea and colonial ascidians on tide-swept exposed circalittoral mixed substrata

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Boulder; cobble; pebble
Zone:	Circalittoral - upper, Circalittoral - lower
Depth band:	5-10 m, 10-20 m, 20-30 m

Biotope description

This variant is typically found on very exposed to moderately exposed, circalittoral mixed substrata subject to moderately strong tidal streams. It most frequently occurs between 10m and 20m water depth. This variant is characterised by a dense hydroid and *Flustra foliacea* turf, along with other scour-tolerant species, growing on the more stable boulders and cobbles which overlie coarse muddy sand and gravel. Although *Nemertesia antennina* is the dominant species within the hydroid turf, other species such as *Halecium halecinum*, *Nemertesia ramosa* and *Hydrallmania falcata* may also be present. Other bryozoans found amongst the hydroid and *Flustra* turf include *Cellepora pumicosa*, *Bugula flabellata*, *Bugula turbinata*, and a crisiid turf. Encrusting red algae, the polychaete *Pomatoceros triqueter* and barnacles such as *Balanus crenatus* may be found on the smaller cobbles and pebbles, which may become mobile during extreme storms. Echinoderms such as *Asterias rubens* and *Ophiothrix fragilis* may be present on the boulders, or the coarse sediment in between. On the larger, more stable boulders, isolated sponge communities may develop, with species such as *Scypha ciliata*, *Dysidea fragilis*, *Hemimycale columella*, *Esperiopsis fucorum* and *Stelligera rigida*. In addition, small *Alcyonium digitatum*, various ascidians (*Clavelina lepadiformis*, *Botryllus schlosseri*), *Pododesmus patelliformis* and top shells (*Calliostoma zizyphinum*, *Gibbula cineraria*) may colonise the upper faces and vertical sides of larger boulders. At some shallower sites, the foliose red algae *Hypoglossum hypoglossoides* may be found on the tops of larger boulders. Within the coarse sediment underlying these boulders and cobbles, anemones such as *Cerianthus lloydii* and *Urticina felina* may be recorded. Under-boulder fauna typically consists of terebellid worms, and crabs such as *Pisidia longicornis* and *Cancer pagurus*.

Situation

This variant is found in wave-exposed locations, resulting in kelp forest in the infralittoral zone being dominated by *Alaria esculentus* and *Laminaria hyperborea*. When the substratum becomes rockier, this biotope will graduate into the variant FluCoAs.SmAs.

Temporal variation

Not known

Similar biotopes

CR.HCR.XFa.FluCoAs.Paur	This variant occurs on slightly less wave-exposed sites but subject to similar tidal streams. While FluCoAs.Paur is found on circalittoral bedrock and boulders, FluCoAs.Mx occurs on mixed substrata (boulders, cobble, pebble and gravel). Although both biotopes feature *Flustra* as a dominant feature of their fauna, FluCoAs.Mx has a much more diverse associated fauna and lacks the abundant sheets of the colonial ascidian *Polyclinum aurantium*.
CR.HCR.XFa.FluCoAs.SmAs	This variant occurs under slightly less wave-exposed conditions but subject to similar tidal streams. They both occur around similar depths but

	FluCoAs.Mx is found on a mixed substratum (boulders, cobbles, pebbles and gravel) whereas FluCoAs.SmAs tends to be found on bedrock or boulders. FluCoAs.SmAs tends to have a more diverse range of sponges , although it tends not to have the range of species found on more mixed sediment as in FluCoAs.Mx (e.g. *Cerianthus lloydii*, *Chaetopterus variopedatus* and *Chlamys varia*).
CR.MCR.EcCr.FaAlCr.Flu	This biotope occurs on moderately wave-exposed coasts subject to similar tidal streams. This biotope is found at much deeper depths than FluCoAs.Mx, with a mean depth range of 20m to 21m. Unlike FaAlCr.Flu, Flu CoAs.Mx is found on more mixed substrata, consisting of boulders, cobbles and pebbles. FluCoAs.Mx also has a diverse sponge and bryozoan 'turf' community.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Scypha ciliata	••••	Occasional	2
Stelligera rigida	•••	Occasional	1
Esperiopsis fucorum	•••	Occasional	1
Hemimycale columella	••••	Occasional	2
Dysidea fragilis	••••	Occasional	2
Halecium halecinum	••••	Frequent	2
Nemertesia antennina	•••••	Frequent	6
Nemertesia ramosa	••••	Frequent	2
Hydrallmania falcata	•••	Occasional	1
Alcyonium digitatum	•••••	Occasional	3
Cerianthus lloydii	•••	Occasional	1
Urticina felina	••••	Occasional	1
Terebellidae	•••	Occasional	2
Pomatoceros triqueter	•••••	Frequent	4
Balanus crenatus	••••	Occasional	2
Pisidia longicornis	••••	Common	3
Cancer pagurus	••••	Occasional	1
Gibbula cineraria	••••	Occasional	2
Calliostoma zizyphinum	•••••	Occasional	3
Pododesmus patelliformis	•••	Frequent	2
Crisiidae	•••	Frequent	1
Cellepora pumicosa	••••	Occasional	2
Flustra foliacea	•••••	Frequent	5
Bugula flabellata	••••	Occasional	2
Bugula turbinata	•••	Occasional	1
Asterias rubens	•••••	Frequent	6
Ophiothrix fragilis	•••	Occasional	1
Clavelina lepadiformis	••••	Frequent	3
Botryllus schlosseri	••••	Occasional	2
Corallinaceae	••••	Occasional	2
Hypoglossum hypoglossoides	••••	Occasional	2

CR.HCR.XFa.SpNemAdia Sparse sponges, *Nemertesia* spp., and *Alcyonidium diaphanum* on circalittoral mixed substrata

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Moderately strong
Substratum:	Boulders; cobbles; pebbles
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m

Previous code

CR.MCR.ByH.SNem Adia 97.06

Biotope description

This biotope is found on moderately wave-exposed sand-scoured, circalittoral boulders, cobbles and pebbles that are subject to moderately strong tidal streams (referred to as lag-cobbles locally). It is characterised by sparse sponges and a diverse bryozoan and hydroid turf. The sparse sponge community is primarily composed of *Dysidea fragilis* and *Scypha ciliata*. The mixed faunal turf is composed of *Nemertesia antennina*, *Nemertesia ramosa*, *Halecium halecinum*, *Sertularia argentea*, *Alcyonium digitatum*, *Bugula flabellata*, *Bugula turbinata*, *Bugula plumosa*, *Flustra foliacea*, *Cellapora pumicosa*, *Alcyonidium diaphanum*, *Cellaria fistulosa* and crisiid bryozoans. The anemones *Epizoanthus couchii*, *Sagartia elegans* and *Cerianthus lloydii* may also be recorded. Echinoderms such as the starfish *Asterias rubens*, *Crossaster papposus*, *Henricia oculata* and the crinoid *Antedon bifida*. Other species present include the colonial ascidian *Clavelina lepadiformis*, the barnacle *Balanus crenatus*, the top shell *Gibbula cineraria*, the polychaete *Pomatoceros triqueter*, the ascidian *Morchellium argus*, *Prosthecareus vittatus* and the crab *Cancer pagurus*. It is distributed off Pen Llyn and over considerable areas of the Irish Sea.

Temporal variation

Not known

Similar biotopes

CR.HCR.XFa.FluCoAs.X	This biotope occurs under more wave-exposed conditions subject to slightly weaker tidal streams. *Flustra foliacea* is present in higher abundances in FluCoAs.X.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Scypha ciliata	••	Occasional	1
Dysidea fragilis	•••	Occasional	2
Halecium halecinum	•••	Occasional	1
Nemertesia antennina	•••••	Occasional	10
Nemertesia ramosa	••••	Occasional	3
Sertularia argentea	••	Occasional	1
Alcyonium digitatum	•••••	Occasional	6
Cerianthus lloydii	•••	Occasional	2
Epizoanthus couchii	••••	Occasional	5
Sagartia elegans	•••	Frequent	2
Prostheceraeus vittatus	•••	Rare	1
Pomatoceros triqueter	•••	Occasional	1
Balanus crenatus	•••	Common	2

Cancer pagurus	••	Occasional	1
Gibbula cineraria	•••	Occasional	1
Crisiidae	••	Frequent	1
Alcyonidium diaphanum	••••	Occasional	2
Cellepora pumicosa	••	Occasional	1
Flustra foliacea	••••	Occasional	3
Cellaria fistulosa	••	Common	1
Bugula flabellata	••••	Occasional	4
Bugula plumosa	••	Occasional	1
Bugula turbinata	•••	Occasional	2
Antedon bifida	•••	Occasional	2
Crossaster papposus	•••	Occasional	2
Henricia oculata	•••	Occasional	1
Asterias rubens	••••	Occasional	3
Clavelina lepadiformis	••••	Occasional	5
Morchellium argus	••	Frequent	1

CR.HCR.XFa.SubCriTf *Suberites* spp. with a mixed turf of crisiids and *Bugula* spp. on heavily silted, moderately wave-exposed, shallow circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Moderately strong
Substratum:	Bedrock, Boulders
Zone:	Circalittoral - upper, Circalittoral - lower
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Extremely shallow

Biotope description

This biotope is found on heavily silted, moderately wave-exposed circalittoral bedrock and boulders (often limestone) that are subject to moderately strong tidal streams. A very high silt loading in the water column means that this 'circalittoral' biotope occurs at unusually shallow depths (1 - 10 m BCD). It is characterised by a mixed faunal turf and `massive' examples of the sponges *Suberites ficus*, *Suberites carnosus* and *Hymeniacidon perleve*. Other sponges recorded in this biotope are *Cliona celata*, *Halichondria panicea*, *Esperiopsis fucorum*, *Raspailia ramosa*, *Polymastia mamillaris*, *Dysidea fragilis*, *Scypha ciliata*, *Stelligera rigida* and *Haliclona oculata*. Also characteristic of this biotope is a dense bryozoan turf with one or more crisiid species., *Flustra foliacea* and *Bugula plumosa*. The polychaete *Polydora* sp. and the rock-boring bivalve *Hiatella arctica* are able to bore into the relatively 'soft' limestone. There is an ascidian component to the biotope, with *Morchellium argus* and *Clavelina lepadiformis* among the most abundant. There may be scattered clumps of the hydroids *Abietinaria abietina* and *Hydrallmania falcata*. Other species present include the anemones *Metridium senile*, *Sagartia elegans* and *Urticina felina*, the starfish *Asterias rubens*, the crab *Necora puber*, the nudibranch *Janolus cristatus* and the soft coral *Alcyonium digitatum*. This biotope has currently only been recorded off the east coast of Anglesey, Wales.

Temporal variation

Not known

Similar biotopes

CR.MCR.CFaVS.CuSpH.As	This biotope is similar to SubCriTf but is found in slighty more wave-sheltered sites, and at deeper depths. It also does not have 'massive' examples of *Suberites* spp. present in SubCriTf.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Scypha ciliata	••••	Occasional	2
Suberites carnosus	•••••	Occasional	3
Suberites ficus	•••••	Frequent	5
Polymastia mamillaris	••••	Frequent	2
Cliona celata	•••••	Frequent	5
Stelligera rigida	••••	Frequent	2
Raspailia ramosa	••••	Occasional	2
Halichondria panicea	•••••	Frequent	4
Hymeniacidon perleve	••••	Frequent	3
Esperiopsis fucorum	•••••	Frequent	4

Haliclona oculata	●●●●	Occasional	1
Dysidea fragilis	●●●●	Frequent	2
Abietinaria abietina	●●●●	Frequent	2
Hydrallmania falcata	●●●●	Occasional	2
Alcyonium digitatum	●●●●●	Frequent	4
Urticina felina	●●●●●	Occasional	4
Metridium senile	●●●●●	Common	6
Sagartia elegans	●●●●●	Frequent	4
Polydora	●●●●●	Frequent	5
Necora puber	●●●●	Occasional	2
Janolus cristatus	●●●●	Occasional	2
Hiatella arctica	●●●●●	Frequent	5
Crisiidae	●●●●●	Frequent	4
Flustra foliacea	●●●●	Frequent	2
Bugula plumosa	●●●●	Frequent	2
Asterias rubens	●●●●●	Frequent	5
Clavelina lepadiformis	●●●●	Occasional	2
Morchellium argus	●●●●●	Occasional	4

CR.HCR.XFa.FluHocu *Flustra foliacea* and *Haliclona oculata* with a rich faunal turf on tide-swept circalittoral mixed substrata

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed
Tidal streams:	Strong, Moderately strong
Substratum:	Cobble; pebble; mud
Zone:	Circalittoral - lower
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m

Previous code

CR.MCR.ByH.Flu.Hocu 97.06

Biotope description

This biotope is typically found on exposed slopes of silty cobble and pebble subject to strong to moderate tidal streams. From afar, large 'finger' growths of the sponge *Haliclona oculata* occur amongst a rich faunal turf of hydroids and bryozoans with *Flustra foliacea* prominant. The dense faunal turf growing on the cobbles is composed of the bryozoans *F. foliacea*, *Alcyonidium diaphanum* and *Crisia eburnea* and sporadic occurrences of the hydroids *Nemertesia antennina*, *Hydrallmania falcata*, *Tubularia larynx*, *Rhizocaulus verticillatus* and *Halecium halecinum*. Caprellid shrimps may be observed within this faunal turf. The hard substratum frequently has a dense covering of the sponge *Haliclona oculata* and occasionally *Esperiopsis fucorum*, while the softer gravely/sand between the cobbles provides a habitat for anemones such as *Urticina felina* and *Cerianthus lloydii*. The nudibranch *Janolus cristatus* may be seen preying on the faunal turf and the fan worm *Sabella pavonia* is occasionally seen amongst the cobbles. The soft coral *Alcyonium digitatum* is often attached to the upper faces of more stable cobbles and rocks, while in the crevices between cobbles, the anemone *Sagartia elegans*, the crab *Cancer pagurus*, the prawn *Pandalus montagui* and the amphipod *Dyopedos porrectus* may be observed. Under-cobble fauna includes terebellid worms and *Harmothoe* spp. This biotope has been recorded from the Menai Strait, Milford Haven and Morcambe Bay.

Temporal variation

Not known

Similar biotopes

CR.HCR.XFa.Mol	This biotope occurs on shallow circalittoral bedrock and cobbles, subject to moderate exposure and moderately strong tidal streams. *Flustra* is also prevalent in this community, but has a more diverse ascidian and bryozoan community than Flu.Hocu, including *Molgula* and *Alcyonidium* respectively.
CR.MCR.EcCr.FaAlCr.Flu	This biotope occurs on moderately exposed circalittoral bedrock and boulders, subject to moderately strong tidal streams. This biotope is subject to considerable sand scour, and has an impoverished fauna dominated by *Flustra foliacea* and *Alcyonium digitatum*. FluHocu has a higher diversity of species than FaAlCr.Flu.
CR.HCR.XFa.FluCoAs.Paur	This biotope occurs on moderately exposed bedrock, unlike FluHocu which tends to occur on a cobblier substratum. This biotope does experience similar tidal stream regimes as FluHocu. While *F. foliacea* is the dominant bryozoan, it is the presence of dense aggregations of *Polyclinium aurantium* which distinguish this as a separate biotope.
CR.HCR.XFa.FluCoAs	See other variants in the FluCoAs biotope.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*

Esperiopsis fucorum	●●●●	Occasional	1
Haliclona oculata	●●●●●	Frequent	5
Tubularia larynx	●●●●●	Occasional	2
Halecium halecinum	●●●●●	Occasional	2
Nemertesia antennina	●●●●●	Frequent	6
Hydrallmania falcata	●●●●●	Occasional	3
Rhizocaulus verticillatus	●●●●	Occasional	2
Alcyonium digitatum	●●●●●	Frequent	5
Cerianthus lloydii	●●●●●	Occasional	3
Urticina felina	●●●●●	Frequent	6
Sagartia elegans	●●●●●	Occasional	4
Harmothoe	●●●●●	Present	1
Terebellidae	●●●●●	Occasional	4
Sabella pavonina	●●●●●	Frequent	3
PYCNOGONIDA	●●●●●	Present	2
Balanus crenatus	●●●●	Frequent	2
Dyopedos porrectus	●●●●●	Frequent	7
Caprellidae	●●●●●	Present	2
Pandalus montagui	●●●●	Occasional	2
Cancer pagurus	●●●●●	Frequent	5
Janolus cristatus	●●●●●	Rare	1
Crisia eburnea	●●●●●	Rare	1
Alcyonidium diaphanum	●●●●●	Frequent	5
Flustra foliacea	●●●●●	Frequent	5
Asterias rubens	●●●●●	Frequent	4

CR.HCR.XFa.Mol *Molgula manhattensis* with a hydroid and bryozoan turf on tide-swept moderately wave-exposed circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Moderately strong
Substratum:	Bedrock; cobble; sand
Zone:	Circalittoral - upper, Circalittoral - lower
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

CR.MCR.As.MolPol 97.06

Biotope description

This biotope is typically found on slightly sand-scoured, tide-swept, moderately exposed circalittoral bedrock and cobbles. It is commonly recorded from the shallower reaches of the circalittoral around depths from 5m to 15m BCD, as it occurs mostly in very turbid waters. From afar, the physical characteristics are usually silted bedrock reefs and cobble, interspersed with patches of clean sand, causing a scour effect on the rock. Dense aggregations of the ascidian *Molgula manhattensis* form a silty mat on the rock and there is a sparse hydroid and bryozoan turf. A hydroid turf, composed of *Nemertesia antennina*, *Halecium beanii*, *Hydrallmania falcata*, *Sertularella gaudichaudi*, *Tubularia indivisa* and *Alcyonium digitatum*, in varying amounts, occurs at most sites on the tops of boulders and ridges. A bryozoan turf is also present, but not usually dense and includes *Flustra foliacea*, *Alcyonidium diaphanum*, *Electra pilosa* and the crust-forming bryozoan *Conopeum reticulum*. The polychaete *Lanice conchilega* thrives in the sandy patches which often occur between the rock ridges. The scour effect tends to reduce the diversity of sponges present with only *Halichondria panicea* occasionally present. Isolated clumps of the polychaete *Sabellaria spinulosa* may be present but they do not occur in dense aggregations as in the Sspi.ByB biotope. The anemones *Urticina felina* and *Sagartia troglodytes* may occur in cracks between cobbles or on stones buried in the sandy substratum. The anemone *Sagartia elegans* is more commonly found attached to crevices in the bedrock. Other species such as the hermit crab *Pagurus bernhardus*, the barnacle *Balanus crenatus*, the polychaete *Sabella pavonia* and *Pomatoceros triqueter* may all be present whilst the crab *Pisidia longicornis* may be found under cobbles and stones. Records of this biotope are distributed along the south coast of England and the north Wales coast as well as Pembrokeshire near the entrance to Milford Haven.

Situation

As this biotope is often recorded on soft rock (chalk), soft rock communities (SfR biotope complex) would be observed in close proximity with species such as *Polydora* and piddocks (*Pholas* and *Barnea* spp). Moderately exposed kelp forests may be found within the 'shallow' infralittoral zone.

Temporal variation

Not known

Similar biotopes

CR.HCR.XFa.FluHocu	This biotope occurs on wave-exposed circalittoral cobble, subject to strong to moderately strong tidal streams. *Flustra* may be found in varying amounts in both these biotopes, but Flu.Hocu has a more diverse range of hydroids and sponges, with *Haliclona oculata* dominant in Flu.Hocu yet absent in Mol.
CR.MCR.EcCr.FaAlCr.Flu	This biotope is found under similar exposure and tidal stream regimes as Mol but occurs in much less turbid conditions. *Flustra* is present in both these biotopes, but is more abundant in FaAlCr.Flu. The absence of *Molgula manhattensis* in FaAlCr.Flu is also noteworthy.
CR.HCR.XFa.FluCoAs.Paur	This biotope is found under similar conditions as Mol but the substratum

tends to be less heterogeneous, composed primarily of bedrock/boulders and it is found in less turbid conditions. *Flustra* and a similar hydroid turf may be found in both biotopes, but FluCoAs.Paur has a diverse range of sponges (including commonly occurring *Cliona celata*) and bryozoan turf with colonial and solitary ascidians. Mol has dense aggregations of *Molgula manhattensis* which distinguish it from others.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	••	Occasional	1
Tubularia indivisa	••••	Occasional	4
Halecium beanii	••	Occasional	1
Nemertesia antennina	•••	Occasional	2
Hydrallmania falcata	•••	Occasional	1
Sertularella gaudichaudi	•••	Occasional	2
Alcyonium digitatum	•••	Occasional	3
Urticina felina	•••	Frequent	4
Sagartia elegans	•••	Occasional	2
Sagartia troglodytes	••	Occasional	1
Sabellaria spinulosa	•••	Occasional	2
Lanice conchilega	••••	Occasional	5
Sabella pavonina	••	Occasional	1
Pomatoceros triqueter	•••	Occasional	2
Balanus crenatus	•••	Occasional	1
Pagurus bernhardus	•••	Occasional	4
Pisidia longicornis	•••	Occasional	1
Alcyonidium diaphanum	•••••	Occasional	11
Conopeum reticulum	••	Present	1
Electra pilosa	•••	Present	1
Flustra foliacea	••••	Occasional	7
Asterias rubens	•••••	Frequent	9
Molgula manhattensis	•••••	Frequent	15

CR.HCR.XFa.SpAnVt Sponges and anemones on vertical circalittoral bedrock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	Strong, Moderately strong, Weak, Very weak
Substratum:	Bedrock
Zone:	Infralittoral - lower, Circalittoral
Depth band:	10-20 m, 20-30 m, 30-50 m
Other features:	Vertical rock

Previous code

IR.FaSwV.CorMetAlc 97.06 in part

Biotope description

This biotope is found on exposed to moderately wave exposed , vertical and overhanging, circalittoral bedrock, subject to strong through to weak tidal streams. This biotope is characterised by a mixed faunal turf of hydroids (*Nemertesis antennina*, *Tubularia indivisa* and *Halecium halecium*) and bryozoans (*Alcyonidium diaphanum* and crisiid turf). There is frequently a diverse range of sponges recorded, including *Cliona celata*, *Pachymatisma johnstonia*, *Dysidea fragilis* and *Hemimycale columella*. There may be dense aggregation of dead mans fingers *Alcyonium digitatum* along with clumps of the cup coral *Caryophyllia smithii*, and the anthozoans *Corynactis viridis*, *Actinothoe sphyrodeta*, *Sagartia elegans* and *Metridium senile*. Other species present include the echinoderms *Echinus esculentus*, *Asterias rubens*, *Marthasterias glacialis*, *Henricia oculata*, *Holothuria forskali* and *Antedon bifida*, clumps of the lightbulb tunicate *Clavelina lepadiformis* and the top shell *Calliostoma zizyphinum*. Three regional variations of this biotope have been recorded. The first variant is characterised by a *Bugula* turf along with the pink sea fan *Eunicella verrucosa*, and has been recorded from around southwest England and Wales. The second variant, characterised by a dense 'carpet' of *Corynactis viridis* and *Metridium senile* has been recorded predominantly from the west coast of Ireland. The final variant is characterised by a very diverse, dense faunal turf of hydroids, bryozoans and ascidians and has been recorded from the coasts around Northern Ireland.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pachymatisma johnstonia	●●●	Occasional	2
Cliona celata	●●●●	Occasional	5
Hemimycale columella	●●	Occasional	1
Dysidea fragilis	●●●	Occasional	2
Tubularia indivisa	●●●	Occasional	2
Halecium halecinum	●●	Occasional	1
Nemertesia antennina	●●●	Occasional	3
Alcyonium digitatum	●●●●●	Frequent	10
Metridium senile	●●	Occasional	1
Sagartia elegans	●●●	Occasional	2
Actinothoe sphyrodeta	●●●	Occasional	3
Corynactis viridis	●●●●	Frequent	10
Caryophyllia smithii	●●●●●	Frequent	9
Calliostoma zizyphinum	●●●	Occasional	2
Crisiidae	●●	Frequent	1
Alcyonidium diaphanum	●●	Rare	1
Antedon bifida	●●	Occasional	1
Henricia oculata	●●●	Occasional	2
Asterias rubens	●●●●	Occasional	4
Marthasterias glacialis	●●●	Occasional	3
Echinus esculentus	●●●●	Occasional	5
Holothuria forskali	●●	Occasional	2
Clavelina lepadiformis	●●●	Occasional	2

CR.MCR Moderate energy circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock;boulders
Zone:	Circalittoral - upper, Circalittoral - lower
Depth band:	10-20 m, 20-30 m

Biotope description

This habitat complex mainly occurs on exposed to moderately wave-exposed circalittoral bedrock and boulders, subject to moderately strong and weal tidal streams. This habitat complex contains a broad range of biotope complexes, from echinoderms and crustose communties (EcCr) to *Sabellaria* reefs (CSab) and circalittoral mussel beds (CMus).

CR.MCR.EcCr Echinoderms and crustose communities

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock, boulders
Zone:	Circalittoral - upper, Circalittoral - lower
Depth band:	10-20 m, 20-30 m, 30-50 m

Biotope description

This biotope complex occurs on wave-exposed, moderately strong to weakly tide-swept, circalittoral bedrock and boulders. Echinoderms, faunal (*Parasmittina trispinosa*) and algal crusts (red encrusting algae) dominate this biotope, giving a 'sparse' appearance. Typical echinoderms present are the starfish *Asterias rubens*, the brittlestar *Ophiothrix fragilis* and the sea urchin *Echinus esculentus*. There may be isolated clumps of the hydroids *Nemertesia antennina* and *Abietinaria abietina*, *Alcyonium digitatum*, the anemone *Urticina felina* and the cup coral *Caryophyllia smithii*. Other species present may include the polychaete *Pomatoceros triqueter* and the top shell *Calliostoma zizphinum*. Five biotopes have been identified within this biotope complex: CarSwi, CarSp, FaAlCr, AdigVt and UrtScr.

Characterising species

	% Frequency	*Abundance (SACFOR)*
Nemertesia antennina	●●●	Occasional
Abietinaria abietina	●●●	Occasional
Alcyonium digitatum	●●●●●	Frequent
Urticina felina	●●●	Occasional
Caryophyllia smithii	●●●	Frequent
Pomatoceros triqueter	●●●	Frequent
Calliostoma zizyphinum	●●●	Occasional
Parasmittina trispinosa	●●●	Frequent
Asterias rubens	●●●●	Occasional
Ophiothrix fragilis	●●●	Frequent
Echinus esculentus	●●●●●	Frequent
Corallinaceae	●●●●	Common

CR.MCR.EcCr.CarSwi *Caryophyllia smithii* and *Swiftia pallida* on circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock; boulder
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m, 30-50 m

Biotope description

This biotope is typically found on the upper and vertical faces of very exposed through to wave-sheltered circalittoral bedrock and boulders, which are typically subject to weak tidal streams. It is characterised by dense aggregations of the cup coral *Caryophyllia smithii* and the sea fan *Swiftia pallida* on the silty substratum. Under the silt, bryozoan crusts such as *Parasmittina trispinosa* and encrusting red algae may be seen. This biotope may have a grazed appearance, perhaps attributable to the frequently occurring *Echinus esculentus* present. There may be a sparse hydroid turf present, with species such as *Nemertesia antennina*, *Nemertesia ramosa* and *Halecium halecinum* present. The soft corals *Alcyonium glomeratum* and *Alcyonium digitatum* may be present on the tops of boulders along with the crinoids *Antedon petasus* and *Antedon bifida*. Other echinoderms occasionally observed include the starfish *Martasterias glacialis*, *Asterias rubens* and *Luidia ciliaris*. Sponges feature only occasionally in this biotope, including species such as *Cliona celata*. The bryozoan *Porella compressa* may also be recorded. Ascidians occasionally present include *Ascidia mentula*, *Clavelina lepadiformis* and *Ciona intestinalis*. Under-boulder fauna typically consists of the crustacean *Munida rugosa*. The polychaete *Pomatoceros triqueter* may be seen encrusting the rocky surface. Two variants of this biotope have been identified; CarSwi.Aglo and CarSwi.LgAs. CarSwi.Aglo is a heavily silted biotope characterised by the sea fan *S. pallida*, the cup coral *C. smithii* and the soft coral *A. glomeratum* and is only present in Irish waters. CarSwi.LgAs has been recorded off the west coast of Scotland, and is characterised by large solitary ascidians and the cup coral *C. smithii*.

Temporal variation

Not known

Similar biotopes

CR.MCR.EcCr.CarSwi.Aglo	see variant for details
CR.MCR.EcCr.CarSwi.LgAs	see variant for details

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Cliona celata	●●●	Occasional	2
Halecium halecinum	●●	Occasional	1
Nemertesia antennina	●●●●	Occasional	4
Nemertesia ramosa	●●	Occasional	2
Alcyonium digitatum	●●●	Occasional	1
Alcyonium glomeratum	●●	Frequent	1
Swiftia pallida	●●●●●	Frequent	14
Caryophyllia smithii	●●●●●	Common	22
Pomatoceros triqueter	●●	Occasional	1

Munida rugosa	●●●	Occasional	2
Parasmittina trispinosa	●●●●	Occasional	5
Porella compressa	●●●	Rare	1
Antedon bifida	●●●	Occasional	2
Antedon petasus	●●	Frequent	1
Luidia ciliaris	●●●	Occasional	2
Asterias rubens	●●●	Occasional	2
Marthasterias glacialis	●●●	Occasional	3
Echinus esculentus	●●●●	Frequent	6
Clavelina lepadiformis	●●	Occasional	1
Ciona intestinalis	●●	Occasional	1
Ascidia mentula	●●●	Occasional	3
Corallinaceae	●●●	Abundant	4

CR.MCR.EcCr.CarSwi.Aglo *Caryophyllia smithii, Swiftia pallida* and *Alcyonium glomeratum* on wave-sheltered circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulder
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m, 30-50 m

Previous code

CR.MCR.XFa.ErSSwi 97.06

Biotope description

This variant typically occurs on sheltered, ridged, circalittoral bedrock or boulders subject to only weak tidal streams, but may be found in somewhat more exposed conditions. It is found in water depths ranging from 15m to 32m. Commonly occurring *Swiftia pallida* characterises this heavily silted biotope along with *Caryophyllia smithii* and frequent *Alcyonium glomeratum*. Under the silt, bryozoan crusts such as *Parasmittina trispinosa* may be found. There is a strong echinoderm component to the community, with the tentacles of *Aslia lefevrei* frequently seen protruding from crevices in the ridged bedrock. *Holothuria forskali* is often seen on the upper faces of boulders and bedrock. *Marthasterias glacialis*, *Asterias rubens*, *Echinus esculentus*, *Henricia oculata* and *Luidia ciliaris* may also be present. A sparse hydroid turf may also be present, with species such as *Polyplumaria frutescens*, *Halecium halecinum* and *Nemertesia antennina*. In addition, there may be anthozoans such as *Isozoanthus sulcatus* and *Corynactis viridis*. The sponge *Suberites carnosus* is typically associated with a heavily silted habitat. Other sponges present include *Cliona celata*, *Stelligera stuposa* and *Polymastia boletiformis*. The only records are from the west coast of Ireland.

Situation

Usually found on bedrock ridges and outcrops surrounded by sand and muddy gravel.

Temporal variation

Not known

Similar biotopes

CR.MCR.EcCr.CarSwi.LgAs	This biotope is found over a broad range of sites with different wave-exposures, subject to moderately strong to very weak tidal streams. Substratum is typically similar to CarSwi.Aglo. CarSwi.LgAs has a lower diversity of sponges and hydroids).
CR.HCR.XFa.SwiLgAs	This biotope occurs in slightly more wave-exposed and more tide-swept sites than CarSwi.Aglo. They both occur across similar depth bands. SwiLgAs appears a lot more biologically diverse, with a greater range of sponges, hydroids, bryozoans and ascidians.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Suberites carnosus	●●●●●	Occasional	8
Polymastia boletiformis	●●●	Occasional	2
Cliona celata	●●●●●	Occasional	6
Stelligera stuposa	●●●	Occasional	2
Halecium halecinum	●●●	Occasional	2

Nemertesia antennina	●●●	Occasional	1
Polyplumaria frutescens	●●●●	Frequent	4
Alcyonium glomeratum	●●●●●	Frequent	6
Swiftia pallida	●●●●●	Common	11
Isozoanthus sulcatus	●●●●	Occasional	4
Corynactis viridis	●●●	Occasional	1
Caryophyllia smithii	●●●●●	Common	12
Parasmittina trispinosa	●●●	Occasional	2
Luidia ciliaris	●●●●	Occasional	4
Henricia oculata	●●●●	Occasional	2
Asterias rubens	●●●●●	Occasional	5
Marthasterias glacialis	●●●●●	Occasional	5
Echinus esculentus	●●●●	Frequent	4
Holothuria forskali	●●●●●	Occasional	6
Aslia lefevrei	●●●●●	Frequent	8

CR.MCR.EcCr.CarSwi.LgAs *Caryophyllia smithii, Swiftia pallida* and large solitary ascidians on exposed or moderately exposed circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock; boulder
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m, 30-50 m

Previous code

CR.MCR.XFa.ErSSwi 97.06

Biotope description

This variant typically occurs on exposed to moderately wave-exposed, circalittoral bedrock and boulders rock subject to mainly weak tidal streams and has a thin layer of silt present. It is found predominantly from 10-30m water depth. From afar, this biotope is mostly distinguished by the frequently occurring seafan *Swiftia pallida*, encrusting red algae and the abundant cup coral *Caryophyllia smithii*. This biotope has quite an impoverished appearance, compared with SwiLgAs which has a strong sponge component. Other species present are typically in low abundance. Echinoderms such as *Echinus esculentus, Antedon bifida, Antedon petasus, Leptometra celtica, Marthasterias glacialis, Luidia ciliaris* and *Asterias rubens* may be recorded. Large hydroids such as *Nemertesia antennina* and *Nemertesia ramosa* may occasionally be seen in isolated clumps on the tops of boulders and rocky outcrops. The anthozoan *Parazoanthus anguicomus* may be recorded. Bryozoans such as *Parasmittina trispinosa* and *Porella compressa* are occasionally observed. The polychaete *Pomatoceros triqueter* may be observed encrusting the sides of rocks and boulders while occasional *Alcyonium digitatum* may also be seen. A small suite of large ascidians may be present, including *Ascidia mentula, Clavelina lepadiformis, Ciona intestinalis, Diazona violacea* and *Ascidia virginea*. Sponges are typically absent from this biotope, although *Cliona celata* may be recorded occasionally. The top shell *Gibbula cineraria* is usually present. Under boulders and overhangs, the squat lobster *Munida rugosa* can usually be seen hiding. All these records are from the west coast of Scotland (East coast of Lewis /Outer Hebrides).

Situation

Above this biotope in the infralittoral zone, you tend to find sheltered kelp forests, with species such as *Laminaria hyperborea*, *Laminaria saccharina* and *Sacchoriza polyschides*. This biotope is found on bedrock and boulder, which may either be protruding from the surrounding sediment, or the sediment may be in a separate 'zone' below the bedrock. These sediments may either be deep mud (with species such as *Pachycerianthus* and *Nephrops*) on the sheltered sites or slightly coarser sediments (with *Pennatula* and *Virgularia*) on slightly more exposed sites.

Temporal variation

Not known

Similar biotopes

CR.HCR.XFa.SwiLgAs	This biotope occurs in slightly more tide-swept sites than CarSwi.LgAs. They both occur across similar depth bands. SwiLgAs appears a lot more biologically diverse, with a greater range of sponges, hydroids, bryozoans and ascidians, although this difference may possibly be due to 'poor data'.
CR.MCR.EcCr.CarSwi.Aglo	This biotope predominantly occurs in the sheltered end of the wave-exposure spectrum, subject to only weak tidal streams. It is typically found across

similar depth bands as CarSwi.LgAs. This heavily silted biotope is characterised by *Swiftia pallilida*, *Alcyonium glomeratum*, *Isozoanthus sulcatus* and the prominent *Holothuria forskali*. This biotope is only present around the coast of Ireland.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Cliona celata	●●●	Occasional	1
Nemertesia antennina	●●●●	Occasional	4
Nemertesia ramosa	●●●	Occasional	2
Alcyonium digitatum	●●●	Occasional	1
Swiftia pallida	●●●●●	Frequent	12
Caryophyllia smithii	●●●●●	Abundant	22
Pomatoceros triqueter	●●●	Occasional	2
Munida rugosa	●●●●	Occasional	4
Gibbula cineraria	●●	Occasional	1
Parasmittina trispinosa	●●●●	Occasional	5
Porella compressa	●●●	Rare	1
Antedon bifida	●●●	Occasional	3
Antedon petasus	●●●	Frequent	3
Luidia ciliaris	●●●	Rare	1
Asterias rubens	●●●	Occasional	1
Marthasterias glacialis	●●●	Occasional	2
Echinus esculentus	●●●●	Frequent	6
Clavelina lepadiformis	●●●	Occasional	1
Ciona intestinalis	●●●	Occasional	1
Diazona violacea	●●●	Occasional	1
Ascidia mentula	●●●●	Occasional	4
Ascidia virginea	●●●	Occasional	1
Corallinaceae	●●●	Abundant	7

CR.MCR.EcCr.CarSp *Caryophyllia smithii*, sponges and crustose communities on wave-exposed circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock; boulder
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m, 30-50 m

Biotope description

This biotope typically occurs on the upper and vertical faces of wave-exposed, moderately strong to weakly tide-swept, circalittoral bedrock or boulders, with a water depth range of 20-30m. This often silty biotope has a typically sparse fauna, appearing grazed, and is characterised by common cup corals *Caryophyllia smithii*, frequent *Alcyonium digitatum* and occasional urchins *Echinus esculentus*. There may be occasional large growths of the sponge *Cliona celata*, *Haliclona viscosa*, *Pachymatisma johnstonia* and the axinellid sponge *Stelligera stuposa*. Echinoderms form a prominent feature of the fauna within this biotope, with species such as *Marthasterias glacialis*, *Asterias rubens*, *Luidia ciliaris*, *Henricia oculata*, *Holothuria forskali*, *Antedon bifida* and *Aslia lefevrei* present. Bryozoan crusts such as *Parasmittina trispinosa* and encrusting red algae cover the rock/boulder surface. The bryozoan *Porella compressa* may also be recorded occasionally. Isolated clumps of hydroids feature species such as *Nemertesia antennina*, *Nemertesia ramosa*, *Abietinaria abietina*, *Halecium halecinum* and *Sertularella gayi*. Other species observed include the anemone *Corynactis viridis*, *Urticina felina*, *Sagartia elegans*, *Calliostoma zizyphinum*, *Balanus crenatus* and *Pomatoceros triqueter*. Two variants within this biotope have been distinguished; CarSp.PenPcom and CarSp.Bri. CarSp.PenPcom tends to have the bryozoans *Pentapora foliacea* and *Porella compressa*, while CarSp.Bri features a dynamic community of brittlestars covering the seabed in a dense mat. *Ophiothrix fragilis* is usually the dominant species in shallow water but tends to be replaced by *Ophiocomina nigra* in deeper water.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pachymatisma johnstonia	●●●	Occasional	1
Cliona celata	●●●●●	Frequent	6
Stelligera stuposa	●●●	Occasional	1
Haliclona viscosa	●●●●	Occasional	3
Halecium halecinum	●●●	Occasional	1
Nemertesia antennina	●●●●	Occasional	3
Nemertesia ramosa	●●●	Occasional	2
Abietinaria abietina	●●●	Frequent	2
Sertularella gayi	●●●	Occasional	1
Alcyonium digitatum	●●●●●	Frequent	6
Urticina felina	●●●	Occasional	2
Sagartia elegans	●●●	Occasional	1
Corynactis viridis	●●●●	Frequent	4
Caryophyllia smithii	●●●●●	Frequent	9
Pomatoceros triqueter	●●●	Occasional	1
Balanus crenatus	●●●	Frequent	1
Calliostoma zizyphinum	●●●●	Occasional	3
Parasmittina trispinosa	●●●●	Frequent	4
Porella compressa	●●	Occasional	1

Antedon bifida	●●●	Frequent	2
Luidia ciliaris	●●●●	Occasional	3
Henricia oculata	●●●●	Occasional	3
Asterias rubens	●●●●	Occasional	4
Marthasterias glacialis	●●●●	Occasional	4
Echinus esculentus	●●●●●	Occasional	6
Holothuria forskali	●●●	Occasional	2
Aslia lefevrei	●●●	Occasional	2
Corallinaceae	●●●	Frequent	2

CR.MCR.EcCr.CarSp.Bri Brittlestar bed overlying coralline crusts, *Parasmittina trispinosa* and *Caryophyllia smithii* on wave-exposed circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Bedrock; boulder
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m, 30-50 m

Biotope description

This variant is typically found on the upper faces of wave-exposed circalittoral bedrock or boulders subject to moderately strong to weak tidal streams, on open coasts. However, the depth at which the variant occurs means that wave action is not so severe on the seabed as to displace the dense mat of brittlestars that covers the seabed. *Ophiothrix fragilis* is usually the most dominant species in shallow water, with *Ophiocomina nigra* usually found amongst them, but sometimes becoming the dominant species in deeper water. Although brittlestar biotopes are typically species-poor, the underlying fauna in this variant is relatively diverse and resembles that of CarSp.PenPcom. Species such as the anemone *Urticina felina*, the cup coral *Caryophyllia smithii*, and the anemone *Corynactis viridis* may occasionally be present. There may also be sparse clumps of various hydroids including *Halecium halecinum*, *Nemertesia antennina*, *Nemertesia ramosa*, *Sertularella gayi* and *Abietinaria abietina*. Soft coral *Alcyonium digitatum* is occasionally present and there may be sparse specimens of the sponges *Cliona celata* and *Polymastia boletiformis*. In addition, various echinoderms such as *Asterias rubens*, *Antedon bifida*, *Echinus esculentus*, *Henricia oculata*, *Marthasterias glacialis* and *Luidia ciliaris* may be observed. The barnacle *Balanus crenatus* and the polychaete *Pomatoceros triqueter* may be seen attached to any available space on the bedrock and boulders not smothered by brittlestars. Bryozoan crusts such as *Parasmittina trispinosa* may also be present.

Situation

Wave-exposed seabed composed of bedrock ridges and/or boulder, cobble slope. Shallower than this biotope, the lower infralittoral kelp park is dominated by *Laminaria hyperborea*. A dense understorey may be present, containing *Antedon* spp., *Phycodrys rubens* and *Plocamium cartilagineum*.

Temporal variation

Not known

Similar biotopes

CR.MCR.EcCr.FaAlCr.Bri	This biotope is found on slightly more wave-sheltered coasts, but subject to similar moderately strong to weak tidal streams. FaAlCr.Bri also tends to be fond on a more heterogeneous seabed, whereas CarSp.Bri is typically found on bedrock or boulders. Although they are both 'brittlestar' biotopes, unlike CarSp.Bri, FaAlCr.Bri is devoid of any sponges, and is characterised by graze-resistant hydroids.
CR.LCR.BrAs.AmenCio.Bri	This biotope is found on sites with greatly reduced wave-exposures and tidal streams , compared to CarSp.Bri. As AmenCio.Bri is found in 'low-energy' sites, it tends to be heavily silted compared to CarSp.Bri. Although both biotopes are dominated by 'brittlestars' AmenCio.Bri is more grazed and barren, and does not have such as diverse range of bryozoan crusts or

hydroids (it does have a diverse range of anemones).

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Polymastia boletiformis	●●●	Occasional	1
Cliona celata	●●●●	Occasional	2
Halecium halecinum	●●●●	Occasional	3
Nemertesia antennina	●●●	Occasional	2
Nemertesia ramosa	●●●	Occasional	1
Abietinaria abietina	●●●	Occasional	1
Sertularella gayi	●●●	Occasional	1
Alcyonium digitatum	●●●●●	Occasional	5
Urticina felina	●●●●●	Frequent	4
Corynactis viridis	●●●	Frequent	2
Caryophyllia smithii	●●●●	Occasional	3
Pomatoceros triqueter	●●●	Occasional	1
Balanus crenatus	●●	Frequent	1
Calliostoma zizyphinum	●●●●●	Occasional	4
Parasmittina trispinosa	●●●	Frequent	2
Antedon bifida	●●●●	Occasional	4
Luidia ciliaris	●●●	Occasional	1
Henricia oculata	●●●●●	Occasional	4
Asterias rubens	●●●●●	Occasional	7
Marthasterias glacialis	●●●●	Occasional	3
Ophiothrix fragilis	●●●●●	Abundant	14
Ophiocomina nigra	●●●●●	Common	12
Echinus esculentus	●●●●	Occasional	4
Corallinaceae	●●●	Frequent	2

CR.MCR.EcCr.CarSp.PenPcom *Caryophyllia smithii* and sponges with *Pentapora foliacea, Porella compressa* and crustose communities on wave-exposed circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock; boulder
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m, 30-50 m

Biotope description

This variant is typically found on the upper faces and vertical sides of wave-exposed bedrock or boulders subject to moderately strong to weak tidal streams. The fauna is often sparse with the frequently observed *Echinus esculentus* giving it a `grazed' appearance, but the community may also be affected by violent storm action working into deep water during winter storms. Despite this spartan appearance, the community is relatively diverse and contains a wide range of sponges, hydroids, bryozoans and echinoderms. This variant is found on open coasts or offshore, and is characterised by the cup-coral *Caryophyllia smithii*, *Alcyonium digitatum*, the sea urchin *Echinus esculentus*, large specimens of the sponge *Cliona celata*, encrusting bryozoans and encrusting red algae. Although this variant tends to occur in deep water (depth range of 20-30m), a high degree of water clarity allows some red algae to grow at these depths. Other species recorded include large specimens of *Haliclona viscosa*, the bryozoans *Parasmittina trispinosa*, *Porella compressa* and *Pentapora foliacea*, the sea cucumbers *Holothuria forskali* and *Aslia lefevrei* and sparse hydroids such as *Abietinaria abietina*, *Nemertesia antennina*, *Nemertesia ramosa* and *Halecium halecinum*. Anemones such as *Corynactis viridis*, *Sagartia elegans* and *Urticina felina* are also frequently seen. Various other species characteristic of wave-exposed rock include the sponges *Pachymatisma johnstonia*, *Stelligera stuposa*, the starfish *Luidia ciliaris*, *Marthasterias glacialis*, *Asterias rubens*, *Henricia oculata*, the crinoid *Antedon bifida*, the barnacle *Balanus crenatus*, the top shell *Calliostoma zizyphinum* and the polychaete *Pomatoceros triqueter*. The majority of the records within this variant originate from the west coast of Ireland.

Situation

Exposed kelp forest and park biotopes such as LhypR with species such as *Laminaria hyperborea* are typically found shallower than this biotope. Deeper, this biotope is believed to graduate into PhaAxi (deep erect sponges), as both these biotopes are common around the west coast of Ireland.

Temporal variation

Not known

Similar biotopes

CR.MCR.EcCr.FaAlCr	This biotope occurs in slightly more sheltered shallower sites with stronger tidal streams. However, they are both found on similar substratum. FaAlCr has a much less diverse, impoverished fauna than CarSp.PenPcom, possibly due to grazing pressure from *E. esculentus*. CarSp.PenPcom also has a more diverse range of sponges, hydroids and bryozoans.
CR.HCR.XFa.CvirCri	This biotope occurs on similar wave-exposed upward-facing bedrock subject to stronger tides than CarSp.PenPcom. The characterising feature of CvirCri are dense aggregations of jewel anemones *Corynactis viridis* and cup corals

	Caryophyllia smithii with an underlying crisiid turf. CarSp.PenPcom has larger amounts of brittle and encrusting bryozoans such as *Porella compressa*, *Pentapora foliacea* and *Parasmittina trispinosa*.
CR.MCR.EcCr.CarSp.Bri	This biotope occurs on similar substratum in similar exposed conditions as CarSp.PenPcom but subject to a stronger tidal stream and only on upper-facing substratum. This biotope is characterised by the abundant *Ophiothrix fragilis* and common *Ophiocomina nigra*. There is typically a reduction in the abundance of *Caryophyllia smithii*.
CR.HCR.DpSp.PhaAxi	This biotope occurs under similar conditions as CarSp.PenPcom, although it tends to be found at significantly deeper depths. Although high abundance's of *C. smithii* are recorded in this biotope, PhaAxi has a much more diverse sponge fauna, especially erect sponges.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pachymatisma johnstonia	●●●	Occasional	2
Cliona celata	●●●●●	Frequent	6
Stelligera stuposa	●●●	Occasional	1
Haliclona viscosa	●●●●	Occasional	3
Halecium halecinum	●●●	Occasional	1
Nemertesia antennina	●●●●	Occasional	3
Nemertesia ramosa	●●●	Occasional	1
Abietinaria abietina	●●●	Frequent	2
Alcyonium digitatum	●●●●●	Frequent	6
Urticina felina	●●●	Occasional	2
Sagartia elegans	●●●	Occasional	1
Corynactis viridis	●●●●	Frequent	5
Caryophyllia smithii	●●●●●	Common	10
Pomatoceros triqueter	●●●	Occasional	1
Balanus crenatus	●●●	Occasional	1
Calliostoma zizyphinum	●●●●	Occasional	3
Parasmittina trispinosa	●●●●	Frequent	4
Porella compressa	●●●	Occasional	1
Antedon bifida	●●●	Frequent	1
Luidia ciliaris	●●●●	Occasional	4
Henricia oculata	●●●●	Occasional	2
Asterias rubens	●●●●	Occasional	3
Marthasterias glacialis	●●●●●	Occasional	4
Echinus esculentus	●●●●●	Occasional	6
Holothuria forskali	●●●●	Frequent	3
Aslia lefevrei	●●●	Occasional	2
Corallinaceae	●●●	Frequent	2

CR.MCR.EcCr.UrtScr *Urticina felina* and sand-tolerant fauna on sand-scoured or covered circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt), Reduced (18-30ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed, Sheltered, Very sheltered, Extremely sheltered, Ultra sheltered
Tidal streams:	Strong, Moderately strong
Substratum:	Bedrock; cobble
Zone:	Circalittoral
Depth band:	0-5 m, 10-20 m, 20-30 m, 30-50 m

Biotope description

This biotope typically occurs on tide-swept circalittoral bedrock, rock adjacent to mobile sand/gravel in gullies, and cobbles on gravel and sand, characterised by scour-tolerant robust species. Although many of these species are found on subtidal rock, they tend to occur in larger numbers in these highly sand-influenced conditions. The dominant species by far is the anemone *Urticina felina* which commonly occurs on rocks at the sand-rock interface, where the scour levels are at a maximum and few species can tolerate this abrasion. The sponge *Ciocalypta penicillus* is also very characteristic of shifting sand-covered rock. This biotope is only occasionally recorded as a separate entity, because its extent is typically restricted to a very narrow band of rock at the sediment interface. Only occasionally does it cover a large extent of rock (e.g. where the wave action is strong enough to cause sand abrasion well up the rock face or where the rock is low-lying). More often, this scoured zone is recorded as part of whatever biotope occurs on the nearby hard substrata. Other species (which are able to survive, and benefit from the reduced competition) include *Balanus crenatus*, *Pomatoceros triqueter*, *Cellaria pumicosa*, *Alcyonidium diaphanum*, *Cliona celata*, encrusting red algae and *Asterias rubens*.

Situation

This biotope tends to be found in close proximity to mobile sand or gravel, producing scour that tends to limit the number of species found.

Temporal variation

Not known.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Cliona celata	••	Rare	1
Ciocalypta penicillus	•	Common	1
Urticina felina	•••••	Common	51
Pomatoceros triqueter	••	Common	4
Balanus crenatus	••••	Abundant	29
Alcyonidium diaphanum	••	Present	1
Cellepora pumicosa	•••	Present	4
Asterias rubens	•••	Rare	4
Corallinaceae	••	Frequent	1

CR.MCR.EcCr.FaAlCr Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	bedrock; boulder; cobble
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m, 30-50 m

Biotope description

This biotope typically occurs on the vertical and upper faces of wave-exposed and moderately wave-exposed circalittoral bedrock or boulders subject to mostly moderate to weak tidal streams (a variant of this biotope containing brittlestar is found on bedrock, boulders and cobbles). The biotope is dominated by faunal (e.g. *Parasmittina trispinosa*) and algal (Corallinaceae) crusts, and tends to have a `grazed' appearance; this may be partially attributable to the abundance of *Echinus esculentus* found in this biotope. Occasionally, the rock may appear pink from a distance, due to the expanses of encrusting red algae on the rock surface. *Alcyonium digitatum* is one of the few species to stand erect from the encrusted rock surface and are frequently encountered, on the tops of rocky outcrops and boulders. Hydroids do not form a prominent feature of this biotope, with only robust species such as *Abietinaria abietina* frequently recorded. Sponges and *Caryophyllia smithii* are rarely present while erect bryozoans and ascidians are scarce (although there are exceptions, see variants). The *Echinus* `grazed' substratum may be interspersed with other encrusting species such as the polychaete *Pomatoceros triqueter* and the saddle oyster *Pododesmus patelliformis*. Other species present include *Asterias rubens*, *Ophiothrix fragilis*, *Urticina felina*, *Ophiocomina nigra*, *Pagurus bernhardus*, *Flustra foliacea*, *Gibbula cineraria*, *Calliostoma zizyphinum*, *Ophiura albida*, *Ciona intestinalis* and *Antedon bifida*. Six variants of this biotope have been recorded. FaAlCr.Flu is dominated by the silt/scour tolerant bryozoan *Flustra foliacea*. FaAlCr.Adig is dominated by *Alcyonium digitatum*. FaAlCr.Sec is dominated by *Securiflustra securifrons*. FaAlCr.Pom looks extremely impoverished (even for a grazed community). FaAlCr.Bri has a dense covering of brittlestars while FaAlCr.Car is only found under weak/very weak tides and is dominated by *Caryophyllia smithii*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Abietinaria abietina	●●●	Occasional	3
Alcyonium digitatum	●●●●●	Frequent	12
Urticina felina	●●●	Occasional	3
Pomatoceros triqueter	●●●●	Common	2
Pagurus bernhardus	●●	Occasional	2
Gibbula cineraria	●●●	Occasional	2
Calliostoma zizyphinum	●●	Occasional	1
Pododesmus patelliformis	●●	Occasional	1
Parasmittina trispinosa	●●	Occasional	2
Flustra foliacea	●●	Frequent	2
Antedon bifida	●●	Occasional	1
Asterias rubens	●●●●●	Occasional	9
Ophiothrix fragilis	●●●●	Frequent	7
Ophiocomina nigra	●●	Frequent	2
Ophiura albida	●●	Frequent	1
Echinus esculentus	●●●●●	Frequent	13
Ciona intestinalis	●●	Occasional	1

Corallinaceae	●●●●	Common	10

CR.MCR.EcCr.FaAlCr.Flu *Flustra foliacea* on slightly scoured silty circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock; boulder; cobble
Zone:	Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m, 30-50 m

Previous code

CR.MCR.ByH.Flu.Flu 97.06

Biotope description

This variant is typically found on the upper faces of moderately wave-exposed circalittoral bedrock or boulders subjected to moderately strong tidal streams. These rocky patches may be interspersed with gravely sand patches, causing a scouring effect. From afar, the variant appears dominated by the bryozoan *Flustra foliacea*. *Alcyonium digitatum* may also be seen attached to the rocky substratum. Under closer inspection, the white tubes of the polychaete *Pomatoceros triqueter* may be observed on the rock and boulder, especially vertical faces. There may be sandy/gravely patches in between the boulders colonised by the anemone *Urticina felina*. The regular occurrence of large numbers of the sea urchin *Echinus esculentus* in this biotope may be responsible for `grazing' the faunal and algal turf, thus keeping species richness relatively low. Other echinoderms that may be seen include the ubiquitous starfish *Asterias rubens* and the common brittlestar *Ophiothrix fragilis*. Sparse clumps of the hydroids *Thuiaria thuja*, *Abietinaria abietina*, *Nemertesia antennina* and *Tubularia indivisa* are occasionally seen attached to the rocky substratum. The hermit crab *Pagurus bernhardus*, the polychaete *Sabella pavonina* and sparse bryozoan crusts may also be present. This biotope is characteristic of the bedrock terraces along the Northumberland coast that are generally species impoverished compared to similar *Flustra* biotopes on the west coasts of the UK, which have a more diverse range of sponges, hydroids and bryozoans. As the turbidity levels increase in this fairly silty biotope, so the species diversity is reduced.

Situation

This biotope typically occurs around coasts subject to sand scour and siltation. Associated biotopes common around the north-east coast of England include circalittoral gravel and coarse sands. Typical species present include *Echinocardium*, *Lanice conchilega*, *Ensis* spp., *Mya truncata* and *Myxicola*. Where suitable substratum is available, exposed kelp forests occur in the infralittoral (the latter normally occupies a narrow band due to the high silt loading in the water column). Where this biotope occurs along with chalk/limestone bedrock and boulder, piddock dominated biotopes (Pid) may also be found.

Temporal variation

Not known

Similar biotopes

CR.HCR.XFa.Mol	This biotope is found under similar exposure and tidal stream regimes as FaAlCr.Flu but occurs on a shallower, more sandy/cobbly substrata . *Flustra* is also prevalent in this community, but there is a more diverse hydroid, ascidian and bryozoan community, including *Molgula* and *Alcyonidium* respectively.
CR.HCR.XFa.FluCoAs.Paur	This biotope is found under similar exposure and tidal stream regimes as FaAlCr.Flu. While *F. foliacea* is the dominant bryozoan present in both, the whole character/species richness of these two biotopes is completely

	different. In addition, FluCoAs.Paur has dense aggregations of *Polyclinium aurantium* which distinguish this biotope from FaAlCr.Flu.
CR.HCR.XFa.FluHocu	The substratum consists predominantly of cobbles rather than bedrock and boulder. FluHocu contains *Flustra* but also has a more diverse faunal component, with *Haliclona oculata*, *Nemertesia antennina*, *Alcyonidium diaphanum* and the amphipod *Dyopedos porrectus*.
CR.HCR.XFa.FluCoAs.SmAs	This biotope occurs over a similar range of wave-exposures but tends to occur in sites subject to moderately strong to strong tidal streams. Both biotopes tend to occupy the same type of substrata (bedrock, boulder, cobble and sand influenced). This biotope has a very diverse sponge, hydroid and bryozoan community compared with FaAlCr.Flu. Characterising species that are absent in FaAlCr.Flu include *Sertularia argentea*, *Balanus crenatus*, *Bugula plumosa* and *Scypha ciliata*.
CR.HCR.XFa.FluCoAs.X	Unlike FaAlCr.Flu, the substratum is more mixed, consisting of boulders, cobbles and pebbles. This biotope also has a diverse sponge and bryozoan 'turf' community.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Tubularia indivisa	●●●	Occasional	3
Nemertesia antennina	●●●	Occasional	2
Abietinaria abietina	●●●	Occasional	3
Thuiaria thuja	●●	Occasional	2
Alcyonium digitatum	●●●●●	Frequent	14
Urticina felina	●●●●	Occasional	4
Sabella pavonina	●●	Occasional	1
Pomatoceros triqueter	●●●●●	Common	13
Pagurus bernhardus	●●●	Occasional	2
BRYOZOA	●●	Occasional	1
Flustra foliacea	●●●●●	Frequent	19
Asterias rubens	●●●●●	Occasional	10
Ophiothrix fragilis	●●●	Frequent	4
Echinus esculentus	●●●●	Occasional	5

CR.MCR.EcCr.FaAlCr.Adig *Alcyonium digitatum, Pomatoceros triqueter,* algal and bryozoan crusts on wave-exposed circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Bedrock; boulders
Zone:	Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m, 30-50 m

Previous code

CR.ECR.Alc.AlcC	97.06

Biotope description

This variant is typically found on the vertical, steep and upper faces of wave-exposed circalittoral bedrock or boulders subject to varying amounts of current. The variant has a very `grazed', sparse appearance, dominated only by the presence of *Alcyonium digitatum* and large expanses of encrusting red alage and bryozoan crusts particularly (*Parasmittina trispinosa*). The sparse appearance can be attributed to the frequently observed sea urchin *Echinus esculentus*. The polychaete *Pomatoceros triqueter* can be locally abundant, and may in some cases cover far more rock surface than *A. digitatum*, especially on vertical faces. Clumps of robust hydroids such as *Abietinaria abietina* occur occasionally. Other species present include the echinoderms *Asterias rubens, Henricia sanguinolenta, Ophiothrix fragilis,* the anemone *Urticina felina, Calliostoma zizyphinum* and *Cancer pagurus*.

Situation

Shallower than this biotope, dense kelp forest is typically found, containing species such as *Laminaria hyperborea* and *Alaria esculentus*. Occasionally, this biotope may be found on rocky outcrops surrounding by coarse sand. With this increased scour, UrtScr may develop at the rock/sand interface. Below this biotope, coarse sediments, muddy gravel and sand are typically recorded.

Temporal variation

Not known

Similar biotopes

CR.MCR.EcCr.CarSp.PenPcom	This biotope occurs at slightly more exposed, deeper sites with weaker tidal streams. However, they are both found on similar substratum. FaAlCr.Adig has a much less diverse, impoverished fauna than CarSp.PenPcom, possibly due to grazing pressure from *E. esculentus*. CarSp.PenPcom has a more diverse range of sponges, hydroids and bryozoans.
CR.MCR.EcCr.FaAlCr.Sec	This biotope is found under slightly less exposed conditions, subject to weaker tidal streams. FaAlCr.Sec is also found at slightly shallower water depths than FaAlCr.Adig. Although both biotopes are similarly quite 'clean' and grazed, FaAlCr.Sec has a more diverse hydroid and bryozoan turf, with *Securiflustra securifrons* dominating.
CR.HCR.XFa.CvirCri	This biotope is found under similar conditions as FaAlCr.Adig. Like FaAlCr.Adig, this biotope has dense *A. digitatum*. However, CvirCri has a diverse sponge community.
CR.HCR.FaT.CTub.Adig	This biotope is found on extremely wave-exposed, extremely tide-swept bedrock or boulders. This biotope is similarly species poor, but is characterised by *Tubularia indivisa*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Abietinaria abietina	●●●	Occasional	2
Alcyonium digitatum	●●●●●	Abundant	22
Urticina felina	●●●	Occasional	3
Pomatoceros triqueter	●●●●●	Common	17
Cancer pagurus	●●●	Rare	1
Calliostoma zizyphinum	●●●	Occasional	2
Parasmittina trispinosa	●●●	Occasional	2
Henricia	●●	Occasional	2
Asterias rubens	●●●●	Occasional	6
Ophiothrix fragilis	●●●	Occasional	2
Echinus esculentus	●●●●●	Frequent	13
RHODOPHYCOTA	●●	Frequent	1
Corallinaceae	●●●●	Common	12

CR.MCR.EcCr.FaAlCr.Sec *Alcyonium digitatum* with *Securiflustra securifrons* on tide-swept moderately wave-exposed circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m

Previous code

CR.ECR.Alc.AlcSec 97.06

Biotope description

This variant is typically found on the upper and vertical faces of moderately wave-exposed circalittoral bedrock subject to moderately strong to weak tidal streams. The rock surface is dominated by *Alcyonium digitatum* and the bryozoan *Securiflustra securifrons*. The rock between these species appears fairly sparse and `grazed', with expanses of encrusting red algae. The sea urchin *Echinus esculentus* is frequently seen, and in collaboration with the light attenuating effects of depth, is probably the principle reason for the lack of algal turf. Other species found include the hydroids *Abietinaria abietina*, *Nemertesia antennina*, *Thuiaria thuja*, the bryozoans *Cellapora pumicosa*, *Parasmittina trispinosa*, *Flustra foliacea*, *Alcyonidium diaphanum* and other bryozoan crusts. Encrusting species such as the polychaete *Pomatoceros triqueter* and the barnacle *Balanus balanus* are frequently observed. Other species present include *Asterias rubens*, *Antedon bifida*, *Ophiura albida*, *Ophiothrix fragilis*, *Caryophyllia smithii*, *Urticina felina*, *Clavelina lepadiformis*, *Calliostoma zizphinium* and *Pandalus montagui*.

Situation

Above this biotope, you tend to find exposed kelp forest and park (LhypR). There is a tendency for slight scouring to occur in this biotope. However, if this scour increases further, for example if water movement increases, mobilising more sand, this biotope may graduate into UrtScr. In more silty sites, there is a tendency for *Securiflustra securifrons* to be replaced by *Flustra foliacea* as the dominant bryozoan, turning the biotope into FaAlCr.Flu.

Temporal variation

Whilst the great majority of species in this variant are most likely present throughout the year, *Clavelina lepadiformis* grows in spring and may show great variation in abundance from year to year.

Similar biotopes

CR.MCR.EcCr.FaAlCr.Adig	This biotope occurs on slightly more exposed sites subject to slightly stronger tidal streams. Although both biotopes are similarly quite 'clean' and grazed, FaAlCr.Sec has a more diverse hydroid and bryozoan turf, with *Securiflustra securifrons* dominating.
CR.MCR.EcCr.FaAlCr.Flu	This biotope occurs under similar conditions as FaAlCr.Sec. FaAlCr.Flu is also found on a slightly more mixed substratum. *Flustra foliacea*, and to a lesser extent *Alcyonium digitatum* are the dominant species within this biotope whereas in FaAlCr.Sec, *Securiflustra securifrons* and *Alcyonium digitatum* dominate. FaAlCr.Flu also tends to have a more silty appearance whereas FaAlCr.Sec appears clean and grazed.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
PORIFERA	●●●	Frequent	1
Nemertesia antennina	●●●	Frequent	2
Abietinaria abietina	●●●●	Frequent	3
Thuiaria thuja	●●●	Occasional	2
Alcyonium digitatum	●●●●●	Common	14
Urticina felina	●●●●	Occasional	2
Caryophyllia smithii	●●●	Frequent	3
Pomatoceros triqueter	●●●●	Frequent	5
Balanus balanus	●●●	Occasional	1
Pandalus montagui	●●	Frequent	1
Calliostoma zizyphinum	●●●	Occasional	1
BRYOZOA	●●●	Frequent	1
Alcyonidium diaphanum	●●	Occasional	1
Parasmittina trispinosa	●●●	Occasional	2
Cellepora pumicosa	●●●	Occasional	2
Flustra foliacea	●●	Occasional	1
Securiflustra securifrons	●●●●●	Frequent	12
Antedon bifida	●●●	Common	3
Asterias rubens	●●●●●	Frequent	6
Ophiothrix fragilis	●●●	Common	2
Ophiura albida	●●●	Frequent	3
Echinus esculentus	●●●●	Frequent	4
Clavelina lepadiformis	●●●	Frequent	2
Corallinaceae	●●●●	Occasional	4

CR.MCR.EcCr.FaAlCr.Bri Brittlestar bed on faunal and algal encrusted, exposed to moderately wave-exposed circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Strong, Moderately strong, Weak, Very weak
Substratum:	Bedrock; boulders; cobbles; pebbles; gravel
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m, 30-50 m

Previous code

CR.MCR.Bri.Oph	97.06
CR.MCR.Bri.Oph.Oacu	97.06

Biotope description

This variant is typically found on the upper faces of exposed and moderately wave-exposed circalittoral bedrock, boulders and cobbles subject to moderately strong to weak tidal streams. It is characterised by high densities of brittlestars (predominantly *Ophiothrix fragilis*, *Ophiocomina nigra* and *Ophiura albida*). In fact, they may form such dense beds that the seabed underneath may not be visible. The rocky substratum is usually colonised by species such as encrusting red algae and the white, calcareous tubes of the polychaete *Pomatoceros triqueter*. Only robust hydroids such as *Abietinaria abietina*, *Alcyonium digitatum* and bryozoan crusts such as *Parasmittina trispinosa* are able to tolerate the significant 'smothering' effect from the dense `mat' of brittlestars. Other species typically seen include *Echinus esculentus*, *Asterias rubens*, *Pagurus bernhardus*, *Anapagurus hyndmanni*, *Gibbula cineraria*, *Urticina felina*, *Pododesmus patelliformis* and *Ciona intestinalis*.

Situation

Shallower than the FaAlCr.Bri variant, kelp park and forest may be found with species such as *Laminaria saccharina* and *Laminaria hyperborea*.

Temporal variation

Not known

Similar biotopes

CR.LCR.BrAs.AmenCio.Bri	This biotope occurs on more wave-sheltered mixed substratum, subject to moderately strong to very weak tidal streams. It tends to have similar species diversity to FaAlCr.Bri, but robust hydroids such as *Abietinaria abietina* have been replaced by more delicate species such as *Kirchenpaueria pinnata*. Occasionally, bryozoan crusts may be present in FaAlCr.Bri as well.
CR.MCR.EcCr.CarSp.Bri	This biotope is found on much more exposed bedrock or boulders. A diverse range of species is associated with this biotope including numerous hydroids, bryozoans and echinoderms.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Abietinaria abietina	●●●	Occasional	2
Alcyonium digitatum	●●●●●	Occasional	6
Urticina felina	●●●	Occasional	3
Pomatoceros triqueter	●●●●	Frequent	12
Anapagurus hyndmanni	●●	Frequent	1
Pagurus bernhardus	●●●●	Occasional	3
Gibbula cineraria	●●●	Occasional	3

Pododesmus patelliformis	●●	Occasional	1
Parasmittina trispinosa	●●	Occasional	1
Asterias rubens	●●●●●	Occasional	7
Ophiothrix fragilis	●●●●●	Abundant	16
Ophiocomina nigra	●●●●	Common	7
Ophiura albida	●●●	Frequent	2
Echinus esculentus	●●●●●	Frequent	10
Ciona intestinalis	●●●	Occasional	2
Corallinaceae	●●●●	Common	8

CR.MCR.EcCr.FaAlCr.Pom Faunal and algal crusts with *Pomatoceros triqueter* and sparse *Alcyonium digitatum* on exposed to moderately wave-exposed circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock; boulders; cobbles
Zone:	Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m, 30-50 m

Previous code

CR.MCR.GzFa.FaAlC	97.06

Biotope description

This variant is typically found on the upper faces of exposed and moderately exposed circalittoral bedrock or boulders subjected to moderately strong to weak tidal streams. From afar, the seabed has a rather sparse, `grazed' appearance, reminiscent of a brittlestar bed after the brittlestars have moved elsewhere. The rocky substratum is generally covered with encrusting red algae and the white, calcareous tubes of the polychaete *Pomatoceros triqueter*, dotted with the abundant urchin *Echinus esculentus*. Under closer inspection, *Alcyonium digitatum* are usually seen attached to the rocky surface underneath rock overhangs and large boulders. Although they may be recorded as abundant or common in some areas, their relatively small size means that their biomass is generally lower than in other biotopes. Sparse clumps of robust hydroids such as *Abietinaria abietina* are frequently observed, and bryozoan crusts such as *Parasmittina trispinosa* are occasionally seen. Echinoderms such as the brittlestars *Ophiothrix fragilis* and *Ophiocomina nigra*, and the crab *Cancer pagurus* may be seen within crevices in the boulders/rock whilst the starfish *Asterias rubens* may be seen on the rock surface. Muddy-gravel patches between boulders (especially within Scottish sealochs) provide a suitable habitat for the anemone *Urticina felina*. The top shell *Gibbula cineraria* is occasionally seen grazing on the rock surface. Within this biotope, there is some regional variation. The robust hydroid *A. abietina* is typically found in higher abundances in northern (Scottish) regions, especially around the Isle of May.

Situation

Above the FaAlCr.Pom variant in the infralittoral zone, species such as *Alaria esculenta* and *Laminaria hyperborea* are found in more wave exposed sites (KFaR.Ala/KFaR.Lhyp) while species such as *Laminaria saccharina* may be found above FaAlCr.Pom in the more sheltered examples. Due to moderately tide-swept conditions this variant is found in, clean, coarse sediment biotopes are generally found below FaAlCr.Pom. Typical species found in these coarse sand/gravely biotopes include *Neopentadactyla mixta* and *Lanice conchilega* (SS.SMx.CMx). Where wave exposure increases, this variant tends to change to CarSp.PenPcom, dominated by *Caryophyllia smithii*, *Corynactis viridis*, encrusting red algae and bryozoan crusts. Where tidal stream and wave-exposure decreases, this variant develops into a similar biotope dominated by encrusting red algae, *Echinus esculentus* and *C.smithii* (FaAlCr.Car).

Temporal variation

Not known

Similar biotopes

CR.MCR.EcCr.FaAlCr.Car	This sub-biotope occurs on wave-exposed to wave-sheltered sites subject to only weak tidal streams. It is similar to FaAlCr.Pom in that it is relatively barren, but has a higher diversity of species, and has frequently occurring

	Caryophyllia smithii and bryozoan crusts.
CR.MCR.EcCr.FaAlCr.Adig	This sub-biotope occurs on more wave-exposed sites, but is subject to similar tidal streams as FaAlCr.Pom. Both these sub-biotopes are very impoverished with a similar range of species, although FaAlCr.Adig tends to have much higher densities of *Alcyonium digitatum* than FaAlCr.
CR.LCR.BrAs.AmenCio.Ant	This biotope occurs in sheltered sea lochs, subject to weak/very weak tidal streams. This biotope is similar to FaAlCr.Pom in that it is relatively barren; heavily grazed by *E. esculentus*. Pink coralline crusts and large solitary ascidians are the prevalent species found.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Abietinaria abietina	●●●	Frequent	4
Alcyonium digitatum	●●●●	Frequent	8
Urticina felina	●●●	Occasional	2
Pomatoceros triqueter	●●●●●	Common	9
Pandalus montagui	●●	Occasional	1
Cancer pagurus	●●	Rare	1
Gibbula cineraria	●●●	Occasional	2
Parasmittina trispinosa	●●●	Occasional	3
Asterias rubens	●●●●●	Occasional	10
Ophiothrix fragilis	●●●●●	Occasional	11
Ophiocomina nigra	●●	Occasional	1
Echinus esculentus	●●●●●	Frequent	18
RHODOPHYCOTA	●●	Common	1
Corallinaceae	●●●●	Common	13

CR.MCR.EcCr.FaAlCr.Car *Caryophyllia smithii* with faunal and algal crusts on moderately wave-exposed circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m

Biotope description

This variant is typically found on the upper and vertical faces of exposed and moderately wave-exposed circalittoral rock, subject to very little water movement. Where this variant is found on slightly more wave-exposed sites, it tends to be found towards the bottom of its depth range. The rocky substratum has a `grazed' appearance, with encrusting red algae. Diversity of species is very low, possibly due to `grazing' pressure from the sea urchin *Echinus esculentus*. From afar, there is little evident epifauna attached to the rocks apart from the white, calcareous tubes of the polychaete *Pomatoceros triqueter* and the cup-coral *Caryophyllia smithii*. In addition, bryozoan crusts such as *Parasmittina trispinosa* are frequently seen. Under closer inspection, a few more species become apparent but few are typically characterising of this particular variant. The echinoderms *Antedon bifida*, *Asterias rubens*, *Ophiothrix fragilis*, *Marthasterias glacialis*, *Ophiocomina nigra* and *Crossaster papposus* are occasionally present. Sparse clumps of hydroids such as *Halecium halecinum*, *Kirchenpaueria pinnata* and *Nemertesia attennina* may be found attached to rocky outcrops or boulders. Small specimens of *Alcyonium digitatum* may be present. The ascidians *Ciona intestinalis*, *Clavelina lepadiformis* and *Ascidia mentula* also occur in this variant but are found in greater numbers in other biotopes. The top shells *Calliostoma zizyphinum*, *Gibbula cineraria*, and the saddle oyster *Pododesmus patelliformis* may be seen on the rock surface whilst the crab *Cancer pagurus* may be seen under boulders and in crevices. The anemone *Metridium senile* may be found under rocky overhangs and on the sides of boulders.

Situation

As FaAlCr.Car occurs on moderately wave-exposed coasts, kelp forests in the infralittoral zone shallower than this variant tend to be dominated by robust kelp species such as *Laminaria hyperborea* (Lhyp) and *Saccorhiza polyschides*. Immediately below FaAlCr.Car (typically bedrock/boulder substratum), sublittoral sediment biotopes such as muddy sands, containing *Nephrops norvegicus*, *Virgularia mirabilis* and *Funiculina quadrangularis* are found. Occasionally, biotopes composed of coarser sand/gravely material may be present, with species such as *Peachea cylindrica* and *Neopentadactyla mixta*. When wave exposure and tidal stream increase, FaAlCr.Car tends to grade into FaAlCr.Pom.

Temporal variation

Not known

Similar biotopes

CR.MCR.EcCr.FaAlCr.Pom	This variant tends to be found in slightly more wave-exposed areas subject to slightly stronger tides and is distinguished from FaAlCr.Car by its lack of *Caryophyllia smithii*.
CR.LCR.BrAs.AmenCio.Ant	This variant is found in wave-sheltered sea lochs subject to only weak (if any) tidal streams. It has a barren appearance apart from frequent large solitary ascidians and a pink appearance due to encrusting corallines.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halecium halecinum	●●●	Occasional	2
Kirchenpaueria pinnata	●●●	Occasional	1
Nemertesia antennina	●●●	Occasional	2
Alcyonium digitatum	●●●●	Occasional	2
Metridium senile	●●●	Occasional	1
Caryophyllia smithii	●●●●●	Frequent	9
Pomatoceros triqueter	●●●●●	Frequent	8
Cancer pagurus	●●●	Occasional	1
Gibbula cineraria	●●●	Occasional	1
Calliostoma zizyphinum	●●●	Occasional	1
Pododesmus patelliformis	●●●	Occasional	2
Parasmittina trispinosa	●●●●	Frequent	4
Antedon bifida	●●●●	Frequent	4
Crossaster papposus	●●●	Occasional	1
Asterias rubens	●●●●	Occasional	4
Marthasterias glacialis	●●●	Occasional	1
Ophiothrix fragilis	●●●	Occasional	2
Ophiocomina nigra	●●	Frequent	1
Echinus esculentus	●●●●●	Frequent	9
Clavelina lepadiformis	●●●	Occasional	2
Ciona intestinalis	●●●	Occasional	2
Ascidia mentula	●●●	Occasional	2
Corallinaceae	●●●●●	Abundant	16

CR.MCR.EcCr.AdigVt *Alcyonium digitatum* and faunal crust communities on vertical circalittoral bedrock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock
Zone:	Infralittoral - lower, Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m, 30-50 m
Other features:	Vertical rock

Previous code

CorMetAlc in part	97.06
AlcByH in part	97.06
Ant in part	97.06

Biotope description

This biotope typically occurs on the vertical faces and overhangs of exposed to moderately exposed lower infralittoral and upper circalittoral bedrock subject to moderately strong to weak tidal streams. Due to the large numbers of the urchin *Echinus esculentus* often recorded, this biotope tends to have a grazed appearance, and the bedrock is often encrusted with pink coralline algae, encrusting bryozoans such as *Parasmittina trispinosa* and the calcareous tubeworm *Pomatoceros triqueter*. Dense aggregations of dead mans fingers *Alcyonium digitatum* may be present along with the cup coral *Caryophyllia smithii*. Other species present include the echinoderms *Asterias rubens*, *Ophiothrix fragilis* and *Antedon bifida*, the ascidians *Clavelina lepadiformis*, *Ciona intestinalis* and *Ascidia mentula*, the anthozoans *Urticina feline*, *Cortynactis viridis*, *Metridium senile* and *Sagartia elegans*, the gastropod *Calliostoma zizyphinum* and the crustacean *Cancer pagurus*. Three regional variations of this biotope have been recorded. One variant found typically off the north-east coast of Scotland and around the Northern Isles, has a very impoverished appearance dominated by anthozoans. A second variant occurs along the west coast of Scotland, extending to Rockall in the west, and the Northern Isles in the north-east, and has a more fauna, characterised by hydroids, sponges, anthozoans and echinoderms. A third variant occurs along the north-east coast of England (Northumberland) up to the Northern Isles and is dominated by *Alcyonium digitatum*, brittlestars and *Echinus esculentus*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Alcyonium digitatum	••••	Common	13
Urticina felina	•••	Occasional	2
Metridium senile	••	Occasional	2
Sagartia elegans	••	Occasional	1
Corynactis viridis	••	Common	2
Caryophyllia smithii	•••	Frequent	4
Pomatoceros triqueter	••••	Common	8
Cancer pagurus	•••	Occasional	2
Calliostoma zizyphinum	•••	Occasional	3
Parasmittina trispinosa	••	Occasional	2
Antedon bifida	•••	Frequent	6
Asterias rubens	••••	Occasional	8
Ophiothrix fragilis	••	Occasional	2
Echinus esculentus	••••	Frequent	9
Clavelina lepadiformis	•••	Occasional	4
Ciona intestinalis	••	Occasional	2
Ascidia mentula	••	Occasional	2
Corallinaceae	••••	Common	10

CR.MCR.CSab Circalittoral *Sabellaria* reefs

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Moderately strong
Substratum:	Bedrock, boulders, cobbles, pebbles
Zone:	Circalittoral - lower
Depth band:	10-20 m, 20-30 m

Previous code

CR.MCR.CSab	97.06

Biotope description

This biotope complex occurs on moderately wave-exposed, circalittoral bedrock, boulders, and cobbles subject to moderately strong tidal streams. This complex is characterised by dense crusts of the polychaete *Sabellaria spinulosa* covering the substratum. Other fauna present in many cases reflects the biotopes found on nearby rock, so to a certain extent, is quite variable. Species typically present include the bryozoans *Flustra foliacea*, *Alcyonidium diaphanum* and *Pentapora foliacea*, the hydroid *Nemertesia antennina*, the sponges *Tethya aurantium* and *Phorbas fictitius*, the anemones *Urticina felina* and *Sagartia elegans*, and the ascidians *Distomus variolosus*, *Polycarpa pomaria* and *Polycarpa scuba*. The barnacle *Balanus crenatus*, the polychete *Pomatoceros triqueter* and *Salmacina dysteri*, the starfish *Crossaster papposus* and *Alcyonium digitatum* may also be recorded. Two variants of the Sspi biotope have been identified: Sspi.ByB and Sspi.As (characterised by didemnid ascidians).

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Tethya aurantium	••	Occasional	1
Phorbas fictitius	••	Occasional	1
Nemertesia antennina	••	Occasional	1
Alcyonium digitatum	••	Frequent	3
Urticina felina	•••	Occasional	5
Sagartia elegans	••	Occasional	1
Sabellaria spinulosa	•••••	Common	32
Pomatoceros triqueter	••	Frequent	3
Salmacina dysteri	••	Occasional	1
Balanus crenatus	••	Frequent	1
Alcyonidium diaphanum	••	Occasional	1
Pentapora foliacea	••	Occasional	2
Flustra foliacea	••••	Occasional	8
Crossaster papposus	••	Occasional	2
Asterias rubens	••••	Occasional	7
Didemnidae	•••	Frequent	10
Polycarpa pomaria	••	Common	2
Polycarpa scuba	••	Common	1
Distomus variolosus	••	Common	3

CR.MCR.CSab.Sspi *Sabellaria spinulosa* encrusted circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock; boulders; cobbles
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m, 30-50 m

Previous code

CR.MCR.CSab.Sspi 97.06

Biotope description

This biotope is typically found encrusting the upper faces of wave-exposed and moderately wave-exposed circalittoral bedrock, boulders and cobbles subject to strong/moderately strong tidal streams in areas with high turbidity. The crusts formed by the sandy tubes of the polychaete worm *Sabellaria spinulosa* may even completely cover the rock, binding the substratum together to form a crust. A diverse fauna may be found attached to, and sometimes obscuring the crust, often reflecting the character of surrounding biotopes. Bryozoans such as *Flustra foliacea*, *Pentapora foliacea* and *Alcyonidium diaphanum*, anemones such as *Urticina felina* and *Sagartia elegans*, the polychaete *Pomatoceros triqueter*, *Alcyonium digitatum*, the hydroid *Nemertesia antennina* and echinoderms such as *Asterias rubens* and *Crossaster papposus* may all be recorded within this biotope. There are two variants; the first (Sspi.ByB) contains significant cover of barnacles (*Balanus crenatus*) and bryozoans. The second (Sspi.As) has a dense turf of didemnid ascidians as well as scour-tolerant bryozoans such as *F. foliacea*, sponges such as *Tethya aurantium* and *Phorbas fictitius*, colonies of the serpulid worm *Salmacina dysteri* and patchy occurrences of the ascidians *Distomus variolosus*, *Polycarpa pomaria* and *Polycarpa scuba*. This biotope has been recorded from the Lleyn Peninsula, Lundy Island (including the wreck of the MV Robert) and the north-east and south coast of England.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Tethya aurantium	••	Occasional	1
Phorbas fictitius	••	Occasional	1
Nemertesia antennina	••	Occasional	1
Alcyonium digitatum	••	Frequent	3
Urticina felina	•••	Occasional	5
Sagartia elegans	••	Occasional	1
Sabellaria spinulosa	•••••	Common	30
Pomatoceros triqueter	••	Frequent	3
Salmacina dysteri	••	Occasional	1
Balanus crenatus	••	Frequent	1
Alcyonidium diaphanum	••	Occasional	1
Pentapora foliacea	••	Occasional	2
Flustra foliacea	••••	Occasional	8
Crossaster papposus	••	Occasional	2
Asterias rubens	••••	Occasional	7
Didemnidae	•••	Frequent	12
Polycarpa pomaria	••	Common	2
Polycarpa scuba	••	Common	1
Distomus variolosus	••	Common	3

CR.MCR.CSab.Sspi.ByB *Sabellaria spinulosa* with a bryozoan turf and barnacles on silty turbid circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Strong, Moderately strong
Substratum:	Bedrock; boulders; cobbles; pebbles; gravel; sand
Zone:	Circalittoral
Depth band:	0-5 m, 5-10 m, 10-20 m, 30-50 m

Biotope description

This variant is typically found encrusting the upper faces of exposed and moderately exposed circalittoral rock and mixed substrata, subject to strong and moderately strong currents and high turbidity levels. The crusts formed by the sandy tubes of the polychaete worm *Sabellaria spinulosa* may completely cover the rock, binding gravel and pebbles together. A diverse fauna may be found attached to this crust, and in many cases reflects the character of nearby biotopes. There is normally considerable variation in the associated fauna encountered. There may be a sparse bryozoan turf (*Flustra foliacea*, *Alcyonium diaphanum*, *Bicellariella ciliata*, *Bugula plumosa* and *Vesicularia spinosa*) attached to the *Sabellaria* crust and available rocky substrata. Other scour-tolerant species such as *Urticina felina* are occasionally observed. Clumps of robust hydroids such as *Tubularia indivisa*, *Nemertesia antennina*, *Hydrallmania falcata* and *Halecium halecinum* may also be observed. Other species which may be present include the polychaete *Pomatoceros triqueter*, *Balanus crenatus*, *Asterias rubens*, *Pagurus bernhardus* and *Gibbula cineraria*. Occasionally, sponges such as *Haliclona oculata* and *Halichondria panicea*, and ascidians such as *Dendrodoa grossularia* may also be observed.

Temporal variation

Not known

Similar biotopes

CR.MCR.CSab.Sspi.As	This biotope is found on the upper faces of moderately exposed, moderately tide-swept circalittoral bedrock, boulders and cobbles. This biotope is similar in that the polychaete *Sabellaria spinulosa* is the prevalent species. However, it is distinguished from Sspi.ByB by a dense turf of didemnid, and other colonial ascidians such as *Polycarpa* sp.
SS.SBR.SspiMx	This biotope is found on circalittoral mixed sediment, not rock or mixed substrata in the case of Sspi.ByB.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	●●●	Frequent	3
Haliclona oculata	●●●	Occasional	2
Tubularia indivisa	●●●●	Occasional	4
Halecium halecinum	●●	Frequent	1
Nemertesia antennina	●●●	Occasional	2
Hydrallmania falcata	●●●	Occasional	2
Urticina felina	●●●●●	Occasional	9
Sabellaria spinulosa	●●●●●	Abundant	22
Pomatoceros triqueter	●●●	Frequent	6
Balanus crenatus	●●●●	Frequent	6

Pagurus	●●●●●	Occasional	3
Gibbula cineraria	●●	Occasional	1
Buccinum undatum	●●●●	Rare	2
Alcyonidium diaphanum	●●●●	Occasional	3
Vesicularia spinosa	●●	Occasional	2
Flustra foliacea	●●●●	Occasional	5
Bicellariella ciliata	●●●	Frequent	3
Bugula plumosa	●●	Frequent	2
Asterias rubens	●●●●	Occasional	4
Dendrodoa grossularia	●●●●	Frequent	4

CR.MCR.CSab.Sspi.As *Sabellaria spinulosa*, didemnid and small ascidians on tide-swept moderately wave-exposed circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Moderately strong
Substratum:	bedrock; boulders; cobbles
Zone:	Circalittoral - lower
Depth band:	10-20 m, 20-30 m

Previous code

CR.MCR.CSab.Sspi 97.06

Biotope description

This variant is typically found on tide-swept, moderately wave-exposed circalittoral bedrock, boulder and cobble subject to slight sand-scour. It occurs predominantly in the lower circalittoral. This variant normally appears as a bedrock/boulder outcrop or reef with a dense crust of the polychaete *Sabellaria spinulosa* and a dense turf of didemnid ascidians and scour-tolerant bryozoans such as *Flustra foliacea*, *Pentapora foliacea* and *Cellaria* species. There may be discreet clumps of *Alcyonium digitatum* and sparse sponges such as *Tethya aurantium* and *Phorbas fictitius*. Patchy occurrences of the small ascidians *Polycarpa scuba*, *Polycarpa pomaria* and *Distomus variolosus* may be present on the tops of rocks and boulders whilst in crevices between, the anemone *Urticina felina* may be found. Species such as *Asterias rubens*, *Crossaster papposus*, the serpulid worm *Salmacina dysteri* and the anemone *Sagartia elegans* are occasionally seen on the rock surface. This variant has been recorded from the Lleyn Peninsula, the Skerries and around Pembrokeshire in Wales.

Temporal variation

Not known

Similar biotopes

CR.MCR.CSab.Sspi.ByB	This biotope is similar in that the polychaete tubeworm *S. spinulosa* is the prevalent species; however, it lacks the dense turf of colonial ascidians such as didemids and *Polycarpa* sp., and instead has more barnacles and a bryozoan turf.
SS.SBR.SspiMx	This biotope is found on circalittoral mixed sediment, not rock or mixed substrata in the case of Sspi.As.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Tethya aurantium	••	Occasional	2
Phorbas fictitius	••	Occasional	2
Alcyonium digitatum	•••	Frequent	6
Urticina felina	••	Occasional	2
Sagartia elegans	••	Occasional	1
Sabellaria spinulosa	•••••	Common	26
Salmacina dysteri	••	Occasional	2
Pentapora foliacea	•••	Occasional	4
Flustra foliacea	••••	Occasional	7
Cellaria	••	Frequent	2
Crossaster papposus	••	Occasional	2
Asterias rubens	••••	Occasional	6
Didemnidae	•••••	Frequent	21
Polycarpa pomaria	•••	Common	4
Polycarpa scuba	••	Common	2
Distomus variolosus	•••	Frequent	4

CR.MCR.SfR Soft rock communities

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Moderately strong
Substratum:	Bedrock
Zone:	Circalittoral - upper
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Soft rock

Previous code

CR.MCR.SfR	97.06

Biotope description

This biotope complex occurs on moderately wave-exposed, circalittoral 'soft' bedrock subject to moderately strong tidal streams. As this complex is found in highly turbid water conditions, the circalittoral zone may begin at the low water mark, due to poor light penetration. This complex is dominated by the piddock *Pholas dactylus*. Other species typical of this complex include the polychaete *Polydora* and *Bispira volutacornis*, the sponges *Cliona celata* and *Suberites ficus*, the bryozoan *Flustra foliacea*, *Alcyonium digitatum*, the starfish *Asterias rubens*, the mussel *Mytilus edulis* and the crab *Necora puber* and *Cancer pagurus*. Foliose red algae may also be present. Three biotopes have been identified within this complex: Pid, Pol and Hia. Please note: in areas subject to very high turbidity, biotopes within this biotope complex may occur in the infralittoral and even the littoral zone.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Suberites ficus	•	Frequent	2
Cliona celata	••	Occasional	3
Alcyonium digitatum	••	Occasional	2
Polydora	••	Abundant	4
Bispira volutacornis	•	Occasional	1
Cancer pagurus	••	Occasional	1
Necora puber	••	Occasional	1
Mytilus edulis	•	Common	2
Pholas dactylus	••••	Common	68
Flustra foliacea	••	Occasional	2
Asterias rubens	••	Occasional	2
Foliose red algae	••	Occasional	3

CR.MCR.SfR. Pid Piddocks with a sparse associated fauna in circalittoral very soft chalk or clay

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Moderately strong
Substratum:	Bedrock
Zone:	Circalittoral - upper
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

CR.MCR.SfR.Pid	97.06

Biotope description

This biotope typically occurs on the upper faces of moderately wave-exposed, tide-swept, upper circalittoral soft rock such as soft chalk or clay. As soft chalk and firm clay is often too soft for sessile filter-feeding animals to attach and thrive in large numbers, an extremely impoverished epifauna results. However, the substratum is sufficiently soft to be bored by bivalves. Species vary with location, but the bivalve borer *Pholas dactylus* is typically predominant. Other species present include the sponge *Suberites carnosus* and the polychaete *Bispira volutacornis*. Foliose red algae may be present on the 'harder', more stable areas of soft rock. Mobile fauna typically consists of the crab *Necora puber*.

Temporal variation

Not known

Similar biotopes

IR.MIR.Ldig.Pid	This biotope is found on sublittoral fringe soft rock on moderately exposed coasts. It is characterised by boring bivalves and the kelp *Laminaria digitata*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Suberites carnosus	••	Frequent	2
Bispira volutacornis	••	Occasional	2
Necora puber	••	Rare	1
Pholas dactylus	•••••	Common	83
RHODOPHYCOTA	••	Occasional	4

CR.MCR.SfR.Pol *Polydora* sp. tubes on moderately exposed circalittoral soft rock

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Bedrock
Zone:	Circalittoral
Depth band:	0-5 m, 10-20 m

Previous code

CR.MCR.SfR.Pol	97.06

Biotope description

Large patches of chalk and soft limestone are occasionally covered entirely by *Polydora* sp. tubes to the exclusion of almost all other species. This tends to occur in highly turbid conditions and spans the infralittoral and circalittoral in limestone areas such as the Great and Little Ormes (North Wales) and Gower (South Wales). It is even present on the lower shore in the Severn estuary. The boring form of the sponge *Cliona celata* often riddles the surface layer of the stone. Other sponges present include *Halichondria panicea*, *Haliclona oculata* and *Hymeniacidon perleve*. *Polydora* sp. also frequently occurs in small patches as part of other biotopes (e.g. FluCoAs). Other species present include *Alcyonium digitatum*, the hydroids *Sarcodictyon roseum*, *Halecium halecinum*, *Abietinaria abietina* and *Tubularia indivisa*, the ascidians *Clavelina lepadiformis*, *Botryllus schlosseri* and *Morchellium argus*, the anemones *Urticina felina*, *Metridium senile* and *Sagartia elegans* and the bryozoans *Flustra foliacea* and a crisiid turf. The starfish *Asterias rubens*, the crabs *Inachus phalangium* and *Carcinus maenas*, the polychaete *Pomatoceros triqueter*, the barnacle *Balanus crenatus* and the brittlestar *Ophiothrix fragilis* may also be seen. Please note: in areas subject to very high turbidity,this biotope may occur in the infralittoral and even the littoral zone.

Temporal variation

Not known

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Cliona celata	••••	Occasional	1
Halichondria panicea	•••	Frequent	3
Hymeniacidon perleve	•••	Occasional	1
Haliclona oculata	••••	Occasional	2
Tubularia indivisa	••	Frequent	1
Halecium halecinum	•••	Frequent	5
Abietinaria abietina	••	Frequent	1
Sarcodictyon roseum	•••	Common	2
Alcyonium digitatum	••••	Common	8
Urticina felina	••••	Occasional	6
Metridium senile	•••	Frequent	2
Sagartia elegans	•••	Frequent	1
Polydora	•••••	Abundant	25
Pomatoceros triqueter	•••	Occasional	1
Balanus crenatus	••	Frequent	1
Inachus phalangium	•••	Occasional	2
Carcinus maenas	••	Frequent	1
Crisiidae	••	Common	1
Flustra foliacea	•••	Frequent	4
Asterias rubens	•••	Frequent	4

Ophiothrix fragilis	●●●	Occasional	2
Clavelina lepadiformis	●●●●	Occasional	3
Morchellium argus	●●●	Frequent	2
Botryllus schlosseri	●●●	Occasional	2

CR.MCR.SfR.Hia *Hiatella*-bored vertical sublittoral limestone rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock
Zone:	Circalittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Vertical limestone or chalk.

Previous code

AlcByH.Hia in part	97.06

Biotope description

Moderately exposed vertical and overhanging soft rock (typically chalk), subject to moderately strong to weak tidal streams, bored by the rock-boring mollusc *Hiatella arctica*. As with other biotopes in the soft rock complex, it is found in areas of high turbidity, where there is poor light penetration. There may be isolated clumps of the hydroid *Nemertesia antennina* and a sparse bryozoan turf formed by various crisiids, *Bugula plumosa* and *Bugula flabellate* (often being grazed on by the nudibranch *Janolus cristatus*), *Alcyonidium diaphanum*, *Flustra foliacea* and *Cellapora pumicosa*. A patchy 'carpet' of the brittlestar *Ophiothrix fragilis* is often recorded along with other echinoderms such as *Asterias rubens* and *Henricia sanguinolenta*. Other species present include the colonial ascidians *Polyclinum aurantium*, *Botrylloides leachi*, *Clavelina lepadiformis*, *Aplidium punctatum* and *Botryllus schlosseri*, dead mans fingers *Alcyonium digitatum* and the crab *Cancer pagurus*. Sponges present include the boring sponge *Cliona celata*, *Halichondria panicea*, *Myxilla incrustans*, *Leucosolenia botryoides*and *Dysidea fragilis*. Occasionally, the foliose red seaweed *Delessaria sanguinea* may be recorded.

Similar biotopes

MIR.HiaSw	Has seaweed community.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Leucosolenia botryoides	●●●	Frequent	2
Cliona celata	●●	Frequent	2
Halichondria panicea	●●●	Frequent	2
Myxilla incrustans	●●	Occasional	1
Dysidea fragilis	●●	Present	1
Nemertesia antennina	●●	Frequent	1
Alcyonium digitatum	●●●	Common	3
Sabellaria spinulosa	●●	Frequent	1
Cancer pagurus	●●●	Occasional	2
Janolus cristatus	●●	Frequent	2
Hiatella arctica	●●●●	Common	7
Crisiidae	●●●	Common	5
Alcyonidium diaphanum	●●●	Frequent	3
Cellepora pumicosa	●●●	Occasional	1
Flustra foliacea	●●	Common	2
Bugula flabellata	●●●	Frequent	2
Bugula plumosa	●●●	Frequent	4
Henricia sanguinolenta	●●	Occasional	2
Asterias rubens	●●●●	Frequent	9
Ophiothrix fragilis	●●●●	Common	10

Clavelina lepadiformis	●●●	Frequent	2
Polyclinum aurantium	●●●●	Frequent	5
Aplidium punctum	●●	Common	2
Botryllus schlosseri	●●	Occasional	2
Botrylloides leachi	●●●	Frequent	4
Delesseria sanguinea	●●	Frequent	2

CR.MCR.CMus Circalittoral mussel beds

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Strong, Moderately strong
Substratum:	Bedrock
Zone:	Circalittoral, Circalittoral - upper
Depth band:	5-10 m, 10-20 m

Biotope description

This biotope complex occurs on moderately wave-exposed upper circalittoral bedrock subject to strong or moderately strong tidal streams. This complex is characterised by dense aggregations of the mussels *Mytilus edulis* or *Musculus discors* 'carpeting' the underlying substrata. Sponges that may be recorded in this complex are *Scypha ciliata*, *Tethya aurantium*, *Pachymatisma johnstonia*, *Dysidea fragilis* and *Cliona celata*. A 'sparse' hydroid/bryozoan turf composed primarily of *Nemertesia antennina*, *Alcyonidium diaphanum* and *Flustra foliacea* is often recorded. Anemones present are *Urticina felina* and *Sagartia elegans*. Other species recorded are the crabs *Cancer pagurus*, *Carcinus maenes* and *Necora puber*, the starfish *Crossaster papposus* and *Asterias ruben*, and *Alcyonium digitatum*. In this upper circalittoral complex, algae species such as *Dictyota dichotoma*, *Cryptopleura ramosa* and *Plocamium cartilagineum*. Two biotopes have been identified: CMyt (*Mytilus* dominated) and Mdis (*Musculus* dominated).

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Scypha ciliata	••	Occasional	2
Pachymatisma johnstonia	••	Occasional	2
Tethya aurantium	••	Occasional	2
Cliona celata	••	Rare	1
Dysidea fragilis	••	Occasional	1
Nemertesia antennina	••	Occasional	2
Alcyonium digitatum	••	Occasional	1
Urticina felina	•••	Occasional	6
Sagartia elegans	•••	Occasional	3
Balanus crenatus	••	Frequent	2
Cancer pagurus	•••	Occasional	4
Necora puber	••	Rare	2
Carcinus maenas	•	Common	1
Mytilus edulis	•••	Abundant	18
Musculus discors	•••	Super-abundant	13
Alcyonidium diaphanum	••	Frequent	1
Flustra foliacea	•••	Occasional	4
Crossaster papposus	••	Occasional	2
Asterias rubens	••••	Frequent	15
Plocamium cartilagineum	••	Occasional	1
Cryptopleura ramosa	••	Frequent	1
Dictyota dichotoma	••	Frequent	1

CR.MCR.CMus.CMyt *Mytilus edulis* beds with hydroids and ascidians on tide-swept, exposed to moderately wave-exposed circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Exposed
Tidal streams:	Strong, Moderately strong
Substratum:	Bedrock; shells; pebbles; gravel
Zone:	Circalittoral
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m

Biotope description

This biotope typically occurs on the upper faces of tide-swept circalittoral bedrock, boulders and mixed substrata exposed to varying amounts of wave action. The mussel *Mytilus edulis* forms dense beds, to the exclusion of other species. The starfish *Asterias rubens* is frequently recorded, and it predates heavily on the mussels. Occasionally, the anemone *Urticina felina* may be seen within crevices in the rock or on gravel patches. Crabs such as *Necora puber* and *Carcinus maenas* may be seen on the rock or mussels whilst fauna observed in crevices typically consists of the lobster *Homarus gammarus* and the crab *Cancer pagurus*. The anemone *Sargatia elegans* can be seen attached to bedrock and cobbles, whereas the barnacle *Balanus crenatus* may be seen attached to the mussels themselves.

Temporal variation

Not known

Similar biotopes

IR.LIR.MytRS	This biotope is found on wave-sheltered, tide-swept infralittoral rock and is characterised predominantly by *Mytilus edulis*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Urticina felina	••••	Occasional	8
Sagartia elegans	•••	Occasional	3
Balanus crenatus	••	Frequent	1
Homarus gammarus	••	Rare	1
Cancer pagurus	•••	Rare	3
Necora puber	•••	Occasional	4
Carcinus maenas	••	Common	3
Mytilus edulis	•••••	Abundant	58
Asterias rubens	••••	Frequent	12

CR.MCR.CMus.Mdis *Musculus discors* beds on moderately exposed circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	Moderately strong
Substratum:	Bedrock; boulders; cobbles
Zone:	Circalittoral - upper
Depth band:	10-20 m

Biotope description

This biotope typically occurs on the upper faces of moderately exposed, moderately tide-swept bedrock, boulders and cobbles in slightly silty conditions. The mussel *Musculus discors* occurs in dense `mats' and occasionally completely coats all available surfaces. There is also often a layer of pseudofaeces, forming a thick, silty matrix. A relatively diverse fauna of cushion and branching sponges is often present on rocky outcrops and other hard substratum that is free of mussels. These include *Tethya aurantium*, *Scypha ciliata*, *Pachymatisma johnstonia*, *Dysidea fragilis*, *Cliona celata* and *Stelligera stuposa*. There may be isolated clumps of silt-tolerant bryozoans such as *Flustra foliacea* and *Bugula plumosa*. Various species may be observed on top of the mussels, including *Asterias rubens*, *Crossaster papposus* and the brittlestar *Ophiura albida*. Occasional *Alcyonium digitatum* and clumps of the hydroid *Nemertesia antennina* are found attached to rocky outcrops and boulders whilst the anemone *Urticina felina* may be seen in crevices in the rock or on gravely patches between boulders. Colonial ascidians such as *Clavelina lepadiformis* and didemnids may occasionally be present. A wide range of seaweeds may be present, including *Dictyota dichotoma*, *Plocamium cartliagineum*, *Dictyopteris membranacea*, *Cryptopleura ramosa* and *Heterosiphonia plumosa*. The crab *Cancer pagurus* may be observed in crevices. The majority of the records for this biotope are from the Lleyn Peninsula.

Temporal variation

Not known

Similar biotopes

IR.LIR.AscSpAs	*Musculus discors* may be present in this biotope, but at nowhere near the density present in Mdis.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Scypha ciliata	••••	Occasional	4
Pachymatisma johnstonia	•••	Occasional	2
Tethya aurantium	••••	Occasional	5
Cliona celata	•••	Rare	2
Stelligera stuposa	•••	Occasional	1
Dysidea fragilis	•••	Occasional	2
Nemertesia antennina	•••	Occasional	1
Alcyonium digitatum	•••	Occasional	2
Urticina felina	•••	Occasional	2
Cancer pagurus	•••	Occasional	2
Musculus discors	•••••	Super-abundant	30
Flustra foliacea	••••	Occasional	5

Bugula plumosa	●●●	Frequent	2
Crossaster papposus	●●●●	Occasional	4
Asterias rubens	●●●●	Frequent	7
Ophiura albida	●●	Frequent	1
Clavelina lepadiformis	●●●	Occasional	2
Didemnidae	●●	Occasional	1
Plocamium cartilagineum	●●●	Occasional	2
Cryptopleura ramosa	●●	Occasional	1
Heterosiphonia plumosa	●●	Occasional	1
Dictyopteris membranacea	●●●	Occasional	1
Dictyota dichotoma	●●●	Frequent	3

CR.MCR.CFaVS Circalittoral variable salinity faunal communities

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered, Ultra sheltered
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock, cobbles
Zone:	Circalittoral - upper, Circalittoral - lower
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

This biotope complex occurs on wave-sheltered, variable salinity bedrock and cobbles, subject to moderately strong to weak tidal streams. This complex contains a suite of sponges able to tolerate the variable salinity conditions like *Hymeniacidon perleve*, *Suberites ficus*, *Halichondria panicea*, *Habichondira bowerbanki*, *Cliona celata* and *Leucosolenia botryoides*. The barnacle *Balanus crenatus* is frequently recorded in this complex. A 'sparse' hydroid/bryozoan turf composed primarily of *Nemertesia antennina*, *Nemerteis ramosa*, *Plumularia setacea*, *Alcyonidium diaphanum* and *Bugula plumosa* is often recorded. Other species recorded are the ascidians *Clavelina lepadiformis*, *Morchellium argus* and *Dendrodoa grossularia*, the anemones *Metridium senile* and *Sagartia troglodytes*, the starfish *Asterias rubens* and the crab *Carcinus maenes*. Two biotopes have been identified within this complex: CuSpH (cushion sponges with hydroids) and HbowEud.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Leucosolenia botryoides	••	Frequent	1
Suberites ficus	••••	Frequent	8
Cliona celata	••	Occasional	1
Halichondria bowerbanki	•••	Frequent	5
Halichondria panicea	•••	Frequent	6
Hymeniacidon perleve	•••	Frequent	8
Nemertesia antennina	•••	Frequent	5
Nemertesia ramosa	••	Frequent	2
Plumularia setacea	•••	Occasional	4
Metridium senile	••	Occasional	3
Sagartia troglodytes	••	Occasional	1
Balanus crenatus	•••	Common	9
Carcinus maenas	•••	Occasional	4
Alcyonidium diaphanum	••	Occasional	1
Bugula plumosa	••	Occasional	2
Asterias rubens	•••	Occasional	4
Clavelina lepadiformis	•••	Frequent	8
Morchellium argus	••	Occasional	2
Dendrodoa grossularia	••	Occasional	1

CR.MCR.CFaVS.CuSpH Cushion sponges and hydroids on tide-swept, turbid, sheltered circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered, Ultra sheltered
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Bedrock; boulders
Zone:	Circalittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

This biotope is found in variable salinity environments and tends to occur on the upper faces of circalittoral bedrock and boulders, in sheltered sites subject to moderately strong tidal streams. This biotope is characterised by aggregations of cushion sponges such as *Hymeniacidon perleve*, *Halichondria panicea*, *Halichondria bowerbanki* and *Cliona celata*, other sponges (*Leucosolenia botryoides* and *Suberites fiscus*) along with occasional hydroid tufts of *Nemertesia antennina*, *Nemertesia ramosa* and *Plumularia setacea*. Other species that may be present include the colonial ascidians *Clavelina lepadiformis* and *Morchellium argus*, *Dendrodoa grossularia*, the anemones *Metridium senile* and *Sagartia troglodytes*, the barnacle *Balanus crenatus*, *Asterias rubens*, *Carcinus maenas* and *Bugula plumosa*. Two variants of this biotope have been recorded; CuSpH.VS and CuSpH.As.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Leucosolenia botryoides	••	Frequent	1
Suberites ficus	••••	Frequent	10
Cliona celata	••	Occasional	2
Halichondria bowerbanki	••	Frequent	2
Halichondria panicea	•••	Frequent	7
Hymeniacidon perleve	••••	Frequent	10
Nemertesia antennina	•••	Frequent	6
Nemertesia ramosa	•••	Frequent	3
Plumularia setacea	•••	Occasional	5
Metridium senile	•••	Occasional	3
Sagartia troglodytes	••	Occasional	1
Balanus crenatus	•••	Common	7
Carcinus maenas	•••	Occasional	3
Bugula plumosa	••	Occasional	2
Asterias rubens	•••	Occasional	3
Clavelina lepadiformis	••••	Frequent	9
Morchellium argus	•••	Occasional	2
Dendrodoa grossularia	••	Occasional	1

CR.MCR.CFaVS.CuSpH.As Cushion sponges, hydroids and ascidians on tide-swept, turbid, sheltered circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered, Ultra sheltered
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Bedrock; boulders
Zone:	Circalittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

This sub-biotope typically occurs in a mixture of turbid, full and variable salinity water, on wave-sheltered and moderately exposed bedrock or boulders. Tidal streams are typically moderately strong but may vary considerably. This sub-biotope occurs in relatively shallow water (typically 5m to 11m water depth) and is dominated by cushion sponges, hydroids and ascidians. On the silty, rocky substrata, large growths of sponge are usually associated with this biotope (*Suberites ficus*, *Hymeniacidon perleve*, *Cliona celata*, *Halichondria panicea*, *Raspailia ramosa*). The tasselled form of *Esperiopsis fucorum* is also notably present. Other epifauna present includes silty hydroids such as *Nemertesia antennina*, *Nemertesia ramosa*, *Plumularia setacea*, *Hydrallmania falcata* and *Halecium halecinum*. Individual colonies of Dead mans fingers *Alcyonium digitatum* and plumose anemones *Metridium senile* may be seen attached to the tops of boulders and ridges. At some sites, whole sides of rocks may be colonised by the anemones *Sagartia elegans*, *Sagartia troglodytes* and *Actinothoe sphyrodeta*. Within crevices in the rocky substratum and at the base of boulders *Urticina felina* and *Cereus pedunculatus* may be found. Ascidians such as *Clavelina lepadiformis*, *Morchellium argus*, *Dendrodoa grossularia*, *Diplosoma listerianum* and *Distomus variolosus* may all be observed. Other ubiquitous species which may be recorded include *Polydora*, terebellid worms, *Balanus crenatus*, *Alcyonidium diaphanum* and *Asterias rubens*.

Temporal variation

Not known

Similar biotopes

CR.MCR.CFaVS.HbowEud	This biotope occurs on reduced salinity circalittoral bedrock and boulders subject to strong to weak tidal streams. Very limited species diversity, unlike CuSpH.As.
CR.MCR.CFaVS.CuSpH.VS	This biotope is closely related to CuSpH.As, but tends to be found in areas that experience less stable, lower salinity seawater. CuSpH.As has amore diverse range of sponges, hydroids and bryozoans than CuSpH.VS.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Suberites ficus	●●●●●	Frequent	10
Cliona celata	●●●●	Occasional	3
Raspailia ramosa	●●●	Occasional	1
Halichondria panicea	●●●	Frequent	3
Hymeniacidon perleve	●●●●	Occasional	5
Esperiopsis fucorum	●●●	Frequent	2
Halecium halecinum	●●●	Occasional	1

Nemertesia antennina	●●●●	Frequent	7
Nemertesia ramosa	●●●	Occasional	3
Plumularia setacea	●●●	Occasional	3
Hydrallmania falcata	●●●	Occasional	1
Alcyonium digitatum	●●●	Occasional	3
Urticina felina	●●●	Frequent	3
Metridium senile	●●●	Frequent	3
Sagartia elegans	●●●	Occasional	1
Sagartia troglodytes	●●	Frequent	1
Cereus pedunculatus	●●●	Occasional	2
Actinothoe sphyrodeta	●●●	Occasional	2
Polydora	●●●	Common	2
Terebellidae	●●●	Frequent	2
Balanus crenatus	●●	Frequent	2
Alcyonidium diaphanum	●●	Occasional	1
Asterias rubens	●●●	Occasional	1
Clavelina lepadiformis	●●●●	Occasional	5
Morchellium argus	●●●●	Occasional	4
Diplosoma listerianum	●●●	Rare	1
Dendrodoa grossularia	●●●	Frequent	2
Distomus variolosus	●●	Frequent	1

CR.MCR.CFaVS.CuSpH.VS Cushion sponges and hydroids on tide-swept, turbid, variable salinity, sheltered circalittoral rock

Habitat classification

Salinity:	Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered, Ultra sheltered
Tidal streams:	Strong, Moderately strong
Substratum:	Bedrock
Zone:	Circalittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

This sub-biotope typically occurs in turbid, variable salinity water, on wave-sheltered bedrock in estuaries subject to strong tidal regimes where circalittoral communities occur in relatively shallow water (typically 5m to 8m water depth). Cushion sponges, hydroids and ascidians dominate the biotope. Large growths (often up to 50cm across) of the sponges *Halichondria panicea* mixed with *Halichondria bowerbanki* almost entirely cover the bedrock, appearing in places like a continuous cushion. *Haliclona oculata*, *Suberites ficus*, *Leucosolenia botryoides*, various hydroids such as *Plumularia setacea*, *Nemertesia antennina*, *Nemertesia ramosa* and various bryozoans such as *Bugula plumosa*, *Bugula turbinata* and *Bowerbankia pustulosa* protude through the *Halichondria* sponge growth. Colonial ascidians such as the lightbulb ascidian *Clavelina lepadiformis* and *Morchellium argus* may also be observed. Other more ubiquitous species include *Balanus crenatus*, *Carcinus maenas*, *Asterias rubens*, *Metridium senile*, *Sagartia elegans* and *Ophiothrix fragilis*.

Temporal variation

Not known

Similar biotopes

CR.MCR.CFaVS.CuSpH.As	This sub-biotope occurs in more marine conditions in the outer parts of estuaries. A diverse range of cushion sponges and hydroids are present, unlike CuSp.VS, together with a number of colonial or small solitary ascidians.
CR.MCR.CFaVS.HbowEud	This biotope occurs in variable saline sheltered circalittoral mixed substratum, subject to varying tidal streams. Similar species range to CuSp.VS although lacks hydroids such as *Eudendrium* spp.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Leucosolenia botryoides	••	Frequent	3
Suberites ficus	••••	Occasional	7
Halichondria bowerbanki	••	Frequent	4
Halichondria panicea	••••	Frequent	10
Hymeniacidon perleve	••••	Frequent	11
Haliclona oculata	•	Occasional	1
Nemertesia antennina	••	Frequent	3
Nemertesia ramosa	••	Frequent	2
Plumularia setacea	•••	Frequent	4
Metridium senile	••	Occasional	3
Sagartia troglodytes	••	Occasional	2

Balanus crenatus	●●●	Common	10
Carcinus maenas	●●●	Occasional	5
Bowerbankia pustulosa	●●	Frequent	1
Bugula plumosa	●●●	Occasional	3
Bugula turbinata	●●	Common	1
Asterias rubens	●●●	Occasional	4
Ophiothrix fragilis	●●	Occasional	1
Clavelina lepadiformis	●●●●	Frequent	10
Morchellium argus	●●	Occasional	1

CR.MCR.CFaVS.HbowEud *Halichondria bowerbanki, Eudendrium arbusculum* and *Eucratea loricata* on reduced salinity tide-swept circalittoral mixed substrata

Habitat classification

		Previous code	
Salinity:	Variable (18-35ppt), Reduced (18-30ppt), Low (<18ppt)	CR.ECR.BS.HBowEud	97.06
Wave exposure:	Sheltered, Very sheltered		
Tidal streams:	Strong, Moderately strong, Weak		
Substratum:	Bedrock; boulders; cobbles; pebbles		
Zone:	Circalittoral		
Depth band:	0-5 m, 5-10 m, 10-20 m		

Biotope description

This biotope typically occurs on circalittoral mixed substrata (bedrock, boulders, cobbles, pebbles and gravel) in the moderately strong, tide-swept narrows near the entrance of Loch Etive, although not in the extremely tide-swept Falls of Lora. This sea loch is unique in having a substantial freshwater input from the surrounding moorland, yielding the most brackish, large sea loch in Scotland. Large growths of the brackish-tolerant sponge *Halichondria bowerbanki* cover the cobble and boulder seabed, interspersed with *Mycale lobata*, the hydroid *Eudendrium arbusculum* and the bryozoan *Alcyonidium diaphanum* which are particularly characteristic of these conditions. Tufts of the bryozoan *Eucratea loricata* are occasional in most areas. Other species recorded include *Carcinus maenas*, *Asterias rubens*, *Crossaster papposus*, *Buccinum undatum*, *Pagurus berhardus*, *Henricia* spp., *Onchidoris bilamellata* and *Palio dubia*, tolerant of the low salinity, are found in the circalittoral throughout this area. Ascidians such as *Ascidiella scabra* and *Corella parallelogramma* may also be present. A very impoverished low salinity version is present in the upper basin of Loch Etive. The biotope CuSpH is similar in several respects to this biotope and will develop in less brackish situations where species-richness is generally greater.

Temporal variation

Not known

Similar biotopes

CR.MCR.CFaVS.CuSpH.VS	This sub-biotope occurs in very sheltered variable salinity bedrock, subject to moderately strong tidal streams. It is much more impoverished than HbowEud, lacking the hydroid *Eudendrium* spp. Also lacks many red algae species.
CR.MCR.CFaVS.CuSpH.As	This sub-biotope occurs in more marine conditions in the outer parts of estuaries. A diverse range of cushion sponges and hydroids are present, unlike HbowEud.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria bowerbanki	●●●●●	Occasional	16
Mycale lobata	●●●	Occasional	2
Eudendrium arbusculum	●●●●●	Frequent	7
Balanus crenatus	●●●●	Frequent	12
Pagurus bernhardus	●●●	Frequent	3
Carcinus maenas	●●●	Occasional	1
Buccinum undatum	●●●	Occasional	3
Onchidoris bilamellata	●●	Frequent	1

Palio dubia	••	Occasional	1
Alcyonidium diaphanum	•••	Occasional	3
Eucratea loricata	•••••	Frequent	15
Crossaster papposus	•••	Rare	1
Henricia	••	Occasional	1
Asterias rubens	•••	Occasional	3
Corella parallelogramma	••••	Occasional	9
Ascidiella scabra	••••	Common	11

CR.LCR Low energy circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt), Reduced (18-30ppt)
Wave exposure:	Sheltered, Very sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock;boulders
Zone:	Circalittoral - upper, Circalittoral - lower
Depth band:	5-10 m, 10-20 m, 20-30 m

Biotope description

This habitat complex occurs on wave-sheltered circalittoral bedrock and boulders subject to mainly weak/very weak tidal streams. The biotopes identified within this habitat complex are often dominated by encrusting red algae, brachiopods (*Neocrania anomala*) and ascidians (*Ciona intestinalis* and *Ascidia mentula*). Two fouling biotopes have also been identified; Aasp has been recorded from disused fishing nets and other artificial substrata, and is characterised by aggregations of *Ascidiella aspersa* whilst AdigMsen has been recorded from steel wrecks, and is characterised by dense aggregations of *Alcyonium digitatum* and *Metridium senile*. The LgAsSp biotope is characteristic of the wave-sheltered conditions found in the Kenmare River on the west coast of Ireland.

CR.LCR.BrAs Brachiopods and ascidians

Habitat classification

Salinity:	Full (30-35ppt), Reduced (18-30ppt)
Wave exposure:	Sheltered, Very sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock, boulders
Zone:	Circalittoral - upper, Circalittoral - lower
Depth band:	5-10 m, 10-20 m, 20-30 m

Biotope description

This biotope complex occurs on the wave-sheltered, circalittoral bedrock and boulders subject to weak tidal streams. The biotopes within this complex are typically found in the Scottish sealochs (with the exception of LgAsSp, recorded off Ireland) and are characterised by brachipod and ascidian communities. Ascidians often recorded in this complex are *Ciona intestinalis*, *Ascidia mentula*, *Ascidia virginea* and *Clavelina lepadiformis*. The brachiopod *Neocrania anomala* is also characteristic of the biotopes within this complex recorded in Scottish sealochs. The polychaete *Pomatoceros triqueter*, the saddle oyster *Pododesmus patelliformis*, the cup coral *Caryophyllia smithii* and encrusting red algae are frequently recorded on the rocky substrata. Echinoderms such as the brittlestars *Ophiothrix fraglis*, *Ophiocomina nigra* and *Ophiura albida*, the starfish *Asterias rubens*, *Crossaster papposus* and *Henricia oculata*, the crinoid *Antedon bifida* and the urchin *Echinus esculentus* are all found in this complex. Other species present include the squat lobster *Munida rugosa*, the hermit crab *Pagurus bernhardus*, *Alcyonium digitatum*, the anemone *Protanthea simplex* and the hydroid *Kirchenpaueria pinnata*. Within this biotope complex, four biotopes have been identified: AmenCio, LgAsSp, AntAsH and NeoPro.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Kirchenpaueria pinnata	••	Occasional	1
Alcyonium digitatum	••	Occasional	2
Protanthea simplex	••	Occasional	2
Caryophyllia smithii	•••	Occasional	2
Pomatoceros triqueter	••••	Frequent	8
Pagurus bernhardus	•••	Occasional	3
Munida rugosa	•••	Occasional	3
Pododesmus patelliformis	••	Occasional	2
Neocrania anomala	••	Frequent	3
Antedon bifida	••	Occasional	1
Crossaster papposus	•••	Occasional	2
Henricia oculata	••	Rare	1
Asterias rubens	••••	Occasional	5
Ophiothrix fragilis	••••	Frequent	8
Ophiocomina nigra	•••	Frequent	4
Ophiura albida	••	Occasional	2
Echinus esculentus	••••	Occasional	7
Clavelina lepadiformis	••	Occasional	1
Ciona intestinalis	••••	Occasional	5
Corella parallelogramma	•••	Occasional	2
Ascidia mentula	••••	Occasional	5
Ascidia virginea	••	Occasional	1
Corallinaceae	•••	Common	8

CR.LCR.BrAs.AmenCio Solitary ascidians, including *Ascidia mentula* and *Ciona intestinalis*, on wave-sheltered circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock; boulders; cobbles
Zone:	Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m, 30-50 m

Biotope description

This biotope predominantly occurs on the upper faces of wave-sheltered (often sealochs) circalittoral bedrock, boulder and cobble slopes with little tidal flow. Apart from the solitary ascidians *Ciona intestinalis* and *Ascidia mentula*, this biotope has a rather barren, pink appearance (due to the encrusting red algae), possibly due to `grazing' pressure from the sea urchin *Echinus esculentus*. Other organisms found encrusting onto the rocky surface include the polychaete *Pomatoceros triqueter* and the cup coral *Caryophyllia smithii*. Other species occasionally encountered include *Alcyonium digitatum*, *Asterias rubens*, *Pagurus berhardus*, *Crossaster papposus*, *Antedon bifida* and *Metridium senile*. Crustaceans such as *Munida rugosa* and *Cancer pagurus* may be recorded in crevices. Two variants of this biotope exist; AmenCio.Ant and AmenCio.Bri. AmenCio.Bri occurs where is a dense `carpet' of brittlestars which sometimes completely cover the rocky substratum. Species present include *Ophiothrix fragilis*, *Ophiocomina nigra* and *Ophiura albida*.

Temporal variation

The abundance of Ciona intestinalis tends to fluctuate seasonally, so it may appear absent at a site at one time of year and then be present at other times, visually altering the appearance of the biotope. Other solitary ascidian species such as Ascidia mentula and Ascidiella aspersa tend to be longer-lived (approximately 7 years and 3 years respectively).

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Alcyonium digitatum	••	Occasional	2
Metridium senile	••	Occasional	1
Caryophyllia smithii	••	Occasional	1
Pomatoceros triqueter	•••	Frequent	7
Pagurus bernhardus	•••	Occasional	4
Munida rugosa	••	Occasional	3
Cancer pagurus	••	Rare	1
Antedon bifida	••	Occasional	1
Crossaster papposus	•••	Occasional	2
Asterias rubens	••••	Occasional	6
Ophiothrix fragilis	••••	Abundant	15
Ophiocomina nigra	•••	Common	10
Ophiura albida	••	Occasional	3
Echinus esculentus	••••	Occasional	10
Ciona intestinalis	•••	Occasional	4
Ascidia mentula	••	Occasional	2
Corallinaceae	•••	Common	8

CR.LCR.BrAs.AmenCio.Ant Solitary ascidians, including *Ascidia mentula* and *Ciona intestinalis* with *Antedon* spp. on wave-sheltered circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered, Ultra sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders
Zone:	Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m, 30-50 m

Biotope description

This variant occurs on circalittoral, vertical and upward facing bedrock or boulder slopes in generally wave-sheltered conditions (often in sea lochs) with little tidal flow. Apart from the large ascidians, *Ascidia mentula* and *Ciona intestinalis*, the rock surface of this biotope has a rather sparse appearance. `Grazing' by the sea urchin *Echinus esculentus* leaves only encrusting red algae (giving the bedrock/boulder substratum a pink appearance), cup corals *Caryophyllia smithii* and the polychaete *Pomatoceros triqueter*. There may be a few hydroid species present such as *Nemertesia* spp. and *Kirchenpaueria pinnata*, occasional *Alcyonium digitatum* and occasional *Metridium senile*. The barnacle *Balanus* spp. and the colonial ascidian *Clavelina lepadiformis* also occasionally occur. At some sites, echinoderms such as the crinoid *Antedon* spp., the starfish *Crossaster papposus*, *Asterias rubens* and the brittlestar *Ophiothrix fragilis* may be found. The squat lobster *Munida rugosa* is likely to be found in crevices, under boulders, and the hermit crab *Pagurus bernhardus* may be observed moving around the rock surface. The brachiopod *Neocrania anomala* is frequently observed (especially where this biotope occurs shallower than NeoPro for example). The saddle oyster *Pododesmus patelliformis* may occasionally be seen attached to the rock/boulder face.

Situation

This biotope is typical of one found in sheltered sealochs. On slightly more wave and tide exposed sites, a transition to the more diverse AntAsH biotope will occur. Below AmenCio.Ant, you may find the NeoPro biotope (especially situated on the sills of sealochs).

Temporal variation

The abundance of *Ciona intestinalis* tends to fluctuate seasonally, so it may appear absent at a site at one time of year and then be present at other times, visually altering the appearance of the biotope. Other solitary ascidian species such as *Ascidia mentula* and *Ascidiella aspersa* tend to be longer-lived (approximately 7 years and 3 years respectively).

Similar biotopes

CR.MCR.EcCr.FaAlCr	This biotope is found on more wave-exposed sites subject to moderately strong to weak tidal streams. They occur on similar substratum and appear similar due to their characteristically barren nature. FaAlCr tends to have a higher abundance of *Alcyonium digitatum* than AmenCio.Ant, while the latter instead has a diverse range of solitary ascidians. AmenCio.Ant also tends to appear more 'silty' than FaAlCr.
CR.LCR.BrAs.AntAsH	This biotope occurs at similar depths and conditions as AmenCio.Ant. It tends to be more species rich, with a diverse range of hydroids and echinoderms. Other species such as *Chaetopterus variopedatus* and *Sabella pavonina* may also be present occasionally.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Kirchenpaueria pinnata	••	Occasional	1
Nemertesia antennina	••	Occasional	1
Alcyonium digitatum	••	Occasional	2
Metridium senile	••	Occasional	2
Caryophyllia smithii	•••	Occasional	5
Pomatoceros triqueter	••••	Frequent	10
Balanus crenatus	••	Occasional	1
Pagurus bernhardus	••	Occasional	2
Munida rugosa	•••	Occasional	5
Pododesmus patelliformis	••	Frequent	1
Neocrania anomala	••	Frequent	1
Antedon bifida	•••	Occasional	4
Antedon petasus	••	Frequent	2
Crossaster papposus	••	Occasional	2
Asterias rubens	•••	Occasional	6
Ophiothrix fragilis	••	Occasional	2
Echinus esculentus	•••••	Occasional	12
Clavelina lepadiformis	•••	Occasional	2
Ciona intestinalis	••••	Frequent	9
Ascidia mentula	•••	Frequent	6
Corallinaceae	•••	Common	7

CR.LCR.BrAs.AmenCio.Bri Dense brittlestars with sparse *Ascidia mentula* and *Ciona intestinalis* on sheltered circalittoral mixed substrata

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock; boulders; cobbles; gravel; sand; mud
Zone:	Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m, 30-50 m

Biotope description

This biotope is typically found on predominantly wave-sheltered (although may be found in wave-exposed through to extremely wave-sheltered sites) circalittoral mixed substrata (Bedrock, boulders, cobbles, pebbles and gravel), subject to moderately strong to weak tidal streams. This biotope often has a silty appearance in parallel with AmenCio.Ant but is characterised by a dense carpet of brittlestars (*Ophiothrix fragilis, Ophiocomina nigra* and to a lesser extent *Ophiura albida*) which virtually cover seabed. Where the underlying substratum is visible, pink coralline crusts and the white calcareous tubes of the keelworm *Pomatoceros triqueter* are often observed. Hydroids and bryozoans are scarce perhaps partly due to the smothering effect of the brittlestars and possibly due to the grazing pressure of the sea urchin *Echinus esculentus* which is occasionally recorded. Other echinoderms present include *Asterias rubens* and *Crossaster papposus*. The solitary ascidian *Ciona intestinalis* may be seen attached to isolated rocks and boulders, whilst on the tops and sides of larger boulders, dead man's fingers *Alcyonium digitatum* may be recorded. The hermit crab *Pagurus bernhardus* is often recorded whilst under boulders and in crevices, the claws belonging to the long-clawed squat lobster *Munida rugosa* may be seen.

Situation

AmenCio.Bri is found in predominantly sheletered areas, so in the infralittoral zone above, kelp forest formed by dense *Laminaria saccharina* and cape-form *Laminaria hyperborea* are frequently recorded. A dense understorey of red algae is also present.

Temporal variation

Not known

Similar biotopes

CR.MCR.BrAs.FaAlCr.Bri	This biotope occurs on more wave-exposed mixed substratum, subject to varying amounts of tide. Tends to have similar species diversity as AmenCio.Bri, but delicate hydroids have been replaced by more robust species such as *Abietinaria abietina*. Occasionally, bryozoan crusts may be present in FaAlCr.Bri.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Alcyonium digitatum	●●●	Occasional	1
Pomatoceros triqueter	●●●	Frequent	3
Pagurus bernhardus	●●●	Occasional	4
Munida rugosa	●●	Occasional	1
Crossaster papposus	●●●	Occasional	2

Asterias rubens	●●●●	Occasional	4
Ophiothrix fragilis	●●●●●	Abundant	27
Ophiocomina nigra	●●●●●	Common	21
Ophiura albida	●●●	Frequent	4
Echinus esculentus	●●●●	Occasional	6
Ciona intestinalis	●●	Occasional	1
Corallinaceae	●●●	Frequent	7

CR.LCR.BrAs.LgAsSp Large solitary ascidians and erect sponges on wave-sheltered circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very sheltered, Extremely sheltered, Ultra sheltered
Tidal streams:	Strong, Moderately strong, Weak, Very weak
Substratum:	Bedrock; boulders
Zone:	Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m

Biotope description

This biotope is typically found on silty circalittoral bedrock and boulders in wave-sheltered channels subject to varying amounts of tidal flow. These fully marine inlets and channels have steep, often vertical sides with small terraces or ledges. This biotope, characterised by erect sponges and large solitary ascidians, appears to be biologically diverse. A diverse ascidian fauna is generally present, including *Ascidia mentula*, *Aplidium punctum*, *Corella parallelogramma*, *Ascidia virginea*, *Botryllus schlosseri*, *Clavelina lepadiformis* and *Ciona intestinalis*. An equally diverse sponge fauna, with massive erect sponges particularly noticeable, compliments these species. Dominant species include *Esperiopsis fucorum*, *Dysidea fragilis*, *Tethya aurantium*, *Polymastia boletiformis*, *Raspailia ramosa*, *Stelligera stuposa*, *Polymastia mamilliaris* and *Pachymatisma johnstonia*. Other sponges present are *Suberites carnosus*, *Haliclona fistulosa*, *Stelligera rigida*, *Mycale rotalis*, *Haliclona simulans*, *Iophon hyndmani* and *Hemimycale columella*. Various sponge crusts may also be present but in most cases in lower abundances. Other significant components of the community include the cup coral *Caryophyllia smithii* and various echinoderms, including the sea urchin *Echinus esculentus* and the starfish *Henricia oculata* and *Marthasterias glacialis*. Small isolated clumps of *Nemertesia antennina* and individual *Alcyonium digitatum* may be seen, whilst the top shell *Calliostoma zizyphinum* may also be present. At present, there are relatively few records in this biotope, as it is only reported from around the south-western coast of Ireland, where sponge diversity is very high.

Situation

Due to the sheltered nature of the biotope, LgAsSp is usually situated as bedrock/boulder outcrops associated with mud slopes and plains. Typical species found within these circalittoral muds include the seapen *Virgularia mirablis* and the anemone *Pachycerianthus multiplicatus*. In the infralittoral zone, sheltered kelp biotopes such as SS.SMp.KSwSS.LsacX with *Laminaria saccharina* occur frequently. In areas where there is a slightly stronger tidal-stream, the circalittoral muddy plains become more muddy gravel plains and slopes. Typical species found within these habitats include the anemones *Mesacmaea mitchellii* and *Aureliana heterocera*. When tidal-streams becomes negligible, but with similar wave-sheltered conditions, you tend to find CarSwi.Aglo biotopes occurring, especially in the same geographical location (around south-west/west Ireland) as LgAsSp.

Temporal variation

Not known

Similar biotopes

CR.LCR.BrAs.AmenCio.Ant	This biotope is found under similar silty, wave-sheltered conditions as LgAsSp but with negligible tidal streams. Found in sheltered sealochs, there is an impoverished faunal component with solitary ascidians dominating. It lacks the diverse sponge component which is characteristic of LgAsSp.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
PORIFERA	••	Frequent	1
Pachymatisma johnstonia	••••	Frequent	3
Tethya aurantium	••••	Frequent	4
Suberites carnosus	•••	Frequent	2
Polymastia boletiformis	••••	Frequent	4
Polymastia mamillaris	••••	Frequent	3
Stelligera rigida	•••	Frequent	2
Stelligera stuposa	••••	Occasional	3
Raspailia ramosa	••••	Frequent	4
Mycale rotalis	•••	Frequent	2
Esperiopsis fucorum	•••••	Frequent	7
Iophon hyndmani	•••	Occasional	2
Hemimycale columella	•••	Occasional	1
Haliclona fistulosa	•••	Occasional	2
Haliclona simulans	•••	Frequent	2
Dysidea fragilis	••••	Frequent	5
Nemertesia antennina	•••	Occasional	1
Alcyonium digitatum	•••	Occasional	1
Caryophyllia smithii	••••	Frequent	3
Calliostoma zizyphinum	•••	Occasional	1
Henricia oculata	•••••	Occasional	4
Marthasterias glacialis	•••	Occasional	2
Echinus esculentus	••••	Occasional	2
Clavelina lepadiformis	•••	Occasional	2
Aplidium punctum	••••	Frequent	4
Ciona intestinalis	•••	Occasional	1
Corella parallelogramma	•••	Common	3
Ascidia mentula	•••••	Common	7
Ascidia virginea	•••	Common	3
Botryllus schlosseri	••••	Occasional	2

CR.LCR.BrAs.AntAsH *Antedon* spp., solitary ascidians and fine hydroids on sheltered circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered, Ultra sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders
Zone:	Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m, 30-50 m

Biotope description

This biotope is typically found on a silty boulder/rock slope, in the sheltered parts of sealochs, subject to slight tidal currents. The seabed consists of smooth, silty bedrock or boulders, often as outcrops on mixed muddy sediment. There are often small vertical faces on the sides of rock ridges, and at few sites, there may be more extensive steep or vertical bedrock. In sharp contrast to the barren, grazed appearance of AmenCio.Ant, the species composition of AntAsH is quite diverse, although no one phyla dominates. A wide range of encrusting species may be found, including the brachiopod *Neocrania anomala*, the saddle oyster *Pododesmus patelliformis*, encrusting red algae and the polychaetes (*Pomatoceros triqueter* and *Protula tubularia*). Other conspicuous species include crinoids on the tops of boulders (*Antedon bifida*, commoner in shallower water and *Antedon petasus*, commoner in deeper water), scattered solitary and colonial ascidians (*Ascidia mentula*, *Ascidia virginea*, *Corella parallelogramma*, *Clavelina lepadiformis* and *Ciona intestinalis*) and tufts of fine hydroids (*Kirchenpaueria pinnata*, *Nemertesia antennina*, *Obelia dichotoma* and *Halceum halecinum*). The cup coral *Caryophyllia smithii* and the crustose bryozoan *Parasmittina trispinosa* are all typically present, as are a wide range of echinoderms, including the sea urchin *Echinus esculentus*, the starfish *Asterias rubens* and *Crossaster papposus*, and the brittlestars *Ophiothrix fragilis* and *Ophiura albida*. Other species recorded are the squat lobster *Munida rugosa*, the hermit crab *Pagurus bernhardus* and the chiton *Tonicella marmorea*.

Situation

The range of biotopes shallower and deeper than AntAsH is typical of a sheltered sealoch. Silted kelp biotopes (e.g. LhypLsac, Lsac) are typically found shallower than AntAsH in the infralittoral zone. Deeper than AntAsH, the boulder slope typically grades into a muddy slope/plain (SS.SMu.CMu or SS.SMx.CMx), along with fauna commonly associated with soft-sediments (e.g. seapens and the mud snail *Turritella*).

Temporal variation

Not known

Similar biotopes

CR.FCR.FaV.Ant	Ant tends to be shallower and is generally species-poor with more grazed crustose species on vertical rock.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halecium halecinum	●●●	Occasional	2
Kirchenpaueria pinnata	●●●●	Frequent	3

Nemertesia ramosa	●●●	Occasional	1
Obelia dichotoma	●●●	Occasional	1
Caryophyllia smithii	●●●●	Occasional	2
Pomatoceros triqueter	●●●●●	Frequent	7
Protula tubularia	●●●●	Occasional	2
Pagurus bernhardus	●●●●	Occasional	3
Munida rugosa	●●●●●	Frequent	5
Tonicella marmorea	●●●	Occasional	1
Pododesmus patelliformis	●●●	Occasional	1
Neocrania anomala	●●●●	Frequent	3
Parasmittina trispinosa	●●●	Occasional	1
Antedon bifida	●●●●	Occasional	2
Antedon petasus	●●●●	Occasional	2
Crossaster papposus	●●●●	Rare	1
Asterias rubens	●●●●●	Occasional	5
Ophiothrix fragilis	●●●●	Occasional	3
Ophiura albida	●●●●	Occasional	2
Echinus esculentus	●●●●●	Occasional	5
Clavelina lepadiformis	●●●	Occasional	2
Ciona intestinalis	●●●●	Frequent	4
Corella parallelogramma	●●●●●	Occasional	4
Ascidia mentula	●●●●●	Occasional	6
Ascidia virginea	●●●●	Occasional	2
Corallinaceae	●●●●	Common	6

CR.LCR.BrAs.NeoPro *Neocrania anomala* and *Protanthea simplex* on low energy circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered, Ultra sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders
Zone:	Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m, 30-50 m
Other features:	Steep slopes

Biotope description

This biotope typically occurs in full to variable salinity conditions on very wave-sheltered circalittoral bedrock and boulder slopes subject to negligible tidal streams (this tends to be in the landward, very sheltered basins of fjordic sealochs). This biotope is characterised by often dense populations of the anemone *Protanthea simplex*, growing on the silty bedrock. The underlying rock surfaces are usually covered by encrusting red algae, the polychaete *Pomatoceros triqueter*, the brachiopods *Neocrania anomala* and *Terebratulina retusa*, the saddle oyster *Pododesmus patelliformis* and the polychaete *Sabella pavonina*. Scattered colonies of *Alcyonium digitatum* and the hydroid *Bougainvillia ramosa* may occasionally be recorded. A diverse range of ascidians including *Ciona intestinalis*, *Ascidia mentula*, *Corella parallelogramma*, *Ascidia virginea*, *Polycarpa pomaria* and *Dendrodoa grossularia* are also occasionally recorded. Echinoderms such as the common brittlestar *Ophiothrix fragilis* are frequently reported with their arms protruding from crevices in the rock, whilst the starfish *Asterias rubens*, *Henricia oculata*, and the sea urchin *Echinus esculentus* and *Psammechinus miliaris* are occasionally found on the boulder/rock surface. The whelk *Buccinum undatum* is often present but in very low numbers. The squat lobster *Munida rugosa* may be seen hiding in crevices. The hermit crab *Pagurus bernhardus* may also be recorded.

Temporal variation

Not known

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Bougainvillia ramosa	••	Occasional	2
Alcyonium digitatum	••	Occasional	1
Protanthea simplex	••••	Common	7
Sabella pavonina	••••	Occasional	4
Pomatoceros triqueter	••••	Frequent	10
Pagurus bernhardus	•••	Occasional	2
Munida rugosa	•••	Occasional	2
Buccinum undatum	•••	Rare	2
Pododesmus patelliformis	•••	Occasional	4
Neocrania anomala	••••	Frequent	10
Terebratulina retusa	••	Occasional	1
Henricia	••	Rare	1
Asterias rubens	•••	Occasional	3
Ophiothrix fragilis	•••	Occasional	3
Psammechinus miliaris	•••	Occasional	3
Echinus esculentus	•••	Rare	2

Ciona intestinalis	●●●●	Occasional	6
Corella parallelogramma	●●●●	Occasional	4
Ascidia mentula	●●●●	Occasional	5
Ascidia virginea	●●●	Occasional	3
Polycarpa pomaria	●●●	Occasional	2
Dendrodoa grossularia	●●	Common	2
Corallinaceae	●●●	Common	6

CR.LCR.BrAs.NeoPro.FS *Neocrania anomala* and *Protanthea simplex* on very wave-sheltered circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered, Ultra sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders
Zone:	Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m, 30-50 m
Other features:	Steep, often near vertical slopes

Biotope description

This variant typically occurs on deep, lower circalittoral bedrock/boulder slopes (often-vertical walls) in the landward, very sheltered basins of fjordic sealochs. In these very sheltered conditions, there are frequently dense populations of the anemone *Protanthea simplex* growing on the silty boulder/rock slope, and on the tubes of the parchment worm *Chaetopterus variopedatus*. The underlying rock surfaces are usually covered with encrusting red algae, the polychaete *Pomatoceros triqueter*, the brachiopod *Neocrania anomala*, the saddle oyster *Pododesmus patelliformis* and the conspicuous fan worm *Sabella pavonina*. Scattered colonies of *Alcyonium digitatum* are occasionally present along with the hydroid *Bougainvillia ramosa*. The barnacle *Balanus balanus* and the hermit crab *Pagurus bernhardus* is occasionally seen on boulder/rock surface, whilst underneath in crevices, the squat lobster *Munida rugosa* may be present. A diverse range of solitary ascidians, typically found in sheltered conditions, are often present including *Ciona intestinalis*, *Corella parallelogramma*, *Polycarpa pomaria*, *Ascidia mentula* and *Ascidia virginea*. Echinoderms such as brittlestars *Ophiothrix fragilis* are frequently seen with their arms protruding from crevices in the rock, whilst the starfish *Asterias rubens*, the sea urchin *Echinus esculentus* and *Psammechinus miliaris* are occasionally found on the boulder/rock surface. The whelk *Buccinum undatum* is often present but in very low numbers.

Situation

Where this biotope occurs on vertical rock cliffs, you tend to find silted sugar kelp *Laminaria saccharina* communities above NeoPro, in the infralittoral zone (Lsac). Where NeoPro occurs on a rock/boulder slope and due to the very sheltered nature of the habitat, it is common to find a mud plain community where slope ends (SS.SMu.CMu). Species such as the seapen *Funiculina quadrangularis*, the anemone *Cerianthus lloydii* and the Norway lobster *Nephrops norvegicus* are typically abundant.

Temporal variation

Not known

Similar biotopes

CR.LCR.BrAs.AntAsH	This biotope is found under slightly more exposed conditons and tends to have a more diverse range of cnidarians and echinoderms than NeoPro.FS. In AntAsH, *Antedon* spp. are occasionally recorded but absent in NeoPro.FS.
CR.LCR.BrAs.NeoPro.VS	This sub-biotope is found under similar physical conditions as NeoPro.FS, but is only found in stable, reduced salinity environments. The ascidian *Dendrodoa grossularia* is commonly recorded in this sub-biotope, but is absent in NeoPro.FS. However, the anemone *Protanthea simplex* is recorded in higher abundances in NeoPro.FS.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Bougainvillia ramosa	••	Occasional	1
Alcyonium digitatum	•••	Occasional	1
Protanthea simplex	••••	Common	9
Sabella pavonina	••••	Occasional	4
Pomatoceros triqueter	•••••	Frequent	12
Balanus balanus	••	Occasional	1
Pagurus bernhardus	•••	Occasional	1
Munida rugosa	•••	Occasional	2
Buccinum undatum	•••	Rare	1
Pododesmus patelliformis	••••	Occasional	6
Neocrania anomala	••••	Frequent	9
Asterias rubens	••••	Occasional	4
Ophiothrix fragilis	••••	Frequent	4
Psammechinus miliaris	••••	Occasional	4
Echinus esculentus	••••	Rare	3
Ciona intestinalis	••••	Occasional	5
Corella parallelogramma	•••	Occasional	2
Ascidia mentula	••••	Occasional	6
Ascidia virginea	•••	Rare	2
Polycarpa pomaria	•••	Occasional	2
Corallinaceae	••••	Common	7

CR.LCR.BrAs.NeoPro.VS *Neocrania anomala, Dendrodoa grossularia* and *Sarcodictyon roseum* on variable salinity circalittoral rock

Habitat classification

Salinity:	Variable (18-35ppt), Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Sheltered, Very sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders
Zone:	Circalittoral - lower
Depth band:	5-10 m, 10-20 m, 20-30 m, 30-50 m

Biotope description

This variant typically occurs on lower circalittoral silty, bedrock/boulder cliffs and ridges in very wave-sheltered fjordic sealochs subjected to variable salinity regimes (such as Loch Etive). In these sheltered conditions, there are frequently dense populations of the ascidian *Dendrodoa grossularia*, the brachiopod *Neocrania anomala* and to a lesser extent, the brachiopod *Terebratulina retusa*, which are able to tolerate the variable salinity. Other solitary ascidians that may be present include *Ciona intestinalis*, *Corella parallelogramma*, *Ascidiella scabra*, *Ascidia mentula*, *Ascidia virginea* and *Polycarpa pomaria*. The anemone *Protanthea simplex* is occasionally seen, although to a lesser extent than in NeoPro, possibly due to the variable salinity. The hydroids *Bougainvillia ramosa* and *Lafoea dumosa*, the cup-coral *Caryophilia smithii* and *Sarcodictyon roseum* are occasionally present. The tubes formed by the polychaete *Sabella pavonina* may be observed standing erect from the rock surface. The rest of the rock surface is usually covered by encrusting red algae and the polychaete *Pomatoceros triqueter* and *Protula tubularia*. The sea cucumber *Psolus phantapus* may be found on the underside of boulders. Other species such as the hermit crab *Pagurus bernhardus* and the spider crab *Hyas araneus* may be found amongst the rock/boulders. The starfish *Asterias rubens*, *Crossaster papposus*, and *Henricia* spp. and the sea urchin *Psammechinus miliaris* are also recorded within this variant. The relatively `bare', silty rock supports low numbers of a relatively few species. Although `barren' rock grazed by the sea urchin *Echinus esculentus* is found in other sea loch biotopes (see FaAlCr.Pom and FaAlCr.Car), *E.esculentus* is virtually absent within NeoPro.VS.

Situation

Due to the variable/reduced salinity conditions present where this biotope is found, you tend to find reduced salinity kelp biotopes above NeoPro.RS, such as LsacRS.Psa and LsacRS.Phy. The very sheltered conditions give rise to muddy sediment slopes/plains beneath NeoPro (SS.SMu.CMu) where species such as the seapen *Funiculina quadrangularis*, the anemone *Cerianthus lloydii* and the Norway lobster *Nephrops norvegicus* are typically abundant.

Temporal variation

Not known

Similar biotopes

CR.LCR.BrAs.NeoPro.FS	This sub-biotope is found under similar physical conditions as NeoPro.RS, but is only in the fully marine, sheltered basins of fjordic sealochs. The ascidian *Dendrodoa grossularia* is absent in this sub-biotope, but is commonly recorded in NeoPro.RS. However, the anemone *Protanthea simplex* is recorded in higher abundances in NeoPro.FS.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution*

			to similarity
Bougainvillia ramosa	●●●	Occasional	2
Lafoea dumosa	●●	Occasional	2
Sarcodictyon roseum	●●●	Occasional	2
Protanthea simplex	●●●	Occasional	3
Caryophyllia smithii	●●	Occasional	1
Sabella pavonina	●●●	Occasional	3
Pomatoceros triqueter	●●●	Frequent	4
Protula tubularia	●●	Occasional	1
Pagurus bernhardus	●●●	Occasional	2
Hyas araneus	●●	Rare	1
Buccinum undatum	●●●	Rare	3
Neocrania anomala	●●●●	Frequent	10
Terebratulina retusa	●●●	Occasional	2
Crossaster papposus	●●●	Occasional	2
Henricia oculata	●●	Rare	1
Asterias rubens	●●●	Occasional	1
Psammechinus miliaris	●●	Occasional	1
Psolus phantapus	●●●	Occasional	2
Ciona intestinalis	●●●●	Occasional	6
Corella parallelogramma	●●●●	Occasional	6
Ascidiella scabra	●●●	Occasional	3
Ascidia mentula	●●●	Occasional	3
Ascidia virginea	●●●	Frequent	5
Polycarpa pomaria	●●●	Frequent	2
Dendrodoa grossularia	●●●	Common	14
Corallinaceae	●●	Frequent	2

CR.FCR Features on circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed, Sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m, 30-50 m
Other features:	Caves, overhanging rock

Biotope description

Circalittoral rock features include circalittoral fouling communities and circalittoral caves and overhangs. These features are present throughout the circalittoral zone in a variety of wave exposures and tidal streams.

CR.FCR.Cv Caves and overhangs (deep)

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed, Sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock
Zone:	Circalittoral
Depth band:	10-20 m, 20-30 m, 30-50 m
Other features:	Caves, overhanging rock

Biotope description

Caves and overhanging rock in the circalittoral zone, away from significant influence of strong wave action (compare IR.FIR.SG). This habitat may be colonised by a wide variety of species, with sponges such as *Dercitus bucklandi*, anemones *Parazoanthus* spp. and the cup corals *Caryophyllia inornatus*, *Hoplangia durotrix* and others particularly characteristic.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Porifera indet crusts	●●●	Occasional	-
Alcyonium glomeratum	●●●	Rare	-
Corynactis viridis	●●●	Frequent	-
Caryophyllia smithii	●●●●	Common	-
Hoplangia durotrix	●●	Rare	-
Balanophyllia regia	●●	Common	-
Leptopsammia pruvoti	●●	Common	-
Crisiidae	●●●	Common	-
Bryozoa indet crusts	●●●	Frequent	-
Clavelina lepadiformis	●●●	Occasional	-

CR.FCR.Cv.SpCup Sponges, cup corals and anthozoans on shaded or overhanging circalittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Weak, Very weak
Substratum:	Bedrock
Zone:	Circalittoral
Other features:	Overhangs; caves

Previous code

CR.MCR.SCupPar	96.7

Biotope description

This biotope occurs on shaded and overhanging rock, such as on cave walls and ceilings although there are very few records of caves in conditions not subject to wave surge (i.e. deeper circalittoral habitats) and almost all are different in species composition. There are also a few examples of similar communities on very deep (70-100 m+) upward facing rock (in Loch Hourn) and more may be found though the use of ROVs. These often species-rich habitats are almost invariably adjacent to well-mixed turbulent water. Characteristic species include the sponges *Stryphnus ponderosus*, *Dercitus bucklandi*, *Chelonaplysilla noevus*, *Pseudosuberites* sp. and *Spongosorites* sp., the anemones *Parazoanthus* spp., the cup corals *Leptopsammia pruvoti*, *Hoplangia durotrix*, *Caryophyllia inornatus* and the soft coral *Parerythropodium coralloides*. *Thymosia guernei* is sometimes present. This biotope is likely to need further splitting with further data and analysis.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Clathrina coriacea	●●●	Common	-
Dercitus bucklandi	●●	Common	-
Stelletta grubii	●●●	Common	-
Stryphnus ponderosus	●	Occasional	-
Thymosia guernei	●	Occasional	-
Spongosorites	●	Occasional	-
Parerythropodium coralloides	●●●	Abundant	-
Parazoanthus axinellae	●●	Occasional	-
Parazoanthus anguicomus	●●	Occasional	-
Caryophyllia smithii	●●●	Occasional	-
Hoplangia durotrix	●●	Occasional	-
Leptopsammia pruvoti	●●	Occasional	-
Parablennius gattorugine	●●	Occasional	-
Thorogobius ephippiatus	●●●	Occasional	-

CR.FCR.FouFa Fouling faunal communities

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Extremely sheltered, Ultra sheltered
Tidal streams:	Moderately strong
Substratum:	Artifical
Zone:	Circalittoral - lower
Depth band:	5-10 m, 10-20 m, 20-30 m

Biotope description

This biotope complex contains two biotopes which, although have different physical habitat characteristics, share the fact that they colonise 'new' areas of artificial substrata relatively quickly. The *Ascidiella aspersa* 'fouling' biotope (Aasp) is found on wave-sheltered artificial substratum such as discarded fishing nets/mooring lines subject to moderately strong to weak tidal streams. A separate 'fouling' biotope (AdigMsen) was identified on moderately wave-exposed wrecks, subject to moderately strong to weak tidal streams. This biotope has a characteristic faunal community of *Alcyonium digitatum* and the anemone *Metridium senile*. Other species recorded in this complex (primarily under the AdigMsen biotope) include the hydroid *Nemertesia antennina*, the anemones *Actinothoe sphyrodeta* and *Sagartia elegans*, the cup coral *Caryophyllia smithii*, the bryozoans *Flustra foliacea* and *Bugula plumosa*, the crabs *Necora puber*, *Cancer pagurus* and *Maja squinado* and the lobster *Homarus gammarus*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Nemertesia antennina	••	Occasional	2
Alcyonium digitatum	••••	Occasional	15
Metridium senile	••••	Frequent	23
Sagartia elegans	••	Frequent	1
Actinothoe sphyrodeta	•••	Occasional	5
Caryophyllia smithii	••	Occasional	1
Homarus gammarus	••	Rare	1
Maja squinado	••	Occasional	5
Cancer pagurus	•••	Rare	7
Necora puber	••••	Rare	12
Flustra foliacea	••	Occasional	2
Bugula plumosa	•	Occasional	2
Ascidiella aspersa	••	Frequent	8

CR.FCR.FouFa.AdigMsen *Alcyonium digitatum* and *Metridium senile* on moderately wave-exposed circalittoral steel wrecks

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Artificial; wrecks
Zone:	Circalittoral - lower
Depth band:	10-20 m, 20-30 m

Biotope description

This biotope is found on moderately wave-exposed circalittoral steel wrecks that are subject to moderately strong to weak tidal streams. The vertical and upward facing sides of the wreck stand proud of the seabed, and may be colonised by dense aggregations of *Alcyonium digitatum*, *Metridium senile* and *Actinothoe sphyrodeta*. *Caryophyllia smithii* and *Corynactis viridis* are also recorded with varying abundance. A mixed faunal turf may also be present on the vertical sides, with *Nemertesia antennina*, *Flustra foliacea* and *Bugula plumosa*. Where tidal stream strength is elevated, for example if the wreck is situated in a straight or sound, the hydroid *Tubularia indivisa* may prevail. Crustaceans such as the crabs *Necora puber*, *Maja squinado* and *Cancer pagurus*, the lobster *Homarus gammarus* and barnacles are all recorded. The top shell *Calliostoma zizyphinum* is also recorded.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
HYDROZOA	••	Frequent	4
Tubularia indivisa	•	Common	2
Nemertesia antennina	••	Occasional	2
Alcyonium digitatum	•••••	Occasional	24
Metridium senile	••••	Common	16
Actinothoe sphyrodeta	••••	Occasional	8
Corynactis viridis	••	Occasional	1
Caryophyllia smithii	••	Occasional	2
CIRRIPEDIA	••	Frequent	3
Homarus gammarus	••	Rare	2
Maja squinado	•••	Occasional	8
Cancer pagurus	••••	Rare	7
Necora puber	••••	Present	10
Calliostoma zizyphinum	••	Occasional	1
Flustra foliacea	••	Occasional	3
Bugula plumosa	•	Frequent	1

CR.FCR.FouFa.Aasp *Ascidiella aspersa* fouling community on circalittoral artificial substrata

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered, Ultra sheltered
Tidal streams:	Moderately strong, Very weak
Substratum:	Artificial; other
Zone:	Circalittoral
Depth band:	5-10 m, 10-20 m, 20-30 m

Biotope description

Sheltered artificial substrata (typically discarded fishing nets or scrap metal on muddy sediment plains), sometimes subject to variable salinity, frequently with high numbers of the ascidian *Ascidiella aspersa* which is capable of rapidly colonising hard substrata. Other species that are quickly able to take advantage of such substrata include the dahlia anemone *Urticina felina* and the plumose anemone *Metridium senile*. Species such as edible crab *Cancer pagurus*, velvet swimming crab *Necora puber* and shore crab *Carcinus maenas* may occasionally be found hiding under the discarded nets/lobster pots/anchor chains.

Situation

As a fouling community, this biotope may be found throughout the circalittoral zone in coastal waters. It may be more prevalent around harbours/moorings/fishing grounds where suitable substratum is available. In situations where wave exposure or tidal stream increases, biotopes dominated by bryozoans and/or robust hydroids (CR.MCR.EcCr) may arise.

Temporal variation

A gradual development of more long-lived species is expected, where the artificial substrata are of a more permanent nature (eg wooden, concrete pier pilings).

Similar biotopes

SS.SBR.Oy	Can have similar epifaunal communities.
SS.SMx.CMx.CreAph	Can have similar epifaunal communities.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Urticina felina	●●●	Rare	2
Metridium senile	●●●●	Occasional	19
Cancer pagurus	●●●	Rare	2
Necora puber	●●●	Occasional	6
Carcinus maenas	●●●	Occasional	3
Ascidiella aspersa	●●●●●	Frequent	58

Circalittoral Rock: Hierarchy Structure Diagram

Circalittoral rock CR

High energy circalittoral rock HCR	Moderate energy circalittoral rock MCR	Low energy circalittoral rock LCR	Features of circalittoral rock FCR

Very tide-swept faunal communities FaT	Deep sponge communities (circalittoral) DpSp	Mixed faunal turf communities XFa	Echinoderms and crustose communities EcCr	Circalittoral *Sabellaria* reefs (on rock) CSab	Soft rock communities SfR	Circalittoral mussel beds (on rock) CMus	Circalittoral faunal communities in variable salinity CFaVS	Brachiopod and ascidian communities BrAs	Circalittoral caves and overhangs Cv	Circalittoral fouling faunal communities FouFa

BalTub	PhaAxi	ByErSp	CarSwi	Sspi	Pid	CMyt	CuSpH	AmenCio	SpCup	AdigMsen
CTub		ByErSp.Eun	CarSwi.Aglo	Sspi.ByB	**Pol**	**Mdis**	CuSpH.As	AmenCio.Ant		**Aasp**
CTub.CuSp		ByErSp.DysAct	CarSwi.LgAs	Sspi.As	**Hia**		CuSpH.VS	AmenCio.Bri		
CTub.Adig		ByErSp.Sag	**CarSp**				**HbowEud**	**LgAsSp**		
		CvirCri	CarSp.Bri					**AntAsH**		
		SwiLgAs	CarSp.PenPcom					**NeoPro**		
		FluCoAs	**UrtScr**					NeoPro.FS		
		FluCoAs.Paur	**FaAlCr**					NeoPro.VS		
		FluCoAs.SmAs	FaAlCr.Flu							
		FluCoAs.X	FaAlCr.Adig							
		SpNemAdia	FaAlCr.Sec							
		SubCriTf	FaAlCr.Bri							
		FluHocu	FaAlCr.Pom							
		MoI	FaAlCr.Car							
		SpAnVt	**AdigVt**							

Circalittoral rock
CR

High energy circalittoral rock
HCR

- Very tide-swept faunal communities — FaT
- Deep sponge communities (circalittoral) — DpSp
- Mixed faunal turf communities — XFa

Moderate energy circalittoral rock
MCR

- Echinoderms and crustose communities — EcCr
- Circalittoral *Sabellaria* reefs (on rock) — CSab
- Soft rock communities — SfR
- Circalittoral mussel beds (on rock) — CMus
- Circalittoral faunal communities in variable salinity — CFaVS

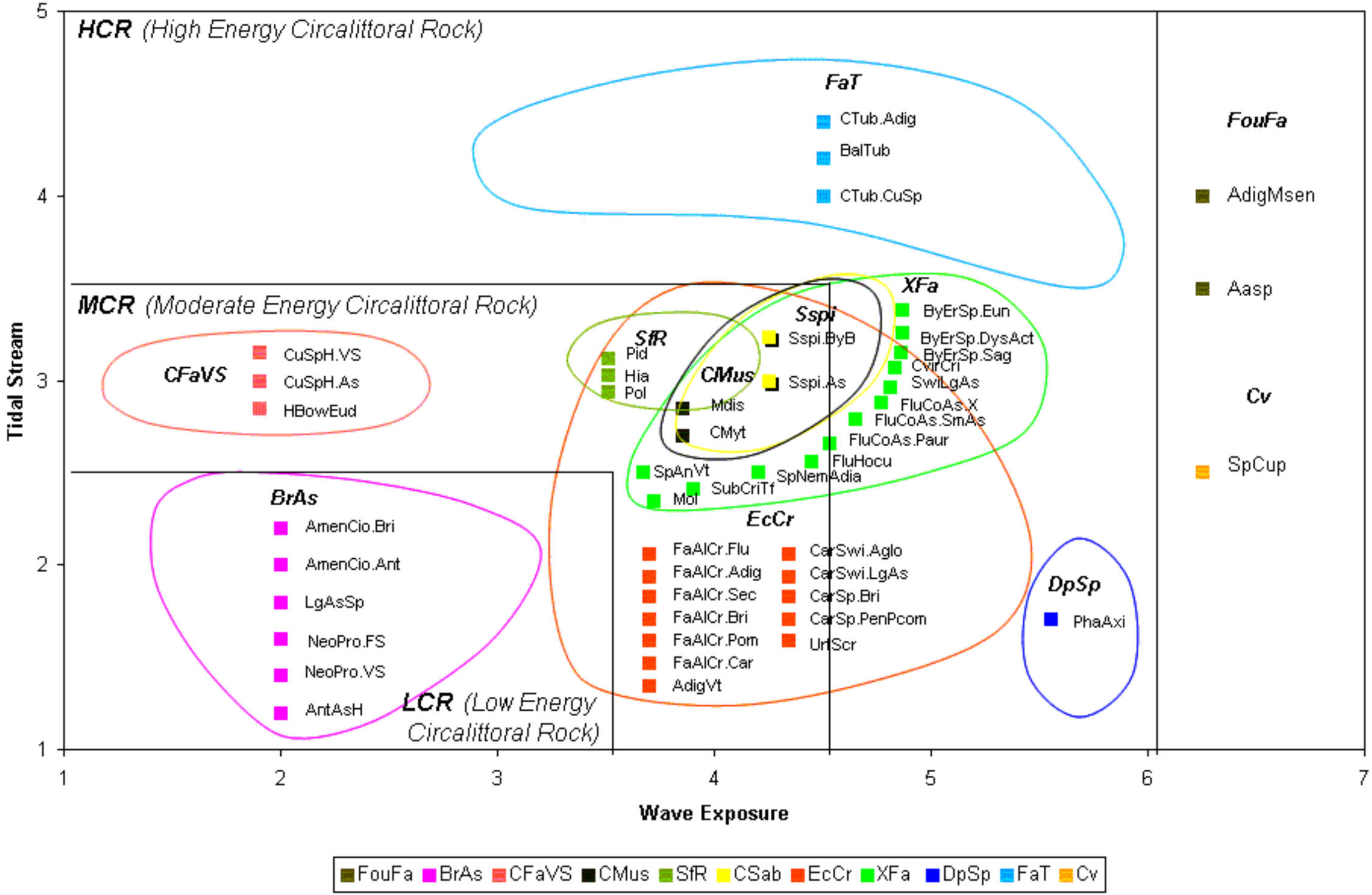
Low energy circalittoral rock
LCR

- Brachiopod and ascidian communities — BrAs

Features of circalittoral rock
FCR

- Circalittoral caves and overhangs — Cv
- Circalittoral fouling faunal communities — FouFa

BalTub	PhaAxi	ByErSp	CarSwi	Sspi	Pid	CMyt	CuSpH	AmenCio	SpCup	AdigMsen
CTub		ByErSp.Eun	CarSwi.Aglo	Sspi.ByB	**Pol**	**Mdis**	CuSpH.As	AmenCio.Ant		**Aasp**
CTub.CuSp		ByErSp.DysAct	CarSwi.LgAs	Sspi.As	**Hia**		CuSpH.VS	AmenCio.Bri		
CTub.Adig		ByErSp.Sag	**CarSp**				**HbowEud**	**LgAsSp**		
		CvirCri	CarSp.Bri					**AntAsH**		
		SwiLgAs	CarSp.PenPcom					**NeoPro**		
		FluCoAs	**UrtScr**					NeoPro.FS		
		FluCoAs.Paur	**FaAlCr**					NeoPro.VS		
		FluCoAs.SmAs	FaAlCr.Flu							
		FluCoAs.X	FaAlCr.Adig							
		SpNemAdia	FaAlCr.Sec							
		SubCriTf	FaAlCr.Bri							
		FluHocu	FaAlCr.Pom							
		Mol	FaAlCr.Car							
		SpAnVt	**AdigVt**							


HCR (High Energy Circalittoral Rock)
MCR (Moderate Energy Circalittoral Rock)
LCR (Low Energy Circalittoral Rock)
FaT
CTub.Adig
BalTub
CTub.CuSp
FouFa
AdigMsen
Aasp
Cv
SpCup
CFaVS
CuSpH.VS
CuSpH.As
HBowEud
SfR
Pid
Hia
Pol
CMus
Mdis
CMyt
Sspi
Sspi.ByB
Sspi.As
XFa
ByErSp.Eun
ByErSp.DysAct
ByErSp.Sag
CvirCri
SwiLgAs
FluCoAs.X
FluCoAs.SmAs
FluCoAs.Paur
FluHocu
SpAnVt
SpNemAdia
SubCriTf
Mol
EcCr
FaAlCr.Flu
FaAlCr.Adig
FaAlCr.Sec
FaAlCr.Bri
FaAlCr.Pom
FaAlCr.Car
AdigVt
CarSwi.Aglo
CarSwi.LgAs
CarSp.Bri
CarSp.PenPcom
UrtScr
DpSp
PhaAxi
BrAs
AmenCio.Bri
AmenCio.Ant
LgAsSp
NeoPro.FS
NeoPro.VS
AntAsH
Tidal Stream
Wave Exposure
1
2
3
4
5
6
7
FouFa BrAs CFaVS CMus SfR CSab EcCr XFa DpSp FaT Cv

The Marine Habitat Classification for Britain and Ireland. Version 04.05

Guidance Notes on the Comparative Tables

This document is an extract from:

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1. Contents

2. Introduction to the comparative tables

The comparative tables enable a rapid comparison of the species composition and the principal physical characteristics between user-defined sets of biotopes (and other classification units). They are equivalent to the biological and physical comparative tables that were included in the back of the biotope manuals in version 97.06 of the classification (Connor *et al*., 1997 a, b).

For version 04.05 of the classification, the comparative tables are provided in the form of two downloadable Excel™ documents. One contains physical data, and the other contains biological (species) data. The information in these tables is based solely on data from the core biotope records, i.e. those field records from the JNCC marine database on which the biotope descriptions are based. The introductory text on the classification website contains a section on data analysis, which describes how these core biotope records were determined.

The tables allow a great deal of flexibility in the way they are used. Their layout and formatting styles were chosen to make them easy and intuitive to use. Nevertheless, the large amount of data they contain, and the large range of filtering options, may lead to confusion. Therefore these guidance notes have been provided. They describe the layout and the filtering options of the tables, as well as details on the derivation of the data.

In order to use the comparative tables effectively, familiarity with the biotope codes and the hierarchical structure of the classification is required. It may help to print out the hierarchy structure diagrams for the five broad habitats, available to view or download from the classification website, and use them as a cross-reference.

Note that the comparative tables contain information for units at all levels in the classification hierarchy, i.e. from broad habitats through to sub-biotopes. For brevity, the term “biotope” is used to refer to all classification units throughout the guidance notes.

3. Biological comparative tables

3.1 Structure of the spreadsheet

The biological comparative tables contain seven worksheets. The two main ones are the "Comparative Table" worksheet, which contains a pivot table enabling a comparative overview over which species are frequently recorded in biotopes, and the "Extended Species Table", which contains additional information, such as the average abundance at which species are recorded within biotopes. The layout of these two worksheets is described in detail below.

The main pivot table (in the "Comparative Table" worksheet) has to process a large amount of species data. Depending on the filtering options chosen, and on the power of the computer being used, it may take a long time for some sets of biotopes to display. In order to enable users with slower processors to make full use of the tables, five additional worksheets were created, each containing information for a single broad habitat. These tables will display instantly. They have a similar layout to the "Comparative Table" worksheet, but without the filtering options. They do not contain any additional information over the main worksheets.

3.2 The Comparative Table worksheet

Each column in the main part of the pivot table represents a biotope, indicated by the biotope code in the column header. The rows contain information on species, with species names listed in taxonomic order down the left. The figures given in each cell represent the percentage of core biotope records within which a given species is recorded. To avoid the size of the table becoming unmanageable, species recorded in less than 20% of core records of a biotope are not shown. The biotopes which are displayed at any one time is user-defined, with a number of options available for filtering the data.

The last row and last column contain the sums of all the figures in the columns / rows, and should be ignored. They are part of the standard set-up of an Excel™ pivot table, but in this instance the figures they contain are meaningless.

The following filtering options are available:

Broad Habitat: (top left corner of worksheet): The drop-down arrow enables the selection of biotopes from within a single broad habitat.

EUNIS Level: (top left corner of worksheet): The drop-down arrow enables the selection of units from within a single hierarchical classification level (from broad habitat to sub-biotope). On the pivot table, the column headings containing biotope codes are coloured according to the standard classification colour scheme, which is used for the classification hierarchy throughout the website. The column headers are colour-coded irrespective of whether the "EUNIS Level" filter is in use or not.

Species Name: Clicking on the drop-down arrow opens up a ticklist, which enables the user to choose a single species or a defined subset of species for which information is to be displayed. The "(Show all)" option at the top of the list will re-display the entire list. Remember that whatever is clicked on or off in this filter, species are only ever shown if they occur in at least 20% of the core biotope records of at least one of the biotopes currently displayed on the table.

Biotope Code: As for the Species Name, clicking on the drop-down arrow opens up a ticklist, enabling the display of any combination of biotopes required.

There is an additional filtering button on the table, which is greyed out. This contains the hierarchical sort order of the biotopes, and has been included in the pivot table to ensure that the columns always appear in the correct classification sort order. The row containing the sort order has been hidden. There is also a hidden column, containing the taxonomic sort order for the species in the form of the alpha-numeric species codes taken from Howson & Picton (1997). Including this in the pivot table ensures that the species will always display in their correct taxonomic order.

If you wish to filter on one of the above options only, it is advisable to double-check all the other filters to make sure that the "show all" option is selected, to avoid inadvertently filtering data you want to include in the table.

Note that Excel™ worksheets are limited to a maximum of 256 columns. The number of biotopes in the classification exceeds this number, so please be aware that if none of the data filters are in use, only part of the classification will be displayed on the table. It is possible, however, to display all units for each broad habitat individually on a single sheet.

3.3 The Extended Species Table worksheet

This worksheet provides additional species data for each biotope, including the total number of core biotope samples, characterising species, average infaunal counts for infaunal species, and SACFOR abundances for all species.

The biotopes are displayed in rows rather than columns, which means that the limit of 256 does not apply, and all data can be displayed at the same time. There is a single row for each species in each biotope – i.e. if there are 10 species within the core records for a biotope, there will be 10 rows with that biotope code (note that the 20% percentage cut-off still applies).

The information displayed in the columns is as follows, with the option to filter on any of them:

Biotope Code: Contains biotope codes, with the filtering option of displaying a single biotope at a time.

Biotope Sort Order: Allows biotopes to be displayed in the correct classification order.

EUNIS Level: Shows the EUNIS level for each classification unit. It is colour-coded in the standard colour scheme used throughout the classification website. Using the filter, it is possible to display units from a single level in the classification hierarchy.

Number of Core Biotope Records: This shows the number of core biotope records for each biotope. It is important to be aware of the number of records on which the information in the tables is based. There are some biotopes for which there are not a lot of records on the JNCC marine database, and which therefore have only a limited number of core records. When the information in the comparative tables is based on only a handful of core records, it needs to be treated with the appropriate level of caution.

Species Name: Lists the species which are recorded in 20% or more of the core biotope records. The filter allows information to be displayed for a single species at a time.

Taxonomic Sort Order: Contains the alpha-numeric taxon codes from Howson & Picton (1997), allowing the species to be displayed in correct taxonomic order.

Percentage Ocurrence: This column contains the same values as the "Comparative Table" worksheet, i.e. the percentage of core biotope samples within which each species is recorded.

Infaunal Density: Some biotopes have core records containing quantitative infaunal sample data. This column shows the average number per m^2 for species recorded in quantitative infaunal samples.

SACFOR: Shows the average frequency of each species on the MNCR SACFOR scale, based on SACFOR data in the core biotope records. Details on the SACFOR scale are included in the introductory text for the classification, available to view or download from the classification website.

Percentage Occurrence Score: This column is intended to provide a rapid visual assessment of the percentage occurrence of species within core biotope records. It is based on the information in the Percentage Occurrence column, with categories broken down as follows:

20-40% ●●
40-60% ●●●
60-80% ●●●●
80-100% ●●●●●

Broad Habitat: Contains the broad habitat code for each biotope, enabling the selection of data from within a single broad habitat through use of the filter.

If you wish to filter on one of the above options only, it is advisable to double-check all the other filters to make sure that the "show all" option is selected. This will avoid inadvertently filtering out data you want to include.

3.4 Biotopes which do not appear in the biological tables

Every species which appears in 20% or more of the core records of a biotope is displayed in the comparative tables, but any species which occurs in fewer than 20% of the core records is not shown. This cut-off percentage was used to keep the tables within manageable size limits.

There are a limited number of biotopes for which no species at all are recorded in 20% of the core biotope records. These biotopes were not picked up in the generation of the tables. This has happened where biotopes are extremely species-poor, or they have no core biotope records. The species-poor biotopes have core records containing physical information, which means that these biotopes are featured in the physical tables even though they do not appear in the biological tables. Biotopes with no core records, on the other hand, were included in the classification based on information from sources other than the JNCC marine database. For these biotopes, there is no information in the physical or biological comparative tables.

Biotopes with no core records (appear neither in the biological nor physical comparative tables):

LR.FLR.Rkp.H
LR.FLR.CvOv.ChrHap
LS.LBR.LMus.Myt.Sa
LS.LBR.LMus.Myt.Mu
SS.SCS.OCS
SS.SCS.OCS.GlapThyAmy
SS.SCS.OCS.HeloPkef
SS.SSa.CFiSa.EpusOborApri
SS.SSa.CFiSa.ApriBatPo
SS.SSa.OSa.MalEdef
SS.SSa.OSa.OfusAfil
SS.SMu.ISaMu.AmpPlon
SS.SMu.OMu.AfalPova
SS.SMu.OMu.ForThy
SS.SMu.OMu.CapThy
SS.SMu.OMu.CapThy.Odub
SS.SMu.OMu.LevHet
SS.SMu.OMu.PjefThyAfil
SS.SMu.OMu.MyrPo
SS.SBR.Crl
SS.SBR.Crl.Lop

Species-poor biotopes (appear in the physical, but not in the biological comparative tables):

LR.FLR.CvOv.BarCv
LS.LCS
LS.LCS.Sh
LS.LCS.Sh.BarSh

4. Physical comparative tables

4.1 The "All Biotopes" worksheet

The "All Biotopes" worksheet shows a summary of the physical data contained in the core records for each biotope. Biotopes are shown in rows, with the first four columns containing "header" information. The first column shows biotope codes, followed in subsequent columns by the EUNIS level (coloured using the standard classification colour scheme), the biotope sort order (allowing the rows to be displayed in the correct classification order), and the number of core records for each biotope.

The remaining columns, where cells have a white background, show summary physical information as indicated by the column headers in the top two rows. Physical factors are split into a number of categories. For example, "salinity" is split into "full", "variable" and "low". The categories are equivalent to the categories used in MNCR field recording, details of which are included in the introductory text which can be read on or downloaded from the classification website.

It is possible to filter the data on any of the columns, i.e. biotope code, EUNIS level, number of core samples, and physical categories (e.g. it is possible to select all samples that fall within a particular salinity category).

The figures in the table show the following:

Salinity *Wave Exposure* *Tidal Streams* *Height / Depth Band* *Biological Subzone* *(% Frequency)*	Each of these factors is split into a number of categories. For each biotope, the figures show the percentage of core biotope records falling into a given category for a given factor. Note that these categories are not recorded as percentage fractions, i.e. a single field record will not be recorded as 50% full salinity and 50% variable salinity. It either falls within the full and/or variable salinity category, or it doesn't. It is possible for a single sample to fall into more than one category for some of the factors. Conversely, some of the samples have no data recorded for some of the factors. This means that the figures will not always add up to 100%.
Mean Height / Depth Range	These two columns show the mean upper and lower height limit of biotopes (in metres above / below chart datum).
Substratum *Inclination* *Particle Size Analysis* *(Mean Percentages)*	Again, these physical factors are split into a number of categories. Unlike the factors above, however, the field records contain percentage figures for these factors. A single field record where a particle size analysis was carried out, for example, may contain 20% gravel, 50% sand and 30% mud. The figures in this table show the mean percentage value for each category.

4.2 Littoral sediment, Littoral Rock, Infralittoral Rock and Circalittoral rock worksheets

These worksheets display the same data as the "All Biotopes" sheet, but with the samples in columns and the physical data in rows. Because there are more than 256 biotopes, the information will not fit on a single worksheet, and has therefore been split into the five broad habitats.

The reason for displaying the data this way around is to allow easy cross-referencing between biological and physical sets of comparative tables. By hiding unwanted columns in these worksheets, it is possible to display any combination of physical biotope profiles adjacent to each other (provided they are from within the same broad habitat).

4.3 Biotopes which do not appear in the physical comparative tables

There are a limited number of biotopes that have no core biotope records. These are listed in section 3.4. They were included in the classification based on information from sources other than the JNCC marine database. For these biotopes, there is no information in the physical (or biological) comparative tables. In the physical tables, the codes have been included, highlighted in red.

References

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Howson, C.M. and Picton, B. E. (1997). *The Species Directory of the Marine Fauna and Flora of the British Isles and Surrounding Seas.* Ulster Museum and The Marine Conservation Society, Belfast and Ross-on-Wye.