Guidelines for the selection of biological SSSI’s
Part 2: Detailed guidelines for habitats and species groups

1a COASTLANDS

To view other chapters of the guidelines visit: http://jncc.defra.gov.uk/page-2303
1 COASTLANDS

1 Introduction

1.1 Coastal habitats are classified into four main types - saltmarshes, sand-dunes, shingle beaches, and seacliffs and slopes. The first three types exhibit successional sequences and can occur in various combinations, showing transitions to each other and to non-maritime habitats. Seacliffs have transitional rather than successional characteristics. Brackish habitats are highly localised, and the most notable are coastal lagoons and grazing marshes, discussed also under Freshwater habitats (C.6, 4 and 5). Variability not only within the main habitats but also in these combinatory, sequential and transitional features should be adequately represented in the SSSI series. A general description of the whole coastline of England and Wales and of Scotland can be found in Steers (1964) and Steers (1973) respectively.

1.2 Saltmarshes, sand-dunes and vegetated shingle beaches are highly localised habitats. The first two cover an estimated 40,000 ha and 56,000 ha respectively (0.46% of Britain). The intertidal flats of marine sediment cover a larger area which is in excess of 225,000 ha, but they are not usually reckoned within the land surface area of Britain: their nature conservation importance is mainly as the feeding habitat of shorebirds and wildfowl (see C.14). Shingle beaches extend around an estimated third of the British coast; the vegetated examples are of particular biological interest, though these cover only a small part (some 4,000 ha) of the total area. Seacliffs and steep slopes occupy a substantial part of the coastline, but mainly in a nearly vertical dimension; their map area is often tiny in the many places where enclosed farmland extends virtually to the cliff edge. However, important transitions to inland habitat types may occur on cliff tops where open-range grazing is still the predominant land-use.

1.3 This localisation of the first three habitats has been greatly magnified by reclamation and other damaging land-use conversion, so that size becomes an important element in site selection. However, although large sites are more likely to contain the full range of plant and animal communities, there are other important attributes which must also be considered. Selection using area as a major attribute is not appropriate for cliff coasts.

1.4 Representation of plant communities (based upon National Vegetation Classification communities where the classification is available) within each of the four main coastal habitats should form the basis for choosing sites within each AOS. It is necessary to structure this selection, because of the successional and transitional nature of the main coastal habitats. A revised list of habitat selection units is therefore given in Table 1. These are described in terms of the NVC communities (Rodwell 1982, 1983, 1985, 1988), which are detailed in Table 2. In practice, although selection of an SSSI could be made on the quality of one of these zones alone, combinations of plant communities
will normally be assessed. The most important sites are therefore those with
some or all of the following attributes:

1.4.1 the widest range and the best examples of the main NVC
communities and of other coastal vegetation types not described in
the NVC;

1.4.2 a complete succession or zonation, including pioneer and mature
communities;

1.4.3 transitions to other, terrestrial vegetation types;

1.4.4 a large area or lateral extent (in continuous or discrete units
depending on the degree of natural or man-made interruptions);

1.4.5 important physiographic features.

1.5 The relative importance of each of these elements to the selection of SSSIs is
different for each of the main coastal formations. Some general guidance for
each is given in 3-10 below.

2 International importance

2.1 Britain has a long and varied coastline in relation to its land area, with an
approximate length of 19,000 km. There are a full range of aspects and
exposures and a wide variety of landforms and substrates spread over a
latitudinal range of over 1,000 km. All the major types of coastal habitat are
well represented, and many sections of coast are little affected by
development. The bird populations of coastal habitats have considerable
international importance, but this is considered separately in C.14. The
present assessment is based on botanical features, and particularly on
costal processes involving plant succession.

2.2 Vegetated shingle beaches are localised, but the three largest examples
(Dungeness, Chesil Beach and Orfordness) are among the most important in
the whole of Europe. Dungeness has a number of associated habitats in
addition to a particularly extensive system of shingle ridges. The British coast
displays a wide range of sand-dunes and estuarine flats and saltmarshes, with
plant communities showing a strongly Atlantic influence. Seacliffs and rocky
shores are also notable features of the British coast; they are associated with
maritime cliff slope and summit heaths of a kind now increasingly rare in
mainland Europe and carry an Atlantic flora on the steep rocky scarps,
including an important lichen element.

2.3 Many of the coastal sites of outstanding international importance are identified
in A Nature Conservation Review. It is difficult to give guidance on
assessment of the rest, in the absence of explicit international opinion on their
value, but discussion with coast/and specialists on this matter should take
account of the particularly Atlantic features of British coastal habitats which
represent extremes in a range of continental variation.
3 Saltmarshes

3.1 Saltmarsh vegetation varies according to factors such as tidal range, relationship to freshwater drainage, particle size of sediments and geographical/climatic position (Adam 1978). Within a saltmarsh ecosystem, different plant communities (Rodwell 1983: see Table 2a) are usually present in a successional relationship. Successions containing notable communities are characteristic of particular geographical areas, so these vegetation complexes make appropriate broad units of selection. The tendency to fine, muddy substrata in southern and eastern England and to coarser, sandy sediments in northern and western Britain appears to be specially important. In conjunction with this, a slow tilting of the land about a south-west/north-east axis is occurring, so that marshes in the south-east are tending to sink in relation to sea level while those in the north-west are rising. Drainage creeks and systems of deepened residual depressions (saltpans) are characteristic physical features of saltmarshes.

3.2 In most areas where they are extensive, saltmarshes have been widely reclaimed for agriculture by means of sea-walls. The reclaimed land has typically become 'fresh' grazing marsh, mainly of neutral grassland, and cut-off creeks have persisted as watery channels or 'fleets', sometimes with remaining brackish influence. These grazing marsh systems often have their own nature conservation value, especially as bird habitats, but they have increasingly been converted to arable use and lost most of their wildlife interest. Many saltmarshes are grazed, and this can modify their botanical composition. Marshes in the south and east tend to have the highest proportion of pioneer and early building stages. The richest flora is often associated with saltmarshes that include transitions to dune. The higher and drier types tend to have the largest breeding bird populations in the absence of heavy grazing by domestic stock.

3.3 Saltmarshes form an important component of many large estuarine systems which are the wintering and migration haunts of internationally important populations of ducks, geese and waders. They are, accordingly, also assessed on ornithological criteria (see C.14), and these may constitute an overriding factor in including large apparently botanically poor saltmarshes within some estuarine sites. Saltmarsh precursors (Zostera and Ruppia) may also form important elements in the succession and provide food for herbivores, notably wigeon.

3.4 Combinations of saltmarsh and sand-dune (also with shingle in certain places) are especially interesting for the study of coastal processes. Association with brackish habitats, in transitional marshes, creeks or coastal lagoons, is a localised and important feature. Natural transitions to non-agricultural habitats, particularly woodland, as the end-point to succession are rare, and even small examples are important. (See NCR, Vol. 1, pp. 26-28.)

3.5 Selection requirements
There are particular geographical relationships within the saltmarsh habitat which can be used as a guide to selecting the best sites within an AOS. These are outlined below, but for a further account see Adam (1978). For each geographical grouping, guidance on the minimum area above which sites should be selected is given. Smaller sites can be selected where they are species-rich or have a better representation of NVC communities.

3.6 South-east and east England

Saltmarshes fall into three basic kinds within this area:

3.6.1 Grazed and formerly grazed saltmarshes with Puccinellia/Aster in often extensive pioneer and mid-marsh zones (mainly in the Wash and Essex and Kent) where reclamation has destroyed most of the upper marsh and transitional communities (especially NVC communities SM11 and 12): all areas above 150 ha are eligible for selection.

3.6.2 Ungrazed or lightly grazed saltmarshes, typically with Halimione as dominant and Inula crithmoides prominent in the upper marsh (especially SM14 and 26): all areas above 150 ha are eligible.

3.6.3 Ungrazed high-level saltmarshes with Limonium: these may have rich transitions to dune, including Mediterranean elements, and are found mainly in north Norfolk (especially SM13, 21 and 25): all areas above 50 ha are eligible.

3.6.4 Saltmarshes with Spartina maritima as a pioneer also occur (SM4). This is an extremely rare vegetation type and all examples should be selected.

3.7 South and south-west England

3.7.1 This area is characterised by the presence of large expanses of Spartina anglica marsh which have developed in the major estuaries and embayments. There are no reasons for selecting this type of marsh on botanical grounds, though it often forms an integral part of an estuarine system selected for its ornithological interest. Examples of S. alterniflora and S. maritima marsh are, however, particularly important (SM4 and 5) and all such areas should be selected.

3.7.2 Other types of saltmarsh are very restricted, being limited to a narrow fringe above the Spartina marsh or present in small estuaries and rias. All areas above 50 ha should be selected.

3.8 Wales

Saltmarsh within this geographical area falls into four main types:
3.8.1 Large areas of grazed marsh with extensive communities dominated by a few species, especially Puccinellia maritima; the upper marsh often includes Juncus maritimus (especially SM13 and 18). Examples will normally fall within sites selected primarily for their ornithological interest, though the upper marsh may include species such as Althaea officinalis.

3.8.2 Spartina marshes, mainly with S. anglica dominant (SM6). This marsh type should not normally be included on botanical grounds in the site selection process.

3.8.3 Ungrazed saltmarshes with Limonium prominent; upper transition communities include Juncus maritimus/Oenanthe lachenalii marsh (especially SM13 and 18). All areas above 50 ha should be selected.

3.8.4 In a limited number of areas on lightly grazed or ungrazed sites sand-dune transitions similar to the those of the north Norfolk coast occur which may include Frankenia laevis and Limonium binervosum. All examples should be selected.

3.9 North-west England/south-west Scotland/Solway

3.9.1 Grazed and often extensive saltmarshes, dominated by Puccinellia maritima, Plantago maritima, Glaux maritima, Festuca rubra and Juncus gerardi. Most examples are species-poor (especially SM16), though some species-rich communities occur at higher levels in Morecambe Bay and the Solway where there are transitions to unenclosed grazing marsh. All areas above 100 ha are eligible for selection.

3.9.2 Saltmarshes with grazing-sensitive species such as Limonium vulgare and Halimione portulacoides at their northern limits (SM13): all areas should be selected.

3.10 Western Scotland

3.10.1 Loch-head marshes with Puccinellia - turf fucoid sub-community, usually grazed, with abundant Armeria, Plantago maritima and Glaux (SM13): all areas above 15 ha are eligible for selection.

3.10.2 Marshes with Juncus gerardi and transitions to mire habitats, often with abundant Blysmus rufus (SM16 and 19): all areas above 15 ha are eligible.

3.10.3 Marshes with transition to dune vegetation: the best example within each AOS should be selected.

3.11 Eastern Scotland
3.11.1 Beach-head marshes, usually small with a compressed transition to flushed grassland or fen (SM16 and 19): at least one example in each AOS should be selected.

3.11.2 Grazed and ungrazed marshes in estuaries, including Juncus gerardi and Festuca rubra upper marsh. Sites may include Juncus maritimus, and in one site (Findhorn) there are transitions to overgrown grassland with Ligusticum scoticum (SM18). All areas above 20 ha are eligible for selection.

3.11.3 Marshes on sandy substrates including Puccinellia pioneer stage. Sometimes extensive transitions to dune occur, with Juncus balticus and Astragalus danicus prominent, notably on Morrich More. All examples should be selected.

3.12 Ecotones

Other transitions from saltmarsh to different habitats (peatlands, woodlands etc.) additional to those already dealt with should be represented (see also C.7, 8.6). The best example of each combination in each AOS should be selected, with quality assessed mainly by the diversity of habitat types, overall extent, floristic richness and any special features.

3.13 Outliers

If other saltmarsh communities, besides those mentioned above, occur in any geographical region but are not included within sites chosen for the main types, the best example in each AOS should be selected. Every saltmarsh sub-community of the NVC present in an AOS should also be represented, preferably by the best example. Quality should be assessed by size and floristic richness. In practice such outliers will almost certainly occur in sites selected for other interests, notably estuarine birds.

3.14 Physiographic features

If important physiographic features, such as erosion/accretion sequences and pan formation, are not included by the above selection process, additional examples should be chosen, with quality assessed on the degree of development of the particular features.

4 Coastal grazing marsh

4.1 Land derived through the embankment of salt marsh but not 'improved' may support important populations of breeding or wintering birds. Some of the neutral grasslands which develop when the sea is thus excluded include plant species found predominantly on the coast, for example Carex divisa, Eleocharis uniglumis and Puccinellia rupestris. In south-eastern England these grasslands frequently include upper saltmarsh NVC communities that are rare or absent from the saltmarsh proper (especially SM16, 18, 20, 23 and 24). Grasslands on sea-walls and embankments may also support important
populations of coastal species including Parapholis incurva, Trifolium squamosum and Bupleurum tenuissimum.

4.2 The ditch systems of coastal grazing marshes may be rich floristically and for invertebrates, with brackish ditches supporting quite different species assemblages from freshwater ditches further inland. Lower saltmarsh NVC communities may be well represented locally (especially SM2, 10 and 13).

4.3 Guidelines are included in C.6, 5.2 for the selection of grazing marsh SSSIs on the basis of their ditch systems. However, in a few AOSs it may be that the best examples of particular saltmarsh NVC communities are on coastal grazing marshes, and such areas could be selected in addition to the saltmarsh lying outside the sea-wall.

5 Sand-dunes

5.1 Sand-dunes are important systems illustrating vegetational succession and coastal physiographic processes. Their seaward fringing sandhills often form in association with shingle and are relatively uniform floristically, with marram Ammophila arenaria as the most characteristic dominant and sand stabiliser. Stable dune areas are differentiated according to the chemical nature of the sand. Acidic, non-calcareous dunes have a relatively restricted flora and their stable areas tend to develop an acidophilous grassland or dwarf shrub heath (see C.4, 4.5). Calcareous dunes, especially those with much shell sand, are often floristically very rich, and stable areas carry a varied dune grassland with numerous dicotyledonous herbs, bryophytes, lichens and fungi. This botanical interest should be assessed in its own right. Dunes vary in the development of wet hollows or slacks, but some have important systems of marshy slacks or even permanent pools, with a contrasting flora to the dry ground and including an important bryophyte component.

5.2 Dune systems vary a good deal in structure, according to the way they develop, and show a particularly distinctive regional variant in the Hebridean machair. Under the extreme windiness of this north-western seaboard, sand (usually calcareous shell-sand) is blown far inland to form gently undulating deposits which become stabilised as herb-rich dune grassland in dry places and eutrophic marsh, sometimes with shallow tarns, in the wetter depressions. The machair is traditionally grazed, and many areas have undergone cycles of cultivation and abandonment. In other areas wind-blown sand may accumulate some distance inland over a rocky coastline. In these instances, especially in northern Scotland, important communities develop with species characteristic of Arctic-Alpine regions of Europe, notably species-rich sandy grasslands with Dryas octopetala and Oxytropis halleri.

5.3 Most other dune systems are formed by successional processes which produce the typically undulating dune landscapes found throughout Britain. The stable areas of these dune systems have often been reclaimed for agriculture, and many of the larger sites have been extensively afforested,
thereby truncating the succession. Sand-dunes are also often important recreational areas, with golf courses or general public access, and some are subject to erosion problems. Building has occurred on the hinterland of many dune systems, reducing their value accordingly.

5.4 Sand-dunes are also important breeding bird habitats, for terns, gulls and strand-line waders, and the damp machair is also distinguished by extremely dense populations of certain waders needing marshy ground, notably dunlin (see C.14, Appendix C). Invertebrates are an important wildlife element on many dune systems. (See NCR, Vol. 1, pp. 28-31.)

5.5 Selection requirements

As with salt marshes, sand-dunes need to be treated as whole ecosystems, with suites of plant communities in successional sequence characteristic of the particular region. Table 2b lists the NVC sand-dune plant communities and sub-communities (Rodwell 1985, 1988). These are less geographically diagnostic than the range of saltmarsh communities, though there are gradations between dunes with a representation of northern species and those with southern floral elements. Ecological variation, however, depends particularly on the lime content of the sand. The range of sand-dune features to be represented is as follows.

5.6 The seven main selection units given in Table 1 provide an initial classification of stages in the succession which could be represented on any one site. Because of the truncation of many dune systems, caused by afforestation and other developments, sites with a complete succession from accreting foredune to stable dunes with grassland, heath or native scrub are of prime importance. Transitions from calcareous dune grassland to dune heath which have developed on decalcified sand are particularly rare and should form an important element in selection. Although the original calcium carbonate content of the beach sand will determine whether dune heath or dune grassland develops, at least in the early stages of succession, there are other important botanical variations between dune systems which depend on location and structure.

5.6.1 Mobile foredune and yellow dune (NVC communities SD2-10)

Where these exist (and they are not universal, as many sites are showing erosion rather than accretion), communities are dominated by few species. Although the majority of sites have Ammophila arenaria as the main dominant, a few sites, notably in the north, have Leymus arenarius.

5.6.2 Calcareous dune (SD10)

There is a broad north/south split in these communities. Prominent in the southern dunes are species typical of inland calcareous grassland such as Ophrys apifera, Anacamptis pyramidalis and Blackstonea...
The more typical dune species are *Euphorbia portlandica*, *E. paralias* and *Eryngium maritimum*, which have a generally southern and western distribution. Occurrence of southern elements of the flora extends some distance northwards into Scotland on the west coast, and the machairs of the Western Isles have clear affinities with dry dune grassland further south. In the east *Astragalus danicus* is locally an important component of dry dune grassland. In the north the representation of northern species such as *Dryas octopetala* is important.

### 5.6.3 Dune slack (SD15 and 16)

These separate broadly into calcicolous (SD15) and acidophilous types (SD16). Dune slacks also show some geographical variation. Prominent amongst the species concerned are *Juncus acutus*, which is present in south-western and western slacks, and *J. balticus* and *Carex maritima*, which are more typically found in the north.

### 5.6.4 Acid dry dune grassland (SD11-14) and dune heath (H10 and 11)

On older dunes or those with lime-deficient sand feeding the system, grasslands more typical of acidic conditions prevail. These may be rich in mosses. Geographical variation within the heathlands is limited, though *Empetrum nigrum*, which has a generally northern and western distribution, may be an important element in wetter heaths. *Juniperus communis* also occurs at a small number of sites and forms an important variant of northern dune vegetation. *Corynephorus canescens* is very restricted and is mainly found on a few east coast sites in southern England. Lichen-rich communities are also characteristic of ungrazed or lightly grazed dune heath.

### 5.6.5 Dune scrub (SD17)

Except in a limited number of cases (e.g. native *Hippophae rhamnoides* in south-east England), dune scrub, particularly with *Ulex europaeus*, *Pinus spp.* and *Betula spp.*, represents an artificial phase in dune succession. Dune systems in Britain are not large enough nor do they normally have a sufficient age to support true succession to primary dune scrub or woodland, though any known examples should be selected.

Within each AOS containing sand-dune systems, the following are eligible for selection.

### 5.6.6 Except in the western and northern Highlands and Islands, any dune systems (excluding forest or enclosed grassland) exceeding 200 ha in area.
5.6.7 If not covered by 5.6.6, the largest dune systems with acidic, intermediate and calcareous substrates or representing different structural types.

5.6.8 The best example of any dune system containing plant sub-communities of Table 2b not represented by selection under 5.6.6 and 5.6.7 or occurring as better examples or in different combinations and relationships. These will be determined especially by extent, floristic richness and presence of community indicator species. Inland dune areas, usually dominated by Carex arenaria, especially in eastern England, should also be selected (see C.4, 1.1).

5.6.9 The best combinations of dune with other coastal habitats (particularly saltmarsh or shingle).

5.6.10 Within the western and northern Highlands and Islands, any discrete system of dry and/or wet machair covering 400 ha or more.

5.6.11 The best example of any machair (of whatever size) showing structural or vegetational features not represented by selection under 5.6.10.

5.6.12 It is important that within this selection the best examples of the range of physiographic features, representing the different processes of dune formation, are included.

6 Shingle beaches and structures

6.1 The shores of Britain are extensively fringed by shingle beds, usually intertidal but extending to a higher, storm-beach level. Locally, ancient shingle deposits now well above tide level are found on raised beaches. The bulk of the shingle beaches are either virtually devoid of vegetation or only sparsely colonised by higher plants. Some high-lying and superficially bare examples are, however, important for lichens. The NVC (Rodwell 1985) recognises only two shingle plant communities (Table 2c), but certain other types, mainly within the lowland heath and categories (Rodwell 1988), occur on the more strongly vegetated and high-lying shingle beds. Shingle often occurs in mixtures with sandy shores and dune systems and also with saltmarsh and seacliff. It is often botanically varied, with a good invertebrate fauna, and also provides important nesting habitat for some coastal birds.

6.2 Selection requirements

6.2.1 Up to 10% of shingle beach (strandline) in an AOS should be selected, provided that it is partially vegetated and represents one or more of NVC communities SD1 and SD2 or has important floristic or invertebrate interest under the appropriate species-groups. Mertensia maritima, Lathyrus japonicus and Crambe maritima are important species in the unstable shingle beach flora. Selection for
ornithological interest can be additional to the 10% chosen on other grounds.

6.2.2 Any area of vegetated shingle structure covering more than 25 ha should be selected. Because of the rarity of this habitat, however, all examples should be considered. Combinations of vegetated shingle with other sedimentary coastal habitat should also be represented.

7 Seacliffs and slopes

7.1 Seacliffs vary greatly in extent, height and gradient, as well as steepness. Large sections of the east coast of England are devoid of cliffs, whereas much of the Atlantic coast of Britain is bounded by long lines of cliff or steep bluffs. Seacliffs typically show not a true succession but a zonation of vegetation, from predominance of halophytes at tide level to a gradual replacement by less salt-tolerant species as the influence of salt spray decreases up the face. Even the summits of tall cliffs may show a maritime influence in their vegetation, and on the storm-swept coast of the western Highlands and Islands halophytic swards occur in places high above the sea. Vertical and nearly vertical seacliffs are usually ungrazed and so form completely natural habitats providing important botanical refuges. Their upper parts and summits often show transitions to other types of vegetation such as heathland, grassland, scrub and woodland with distinctive coastal features. Agricultural encroachment has limited these habitats to a narrow cliff-edge strip in many places, but they are well represented on steep but less precipitous slopes above the sea, and in many parts of western Scotland the cliff-top communities merge into continuous expanses of moorland vegetation.

7.2 Geology has an important differentiating effect, especially according to variations in lime content of the rock. The lower sections of cliffs show considerable uniformity in vegetation, imposed by the strong saline influence, but at higher levels acidophilous and calcicolous communities become clearly separated. One of the most important features of the seacliffs is that they provide the breeding refuges for large numbers of seabirds, some with a highly restricted global distribution, so that they are among the internationally important wildlife features of Britain (see C.14, 3.1-3.2). Botanical and ornithological interest do not usually coincide, but they may be juxtaposed on adjoining sections of cliff. (See NCR, Vol. 1, pp. 32-35.)

7.3 Selection requirements

Some seacliffs occur as isolated, short sections, but in many areas they form long, continuous stretches with little or no break for considerable distances. The appropriate length of cliff section to select will vary according to the total extent of cliff, the amount of linear variation and the importance of the features present. It will be important to represent major geological and structural differences along a cliff coast and the associated range of different habitats and any major seabird colonies. The highest cliffs will often be the most
important, but not necessarily so, and the extent of cliff-top heath or other hinterland habitat should also be regarded as a significant feature.

7.4 Geology is regarded as important for its effect on biological features, and sections should be selected for their best habitat and species attributes. Selection of sites within each AOS should ensure adequate representation of the main NVC communities and sub-communities characteristic of the geographical zones (Rodwell 1982, 1983, 1988). The best examples of vegetation types listed in Table 2d should be included for each AOS. Even within a single geological formation, extended or additional sections should be selected to include important features not obviously exposed to salt spray, especially sub-maritime habitats such as cliff woodland and scrub and cliff-top heathland of high floristic interest. This will be particularly important where unstable cliffs support ephemeral communities, flushes (often of significance for invertebrates) and other non-maritime vegetation on landslides associated with clay or chalk deposits. There are floristic features which are important within each of the main geological formations, and the distinctive northern and southern floristic elements should also be included within the three following groupings.

7.4.1 Vegetation on rock crevices and ledges

Geographical relationships are best seen in this open vegetation: in the south, this is characterised by the presence of MC1 with Crithmum maritimum or Inula crithmoides in the rock crevices. MC2 is the northern equivalent of MC1 and has Ligusticum scoticum replacing these two species. Rock-ledge vegetation has Brassica oleracea in communities of MC4 as a southern type. Rhodiola rosea (MC3) replaces Brassica oleracea as the northern equivalent of MC4.

7.4.2 Maritime cliff and cliff-top vegetation

A variety of communities and sub-communities (MC5-10) are represented within this grouping. Table 2d provides some details of the geographical distribution. Communities MC6 and MC7 represent a nutrient-enriched vegetation occurring on seabird cliffs. Seabird colonies will be selected according to their own criteria (see C.14, 3.1-3.2), and the cliff section length will be determined by the extent of each colony.

7.4.3 Sub-maritime and para-maritime vegetation

Many cliffs or parts of them, particularly on the south and east coasts, are not exposed to maritime conditions because of their relatively sheltered position. In these circumstances NVC maritime cliff communities are non-existent or limited to a narrow fringe at the base of the cliff. Depending on the stability of the cliff, a variety of ephemeral, flush and scrub communities develop which may be important in their own right. They may also have important
invertebrate populations. At the moment these are insufficiently well classified to enable specific guidance to be given on selection. However, along with elements of MC12 (the least maritime of the NVC cliff communities, Festuca rubra - Hyacinthoides non-scripta), they represent one extreme of the maritime cliff habitat which should, if present, be represented within the series of sites. There are also a number of heathland communities which span the range from maritime to para-maritime vegetation (see C.4, Table 10).

8 Marine islands

8.1 Small coastal islands tend to consist chiefly of one or more of the main habitats already dealt with, especially seacliffs and their birds, but they often have a large extent of maritime grassland and may be managed as sheepwalk. Many are bounded by seacliffs, at least in part, but others are fringed only by low rocky shores. They include important breeding and resting places for grey and common seals (see C.13, 1.2-1.4 and 3.1). These islands often have a combined biological interest which makes them extremely important. The numbers of such islands along the coasts of England, Wales and southern Scotland is small, and many of them qualify for selection on ornithological grounds alone. In the western and northern Highlands and Islands, however, their number is legion, and many are unsurveyed. The important seabird and seal islands are all known, but little further guidance can be given over selection for vegetational interest, except to say that the full range of plant communities and species should be represented within each AOS.

9 Coastal lagoons

9.1 Saline coastal lagoons represent a very rare habitat. Any examples above 0.5 ha should be considered for selection.

9.2 Freshwater coastal lagoons are also very limited; notable examples include Slapton Ley in Devon. Consideration should always be given to including these areas (and saline lagoons) if not selected under other criteria, especially if they have vegetated shingle formations which are important to their survival.

10 Estuaries

10.1 Estuaries may be identified predominantly for their bird populations (see C.14). However, several component habitats combine to provide suitable areas for winter feeding and roasting. These include, notably, tidal flats and saltmarshes and adjacent areas of sand-dunes or shingle (which frequently enclose tidal estuaries) and may be important in their own right for their vegetation or invertebrates or as breeding sites for birds and some other vertebrate animals including natterjack toad and sand lizard (see C.15).

10.2 Combinations of these sedimentary habitats may also be important because they form significant geomorphological units of national or international
importance. It is essential therefore that estuaries are not selected solely for their ornithological value but are recognised for this combination of interests. Site integrity therefore becomes an important concept in defining the boundaries of extensive sites. This is dealt with in more detail in 11 below. (See also B, 5.6-5.13.)

11 Definition of boundaries of coastal sites

11.1 As in the case of the uplands (C.9), the coastal formations consist of a mosaic of habitats which lie in juxtaposition to one another. These habitats can conveniently be divided into soft coasts and hard coasts, the former including intertidal sedimentary shores, saltmarshes, shingle structures, sand-dunes and coastal grazing marshes. The latter comprise rocky shores and sedimentary shorelines backed by seacliffs. Soft clay cliffs may be classified within the hard coast element because of the similarities in topography to other cliff habitats.

11.2 Soft coasts

11.2.1 Physical processes are crucial to the existence of the habitats which make up a sedimentary coastline. Thus the movement of material, by both the sea and the wind, results in the formation of a series of habitats from soft intertidal sediments to sand-dunes and shingle features above High Water Mark. Because of the underlying physical processes and the associated biological successions which take place, the area of intrinsic scientific interest of a sedimentary coast is taken to include all those semi-natural habitats which lie adjacent to one another and where there is an important functional interdependence.

11.2.2 In estuaries, where these habitats are most clearly in physical association, saltmarshes in particular may be dependent on the presence of other features. Thus a shingle structure may enclose a saltmarsh, and loss of the protecting shingle would ultimately result in loss of the saltmarsh. Sand-dunes may similarly perform the same function. In both cases, if the saltmarsh is valuable, regardless of the status of the protecting structures (although many will be important for nesting terns and other birds or for their vegetation), these will have to be incorporated within the site.

11.2.3 The seaward limit of most sedimentary coastal sites will be Mean Low Water Mark (neap tides in England and Wales; spring tides in Scotland). In many estuaries the practical difficulties of drawing a meaningful line around what is often a complex and unstable natural boundary necessitates a different approach. Marine habitats and a few offshore banks do not come within the legal framework of SSSI protection. However it may be convenient to draw a line across the mouth of the estuary from suitable points on the shoreline.
channels and intertidal banks move, this is the only way of ensuring that those areas which qualify are within the SSSI.

11.2.4 All active sedimentary habitats depend for their continued survival on the availability of suitable ‘feeder’ material. Thus in most circumstances the integrity of the site will only be maintained by including the source (normally the fronting intertidal sand and/or shingle) within the protected area. In some cases deposits may be derived from further afield and it may be necessary to consider incorporating these areas also.

11.2.5 The landward boundaries of estuarine and other soft coast areas may be easy to define where an artificial structure forms a clear demarcation between the natural habitats and those created or substantially modified by man. These include sea-walls, earth banks, jetties, roads and railways.

11.2.6 There are a number of problems in defining the landward boundary in soft coast areas and these are dealt with below for each of the component habitats.

11.2.7 Sand-dunes

Normally those systems which have been identified as being of importance will be included in totality; i.e. the site selected will include the whole system together with the sandy shore above Mean Low Water Mark. However, there are many examples of dunes which have been modified by man’s activity and where the decision is not always clear. The most frequent of these are considered below.

11.2.8 Golf courses (links): These may not always be highly modified and may contain, particularly in the non-intensively managed 'roughs', substantial areas of important vegetation. Intensively managed greens, tees and fairways are usually of limited interest and should be excluded where they form a substantial proportion of the site.

11.2.9 Mature, highly modified dune grassland: Normally areas towards the rear of dune systems which have been subject to fertiliser treatment or heavy grazing and eutrophication should not be incorporated within the site. The machairs of the Western Isles pose a particular problem here, since much of their importance lies in their history of traditional agricultural use, including grazing. However, the same principles should apply, particularly where fencing, to allow increased stocking rates in a paddock system, is evident or where the traditional rotation has been shortened and herbicides and artificial fertilisers are used.

11.2.10 Dune plantations: Artificial plantations should be excluded from the site boundary, unless they contain features of particular interest in their own right (e.g. surviving species-rich slacks). Even then, the...
interest may be so restricted that there is little justification for their inclusion.

11.2.11 Ungrazed dune with invasive dense scrub: Where this forms part of a natural succession or where control measures are likely to be successful in maintaining the interest of the site, the stands should be included. Areas where dense scrub has all but destroyed the main dune interest in the absence of grazing should normally be excluded if rehabilitation is impossible, except where they are important for migratory passerine birds. There may be some scrub types - notably Hippophae in the east - where some examples should be included within the SSSI series.

11.2.12 Dune heath: This should normally be included within the site boundary, as it is usually impossible to separate the dune from the heath vegetation in the succession. (See also C.4, 1.2 and 4.5.) If it also forms part of the range of variation shown by lowland heathland, this should be noted in the description.

11.2.13 Areas of dune rehabilitated by biological methods should normally be retained within existing sites and included in new ones. Artificial works, such as the building of protective walls, may require deletion from existing sites and would not normally be included in new ones, since all natural processes have presumably ceased to function.

11.2.14 Saltmarshes

All examples should be carefully investigated and, where they form an integral part of the system, they should be included in the SSSI. This is particularly important where transitions to non-tidal vegetation occur both in the upper marsh and in the upper estuary. In England and Wales these transitions are usually absent because of the construction of sea-walls which have truncated the natural succession. However, in several areas sand-dune/saltmarsh interfaces occur and these are often rich in unusual plants.

11.2.15 In Scotland natural transitions to sand-dune and other non-tidal vegetation are much more frequent, though not so obviously associated with estuaries. They are again often species-rich and normally the full succession should be included within the site boundary. Loch-head and beach-head marshes and those associated with a few machair sites in the Outer Hebrides are amongst the most important. These transitional areas may also be of considerable importance for invertebrates.

11.2.16 Vegetated shingle
This is a rare habitat and consideration should always be given to its inclusion within an existing site, even though it may not be particularly species-rich.

11.2.17 Coastal grazing marshes (enclosed, unimproved or semi-improved saltmarsh)

In some areas, particularly in Essex and Kent, these are an important habitat in their own right. Guidelines for the selection of grazing marsh ditch systems are included in C.6, 5.2, and they may be treated as a component part of a coastal SSSI if appropriate.

11.2.18 Since all the component habitats within the area of core interest on a sedimentary coast are functionally interdependent, there is normally no requirement for additional land to be notified to protect this interest. The exception may occur where a pollution-free estuary has a substantial freshwater riverine input. Because this situation is rare, it may be felt that the quality of the water is important and justifies a more extensive boundary.

11.2.19 Estuaries - inclusion of peripheral land

Special problems occur where estuaries support large populations of waterfowl (wildfowl and waders) which use land outside the area of interest as defined above. Where this consists of coastal grazing marshes of known biological interest, no difficulties occur and these should be included within a coastal site. Where a large area of enclosed marsh has been converted to arable or other intensive agricultural use, it should not normally be included. (See also C.14, 3.3-3.4.) There will, however, be situations where exclusion may not be appropriate for one or more of the following reasons.

11.2.19.1 Individual 'improved' fields lie within a matrix of important unimproved land.

11.2.19.2 Other features of importance, notably drainage ditches, exist within a predominantly arable area. (See also C.6, 5.2.6.)

11.2.19.3 In areas of industrial activity, housing, etc., where little undeveloped land remains, small areas of intensively farmed land may provide the only high-tide bird roosts adjacent to the intertidal area.

In these instances it may be necessary for 'improved' land to be included within the SSSI for its ornithological interest to be retained. This should, however, be considered to be the exception rather than the rule.

11.3 Hard coasts (including cliffed soft rock and clay coasts)
11.3.1 Seacliffs, which form the predominant habitat on this type of coastline, have none of the complexity of estuaries. In many respects they are similar, in so far as boundary definition is concerned, to woodlands and grasslands (C.2 and C.3). In this case the area of intrinsic interest may be defined as including the shoreline, the cliff and the cliff-top. Some difficulties will occur in identifying the limit of maritime influence on the vegetation and the extent to which non-maritime and transitional communities should be included within the SSSI boundary, particularly on cliff-tops. Generally, where there is a natural transition between maritime communities and inland grassland or heath, the site boundary should be drawn to encompass both interests. The non-maritime element need not always be of special interest in its own right, but normally any major landward extension of the boundary would depend on that being so. The boundary in the former case would be taken as the most convenient and nearest physical feature on the cliff-top, and in the latter as the limit of the grassland or heathland interest. Unlike on soft coasts, there is usually no justification for including land not of intrinsic interest in its own right or not forming part of the transition to non-maritime vegetation, though occasionally seepage zones may be important and the streams or flushes associated with these may need to be included in a site in order to protect the water quality.

11.3.2 Seacliffs often have a considerable species interest by virtue of the large colonies of seabirds which use them for breeding (see C.14, 3.1-3.2). The definition of the boundary will be concerned in these cases with including the major breeding areas. In effect this restricts the site to the cliff from Mean Low Water up to the cliff-top. However, because the majority of the species concerned use the sea surface for feeding, resting and moulting, the actual area of interest extends beyond the Mean Low Water Mark. A note should be made in the site description of the extent of this interest.

11.4 Little comment has been made on the marine interest below Mean Low Water Mark except in the case of estuaries, since this is outside the scope of the legislation for SSSIs.
12 References


Table 1  Habitat selection units for coastlands
See Table 2 for details of the National Vegetation Classification communities.

<table>
<thead>
<tr>
<th>Previous units</th>
<th>New units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flats</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td><strong>Zostera/Ruppia low marsh</strong> - SM1-3 <em>Zostera</em> spp., <em>Ruppia maritima</em> and communities with <em>Eleocharis parvula</em>.</td>
</tr>
<tr>
<td><strong>Saltmarshes</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td><strong>Pioneer marsh</strong> - includes SM4-6 <em>Spartina</em>, SM7-9 <em>Salicornia</em> (including <em>Arthrocnemum</em>)/<em>Suaeda</em> stands and SM11 and SM12 <em>Aster</em> stands.</td>
</tr>
<tr>
<td>2</td>
<td><strong>Low - mid marsh</strong> - includes SM10 transitional low marsh, the sub-community of SM13 with <em>Puccinellia</em> dominant and all three SM14 <em>Halimione</em> communities.</td>
</tr>
<tr>
<td>3</td>
<td><strong>Mid - upper marsh</strong> - includes sub-communities of SM13 which have <em>Limonium</em>, <em>Armeria</em>, <em>Plantago maritima</em> and <em>Glaux</em> prominent, SM16 <em>Festuca</em> communities, SM17 <em>Artemisia</em>, SM19 and SM20 communities of wet depressions and SM15 and SM18 with <em>Juncus maritimus</em>.</td>
</tr>
<tr>
<td>4</td>
<td><strong>Drift-line</strong> - SM24 and SM28 <em>Elymus</em> communities and SM25 <em>Suaeda vera</em>.</td>
</tr>
<tr>
<td>5</td>
<td><strong>Swamps</strong> - S4 and S19-21 (covered in the NVC classification of swamp vegetation: see also C.7); may form important upper marsh or upper estuary transitions.</td>
</tr>
<tr>
<td>6</td>
<td><strong>Transitions</strong> - include SM21 and SM22 dune transitions, MG11-13 freshwater transitions (covered in the NVC classification of mesotrophic grassland: see also C.3) and M28 mire transitions (see C.7, 8.6.1).</td>
</tr>
<tr>
<td><strong>Sand-dunes</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td><strong>Strandline</strong> - SD1-4; these include elements of the two vegetated shingle beach communities (see below).</td>
</tr>
<tr>
<td>2</td>
<td><strong>Yellow dune</strong> - SD5-8 dominated by <em>Ammophila</em>/Leymus.</td>
</tr>
<tr>
<td>3</td>
<td><strong>Dune grassland</strong> - SD9 and SD10 fixed dune and calcareous dune grassland.</td>
</tr>
<tr>
<td>4</td>
<td><strong>Acid dry dune grassland</strong> - includes SD11-14, including acid dune grassland with <em>Carex arenaria</em>.</td>
</tr>
<tr>
<td>5</td>
<td><strong>Dune heath</strong> - Communities identified in the NVC heath classification (see C.4) are included here.</td>
</tr>
<tr>
<td>6</td>
<td><strong>Dune slack</strong> - includes SD15 and SD 16.</td>
</tr>
<tr>
<td>7</td>
<td><strong>Dime scrub</strong> - includes SD17 <em>Hippophae</em>.</td>
</tr>
<tr>
<td><strong>Vegetated shingle beaches</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td><strong>Vegetated shingle beaches</strong> - SD1 and SD2; these include communities with <em>Mertensia</em>.</td>
</tr>
<tr>
<td>2</td>
<td><strong>Stable vegetated shingle</strong> - No NVC communities have been specifically identified, but heathland communities (see C.4) are particularly important.</td>
</tr>
<tr>
<td><strong>Seacliffs (hard and soft rock)</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td><strong>Maritime rock crevice and cliff ledge</strong> - include MC1-4 open communities.</td>
</tr>
</tbody>
</table>
2  **Maritime cliff and cliff-top grassland** - MC5 and MC8-10 communities with *Festuca rubra* and *Armeria* prominent.

3  **Cliff-top sub-maritime grassland** - includes elements of MC10 and MC11.

   N.B. The distinction between 2 and 3 is difficult. The determining factor for 2 is the presence of salt-tolerant species as dominants or co-dominants.

4  **Para-maritime vegetation** - includes MC12, though almost any inland grassland or heathland types may be found on unexposed cliffs or cliff-tops.

   N.B. The soft rock component, particularly that associated with very unstable cliffs which may have a variety of plant communities from ephemeral grassland to semi-permanent flushes and closed woodland, has not been adequately surveyed. Examples not included under other formations should be considered under 4.

5  **Perched saltmarshes** – SM16 saltmarsh communities in splash zone on cliff-tops.

6  **Maritime and sub-maritime heaths** – A number of heathland communities (see C.4) are well represented on the coast, including H7 with *Scilla verna*.

*Coastal grazing marsh*  
A complex of neutral grassland derived from enclosed saltmarsh, including brackish to freshwater ditches.

*Marine islands*  
A complex of maritime communities including grassland and heath on low rock, mainly on Scottish islands. No specific communities have been defined, but features associated with extreme exposure are important.

*Coastal lagoons*  
As yet no specific criteria have been established.

*Estuaries*  
These are dealt with mainly under Birds (C.14), but the combination of coastal habitats forming an integral unit is important.

*Habitat selection units not in previous system*
Table 2 Coastal habitat selection units and their National Vegetation Classification (NVC) equivalents

<table>
<thead>
<tr>
<th>Habitat units</th>
<th>NVC community equivalents</th>
<th>Community descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Saltmarsh vegetation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Saltmarsh vegetation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*</td>
<td>Restricted; in Scotland mainly in the south.</td>
<td></td>
</tr>
<tr>
<td>**</td>
<td>Absent from Scotland or virtually so (except on the north shore of the Solway).</td>
<td></td>
</tr>
<tr>
<td>Zostera/Ruppia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>low marsh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SM1</td>
<td>Zostera communities</td>
<td>Includes stands of <em>Zostera marina</em>, <em>Z. angustifolia</em> and <em>Z. noltii</em>.</td>
</tr>
<tr>
<td>SM2</td>
<td><em>Ruppia maritima</em> saltmarsh [Ruppietum maritimae Hocquette 1927]</td>
<td>Submerged vegetation in brackish pools, in dried-up pans or more rarely open mudflats.</td>
</tr>
<tr>
<td>**SM3</td>
<td><em>Eleocharis parvula</em> saltmarsh [Eleocharetum parvulae (Preuss 1911/12) Gillner 1960]</td>
<td><em>Eleocharis parvula</em> in diminutive sward, sometimes obscured by algae or freshly deposited silt; south and west.</td>
</tr>
<tr>
<td>b) Salicornia/ Suaeda communities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SM4</td>
<td><em>Spartina maritima</em> saltmarsh [Spartinetum maritimae (Emb. &amp; Regn. 1926) Corillion 1953]</td>
<td><em>Spartina maritima</em> in isolate clumps or as extensive stands; south and east England.</td>
</tr>
<tr>
<td>**SM5</td>
<td><em>Spartina alterniflora</em> saltmarsh [Spartinetum alterniflorae Corillion 1953]</td>
<td><em>Spartina alterniflora</em> in a sense cover with <em>S. anglica</em>, <em>Puccinellia maritima</em> and <em>Aster tripolium</em>; only on the South coast.</td>
</tr>
<tr>
<td>SM6</td>
<td><em>Spartina anglica</em> saltmarsh [Spartinetum townsendii (Tansley 1939) Corillion 1953]</td>
<td><em>Spartina anglica</em>, sometimes with <em>S. x townsendii</em>, often in very extensive stands; mainly England and Wales, extending into Scotland.</td>
</tr>
<tr>
<td>b) Salicornia/ Suaeda communities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SM8</td>
<td>Annual <em>Salicornia</em> saltmarsh [Salicornietum europaeae Warming 1906]</td>
<td>Annual <em>Salicornia</em> spp. In usually open vegetation; mostly absent from Scotland except in the south-west.</td>
</tr>
<tr>
<td>SM9</td>
<td><em>Suaeda maritima</em> saltmarsh [Suaedetum maritimae (Conrad 1935) Pignatti 1953]</td>
<td><em>Suaeda maritima</em> in usually open vegetation and often in small stands; absent from most of Scotland.</td>
</tr>
<tr>
<td>**SM7</td>
<td><em>Arthrocnemum perenne</em> (Salicornia perennis) stands</td>
<td><em>Arthrocnemum perenne</em> in dense pure stands or as an open mosaic with <em>Halimione</em>, <em>Puccinellia</em> and <em>Suaeda</em>; south-east England only.</td>
</tr>
<tr>
<td>c) Aster communities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>**SM12</td>
<td>Rayed <em>Aster tripolium</em> on saltmarshes</td>
<td>Rayed <em>Aster tripolium</em> dominant; mainly south and east England.</td>
</tr>
</tbody>
</table>
2 Low - mid marsh

[a] Puccinellia-dominated communities

** SM10  Transitional low-marsh vegetation with Puccinellia maritima, annual Salicornia species and Suaeda maritima.

Annual Salicornia spp., Suaeda and Puccinellia co-dominant in various proportions often with Aster tripolium. Frequently occurs as a mosaic with SM8, SM6, or SM13, or in south-east England, SM11 or SM14; mainly England and Wales.

SM13  Puccinellia maritima saltmarsh

[Puccinellietum martimae (Warming 1906) Christiansen 1927]

- Sub-community with Puccinellia maritima dominant

Puccinellia in low, open or closed vegetation or occasionally in dense, tall swards but with no extensive understorey of turn fucoids; extensive, widespread low marsh community except in west Scotland.

[b) Communities with Halimione dominant or co-dominant]  ** SM14  Halimione portulacoides saltmarsh

[Halimionetum portulacoidis (Kühnholz-Lordad 1927) Des Abbayes & Corillion 1949]

- Sub-community with Halimione portulacoides dominant

- Juncus maritimus sub-community

Halimione as an even-topped bushy canopy or discrete hemispherical bushes in species-poor vegetation; mainly south and east.

- Puccinellia maritima sub-community

Halimione co-dominant with Puccinellia maritima in intimate mixtures in which shoots of the latter emerge through as open network of shoots of the former; Festuca rubra rare and never abundant; mainly south and east.

3 Mid - upper marsh

[a] Limonium/Armeria communities]

** SM13  Puccinellia maritima saltmarsh

A diverse visually distinct community because of the presence of Limonium vulgare (or locally L. Humile); Halimione and annual Salicornia spp. present and sometimes abundant.

- Limonium vulgare – Armeria maritima sub-community

[b] Communities with Puccinellia/Festuca/Plantago

** SM13  Puccinellia maritima saltmarsh

- Glaux maritima sub-community

Puccinellia maritima and Glaux maritima co-dominant in species-poor vegetation, usually in small stands. Found in old turf-cuttings etc. and sandy upper marsh; common and sometimes extensive on the west coast.
### SM16 Festuca rubra saltmarsh [Juncetum gerardi Warming 1906]

- **sub-community with tall Festuca rubra dominant**

Festuca rubra as a thick springy mattress of tall and dense vegetation; scattered in England and Wales.

### SM17 Artemisia maritima saltmarsh [Artemisietum maritimae Hocquette 1927]

- **sub-community with Artemisia maritima prominent**

Artemisia maritima prominent in usually small stands of variable vegetation ranging from rank grassy patches with much Festuca rubra to open bushy canopy of A. maritima over low Halimione; widespread in East Anglia and on south coast.

### [c) Loch-head marshes]

- **Puccinellia maritima saltmarsh**

Puccinellia maritima dominant or co-dominant with *Plantago maritima* and/or *Armeria maritima*, with a conspicuous understorey of diminutive turf fucoids; characteristic of loch-head marshes in western Scotland, where is largely replaces the Puccinellia-dominated sub-community.

### [d) Juncus gerardi communities]

- **Festuca rubra saltmarsh**

- **Puccinellia maritima sub-community**

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

- **Sub-community with Juncus gerardi dominant**

Juncus gerardi as generally small and often roughly circular patches of sometimes tall vegetation; most frequently found in south-east England.

- **Festuca rubra – Glaux maritima sub-community**

Short swards of very variable composition but usually dominated by *Festuca rubra* and *Agrostis stolonifera* with some *Juncus gerardi*, *Glaux maritima*, *Triglochin maritima*, *Armeria maritima* and *Plantago maritima*; other species absent or <10% cover; mainly western Britain.

- **Leontodon autumnalis sub-community**

Carex flacca constant and sometimes abundant; present at the upper limits of the marsh; western, but most frequent in Scotland.
- Carex flacca sub-community

[e] Wet communities in depressions on upper marsh

Open community of the upper marsh with Blysmus rufus dominant; mainly western Scotland, where it can be very extensive.

SM20  Eleocharis uniglumis saltmarsh [Eleocharetum uniglumis Nordhagen 1923]
Open community of the upper marsh with Eleocharis uniglumis dominant; mainly western Scotland, where it can be extensive.

3 Mid - upper marsh (contd)

[f] Juncus maritimus communities

* SM15  Juncus maritimus – Triglochin maritima saltmarsh
Tall tussocks with Juncus maritimus overwhelmingly dominant; widespread, except Scotland.

SM18  Juncus maritimus saltmarsh
- Plantago maritima sub-community
Luxuriant vegetation with Plantago maritima and Triglochin maritima; Oenanthe lachenalii never abundant; mainly western.

- Oenanthe lachenalii sub-community
Oenanthe lachenalii usually distinctive in this sub-community, with Triglochin maritima and Leontodon autumnalis; widespread in the west, particularly in Wales.

- Festuca arundinacea may be co-dominant; includes mesotrophic grassland species; widespread in the west.
4 Drift-line

(a) Agropyron-dominated communities (Elymus)

** SM24 Elymus pycnanthus saltmarsh [Atriplici-
Elymetum pycnanthii Beetlink & Westhoff 1962]
Elymus pycnanthus as stiff tussocks, usually
without Suaeda vera or Inula crithmoides; most
abundant in south-east England.

SM28 Elymus repens saltmarsh [Elymetum repentis-
maritimum Nordhagen 1940]
Elymus repens in a closed grassy ward; northern
equivalent of SM24.

(b) Suaeda fruticosa scrub
(Suadetum verae (Arenes 1933) Gehu 1975)

** - Elymus pycnanthus sub-community
Elymus pycnanthus and Suaeda vera co-dominant;
North Norfolk only.

** - Halimione portulacoides sub-community
Halimione portulacoides and Suaeda vera co-
dominant; North Norfolk only.

5 Swamps

S4 Phragmites australis swamp and reed-
beds [Phragmitetum australis]
(Gams 1927) Schmale 1939

S19 Eleocharis palustris swamp
[Eleocharitetum palustris Schennikow 1919]
Pure stands of halophytes or sub-communities with
Atriplex hastata, Agrostis stolonifera and Potentilla
anserina in standing or sluggish brackish water or
rarely inundated upper marsh (see C.7, 8.6.1).

S20 Scirpus lacustris ssp. tabernaemontani
swamp [Scirpetum tabernaemontani]
Passarge 1964

S21 Scirpus maritimus swamp [Scirpetum
maritimi (Br.-Bl. 1931) R. Tx. 1937]

6 Transitions

(a) Dune transitions

** SM21 Suaeda vera – Limonium binervosum
saltmarsh
Species-rich upper marsh and strandline, with
Festuca rubra, Plantago maritima and Artemisia
maritima; North Norfolk only.

[Scattered examples of a similar community occur
Frankenia laevis and Limonium bellidifolium are constant; North Norfolk only, rare.

Short, uneven, open sward dominated by Halimione portulacoides and Frankenia laevis; confined to south coast of England and scattered sites in Wales.

Variable, species-poor swards dominated by mixtures of Festuca, Agrostis and Potentilla with Trifolium repens.

Lolium often co-dominant in grassy reseeded and fertilised swards of reclaimed but periodically inundated marshes.

Open and often disturbed vegetation of muddy drift-lines and upper marsh stock refuges with Atriplex, Tripleurospermum maritimum and Polygonum aviculare.

Honkenya frequent on sand and shingle drift-lines with freshwater seepage.

Lush mixtures of Agrostis and Alopecurus in...
A relatively common community of the upper transition of grazed saltmarshes in Scotland, particularly where there are freshwater flows into the marsh.

These communities are not specifically included within the habitat selection units, but examples should be included where they form part of a site selected on other grounds.

Spergularia marina, Puccinella distans and P. maritima in often small stands of usually open vegetation; widespread but local.

Inula crithmoides in abundance, usually with Halimione co-dominant; south-east England.

Sagina maritima, Plantago coronopus etc. in often open or fragmentary vegetation in breaks within swards of other communities, especially the Juncetum gerardi (SM16).

Unstable shingle community.

Cakile maritima and Honkenya peploides constant, with scattered plants of Atriplex hastata, A. laciniata, Salsola kali and Tripleurospermum maritimum; unstable sand and sand-shingle communities.

Beta vulgaris ssp. maritima constant without Galium aparine, Stellaria media, Glaux maritima and Armeria maritima; mainly southern.
<table>
<thead>
<tr>
<th>SD4</th>
<th>Atriplex hastata – Galium aparine strandline</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Galium aparine constant, with frequent Stellaria media, Glaux maritima and Armeria maritima but no Beta vulgaris ssp. maritima; mainly northern.</td>
</tr>
</tbody>
</table>

2 Yellow dune

<table>
<thead>
<tr>
<th>SD5</th>
<th>Elymus farctus forédune</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Elymus farctus constant and often abundant, with scattered Honkenya peploides, Cakile maritimus and Atriplex hastata but without Ammophila arenaria or Leymus arenarius.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SD6</th>
<th>Ammophila arenaria dune - Ammophila arenaria sub community</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Elymus farctus constant, with occasional Cakile maritima and Honkenya peploides.</td>
</tr>
<tr>
<td></td>
<td>Elymus farctus sub-community</td>
</tr>
</tbody>
</table>
2 Yellow dune (contd)

- *Carex arenaria* sub-community
  - Carex arenaria constant; strandline species absent.

- *Senecio jacobaea* sub-community
  - Senecio jacobaea constant, with occasional *Hypochoeris radicata* and *Rubus fruticosus* agg.

- *Festuca rubra* sub-community
  - Festuca rubra present; *Poa pratensis* and *Sonchus arvensis* absent.

- *Poa pratensis* sub-community
  - *Poa pratensis* present, frequently with *Sonchus arvensis*.

SD7 *Leymus arenarius* dune

- *Elymus farctus* sub-community
  - *Leymus arenarius*, with *Elymus farctus*.

- *Elymus repens* sub-community
  - *Leymus arenarius*, with *Elymus repens* constant; no *Elymus farctus*.

- *Festuca rubra* sub-community
  - *Festuca rubra* constant; *Elymus farctus* and *E. repens* normally absent, although when present with occasional *Senecio jacobaea* and/or *S. vulgaris*.

SD8 *Leymus arenarius* - *Ammophila arenaria* dune

- Typical sub-community
  - *Leymus arenarius* constant and often co-dominant with *Ammophila arenaria*; *Elymus farctus* absent.

- *Elymus farctus* sub-community
  - *Leymus arenarius* constant and often co-dominant with *Ammophila arenaria*; *Elymus farctus* present.

3 Dune grassland

SD9 *Ammophila arenaria* – *Ononis repens* dune

- *Brachythecium albicans* sub-community
  - *Brachythecium albicans* frequent; *Arenaria serpyllifolia* and *Crepis capillaris* if present, very scarce.

- *Hyphnum cupressiforme* sub-community
  - *Hyphnum cupressiforme* constant; *Arenaria serpyllifolia* and *Crepis capillaris* frequent.
Acid dry dune grassland

**SD10**  
*Festuca rubra* – *Galium verum* dune

- **Bellis perennis** sub-community  
  *Ammophila arenaria* with reduced frequency; *Bellis perennis* constant.

- **Euphrasia officinalis** agg. sub-community  
  *Ammophila arenaria* with reduced frequency; *Ranunculus acris*, *Euphrasia officinalis* agg., *Carex arenaria* and *Rhytidiadelphus squarrosus* constant, with frequent *Viola tricolor* ssp. *curtisii*.

- **Thymus praecox** sub-community  
  *Ammophila dune* with *Thymus praecox* and *Koeleria macrantha* constant, frequently with *Veronica chamaedrys*, *Cerastium fontanum*, *Campanula rotundifolia* and *Climacium dendroides*, *Astragalus danicus* occasional.

- **Hypochoeris radicata** sub-community  
  *Hypochoeris radicata*, *Hylocomium splendens* and *Rhytidiadelphus squarrosus* constant, frequently with *Anthoxanthum odoratum*, *Vicia sativa* ssp. *nigra* and *Pettigera canina*.

**SD11**  
*Ammophila arenaria* – *Festuca ovina* – *Agrostis capillaris* dune

- **Brachythecium albicans** sub-community  
  *Brachythecium albicans* and *Tortula ruralis* ssp. *ruraliformis* frequent, with *Festuca rubra*, *Cerastium fontanum*, *Rumex acetosella* and *Senecio jacobaea* present when *Pleurozium schreberi* and *Hylocomium splendens* are absent.

  *Pleurozium schreberi* and *Hylocomium splendens* constant, with *Galium saxatile* and *Ceratodon purpureus* frequent.
Acid dry dune grassland (contd)

SD12  Carex arenaria dune
-  Carex arenaria sub-community
  Very species-poor swards dominated by Carex arenaria, sometimes with Festuca ovina.
-  Holcus lanatus – Senecio jacobaea
  sub-community
  Holcus lanatus and Senecio jacobaea constant, with Cerastium fontanum frequent.
-  Dicranum scoparium sub-community
  Dicranum scoparium constant; Holcus lanatus and Senecio jacobaea rare.

SD13  Carex arenaria – Cladonia spp. dune
-  Ammophila arenaria sub-community
  Ammophila arenaria constant, with frequent Aira praecox in open swards; Corynephorus canescens a distinctive occasional.
-  Festuca ovina sub-community
  Festuca ovina constant, with Ammophila arenaria Aira praecox and Corynephorus canescens absent or infrequent.

SD14  Ammophila arenaria – Phleum arenarium dune
-  Thymus praecox – Arenaria serpyllifolia
  sub-community
  Combinations of Arenaria serpyllifolia, Thymus praecox, Lotus corniculatus, Galium verum, Anthyllis vulneraria, Hypnum cupressiforme, Homalothecium lutescens and Tortula ruralis ssp. ruraliformis present.
  Combinations of species in Thymus praecox Arenaria serpyllifolia sub-community absent.
-  Typical sub-community

Dune Heath

This includes communities dominated by ericaceous dwarf shrubs, including H10 Calluna vulgaris – Erica cinerea and H11 Calluna vulgaris – Carex arenaria. Erica tetralix may be an important component in wetter situations, which grade into M15 and M16 wet heath (see C.8, Table 21).

Dune Slack

SD15  Salix repens –
-  Holcus lanatus
  dune slack
- **Equisetum variegatum** sub-community
  Four or more of *Hydrocotyle vulgaris*, *Carex flacca*,
  *Lotus corniculatus*, *Agrostis stolonifera*, *Leontodon taraxacoides*,
  *Equisetum variegatum* and *Anagallis tenella* together with an extensive bryophyte layer.

- **Pulicaria dysenterica** sub-community
  *Mentha aquatica*, *Pulicaria dysenterica* and *Equisetum palustre* constant,
  with *Juncus maritimus*, *J. acutus* and *Scirpus holoschoenus*
sometimes locally abundant; wet dune slack.

- **Holcus lanatus** – *Festuca rubra*
  *Carex flacca* frequent; *Carex nigra* and *Galium palustre* occasional.

- **Calliergon cuspidatum** sub-community
  *Carex nigra* and *Galium palustre* frequent, the former often abundant; *Carex flacca* rare.

### 7 Dune Scrub

**SD16**  **Potentilla anserina** – *Carex nigra*
  *Carex nigra* dune slack

**SD17**  **Hippophae rhamnoides**
  dune scrub

- **Ammophila arenaria** – *Sonchus arvensis*
  *Solanum dulcamara* constant and *Stellaria media*
  and *Brachythecium rupestris* frequent.

- **Rubus fruticosus** agg., *Arrhenatherum elatius* and *Hypochoeris radicata* constant.

- **Solanum dulcamara** sub-community
  *Urtica dioica*, *Holcus lanatus*, *Galium aparine*,
  *Cirsium vulgare* and *C. arvense* frequent.

- **Urtica dioica** – *Holcus lanatus* sub-community

In addition to the communities identified above, dune grassland and dune heath grade into communities of typical grassland, heathland and fen (see C.3, C.4, C.9, 8).
and C.7, 8.6.2).

SUBJECT TO REVISION - For further information see http://jncc.defra.gov.uk/page-2303
NOTE: Dune grassland occurring inland is now covered by the revised Lowland Grassland chapter
c) Shingle Vegetation

Information on shingle communities is very limited and there is only one community (SD1) specifically identified as such in the NVC, included in the sand-dune communities (Rodwell 1985).

1 Vegetated shingle beaches

SD1 Crambe maritima – Glaucium flavum
This community incorporates stands of Mertensia maritima which occur predominantly in the north of Scotland.

SD2 Cakile maritima – Honkenya peploides
The bulk of the examples of this community are on sandy strandlines and will be selected under the guidelines for sand-dunes (see Table 2b).

2 Stable vegetated shingle – communities yet to be assigned

Stable shingle includes communities in which Armeria maritima and Silene vulgaris ssp. maritima are important components occurring within the spray zone. Lichen-rich heath and scrub may also be present. A study of vegetated shingle structures in Great Britain is being carried out and this will elucidate these communities.

d) Seaciff vegetation

NVC Communities NVC sub-communities Community descriptions

1 Maritime rock crevice and cliff ledge

MC1 Crithmum maritimum – Spergularia rupicola
One or more of Inula crithmoides, Limonium binervosum and Parapholis incurva present; limestone of southern England and South Wales.

- Inula crithmoides sub-community

- Typical sub-community

- Rayed Aster tripolium sub-community

Crithmum maritimum and Spergularia rupicola present, normally without Inula crithmoides etc.

Rayed Aster tripolium present, normally without Inula crithmoides etc.; south-west.
MC2  *Armeria maritima* –  *Ligusticum scoticum* maritime rock-crevice community  
Open, generally species-poor vegetation with *Festuca rubra* and *Ligusticum scoticum* present and *Crithmum maritimum* absent; low-growing, open vegetation; Scotland north of Galloway.

MC3  *Rhodiola rosea* –  *Armeria maritima* maritime cliff-ledge community  
Luxuriant vegetation of cliff-ledges, with *Rhodiola rosea* prominent; Scotland.

MC4  *Brassica oleracea* maritime cliff-ledge community  
- *Beta vulgaris* ssp. *maritima* sub-community  
  *Festuca rubra*, *Dactylis glomerata* and *Daucus carota* ssp. *gummifer* with *Brassica oleracea* and *Beta vulgaris* ssp. *maritima* present.
- *Ononis repens* sub-community  
  *Ononis repens*, *Centaurea scabiosa* and *Rumex acetosa* present with *Brassica oleracea* and *Silene nutans*; limestone in southern England and South Wales.

2 Maritime cliff and cliff-top grassland

MC5  *Armeria maritima* – *Cerastium diffusum* ssp. *diffusum* maritime therophyte community  
Short open turf on shallow soils with cushions of *Armeria maritima* and tussocks of *Festuca rubra* and *Plantago coronopus*; includes winter annuals in the bare ground, many of which are national rarities.

- *Desmazeria marina* sub-community  
  *Armeria maritima*, *Festuca rubra* and *Plantago coronopus* constant and sometimes abundant, with *Desmazeria marina* and *Bromus hordeaceus* ssp. *ferronii*; limestone from Dorset to North Wales.
2 Maritime cliff and cliff-top grassland (contd)

- **Anthyllis vulneraria** sub-community
  - Sedum anglicum (rarely *S. acre*) with frequent Desmazeria marina, Spergularia rupicola and Anthyllis vulneraria; *Arenaria serpyllifolia* absent; widespread to north-east Scotland.

- **Aira praecox** sub-community
  - Sedum anglicum (rarely *S. acre*) present with *Aira praecox* and *Festuca ovina* constant; Desmazeria marina, Spergularia rupicola and Anthyllis vulneraria infrequent; widespread, particularly around the Mull of Galloway.

- **Arenaria serpyllifolia** sub-community
  - Sedum *acre* present, with *Arenaria serpyllifolia*, *Bromus hordeaceus* and *Thymus praecox*; limestone in southern England and South Wales.

**MC6**
- Atriplex hastata –
- Beta vulgaris
  - *ssp. maritima*
  - seabird cliff community

**MC7**
- Stellaria media –
- Rumex acetosa
  - seabird cliff community

**MC8**
- Festuca rubra –
- *Armeria maritima*
  - maritime grassland

- **Typical sub-community**
  - *Festuca rubra* dominant and forming a thick mattress-like sward, with *Holcus lanatus* and Anthyllis vulneraria frequent and *Crithmum maritimum* and *Ligusticum scoticum* absent; *Asparagus officinalis* a notable rarity.

Vegetation dominated by *Festuca rubra*, with *Crithmum maritimum* and *Daucus carota* ssp. *gummifer* present; open areas may have species of communities MC1 and MC4; southern in distribution.

- **Crithmum maritimum** sub-community
  - Vegetation dominated by *Festuca rubra*, with *Ligusticum scoticum* present; northern in distribution.

**NOTE:** Dune grassland occurring inland is now covered by the revised Lowland Grassland chapter.
- **Ligusticum scoticum** sub-community

  Festuca rubra, Plantago maritima and *P. coronopus* abundant in short light turf. *Euphrasia* spp. and *P. lanceolata* infrequent (grazed).

- **Holcus lanatus** sub-community

  Festuca rubra generally dominant, but with *Anthyllis vulneraria* and *Silene vulgaris* ssp. maritima constant and sometimes abundant; south-west England and Wales.

- **Plantago coronopus** sub-community

  *Armeria maritima* dominant, with some *Festuca rubra*, in a very species-poor community.

- **Anthyllis vulneraria** sub-community

- **Armeria maritima**-dominated sub-community

  Lightly grazed, rank, tussocky sward dominated by *Festuca rubra*, with *Holcus lanatus*.

  **MC9**  
  *Festuca rubra* – *Holcus lanatus* maritime grassland

  Plantago maritima constant, with infrequent *Achillea millefolium*, *Dactylis glomerata* and *Anthoxanthum odoratum*, most common in the north, where it sometimes includes the rare *Primula scotica*.

- **Plantago maritima** sub-community

  *Dactylis glomerata* constant and often abundant, with frequent *Scilla verna* and *Daucus carota* ssp. gummifer; mainly south-west, but occasional in Scotland.

- **Dactylis glomerata** sub-community
2 Maritime cliff and cliff-top grassland (contd)

- Achillea millefolium sub-community
  Achillea millefolium and Galium verum constant, with many occasional species of characteristic of richer neutral or calcareous grassland; especially around the Solway Firth.

- Primula vulgaris sub-community
  Primula vulgaris constant, with frequent Geranium sanguineum, particularly in the west.

- Anthoxanthum odoratum sub-community
  Anthoxanthum odoratum, Agrostis capillaris, Pea subcaerulea and Potentilla erecta frequent; only in Scotland.

3 Cliff-top sub-maritime grassland

MC10 Festuca rubra – Plantago spp.
  maritime grassland

- Armeria maritima sub-community
  Festuca rubra, Plantago lanceolata and Euphrasia spp. abundant in a short, tight turf; Carex panicea absent; includes Oxytropis halleri and Primula scotica.

- Carex panicea sub-community
  Festuca rubra and Plantago maritima sward, with Carex panicea and Lotus corniculatus constant.

- Schoenus nigricans sub-community
  Schoenus nigricans and Lolinia caerulea present and sometimes dominant, with Carex serotina, Danthonia decumbens, Potentilla erecta and Carex panicea.

MC11 Festuca rubra – Daucus carota ssp. gummifer
  maritime grassland

- Bromus hordeaceus ssp. ferronii sub-community
  Short tussocky grass sward, usually with Festuca rubra most abundant; the maritime element is fairly small.

- Ononis repens sub-community
  Armeria maritima and Bromus hordeaceus ssp. ferronii frequent; confined to cliffs on calcareous rocks; west and south-west.

- Ononis repens sub-community
  Ononis repens with Centaurea scabiosa and Rumex acetosa; includes species of open and/or calcareous situations.

- Sanguisorba minor present, often with Brachypodium pinnatum; numerous occasional species characteristic of inland calcareous grassland.
4 Para-maritime vegetation

**MC12**  
**Festuca rubra** –  
Hyacinthoides non-scripta maritime bluebell community

- **Sanquisoba minor** sub-community  
  Festuca rubra generally dominant, with abundant Holcus lanatus; Hyacinthoides non-scripta present; Plantago coronopus absent.

  - **Armeria maritima** sub-community  
    Armeria maritima and Silene vulgaris ssp. maritima constant.

  - **Ranunculus ficaria** sub-community  
    Ranunculus ficaria and Horehleum sphondylium frequent in small amounts.

5 Perched saltmarshes

**SM16**  
**Festuca rubra** saltmarsh

- **Leontodon autumnalis** sub-community  
  Present on cliff-tops where salt-water spray may reach considerable heights, on exposed coasts in the north of Scotland.

6 Maritime and sub-maritime heaths

These are covered in C.4. Important examples of H4 Ulex gallii – Agrostis curtisii heath occur on the coasts of south-west England and South Wales and of H5 and H6 Erica vagans heath on the coast of the Lizard in Cornwall (see C.4, Table 10).

N.B. A variety of other para-maritime habitats may occur on the coast. As these can represent virtually all the main vegetation types in Great Britain, only those which have a specifically coastal (as opposed to maritime) aspect by virtue of climate amelioration, exposure or increased instability should be considered for inclusion in the coastal site.
Intertidal Habitats and Saline Lagoons

Forward

This document contains guidelines for the selection of intertidal marine habitats and saline lagoons, including their associated communities and species, as Sites of Special Scientific Interest (SSSIs). It is an addition to the original Guidelines for selection of biological SSSIs (Nature Conservancy Council 1989), hereafter referred to as the “Guidelines”. These supplementary guidelines should therefore be applied in close association with the Guidelines, which did not include intertidal marine habitats or significant references to saline lagoons. The scope of this supplement is limited to intertidal habitats, saline lagoons and their associated communities and species. It does not cover fringing communities dominated by angiosperm vegetation such as saltmarsh (included in the original Guidelines).

Technical terms not defined in the text are explained in the Glossary.

Selection of marine intertidal habitats and saline lagoons is undertaken on the same basis as the selection of other wildlife habitat types, with sites being selected using the same criteria, documentation and procedures. A notable difference is that animals as well as vegetation characterise marine habitats and are therefore important in establishing habitat units and are used in the assessment of habitats.

The primary criteria for site assessment and selection defined in A nature conservation review (Ratcliffe 1977) are size, diversity, naturalness, rarity, fragility and typicalness with recorded history, position in an ecological or geographical unit, potential value and intrinsic appeal as secondary criteria. The guidance on these criteria given in this supplement is in addition to that in the Guidelines and relates to special considerations needed when evaluating intertidal or saline lagoon marine habitats, communities and/or species.

The procedure for selecting SSSIs takes account of the overall extent and nature of relevant habitats and their associated communities and species in Great Britain using information held by the Marine Nature Conservation Review (MNCR).

For the purpose of guiding assessment and selection, shores and lagoons have been divided into 'selection units' where similar groups of communities are likely to occur. Rocky intertidal areas have been divided into eight units based mainly on wave exposure. Sediment intertidal areas have been divided into four units based on wave exposure and sediment type. Saline lagoons have been separated into five units based on physiographic type. These groupings are described in Sections 2.9.4, 2.9.5 and 3.10 respectively.
In summary, the procedure for identifying an intertidal or lagoonal SSSI is as follows.

- For each of the shore or saline lagoon selection units described in Sections 2.9.4, 2.9.5 and 3.10, available data on plant and animal communities and the species present are assembled. The particular communities or mixtures of communities present at different sites are identified.

- Data from each location are tested against the 'criteria for assessment and selection' and sites with habitat or community features fulfilling one or more of those criteria are considered further.

- Within each Area of Search (AOS), a minimum aim of SSSI selection is to include examples (and preferably the best) of the full range of habitats and associated communities which satisfy the guidelines for selection.

- Particular care is taken to ensure that habitats and their associated communities and species which have a restricted national or international distribution are included in SSSIs. In general, the more important the habitat (according to degree of rarity or if listed in international conventions), the greater the percentage of that habitat that should be selected.

This approach is consistent with that adopted in the Guidelines and is important for maintaining consistency across the SSSI series. Chapter 1 of the Guidelines, which addressed coastlands, is of particular relevance here given the reference to the selection of marine islands, coastal lagoons, intertidal sediment shores, estuaries and the NVC marine grass *Zostera* spp. community. Some existing SSSIs will therefore already have these features cited. In relation to saline lagoons, Chapter 6 (Freshwater habitats) includes brackish standing waters characterised by *Ruppia* spp. and at least occasional fucoids. The Guidelines (p. 116) indicate that special consideration should be given to 'Type 6' open water habitats showing a transition from freshwater to saline conditions and those with a halocline. Some saline lagoons will therefore already have been notified as SSSIs using these broad guidelines.

This supplement to the Guidelines is a natural extension of the rationale, operational approach and criteria of the original document. The details given here cover only variations from the original guidance. They cover the key issues that are likely to be of most concern when considering the addition of areas of intertidal marine habitats or saline lagoons including their communities and species to the SSSI series. The selection is oriented towards a 'whole shore' or 'whole lagoon' approach, covering the main, easily recognisable types but with a clear linkage to the more detailed MNCR
classification system (Connor 1994). These supplementary guidelines are supported by annexes which provide information on habitats of at least national importance (Annex 1) with their associated communities, and on nationally rare and scarce species (Annex 2).
1b Intertidal Habitats

To be re-numbered after consultation

1 Introduction

'Intertidal' habitats are strictly-speaking those which occur between the limits of tidal rise and fall. The 'intertidal' is therefore defined by physical boundaries whereas the scientific term 'littoral' is biologically defined and refers to the area of the shore that is occupied by marine organisms which are adapted to, or need, alternating exposure to air and wetting by submersion, splash or spray. On rocky shores, the upper limit of the littoral zone is marked by the top of the *Littorina/Verrucaria* belt and the lower limit by the top of the laminarian zone with the main zone between termed the eulittoral (Lewis 1964). Because of the effects of wave wash and spray, especially on wave-exposed rocky coasts, marine species may extend above extreme high water level. These upper shore (upper littoral fringe) and splash zone (supralittoral) communities are therefore included in this supplement and the term 'intertidal' is therefore used loosely.

This supplement includes communities of the sublittoral fringe, a transition zone between the characteristic communities of the majority of the intertidal (the 'eulittoral') and the fully submerged sublittoral zone. However, in England and Wales sublittoral fringe communities may only occasionally be included within SSSIs as these communities normally occur below Mean Low Water (MLW) level, the usual lower limit of planning authority boundaries and to which SSSIs extend. Sublittoral fringe communities may be present above MLW level where:

- habitats are shaded because of coastal aspect (north facing) and/or topographical features such as overhangs;
- wave action is strong and frequent, maintaining a wet environment above MLW;
- lower shore communities are not subject to strong sunlight because low water of spring tides occurs in the early morning and evening at that location;
- an intertidal area is connected to the open sea by a restricted channel causing low water level in this area to be above MLW on the open coast.

In Scotland, sublittoral fringe communities may usually be included in SSSIs as the planning boundary is Mean Low Water of Spring Tides. Sublittoral
fringe communities can also be important in determining the shore type present at a site.

1.2 Criteria for assessment and selection

2.2.1 Size (extent) Consideration of size needs to take account both of the length of coastline and the width of the shore. For sediment shores, which by their nature are gently sloping, physical area is a valid measure of size. In this context many of the concepts and principles outlined in the Guidelines are valid. Considerations will revolve around viability, including the extent and continuity of the particular features of interest; edge effects, including proximity to potentially harmful or change-creating activities; and the particular environmental context of the site under consideration.

For rocky coasts, where tidal range varies around the country and shore inclination varies from near horizontal platforms to vertical cliffs, the length of coast is usually the main size factor in the evaluation, although wide expanses of rocky shore would confer extra importance. As a general principle, rocky coasts should be considered for selection where the qualifying feature(s) extend over at least 1 km of coastline. It is possible that within the area included, the quality may not be uniform nor the habitat continuous. Areas that contain marine habitats, communities and species of at least national importance are a case where the quality standard may be adjusted to ensure adequate representation of highly-rated smaller areas within the AOS. The length of coast included may also be influenced by the extent of other coastal and terrestrial habitat types adjacent to the intertidal area which qualify in their own right for SSSI designation and where it would be appropriate to match the location of boundaries.

2.2.2 Diversity The application of this criterion is difficult and is open to many of the comments and concerns discussed in the original Guidelines. 'Diversity' is applied to both species richness and to habitat diversity at a site. Some intertidal marine habitats and communities are intrinsically richer in species than other types. For example, moderately exposed rocky shores are usually richer in species than extremely exposed shores. Comparison of species richness should therefore be between the same habitat types. Within the same shore types, some examples will have a much wider range of habitats and associated communities than others. This is usually because of the 'architecture' of the shore, with rich examples having overhangs, underboulder habitats and pools as well as open rock surfaces. The assessment of diversity of habitats will therefore only compare similar shore types.

2.2.3 Naturalness As with terrestrial habitat types, truly natural examples unmodified by humans are highly valued. Although the intertidal zone has generally been modified to some extent by humans (for instance,
through the building of structures, disturbance, pollution, introduction of non-native species or through the claiming of intertidal areas for land), the impact on many intertidal marine habitats, communities and species is not generally as severe as for some terrestrial habitats. SSSIs will not normally extend into areas which are substantially modified by structures, mariculture, recreational use or pollution.

2.2.4 Rarity

Rarity has the same influence on the selection process as for non-marine habitat types. The scarcer the habitat, or the community or the species occurring there, the greater the percentage of that habitat type or species population which needs to be protected. This may require the selection of degraded examples or smaller individual areas as SSSIs. Annex 1 provides a list of marine intertidal communities considered by the MNCR to be at least nationally important. Annex 2 provides a definition of rarity and scarcity as applied to marine species and a list of species occurring in the intertidal and currently considered to fit these definitions. These Annexes are minimum list. As information on the Great Britain marine resource continues to grow, additional habitats and species may be added to these lists. Species which are rare in Great Britain are more abundant elsewhere in Europe are nevertheless of particular interest in a Great Britain context.

2.2.5 Fragility

Essentially, this criterion is used as a synonym of 'sensitivity' in the context of these guidelines and should primarily be considered as a management issue. It also has to encompass 'vulnerability' which infers a degree of threat. Habitats, communities and species are likely to be sensitive if they are: fragile (brittle); long-lived with poor or no recruitment (and therefore would be slow to recover or would not recover if damaged); are susceptible to pollution; have poor recruitment; have short-lived or no dispersal stage; are unable to move away, or require the site (habitat) for a part of their life (e.g. reproduction, nursery area, feeding). However, fragility is not normally an issue in intertidal habitats; the high degree of natural stress, especially physical stress from wave action, ensures robustness. Robust habitats, communities and species are as scientifically valuable as fragile ones and can also be as vulnerable as fragile ones to severe impacts. However, fragile features are generally more threatened and therefore require greater or more urgent management measures.

2.3 Areas of Search

Areas of Search (AOS) for intertidal SSSIs are based on the major 'coastal cell' boundaries (Figure 1) established in recent years as the areas within which localised coastal sediment processes are considered to be largely restricted (Motyka & Brampton 1993; HR Wallingford 1995). Many of the boundaries of coastal cells are close to those of MNCR coastal sectors and English Nature's Natural Maritime Areas. For selection purposes, sites which cross a cell boundary will be assigned to the AOS with the greatest proportion.
of the scientific interest for selection purposes. Outlying islands may not be included in cells but should be assigned to the nearest adjacent cell for selection purposes.

Within an AOS it is possible that intertidal SSSIs will have already been designated for a number of different species, habitats or geological features, although most existing SSSIs are not designated for their marine species, communities or habitats. The intertidal marine biological interest of these SSSIs will need to be evaluated against these guidelines and against other locations holding the same communities and species in the AOS. The addition of a further intertidal SSSI with similar habitats and associated communities and species within that AOS should be undertaken only if the quality is clearly and significantly higher in the additional site. Comparisons with existing SSSIs would be recorded as part of the process. Distinct variants of a particular shore type may be worth selecting as additional SSSI to provide adequate coverage of variation within the AOS.
Figure 1  The Areas of Search used for intertidal SSSI selection. Based on the major coastal cell boundaries for inshore areas of England and Wales (Motyka & Brampton 1993) and for Scotland (HR Wallingford 1995). The precise boundaries for the Scottish coastal cells are still being finalised and some changes may be expected especially in relation to cell S5 which may be subdivided.
2.4 International importance

The very extensive and varied nature of the intertidal resource in Great Britain compared with that of other countries in the north-east Atlantic (North Cape in Norway to Gibraltar) has led to some of our coastal features being of international importance. International importance is established by the presence of habitats, communities or populations of species which are one of the best examples, the most extensive examples of a limited shore type or the only examples in the north-east Atlantic. Examples of such habitats can be found on the chalk shores of south-east England, in the sealochs of Scotland and on the offshore islands of the western coasts of Britain. Rare species are often associated with these habitat types and include, for instance, the particular algae which colonise chalk cliffs, the beds of detached growth forms of seaweeds in sealochs and the species of algae found only on very wave-exposed island promontories. There are no intertidal marine species considered truly endemic to Britain although several are only recorded from Britain, probably because of rarity rather than limited geographical range.

Although there are clearly features of international importance present in Britain, the poor knowledge of the extent and quality of these features along coastlines of the north-east Atlantic means that attempting to identify international importance with certainty is difficult. Therefore, communities and habitats which are of national and possibly international importance are described as "at least nationally important" in this supplement.

Some intertidal habitats, communities and species are included in international conservation directives and conventions. For sites to be protected under those measures, the presumption and requirement in almost all cases is that they will have been designated as SSSIs.

2.5 Gathering supporting information

Potential intertidal SSSIs may be identified through a variety of sources. The most usual routes are through MNCR recommendation, through previous studies and reports, by expert opinion or through work connected with the identification of broader areas for international initiatives, for example the site selection process supporting the implementation of the EC Habitats Directive. These sources of information will not necessarily have assessed areas in a similar manner. Assessment may be linked to particular criteria or to the interest of individuals. Of the above the most consistent in approach is the MNCR which bases its selection process on an expansion of the criteria defined in A nature conservation review (Ratcliffe 1977). The work of the MNCR will result in the identification of locations which will have the same importance as NCR and GCR sites for nature conservation. These will have been selected taking into account biogeographic variation and the restricted geographical nature of particular habitat types.
Once an area has been identified as a potential SSSI, further information may need to be gathered to provide an adequate description of the features and to help determine the extent of interest and appropriate boundaries. Referral to original survey reports will be required. The geographical query system of the MNCR database and UKDMAP (Barne et al. 1994), both held at country agency headquarters, may be a useful way to gather relevant information. A potential source of data in the future will be Geographical Information Systems (GIS), e.g. the GIS being developed by English Nature to underpin work on Natural Areas. Specialist Support Teams in country agency headquarters can advise on these issues and on new survey work, should this be required.

Phase 1 survey and, preferably, mapping of sites to be considered for designation are desirable firstly to determine the most appropriate boundaries of a proposed site and, secondly, to describe the habitats within the site. A Phase 1 mapping technique has been developed which is appropriate to marine habitats but is linked to existing terrestrial Phase 1 techniques (Richards, Bunker & Foster-Smith in prep.). The technique is based on the ground truthing of information from aerial photographs to produce habitat maps which can then be incorporated into a Geographical Information System (GIS).

### 2.6 Selecting boundaries for intertidal sites

Setting of boundaries should take account of the potential site integrity and functionality. In the fluid medium of marine areas, establishing the area important for functionality or integrity is very difficult. Enclosed coast areas come closest to the concepts of functional units.

Boundaries should be established to include all of the features which contribute to selection of the site as an SSSI. Additional intertidal areas can be included where they occur amongst a mosaic of qualifying features and where to exclude them would result in fragmentation and reduce viability of the site.

Boundaries must also be clearly identifiable on the ground. This may mean that boundaries are drawn between conspicuous features on the coast (e.g. where rocky shores meet sediment flats) or that they are a continuous extension of the boundaries of landward habitat features that are also being included as part of the site (e.g. hedge, fence or property line). In all cases, convenience must not compromise the setting of boundaries that relate to the extent of the special interest.

Establishing boundaries for intertidal areas may be problematical given the extent of the features, which sometimes cover large or lengthy continuous areas. As sometimes happens for other extensive habitats, such as grasslands and heaths, it may be desirable to select parts of the total area. The definition of such boundaries may be a difficult and pragmatic business.
The guiding principle here is that the diversity which is characteristic of the particular ecosystem in a given AOS must be fully represented in the selected site. Such considerations are well practised within the existing SSSI series and further guidance on the approach is provided in the original *Guidelines*. In other situations, where particularly highly rated features are scattered across a shore with no other particular interest, the whole general shore area could be considered for designation through its ecological relationship with those particular highly rated features concerned. If the area does meet the relevant criteria then site boundaries should be established that encompass all or most of the scattered features of particular interest.

### 2.7 Approval package

The standard approval package is used to submit requests to the appropriate country agency council or board for approval. The package should be prepared as for other SSSIs using the MNCR codings given in these guidelines and the standard list of Potentially Damaging Operations (PDO) (now Operations Likely to Damage - OLD - in England).

### 2.8 Land ownership

On intertidal areas, land ownership may not be the access issue that it is for terrestrial habitat types. Land is still in the private ownership of individuals, organisations or the Crown or may be leased from the Crown but access is usually quite straightforward. However, as with terrestrial areas, it is good practice to try to identify ownership in the earliest stages so that the owners may be involved throughout the selection process. Sources of ownership information, such as the Crown Estate, may lead to the identification of the majority of individuals but, often, the full list of owners will only become known as word spreads of the potential SSSI designation.

### 2.9 Detailed guidelines

#### 2.9.1 Introduction

The approach taken in this supplement to the *Guidelines* is based on selection units consisting of whole shores, i.e. from the top of the shore to low water. Each whole shore typically consists of a series of vertically zoned communities. This approach is the most compatible with the terrestrial situation where broad habitats rather than separate communities form the basis of the selection process. It is also the most pragmatic approach as whole shores are the most readily defined units for deciding on the extent of an area for selection and management.

#### 2.9.2 Criteria for selection

The selection of SSSIs for intertidal marine habitats, communities and species will be based on the approach outlined in Section 1 which closely follows the selection approach given in the *Guidelines*. Representation of marine habitats and communities (based upon...
the MNCR classification of biotopes) and species within the groupings listed in Sections 2.9.4 and 2.9.5 should form the basis for choosing sites within each AOS. In practice, although selection could be based on single MNCR community types, combinations of communities into whole shore types will be the normal basis for selection and designation.

Sites which are selected for designation must satisfy some or all of the following criteria.

1. The site includes the best example of a particular habitat type with its associated communities within that AOS.

2. The site contains a variety of high quality shore types which represent the range and variation within that AOS.

3. The site contains good quality examples of specialised habitats such as rockpools, overhangs and gullies or unusual features in addition to 1. and 2. above.

4. The site contains habitat or community features of a restricted nature on a national or international (north-east Atlantic) basis.

5. The site has a complete zonation down the shore including, where relevant, mature community types.

6. The site contains one or more marine species currently considered nationally rare or scarce including those listed in schedules 5 and 8 of the Wildlife & Countryside Act 1981 (as amended).

7. The site is a large area or has extensive lateral extent in continuous or discrete units depending on the degree of natural and man-made interruptions.

Normally one good quality example of each selection unit type (see 2.9.3), meeting one or more of the above criteria should be designated within an AOS, although several sites may be needed in order to adequately represent the full range of communities encountered on each type of shore.

For communities of at least national importance, it would be expected that all highly rated examples, as assessed by the MNCR, in an AOS would be included in SSSIs.

Communities which are considered of at least national importance are listed in Annex 1. Species which are assessed as nationally rare or scarce are listed in Annex 2. Non-avian marine species, including saline lagoonal species, listed
in Schedules 5 and 8 of the Wildlife and Countryside Act 1981 (as amended) are listed in Annex 3.

Intertidal areas (including when covered by water) will be considered of special interest for non-avian mobile species scheduled for protection under the Wildlife and Countryside Act 1981 (as amended) when they are used on a regular basis. The site will be considered of special interest because of the use they make of the area which could include breeding or feeding. Selection criteria for seals are included in the original Guidelines.

Assessment of importance will take account of whether the site has transitions inland to coastal terrestrial vegetation types, geological or geomorphological features or, seawards, to lower shore or subtidal marine community types which are of high interest. Sites which have such features will be more highly rated than otherwise identically rated locations.

2.9.3 Selection units - general description

Shores have been separated into rock (hard) substrata and sediment (soft) substrata types (see Figures 2 and 3); each is divided into further selection units. Details of the selection units for rocky and sediment shores, together with a summary description and guidance on the selection approach for each, are provided below.

Some of the marine selection units based on the whole shore overlap with existing selection units in the Guidelines, particularly for some of the coastland habitats such as saltmarsh, but also in a more general way for estuaries as a general feature. It is therefore particularly important during the early stages of assessing a potential site that comparisons are made with existing intertidal SSSIs to determine the potential degree of overlap of designated features within these units.

The MNCR codes given for each habitat and associated community refer to the MNCR national biotope classification (Connor 1994). Full technical descriptions of each community type are provided in the MNCR intertidal biotope manual (Connor et al. 1995). The descriptions given below are brief and as non-technical as possible. The different communities are, where possible, described in the order they are likely to be encountered from the top of the shore down to low water level. Ephemeral communities may be present at many sites but are usually of low conservation value. They are listed in the descriptions of selection units for completeness and are marked 'Ephem. '. Taxonomic nomenclature follows Howson (1987).

Many of the habitats and associated communities listed in this document will be of regional importance. Those which are of at least national importance are indicated on the list for each selection unit and in Annex 1. A list of those species occurring in intertidal habitats and saline lagoons and currently considered of at least national importance is given in Annex 2.
Assigning scores to the nationally rare and scarce marine species listed in Annex 2 is not recommended at present because of the inadequate knowledge of distribution. In any assessment based on the presence of rare or scarce species, advice should be sought on the adequacy of distribution records and the identification expertise required for a species. Distribution records for species which are conspicuous and easily identified and occur in accessible habitats should be complete for areas which have been surveyed, as should records for ‘popular’ taxonomic groups whether or not they are conspicuous. Species which are inconspicuous, occur in little-sampled but widespread habitats and/or are taxonomically ‘difficult’ are likely to be under-recorded. Other factors also have to be taken into account in considering the ‘importance’ of a species including its vulnerability and the viability of its population at the site.

In each of the selection units, consideration should be given to the communities found on the extreme lower shore. These communities are frequently the most species rich areas of the shore (being much less exposed to desiccation than upper shore communities) but may not be eligible for inclusion in the SS SI if they are below the planning authority boundary. Communities of the sublittoral fringe (rocky shores) or lower shore (sediment shores) may fall within planning boundaries in England and Wales in circumstances where these zones range above the MLW level. Sublittoral fringe communities may occur above MLW level on wave-exposed sites where zones are raised by wave swash or where low water of spring tides occurs in early morning and late evening allowing species sensitive to desiccation and characteristic of the sublittoral fringe are able to survive above MLW level.

2.9.4 Rocky shores - general description Rocky shores are dominated by species of plant and animal which are adapted to the rigours of a life of alternating immersion in seawater and exposure to the air. The composition of shore communities is determined mainly by the ability of these species to survive the desiccating effects of exposure to air and the various degrees of wave action, ranging from the almost constant pounding of Atlantic waves on western headlands to the stillness of enclosed backwaters where even a force 10 gale may only ripple the surface. The ‘architecture’ of rocky shores is also very important with some rock structures creating platforms, cliffs, overhangs, caves, pools, boulder fields and other features which encourage higher species diversity compared with uniform rocky slopes. Tidal rise and fall is a major factor determining one of the most striking features of rocky shores - the horizontal banding, or zonation, of species brought about by the direct physical effects of alternate immersion in water and drying in air and by biological interactions, especially competition for space, predation and grazing. The lowest part of the shore is a transition between the rigorous habitat which is exposed by every tide and the continuously submerged area beyond the lowest tides. In this sublittoral fringe, large brown algae, the kelps,
overgrow the rock and, through their sweeping action and the shade they create, allow the survival of few species except encrusting red algae and animals or algae inhabiting fissures, crevices, overhangs or the kelp holdfasts. On wave-exposed coasts, the shore is characterised by limpets, barnacles and mussels together with small gastropod molluscs found living in crevices, sometimes many metres above the high water mark, where wave splash provides their saltwater environment. In contrast, sheltered shores are dominated by brown seaweeds (fucoid algae) which provide shade and create a damp understorey habitat where a more diverse fauna thrives, especially gastropods and crustaceans. Mussels are a feature of many rocky shores, with small individuals occurring on exposed coasts and clumps of large mussels in more sheltered conditions. Unstable hard substrata, ranging from large boulders on exposed shores to cobbles and pebbles on sheltered shores, may only support communities of ephemeral algae, which grow in periods of calm weather, and mobile animals, especially small prosobranch molluscs and crustaceans. Scour from mobilised sand or pebbles adjacent to the rock can also determine the type of community present. Rocky shore communities similar to those of bedrock can develop even on shingle and cobbles in the extreme shelter of sealochs and estuaries where there is little or no disturbance by wave action. The variety of life on open surfaces of rocky shores above mean low water mark is generally small, with up to 60 species of macroalga and 50 species of conspicuous animal on a relatively rich extensive shore. However, the variety of species present greatly depends on the exposure of the shore, geographical location and slope so that number of species present may not be a primary factor in determining importance.

The desiccating effects found on the open shore are ameliorated in rockpools, under overhangs, in caves, under boulders and below dense algae where relatively rich communities can develop. Under small boulders, there may be as many as 50 conspicuous animal species (although highly characteristic underboulder communities may include many less). Rock type is also important, particularly if it retains water or is soft enough to allow penetration of the holdfasts of algae. Rocks which are soft enough to allow animals to bore into them provide security from predators and, when the inhabitant dies, a habitat for nestling species. Other rock types are creviced and, within the crevices, a distinctive fauna can develop. Such conditions add to the diversity of a shore and can be additional reasons for considering an area as of particular conservation importance.

Where rocky substrata occur in the low or variable salinity zones of estuaries, they are generally characterised by a low number of species which also occur in full salinity. However, some species are characteristic of rocky substrata in reduced salinities and particular communities develop where they are dominant. These species include a range of highly characteristic green and other filamentous algae, the brown alga *Fucus ceranoides*, the hydrozoan *Cordylophora caspia*, the barnacle *Balanus improvisus* and sphaeroomid isopods.
Rocky shores comprise about 35% of the coastline of Great Britain but are mainly a feature of the open coast and are rarely encountered in estuaries. Natural rocky shores are rare in the east basin of the Irish Sea between Colwyn Bay and Morecambe Bay and on the east coast of England between Flamborough Head and the Thames. Characteristic 'rocky' shore communities do, however, develop in these areas on structures such as breakwaters and piers.

![Figure 2: Rocky shore selection units and special features. Only the most conspicuous characterising species are illustrated and are listed from the upper to the lower shore. Species names in parentheses are important but too small or crustose in nature to illustrate.](http://jncc.defra.gov.uk/page-2303)

**Figure 2** Rocky shore selection units and special features. Only the most conspicuous characterising species are illustrated and are listed from the upper to the lower shore. Species names in parentheses are important but too small or crustose in nature to illustrate. **To be re-scanned after consultation.**
Rocky shores - special features

A rock peninsula or an extensive, very broken, rocky shore may include communities characteristic of exposed and sheltered conditions within a small area, thus producing a site with a very wide variety of representative communities and species which would be particularly favoured as a candidate site.

Rocky shores may be of particular conservation importance if they hold a wide range of sub-habitats, such as surge gullies, caves, overhangs, under-boulders and rockpools. Although such features are widespread, sites which hold well developed and species rich examples of these are to be valued. Sites which represent the extremes of exposure or shelter are of limited extent on a national basis and therefore also of particular interest. Rocky shores are typically not extensive in estuaries. Such hard substrata within mid- and upper estuaries subject to variable or low salinity may therefore be important.

Shores may be species rich or include species rarely encountered in the intertidal for a variety of reasons. For instance, north-facing shores in coastal areas with high turbidity may hold circalittoral (below the zone dominated by algae) species which live in shallow water because of the turbidity and can survive on the shore because of shading from the sun. Such shores are unusual and of increased conservation interest. Shores where the low spring tides occur in the early morning and evening might have richer lower shore communities than where midday low spring tides result in greater desiccation and bleaching.

Rocky shores - selection units

For rocky shore selection units, exposure to wave action has been used as the primary basis for the division given here as this leads to the most readily identifiable units on the ground. There is a gradation from exposed rocky shore dominated by barnacles and mussels, through moderately exposed shores supporting mixtures of barnacles and fucoid algae, to sheltered shores densely covered by fucoid algae. Sheltered stony beaches may also support fucoid algal communities or have mixtures of fucoids, barnacles and mussels.

Rocky shores have been divided into four selection units.

(i) Exposed rocky shores (predominantly extremely exposed to exposed to wave action)

These shores are present where the coast faces prevailing winds and swell and is not sheltered by coastal and offshore features. They occur particularly on northern and western coasts and on headlands. Given the extreme conditions and the limited range of species that can tolerate these conditions, the shores support fewer communities and species than rocky shores in less wave-exposed conditions.
Below a very broad grey and yellow lichen band in the splash zone, a distinct band of black lichens is present and the alga *Porphyra umbilicalis* may be found. The black lichens may also be associated with sparsely distributed barnacles (the species differ in the north and east compared to the west and south coasts of Britain). The eulittoral zone is usually dominated by mussels and/or barnacles with a dense red algal turf occurring towards the lower shore margin. At the sublittoral fringe, the kelp *Alaria esculenta* typically occurs. This species is very characteristic of highly wave-exposed conditions and is often accompanied by a dense band of small mussels. In only slightly less exposed conditions, the kelp *Laminaria digitata* may occur mixed with *A. esculenta*. The presence of good quality rockpools and surge gullies adds interest to these shores.

The communities and their habitats which may be encountered on these shores are listed in Table 1.
Table 1. Communities and their habitats which may be encountered on exposed rocky shored selection unit i)

<table>
<thead>
<tr>
<th>Community or habitat type</th>
<th>Community &amp; habitat</th>
<th>MNCR biotype code</th>
<th>Importance *= at least nationally important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lichens</td>
<td>Yellow and grey lichens on supralittoral rock</td>
<td>LRK.YG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Verrucaria maura and sparse barnacles on exposed littoral fringe rock</td>
<td>LRK.VER.B</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Verrucaria maura and Porphyra umbilicalis on very exposed upper littoral fringe bedrock</td>
<td>LRK.VER.POR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Prasiola stipitata on nitrate enriched littoral fringe rock</td>
<td>LRK.PRA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lichina Pygmaea on steep exposed lower littoral fringe rock</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mytilus edulis and barnacles on very exposed mid-and lower-eulittoral bedrock</td>
<td>LRK.MB</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Barnacles and Patella vulgata on exposed upper- and mid-eulittoral bedrock</td>
<td>LRK.BP</td>
<td></td>
</tr>
<tr>
<td>Fucoid algae</td>
<td>Fucus distichus subsp. aniceps and Fucus spiralis f. nana on extremely exposed littoral fringe bedrock</td>
<td>LRK.FDIS</td>
<td>*</td>
</tr>
<tr>
<td>Himanthalia</td>
<td>Himanthalia elongata and red algal turf on exposed to moderately exposed lower-eulittoral bedrock</td>
<td>LRK.HIM</td>
<td></td>
</tr>
<tr>
<td>Red algae</td>
<td>Catenella caespitosa on overhanging or shaded vertical littoral fringe rock</td>
<td>LRK.CAT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Red algal turf on very exposed to moderately exposed lower-eulittoral rock</td>
<td>LRK.RED</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Palmaria palmata on exposed eulittoral rock</td>
<td>LRK.RED.PAL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Corallina officinalis on exposed lower-eulittoral rock</td>
<td>LRK.RED.COR</td>
<td></td>
</tr>
<tr>
<td>Kelps</td>
<td>Alaria esculenta and small Mytilus edulis on very exposed sublittoral fringe bedrock</td>
<td>LRK.AL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Laminaria digitata and Alaria esculenta on exposed sublittoral fringe bedrock</td>
<td>LRK.LDIG.AL</td>
<td></td>
</tr>
<tr>
<td>Rockpools</td>
<td>Coralline crusts, Corallina officinalis and Littorina littorea in shallow eulittoral rockpools</td>
<td>LRK.COR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fucus serratus and Laminaria digitata in deep eulittoral rockpools</td>
<td>LRK.FK.BEP</td>
<td></td>
</tr>
<tr>
<td>Faunal turfs</td>
<td>Faunal turfs of sponges, anemones and Mytilus edulis on surge gullied in the sublittoral fringe</td>
<td>LRK.SAM</td>
<td></td>
</tr>
</tbody>
</table>
Additional considerations The *Fucus distichus* subsp. *anceps* and *Fucus spiralis* f. *nana* community is restricted to the far north and west of Great Britain and sites may be considered for designation to provide representation of this geographically restricted shore type within the SSSI series. This is an unusual community that will not necessarily occur on most good quality (representative) extremely or very exposed rocky shore sites.

(ii) Moderately exposed rocky shores

Moderately wave-exposed shores are more common than the previous category and generally support a greater variety of communities and species although this depends markedly on shore topography. Below a band of yellow and grey lichens the upper shore is characterised by the black lichen *Verrucaria maura*. The mid-shore typically supports one or more of a range of communities such as barnacle/limpet mosaics, fucoid algae/barnacle mosaics or mussel beds with red algae and fucoids, the latter typically found in silted areas. On the upper shore the predominant fucoid algae are the channelled wrack *Pelvetia canaliculata* and the spiral wrack *Fucus spiralis*, in the mid-shore it is bladderwrack *Fucus vesiculosus* and on the lower shore it is either serrated wrack *Fucus serratus* or thongweed *Himanthalia elongata*. Around the sublittoral fringe, dense forests of the kelp *Laminaria digitata* occur.

On rocky shores near sandy beaches, sand scour may cause part or all of the mid-shore to become dominated by ephemeral algae such as the red alga *Porphyra purpurea* and the green algae *Enteromorpha* spp. which grow rapidly over scoured rock during calm periods. Further down the shore the sand may be bound to the rock by the red alga *Audouinella floridula*. Of particular note on sandy beaches are reefs of the worm *Sabellaria alveolata*. These are particularly important when well developed into honey-comb reefs, a feature restricted to parts of the west coast of Britain between Cornwall and the Solway.

Communities that occur on chalk shores are of considerable marine conservation interest. Chalk is a restricted coastal feature in Britain only found in significant amounts in north-east and south-east England. England has the greatest extent of chalk shore in Europe. The soft, alkaline nature of chalk means that certain species flourish which do not occur anywhere else. British chalk is the type locality for a range of microscopic algae. They occur in caves and on rock surfaces around the high water mark.
Other soft types of solid substratum (e.g. clay and peat) are of interest in that they have a highly restricted British distribution and can only be colonised by a particular range of marine species.

The communities and their habitats which may be encountered on these shores are listed in Table 2.
Table 2. Communities and their habitat which may be encountered on moderately exposed rocky shores (rocky shores selection unit ii)

<table>
<thead>
<tr>
<th>Community or habitat type</th>
<th>Community &amp; habitat</th>
<th>MNCR biotype code</th>
<th>Importance *= at least nationally important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lichens</td>
<td>Yellow and grey lichens on supralittoral rock</td>
<td>LRK.YG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Verrucaria Maura on moderately exposed to sheltered upper littoral fringe rock</td>
<td>LRK.VER.VER</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Prasiola stipitata on nitrate enriched littoral fringe rock</td>
<td>LRK.PRA</td>
<td></td>
</tr>
<tr>
<td>Ephemeral red &amp; green algae</td>
<td>* Enteromorpha spp. On low salinity, or disturbed, littoral fringe hard substrata</td>
<td>LRK.ENT</td>
<td>Ephem.</td>
</tr>
<tr>
<td></td>
<td>Ephemerol algae including Porphyra spp. and Enteromorpha spp. On sand-scoured eulittoral rock</td>
<td>LRK.EPH</td>
<td>Ephem.</td>
</tr>
<tr>
<td>Fucoid algae</td>
<td>* Pelvetia canaliculata on moderately exposed to sheltered lower-eulittoral fringe rock</td>
<td>LRK.PEL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Fucus spiralis on moderately exposed to sheltered upper-eulittoral rock</td>
<td>LRK.FSP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Fucus vesiculosus and barnacle mosaics on moderately exposed mid-eulittoral rock</td>
<td>LRK.FVES.BP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dense Fucus Vesiculosus on sheltered mid-eulittoral rock</td>
<td>LRK.FVES.LIT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Fucus serratus on full salinity, moderately exposed to sheltered lower-eulittoral rock</td>
<td>LRK.FSE.FS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Fucus serratus and red algal mosaics on moderately exposed lower-eulittoral rock</td>
<td>LRK.FSE.RED</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Audouinella floridula and Fucus serratus on sand-abraded lower-eulittoral rock</td>
<td>LRK.FSE.AUD</td>
<td></td>
</tr>
<tr>
<td>Himanthalia</td>
<td>* Himanthalia elongata and red algal turf on exposed to moderately exposed lower-eulittoral rock</td>
<td>LRK.HIM</td>
<td></td>
</tr>
<tr>
<td>Red algae</td>
<td>* Laurencia pinnatifida and Gelidium pusillum on moderately exposed mid-to lower-eulittoral rock</td>
<td>LRK.RED.LAU</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Mastocarpus stellatus and Chondros crispus on moderately exposed lower-eulittoral rock</td>
<td>LRK.RED.MAS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Palmaria palmata on moderately exposed lower-eulittoral rock</td>
<td>LRK.RED.PAL</td>
<td></td>
</tr>
<tr>
<td>Upper-shore chalk</td>
<td>Chrysophyceaea on upper littoral fringe and supralittoral vertical chalk</td>
<td>LRK.CHR</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Red and green velvety algal bands on upper littoral fringe of chalk caves</td>
<td>LRK.APP</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Mats of Blidingia spp. On littoral fringe vertical chalk</td>
<td>LRK.BLID</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Filamentous algae Ulothrix flacca and Urospora spp. On littoral fringe chalk</td>
<td>LRK.UU</td>
<td>*</td>
</tr>
</tbody>
</table>
Table 2 continued

<table>
<thead>
<tr>
<th>Type</th>
<th>Community</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piddock-bored rock</td>
<td><em>Fucus serratus</em>, piddocks and red algae on moderately exposed lower-eulittoral soft rock</td>
<td>LRK.FSE.PID</td>
</tr>
<tr>
<td></td>
<td><em>Laminaria digitata</em> and piddocks on sublittoral fringe soft rock</td>
<td>LRK.LDIG.PID</td>
</tr>
<tr>
<td></td>
<td>Piddocks and <em>Mytilis edulis</em> on eulittoral firm clay</td>
<td>LRK.PID.CLAY</td>
</tr>
<tr>
<td></td>
<td>Piddocks and a dense algal mat on fossilised peat outcrops</td>
<td>LRK.PID.PEAT</td>
</tr>
<tr>
<td>Sand-scoured rocks</td>
<td><em>Sabellaria alveolata</em> reefs on sand-abraded mid- and lower-shore mixed substrata</td>
<td>LMXD.SAB</td>
</tr>
<tr>
<td>Mussels and barnacles</td>
<td>Dense <em>Mytilus</em> beds, red algae and fucoids on silted mid- and lower-eulittoral rock</td>
<td>LRK.MYT</td>
</tr>
<tr>
<td></td>
<td>Barnacles and <em>Patella vulgata</em> on exposed upper- and mid-eulittoral rock</td>
<td>LRK.BP</td>
</tr>
<tr>
<td>Kelps</td>
<td>Dense <em>Lamiraia digitata</em> on moderately exposed to sheltered sublittoral fringe rock</td>
<td>LRK.LDIG.LDIG</td>
</tr>
<tr>
<td></td>
<td><em>Saccorhiza polyschides</em> on moderately exposed to sheltered sublittoral fringe rock</td>
<td>LRK.SPOL</td>
</tr>
<tr>
<td>Rockpools</td>
<td><em>Enteromorpha</em> spp. and <em>Cladophora</em> spp. In shallow littoral fringe rockpools</td>
<td>LRK.CHl</td>
</tr>
<tr>
<td></td>
<td>Coralline crusts, <em>Coralina officinalis</em> and <em>Littorina littorea</em> in shallow eulittoral rockpools</td>
<td>LRK.COR</td>
</tr>
<tr>
<td></td>
<td><em>Fucus serratus</em> and <em>Laminaria digitata</em> in deep eulittoral bedrock pools</td>
<td>LRK.FK.BEP</td>
</tr>
<tr>
<td></td>
<td><em>Fucus serratus</em>, <em>Laminaria digitata</em> and sand-tolerant algae in eulittoral sediment-floored rockpools</td>
<td>LRK.FK.SP</td>
</tr>
<tr>
<td>Overhang/vertical faces/under-boulders</td>
<td>Shade-tolerant red algae and sponges on overhanging lower-eulittoral rock</td>
<td>LRK.RSP</td>
</tr>
<tr>
<td></td>
<td>Faunal turfs of sponges, anemones and <em>Mytilus edulis</em> in surge gullies in the sublittoral fringe</td>
<td>LRK.SAM</td>
</tr>
<tr>
<td></td>
<td>Faunal turfs of bryozoans, ascidians and sponges on overhanging and vertical lower-shore bedrock</td>
<td>LRK.BAS</td>
</tr>
<tr>
<td></td>
<td>Faunal turf of encrusting bryozoans, serpulid worms and <em>Porcellana platycheles</em> on under-boulder surfaces</td>
<td>LRK.BSP</td>
</tr>
</tbody>
</table>

**Additional considerations** The communities present on steep rocky shores and extensive rocky platforms are typically very different in character and examples of each may be considered for designation. At all sites, the communities present in rockpools, overhangs and surge gullies add to the interest of the site, especially where these habitats and their associated communities are well developed. Sufficient sites should be considered for designation to provide adequate representation within the SSSI series of the geographically
restricted communities on chalk, soft rock and Sabellaria types. These are unusual communities that will not occur on most good quality (representative) sites of this selection unit type.

(iii) Sheltered rocky shores (predominantly sheltered to very sheltered from wave action)

This is a broad selection unit and such shore types therefore occur frequently around Great Britain.

On shores predominantly of bedrock and boulders, there are zones of yellow and grey lichens and of black lichens at the top of the shore, although these are typically much narrower than on more exposed shores. The upper shore is usually marked by a zone of the channelled wrack Pelvetia canaliculata. The mid- to low shore supports a range of different communities distinguished by the dominant fucoid algae Fucus spiralis, Fucus vesiculosus or Fucus serratus. In more sheltered conditions the Fucus vesiculosus on the mid-shore is replaced by the egg wrack Ascophyllum nodosum. With increasing shelter, the horizontal extent and density of the Ascophyllum zone increases until, in the most sheltered situations, the whole mid-shore may be covered in a dense canopy of this species. The sublittoral fringe in very sheltered conditions may be dominated by the kelp Laminaria saccharina on its own or with Laminaria digitata. Interesting variants are where the sublittoral fringe is dominated by the kelp Saccorhiza polyschides, an opportunistic annual species on shores in the west and south-west.

In tide-swept areas, particularly associated with tidal rapids in sealochs, Ascophyllum nodosum, Fucus serratus and Laminaria digitata zones may also have well developed populations of sponges, ascidians and other species which significantly increase the species richness of these sheltered rocky shores. These are often present on surfaces above the relevant low water limit for SSSIs and so are included here. The communities and their habitats which may be encountered on these shores are listed in Table 3.
Table 3. Communities and their habitats which may be encountered on sheltered rocky shores (rocky shores selection unit iii)

<table>
<thead>
<tr>
<th>Community or habitat type</th>
<th>Community &amp; habitat</th>
<th>MNCR biotype code</th>
<th>Importance *= at least nationally important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lichens</td>
<td>Yellow and grey lichens on supralittoral rock</td>
<td>LRK.YG</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Verrucaria Maura</em> on moderately exposed to sheltered upper littoral fringe rock</td>
<td>LRK.VER.VER</td>
<td></td>
</tr>
<tr>
<td>Green algae</td>
<td><em>Enteromorpha spp.</em> On low salinity, or disturbed, littoral fringe hard substrata</td>
<td>LRK.ENT</td>
<td>Ephem</td>
</tr>
<tr>
<td>Fucoid algae</td>
<td><em>Pelvetia canaliculata</em> on moderately exposed to sheltered lower-eulittoral fringe rock</td>
<td>LRK.PEL</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Fucus spiralis</em> on moderately exposed to sheltered upper-eulittoral rock</td>
<td>LRK.FSP</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Fucus vesiculosus</em> and littorinid molluscs on sheltered mid-eulittoral rock</td>
<td>LRK.FVES.LIT</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Fucus ceranoides</em> on low salinity eulittoral rock</td>
<td>LRK.FCER</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Ascophyllum nodosum</em> on full salinity very sheltered mid-eulittoral rock</td>
<td>LRK.ASC.ASC</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Ascophyllum nodosum</em>, sponges and ascidians on tide-swept mid-eulittoral rock</td>
<td>LRK.ASC.T</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Ascophyllum nodosum</em> and Fucus vesiculosus on variable salinity mid-eulittoral rock</td>
<td>LRK.ASC.VS</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Fucus serratus</em> on full salinity moderately exposed to sheltered lower-eulittoral rock</td>
<td>LRK.FSE.FSE</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Fucus serratus</em>, sponges and ascidians on tide-swept lower-eulittoral rock</td>
<td>LRK.FSE.T</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Fucus serratus</em> and large Mytilus edulis on variable salinity lower-eulittoral rock</td>
<td>LRK.FSE.VS</td>
<td></td>
</tr>
<tr>
<td>Kelps</td>
<td><em>Laminaria digitata</em> on moderately exposed to sheltered sublittoral fringe rock</td>
<td>LRK.LDIG.LDIG</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Laminaria digitata</em>, ascidians and bryozoans on tide-swept sublittoral fringe rock</td>
<td>LRK.LDIG.T</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Laminaria digitata</em> and Laminaria saccharina on sheltered sublittoral fringe rock</td>
<td>LRK.LDIG.LSAC</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Laminaria saccharina</em> on very sheltered sublittoral fringe rock</td>
<td>LRK.LSAC</td>
<td></td>
</tr>
</tbody>
</table>
## Additional considerations

At all sites, rockpools, overhangs and underboulder habitats typically add to the interest, especially where they are well developed. Sufficient sites should be considered for designation within the SSSI series to provide adequate representation of the geographically restricted sheltered tide-swept communities. These are unusual communities that will not normally occur on most good quality (representative) sites of this selection unit type.

### (iv) Shores of mixed substrata (stones & sediment)

Shores of mixed substrata (cobbles, pebbles and sediment) are often characterised by communities of fucoid algae similar to those on bedrock and boulders. These habitats, however, typically support fewer species, especially where freshwater reduces the salinity. Where there are few stable rocks, the fucoid algae are replaced by barnacle communities and by clumps of large mussels *Mytilus edulis*; the latter may be present as extensive mussel beds.

Mixed substrata shores subject to strong tidal streams may support rich communities of sponges, ascidians and red algae.

Under conditions of variable or lowered salinity, rocky shore species are reduced to a limited number, that can tolerate these conditions. Within areas of variable salinity, *Fucus ceranoides* is the characteristic brown alga, especially in locations where freshwater runs across the intertidal area. In summer the eulittoral zone may be dominated by dense ephemeral red and green algae, the same community that can

---

**Table 3 continued**

<table>
<thead>
<tr>
<th>Rockpools</th>
<th>LRK.CHL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enteromorpha spp. and Cladophora spp. in shallow littoral fringe rockpools</td>
<td></td>
</tr>
<tr>
<td>Coralline crusts, <em>Corallina officinalis</em> and Littorina littorea in shallow eulittoral rockpools</td>
<td>LRK.COR</td>
</tr>
<tr>
<td><em>Fucus serratus</em> and <em>Laminaria digitata</em> in deep eulittoral bedrock pools</td>
<td>LRK.FK.BEP</td>
</tr>
<tr>
<td><em>Fucus serratus</em>, <em>Laminaria digitata</em> and sand-tolerant algae in eulittoral sediment-floored rockpools</td>
<td>LRK.FK.SP</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overhang/vertical faces/under-boulders</th>
<th>LRK.RSP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shade-tolerant red algae and sponges on overhanging lower-eulittoral rock</td>
<td></td>
</tr>
<tr>
<td>Faunal turfs of bryozoans, ascidians and sponges on overhanging and vertical lower-shore bedrock</td>
<td>LRK.BAS</td>
</tr>
<tr>
<td>Faunal turf of encrusting bryozoans, serpulid worms and <em>Porcellana platycheles</em> on under-boulder surfaces</td>
<td>LRK.BSP</td>
</tr>
</tbody>
</table>
develop in areas subject to siltation. In areas where the salinity is constantly low, brown fucoid algae may be lacking altogether and shores may be dominated by green algae *Enteromorpha* spp.

In extremely sheltered areas subject to freshwater run-off, beds of the internationally important free-living mackaii form of *Ascophyllum nodosum* may develop. The form is an 'ecad' produced in response to particular habitat factors, the characteristic adaptations not being heritable. Often exploited by man in the past and occurring in areas subject to human disturbance, extensive beds of this alga are rare. Sites should be designated within an AOS where they support good examples of *Ascophyllum nodosum* ecad *mackaii* beds which cover a significant proportion of the shore.

The communities and their habitats which may be encountered on these shores are listed in Table 4.

**Table 4.** Communities and their habitats which may be encountered on shores of mixed substrata (rocky shores selection unit iv).

<table>
<thead>
<tr>
<th>Community or habitat type</th>
<th>Community &amp; habitat</th>
<th>MNCR biotype code</th>
<th>Importance *= at least nationally important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green &amp; red algae</td>
<td>Ephemeral red and green algae on variable salinity or silted eulittoral mixed substrata</td>
<td>LMXD.EPH</td>
<td>Ephem</td>
</tr>
<tr>
<td>Fucoid algae</td>
<td><em>Fucus vesiculosus</em> on sheltered mid-eulittoral and littorinid molluscs on mixed substrata</td>
<td>LMXD.FVES</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Ascophyllum nodosum</em> on fully marine mid-eulittoral mixed substrata</td>
<td>LMXD.ASC</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Fucus serratus</em> on sheltered low eulittoral mixed substrata</td>
<td>LMXD.FSE</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Fucus ceranoides</em> on low salinity mixed substrata</td>
<td>LMXD.FCER</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Barnacles and <em>Littorina littorea</em> on mobile mid-to lower-shore mixed substrata</td>
<td>LMXD.BLIT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hydroids, ephemeral algae and <em>Littorina littorea</em> in shallow pools on mixed substrata</td>
<td>LMXD.HYD</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Ascophyllum nodosum</em> ecad <em>mackaii</em> beds on extremely sheltered, variable salinity mixed substrata</td>
<td>LMXD.AMAC</td>
<td>*</td>
</tr>
<tr>
<td>Fauna &amp; algae</td>
<td>Sponges, ascidians and red algae on tide-swept lower-shore mixed substrata</td>
<td>LMXD.SAR</td>
<td>*</td>
</tr>
<tr>
<td>Mussels</td>
<td><em>Mytilus edulis</em> beds on sheltered eulittoral mixed substrata</td>
<td>LMXD.MYT</td>
<td></td>
</tr>
</tbody>
</table>

**Additional considerations** Sufficient sites should be considered for designation to provide adequate representation of the geographically...
restricted rich sheltered tide-swept types and the *Ascophyllum nodosum* ecad *mackaii* beds within the SS SI series. These are unusual communities that will not occur on most good quality (representative) sites of this selection unit type.

### 2.9.5 Sediment shores - general description

Sediment shores range from being almost devoid of life, as in shingle and mobile sand on surf beaches, to being rich in species (in sediment shore terms) such as on sheltered muddy gravel shores. Some characteristically littoral species occur on sediment shores but the richest communities are the lower shore margins of much more extensive shallow sublittoral communities. Macrofaunal species which typically colonise sediments include polychaete worms, amphipod crustaceans, bivalve molluscs and (at extreme low water level) burrowing sea urchins. Particle size, the mixture of sediment grades, organic content and the stability of the sediment have the greatest importance in determining the types and number of species which colonise a particular sediment. Different sediment types, ranging from coarse muddy gravel to fine mud, have very different and distinctive assemblages of species. Different communities occur at different heights on the shore with about three zones merging into each other. This zonation is caused by the varying degrees of water retention during low tides, which in turn is affected by sediment grade, finer sediments retaining water to a greater degree than coarse well-drained sediments. However, the zonation is less apparent where fine-grained water-retentive sediment flats, as found in estuarine situations, show less variation in faunistic composition with height than do coarser well-drained beaches.

Muddy sediments occur along estuarine gradients and are characterised by particular species not present, or not present in high abundances, in full salinity. These species include the polychaete worm *Hediste diversicolor* and the bivalve mollusc *Scrobicularia plana*.

Sediment shores comprise about 52% of the coastline of Great Britain, representing a total area of over 235,000 ha, with their greatest extent in semi-enclosed or enclosed areas such as bays and estuaries but with some extensive areas of sand on the open coast, especially along the North Sea and Irish Sea margins. Extensive areas of intertidal sediment also occur on offshore drying banks.

Sandy shores on the open coast may be highly dynamic with impoverished communities. However, with increasing shelter, they support increasingly diverse communities which may include some long-lived species. Such communities are more sensitive to physical disturbance than those of more dynamic shores. Communities with long-lived species are usually low on the shore where sediments do not drain and wave action is likely to be less. Sandy-mud shores, just within marine inlets, in full salinity are likely to be rich in species and of particular marine conservation interest.
Sediment shores - special features  The presence of coarse material on sediment shores often signals increased species richness. Mixed sediments often include the richest examples of communities of burrowing species. This seems to reflect their longer term stability which allows for the recruitment and survival of a variety of long-lived and often slower-growing species. Many mixed sediments include coarse substrata at the surface so that both burrowing species and species of alga and animal attached to the surface occur in the same habitat, thus giving a high species richness. This is especially the case in areas of shore subject to the influence of moderate tidal flow.

Many muddy shores are highly productive and this is often signalled by their importance for populations of wading birds. Birds are considered in the Guidelines and extensive SSSIs established for their importance. From a non-avian marine wildlife conservation perspective, high species richness is likely to be more important than high productivity which might only affect importance in the context of the current guidelines with regard to the support of populations of marine predators especially fish and Crustacea. Likewise, seagrasses on the shore are often highly valued as a source of food for some birds but, in assessing their nature conservation importance, consideration should also be given, as for other marine habitats, to the quality of the habitat, including its local extent, species richness and rarity. Muddy shores subject to fully saline conditions are a feature of the rias of south-west Britain and the fjordic sealochs in Scotland. Those of the sealochs are generally rare and of regional or higher conservation importance because of that rarity.

Although the most species rich muddy shores are likely to be in full salinity situations, those with characteristic species in low or variable salinity are also important and should be included in a representative series. Some of the richest 'muddy' shores have mixed sediments, including coarse material below the surface.
Figure 3. Sediment shore selection units. The biotopes illustrated are some of the most commonly encountered ones. Only some of the most conspicuous characterising species are illustrated. Separate blocks are to different scales. The full range of intertidal biotopes found in each selection unit is listed in Section 2.9.5.
range of intertidal biotopes found in each selection unit is listed in Section 2.9.5. To be re-scanned after consultation.

**Sediment shores - selection units**  
The divisions are made on the basis of exposure to wave action and sediment type with further consideration in relation to salinity. It is important to recognise, however, that sediment type and associated communities often grade only gradually from one to another without clear distinctions. Care has to be taken in assessing the type of communities present on shores as population abundance varies with time. Sediment shores have been divided into four selection units.

(i) **Wave-exposed sandy shores (with burrowing crustaceans and polychaetes)**

This selection unit occurs on wave-exposed open coasts. These shores include only a few communities due to the high mobility and free-draining nature of the sediment. On the most exposed sandy or shingle beaches a search for infauna may reveal no species except for animals associated with driftweed on the strand-line. On less exposed beaches the community is likely to be dominated by burrowing amphipods, the isopod *Eurydice pulchra* and a few species of small polychaete worms. The amphipods generally belong to the genera *Bathyporeia*, *Pontocrates* and *Haustorius*. Typical polychaetes found on such exposed sandy shores include *Scolelepis squamata*, *Paraonis fulgens* and *Nephtys cirrosa*. Bivalve molluscs are usually absent on such exposed sandy shores although the occasional specimen of *Angulus tenuis* may be found. From time to time a particularly successful recruitment of *Arenicola marina* may result in colonisation of the mid-shore; this is a temporary phenomenon and not of particular conservation interest. Oligochaete worms may be found associated with freshwater run-off on the upper shore.

The communities and their habitats which may be encountered on these shores are listed in Table 5.

**SUBJECT TO REVISION - For further information see [http://jncc.defra.gov.uk/page-2303](http://jncc.defra.gov.uk/page-2303)**

**NOTE**: Dune grassland occurring inland is now covered by the revised Lowland Grassland chapter.
Exposed shores of shingle or coarse sand with no apparent macrofauna (LMXD.BAR and LSND.BAR) occur in this selection unit but have little marine biological interest.

**Additional considerations** None are identified.

(ii) Moderately exposed sandy shores (with polychaetes and bivalves)

Moderately exposed sandy shores are generally found on open coasts not exposed to strong wave action. They may also occur near the mouths of marine inlets. The sediments are usually of fine sand but may be slightly muddy at the more sheltered end of the range. Moderately exposed sandy shores generally support communities with greater species richness than exposed sandy shores. The major difference is the presence of certain species of bivalve and many more species of polychaete. In fine, clean sand the typical bivalves are *Angulus tenuis*, *Fabulina fabulina* and *Donax vittatus* whereas the cockle *Cerastoderma edule* is generally found in slightly more muddy sand. On the extreme lower shore the razor shell *Ensis siliqua* may be found, often in conjunction with the burrowing heart urchin *Echinocardium cordatum*. Beds of eelgrass *Zostera marina* may be exposed on low spring tides. Typical polychaetes include the lugworm *Arenicola marina*, often in high numbers, as well as *Nephtys cirrosa*, *Nephtys hombergii*, *Pygospio elegans*, *Spio filicornis* and *Scoloplos armiger*. Oligochaete worms may be found associated with freshwater run-off on the upper shore. Where the shore is tide-swept there may be beds of the sand mason worm *Lanice conchilega* on the low shore. Burrowing crustaceans, principally *Bathyporeia* spp., are often found in high numbers (although generally less numerous than on more...
exposed sandy beaches). Cumaceans and the polychaete *Ophelia rathkei* may be present.

The communities and their habitats which may be encountered on these shores are listed in Table 6.
Table 6. Communities and their habitats which may be encountered on moderately exposed sandy shores (sediment shores selection unit ii).

<table>
<thead>
<tr>
<th>Community &amp; habitat</th>
<th>MNCR biotype code</th>
<th>Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amphipod <em>Talitrus saltator</em> in decomposing macro-algae on the strand-line</td>
<td>LMXD.TAL</td>
<td></td>
</tr>
<tr>
<td>Burrowing amphipods, the polychaete <em>Nephtys cirrosa</em> and thin tellins <em>Angulus tenuis</em> in lower-shore clean stable sands</td>
<td>LSND.AP.ANG</td>
<td></td>
</tr>
<tr>
<td>Sand mason worm <em>Lanice conchilega</em> in tidal-scoured lower-shore sands</td>
<td>LMSND.LAN</td>
<td></td>
</tr>
<tr>
<td>Polychaetes and the cockle <em>Cerastoderma edule</em> in lower-shore slightly muddy sands</td>
<td>LMSND.PC</td>
<td></td>
</tr>
<tr>
<td>Lugworm <em>Arenicola marina</em> and bivalves in mid- to lower-shore muddy sands</td>
<td>LMSND.ARB</td>
<td></td>
</tr>
<tr>
<td>Urchin <em>Echinocardium cordatum</em> and razor shell <em>Ensis siliqua</em> in lower-shore fine sands and muddy sands</td>
<td>LMSND.ECH</td>
<td></td>
</tr>
<tr>
<td>Eelgrass <em>Zostera marina</em> or <em>Z. angustifolia</em> beds in lower-shore fine sands and muddy sands</td>
<td>LMSND.ZOS</td>
<td></td>
</tr>
</tbody>
</table>

Additional considerations None are identified.

(iii) Sheltered muddy shores (including estuarine muds)

These shores are almost invariably found in the shelter of marine inlets. The exception to this is where shallow water extends a long way out to sea on the open coast and the wave energy is dissipated before reaching the shore. Particle size and salinity are often well correlated, with muddy shores often found under estuarine conditions. However, fully marine muds occur in the rias of south-west Britain and some sealochs. Muds typically support a greater biomass than other intertidal sediments, the abundance of bivalve and polychaete species being particularly high. The burrowing amphipods of the genus *Bathyporeia* are often absent in very muddy substrata but *Corophium volutator* may be present in high numbers. The cockle *Cerastoderma edule* is often abundant in fully marine sandy muds with *Macoma balthica* being typical of finer muds. In reduced salinity muds *Macoma* is replaced by *Scrobicularia plana*, particularly on the mid- and upper shore. The polychaete *Hediste diversicolor* is widespread in muddy substrata and is often particularly abundant in reduced salinity conditions. Other polychaetes found in muddy shores include *Nephtys hombergii*, *Streblospio shrubsollii*, *Tharyx marioni* and *Manayunkia aestuarina*. In very low salinities very few species occur other than oligochaete worms. The prosobranch *Hydrobia ulvae* is typically common on the surface of the mud and the eelgrass *Zostera noltii* may also be found. Filamentous green algae frequently cover the surface of the mud but
these are of low conservation interest because of their ephemeral and widespread nature.
The communities and their habitats which may be encountered on these shores are listed in Table 7.

Table 7. Communities and their habitats which may be encountered on sheltered muddy shores (sediment shores selection unit iii).

<table>
<thead>
<tr>
<th>Community &amp; habitat</th>
<th>MNCR biotype code</th>
<th>Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ragworm <em>Hediste diversicolor</em>, Baltic tellin <em>Macoma balthica</em> and cockle <em>Cerastoderma edule</em> in lower-shore sandy muds</td>
<td>LMUD.HM.CER</td>
<td>* = at least nationally important</td>
</tr>
<tr>
<td>Ragworm <em>Hediste diversicolor</em>, Baltic tellin <em>Macoma balthica</em> and the polychaete <em>Manayunkia aestuarina</em> in low salinity mid-shore sandy muds</td>
<td>LMUD.HM.MAN</td>
<td></td>
</tr>
<tr>
<td>Ragworm <em>Hediste diversicolor</em>, Baltic tellin <em>Macoma balthica</em> and the polychaete <em>Nephtys hombergii</em> in low salinity lower-shore sandy muds</td>
<td>LMUD.HM.NEP</td>
<td></td>
</tr>
<tr>
<td>Ragworm <em>Hediste diversicolor</em> and peppery furrow shell <em>Scrobicularia plana</em> in reduced salinity upper-and mid-shore muds</td>
<td>LMUD.HS</td>
<td></td>
</tr>
<tr>
<td>Eelgrass <em>Zostera noltii</em> beds in upper- and mid-shore sandy muds or muds</td>
<td>LMUD.HS.Z</td>
<td></td>
</tr>
<tr>
<td>Lugworm <em>Arenicola marina</em> in fully saline mid-to lower-shore muds</td>
<td>LMUD.AR</td>
<td></td>
</tr>
<tr>
<td>Ragworm <em>Hediste diversicolor</em> and oligochaete worms, sometimes with the amphipod <em>Corophium volutator</em> in lower-salinity muds</td>
<td>LMUD.HO</td>
<td></td>
</tr>
</tbody>
</table>

Additional considerations Preference may be given to examples which support rare or scarce species. The *Zostera* communities are only of marine conservation interest if they are extensive in nature and have a particularly well developed infaunal community structure; as with other communities, only the best examples are of national importance.

(iv) Muddy gravel shores

Intertidal muddy gravels are not widespread but may be found in sealochs and some other marine inlets. Muddy gravels may support the bivalves *Venerupis senegalensis*, *Mya truncata* or *Mya arenaria* but often the most abundant species in this substratum, particularly under conditions of reduced salinity, is *Hediste diversicolor*. The communities and their habitats which may be encountered on these shores are listed in Table 8.
Table 8. Communities and their habitats which may be encountered on muddy gravel shores (sediment shores selection unit iv).

<table>
<thead>
<tr>
<th>Community &amp; habitat</th>
<th>MNCR biotype code</th>
<th>Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gaper <em>Mya arenaria</em> and polychaetes in reduced-salinity muds and muddy gravel shores</td>
<td>LMGR.MYA</td>
<td>* = at least nationally important</td>
</tr>
<tr>
<td>Carpet shell <em>Venerupis senegalensis</em> and blunt gaper <em>Mya truncata</em> in muddy gravel shores</td>
<td>LMGR.VEN</td>
<td></td>
</tr>
<tr>
<td>Ragworm <em>Hediste diversicolor</em> in low salinity muddy gravel shores</td>
<td>LMGR.HED</td>
<td></td>
</tr>
</tbody>
</table>

Additional considerations Preference may be given to examples which support nationally important communities or rare or scarce species. Of particular interest are muddy gravels that have populations of the burrowing bivalves *Mya arenaria*, *Mya truncata* and *Venerupis senegalensis*, sipunculans and burrowing holothurians. Sites with such species may be considered for additional selection within an AOS, particularly if the infaunal community is rich and the habitat extensive.
3.1 Introduction

Saline lagoons are areas of marine saline water where the concentration of salts is reduced by ground or surface fresh-water input or concentrated by evaporation. Connection with the open sea is limited by sediment, shingle or rocky barriers, with the degree of separation being used as a basis for the distinction of five physiographic types (based on Barnes (1988) and Sheader & Sheader (1989)). Freshwater input is usually from direct drainage of surrounding land or groundwater seepage. There is generally no major riverine input, or in cases where rivers drain into saline lagoonal systems, the lagoon basin is distinctly different from the physiographic features of an estuary (Pritchard 1967). However, there are situations where the status of a location as a saline lagoon (as opposed to an estuary, an arm of the sea or an enclosed bay etc.) will be unclear and any dispute about whether a site constitutes a 'saline lagoon' will be resolved by reference to a more detailed definition of saline lagoonal habitats held by country agency headquarters staff.

3.2 Criteria for assessment and selection

3.2.1 Size (extent)  Size needs to take account of the relative size of different saline lagoon types within the selection units. These guidelines include the entire range of saline lagoonal types, from small sediment-filled isolated saline lagoons, generally covering an extent of less than 0.5 ha, to larger brackish water systems such as The Fleet, Dorset, (480 ha) or those at the heads of fjardic sealochs which may cover up to 100 ha each but totalling several hundred hectares when adjacent ones are taken together.

Larger saline lagoons are more stable in character and this is likely to encourage species richness but shape and complexity of the lagoon are also important (Bamber et al. 1992). Larger saline lagoons have a higher number of specialist saline lagoonal species if their shape is long and narrow, encouraging a longitudinal salinity gradient and localised variation in the habitat (Bamber et al. 1992). Larger saline lagoons with a complex shape are therefore preferable to small simple lagoons which are susceptible to environmental fluctuations.

3.2.2 Diversity  Diversity (in terms of species richness and the variety of habitats in a particular lagoon) is related broadly to the degree of stability of the environment and the diversity of the physical and chemical habitats present. Generally, diversity increases in the order: isolated lagoons,
percolation lagoons, sluiced lagoons, Billed lagoons and lagoonal inlets, although there is a degree of overlap in diversity between the types.

The distribution of saline lagoons is not uniform around Great Britain and many AOS have a high concentration of lagoons of particular types. Shingle structures are predominantly a feature of the eastern and southern coasts of Great Britain, and this affects the distribution of percolation pools which rely on a permeable barrier for their development. Isolated saline lagoons may occur behind saltmarsh barriers, especially in England, where the separation is due to an accreting sediment barrier or may occur in Scotland where there is a rock barrier at above mean high water. Types fringed by rock will contain communities similar to those enclosed by shingle or sediment but will additionally contain fringing rocky communities which, particularly in the Scottish types, will increase the habitat diversity.

Some saline lagoon systems have a very wide range of associated communities and species because of the salinity gradient which occurs along them or between different interconnected basins in a lagoon system. Diversity of types can also be increased if conditions of oxygenation and summer warming of surface layers along a gradient or between interconnected basins creates different communities.

Larger, more complex saline lagoons tend to have a higher species richness than small simple lagoons. However this is a broad generalisation and between types there is a wide degree of overlap depending on other factors such as depth, water exchange, age of the lagoon and proximity to other lagoons.

Saline lagoons often have a low diversity of habitats and associated communities, with many lagoons characterised by single communities. By far the most widespread habitat type is sediment, particularly mud and some fine sand. The community associated with this sediment will vary according to prevailing conditions but is generally one of loose-lying algae with an infauna of polychaete worms and bivalve molluscs living in the sediment and amongst the algae. Particularly noteworthy sediment communities occur at sites with beds of tasselweed *Ruppia* spp. or eelgrass *Zostera* spp. *Ruppia* communities are often present in stable low salinity lagoons, whilst *Zostera* communities may be present in higher salinity lagoons which have a large water volume and stable conditions. Where present these communities may cover large areas, but *Zostera* in particular is not a common constituent of saline lagoons although it occurs commonly in marine inlets and on the open coast. Also associated with the sediment habitat may be stoneworts such as *Chara aspera* or *Lamprothamnium papulosum*.

### 3.2.3 Naturalness

Many saline lagoons are not natural features, having been created by human activities such as gravel extraction and quarrying or
having been modified by installation of sluices. This need not be a down-weighting factor, since the biology of non-natural systems may be superior to that of many natural systems. However, in general, only sites which are composed of natural substrata are considered here, thus excluding the lagoonal habitats created by docks. The factors which have created the lagoonal conditions need to be taken account of when deciding management issues and Potentially Damaging Operations (referred to as Operations Likely to Damage in England).

It should also be borne in mind that many saline lagoons are temporary features on eroding or depositional coastlines. As such their continued existence may well depend on active intervention to maintain them, thus affecting their naturalness.

3.2.4 Rarity Saline lagoons are a rare habitat, with a limited distribution in Europe at least. This is predominantly due to the unusual conditions required for their formation (depositional coasts with suitable Quaternary deposits offshore for barrier beach formation, or in the case of obs in Scotland, glacial action and subsequent inundation by sea-level rise). Barnes (1980) estimated that only 5.3% of Europe's coastline is suitable for the formation of saline lagoons (‘lagoons’ as defined by Barnes, i.e. excluding man-made habitats, ponds, obs and fjardic habitats), giving a length of 2693 km, equivalent to around 8.4% of the world's lagoonal coastline.

Species which inhabit lagoons are those which can survive the rigours of fluctuating or permanently lowered salinity, extremes of temperature variation and, in some saline lagoons, temporary deoxygenation. Since they are predominantly marine species, assessment of rarity uses the criteria developed for marine species (Annex 2). Their rarity is linked to degree of specialisation in inhabiting saline lagoons. Bamber et al. (1992) identified saline lagoonal specialist biota from their study mainly of English and Welsh lagoons as predominantly "stenohaline marine lagoonal specialists", and "eurhaline lagoonal specialists" but with an additional category of "under-recorded lagoonal species". Other species which occurred in saline lagoons they studied were predominantly "freshwater species", "estuarine species pre-adapted to lagoons" and "estuarine species incidental in lagoons". They hypothesised that lagoonal specialist species, the main contributors to rare species in lagoons, are "adapted to the stresses of a variable environment (in terms of its salinity, temperature and pH) of reduced tidal exchange, though being evolved from marine ancestors prefer a salinity of 35‰. They survive in saline lagoons because here they are not outcompeted by their less tolerant marine or estuarine counterparts." Species predominantly or only found in saline lagoonal habitats are shown in Box 1. It is also possible that freshwater or marine species which are rare might, by chance or favourable conditions, be recorded from a lagoon.
Many lagoonal specialist species are protected by the Wildlife and Countryside Act 1981 and the presence of a viable population of any of these protected species would warrant the selection of a saline lagoon as an SSSI. The presence of other, unprotected, lagoonal specialist species may not be enough to justify selection of the site as an SSSI, but it would raise the value of the site when compared to similar locations lacking lagoonal specialists.

3.2.5 Fragility  General principles are as for intertidal marine habitats (Section 2.2.5). However, lagoons are very sensitive to changes in hydrodynamic regime and, to a lesser extent, water quality and hence are vulnerable to such activities as dumping of waste, infilling and physical disruption to the fluxes of saline and freshwater input.

3.3 Areas of Search

The AOS used for saline lagoons are the same as those used for terrestrial habitats since saline lagoons occur within terrestrial areas. Terrestrial AOS are based mainly on county boundaries and are illustrated in the Guidelines.
Specialist saline lagoonal species (i.e. species distinctly more characteristic of saline lagoon-like habitats than of freshwater, estuarine brackish waters or of the sea) recorded in Britain (after Barnes (1989) and Bamber et al. (1992) but excluding species widely found in brackish ditches or other non-lagoon habitats).

### Cnidaria
- Gonothyraea loveni
- Edwardsia ivelli*(a, b)
- Nematostella vectensis

### Bryozoa
- Conopeum seurati
- Victorella pavida**(a, c)

### Polychaeta
- Armandia cirrhosa**(a)
- Alkmaria romijni**

### Insecta
- Paracyamus aenus**

### Crustacea
- Idotea chelipes
- Sphaeroma hookeri
- Gammarus inesnibilis**(a)
- Gammarus chevreuxi
- Corophium insidiosum

### Flora
- Chara baltica
- Chara connivens
- Lamprothamnium papulosum**
- Tolypella nidifica
- Ruppia maritima
- Ruppia cirrhosa
- Chaetomorpha linum

### Mollusca
- Onoba aculeus
- Littorina tenebrosa
- Tenellia adpersa**
- Cerastoderma glaucum (a)
- Hydrobia ventrosa (a)
- Hydrobia neglecta (a)

** Protected by the wildlife and Countryside Act 1981.
(a) In Britain known only from saline lagoon-like habitats
(b) Known only from Widewater, West Sussex; now possibly extinct
(c) Known only from Swanpool, Cornwall

### 3.4 International importance

Barnes (1989) considers that saline lagoons in Britain (mainly English lagoons corresponding to the definition used by Barnes of lagoons) are "of unusual 'North Atlantic' physiographic types from a global viewpoint". In particular, British together with Breton, coastal lagoons are unusual because they:

1. are mostly closed (i.e. landlocked);
2. are located behind barriers of shingle (rather than sand), and
3. mostly receive their marine salts via percolation through the enclosing barrier (rather than by direct inflow).

Taken together, the better British lagoons possess a typical assemblage of European saline lagoonal species but their closed nature means that most
contain a limited subset of those species, and further that each may contain a
different subset (R.S.K. Barnes, pers. comm.). It is the large tidal range in
Britain (compared with most other areas of Europe with extensive lagoons)
which is particularly important and which also results in the development of
the rock-bound lagoonal habitats which occur in parts of Scotland. Here,
isolation and subsequent development of brackish conditions is brought about
by limited access to seawater usually only near to high tide. The saline
lagoonal inlets and Billed lagoons of western Scotland are not represented
elsewhere in Europe, since Scotland is unusual in having fjardic inlets
coinciding with a large tidal range (compared with the west coast of Sweden
and southern Norway which has a glaciated coastline but limited tidal
movement). Since lagoons are a priority habitat under the EC Habitats
Directive (Council of the European Communities 1992), Great Britain has an
international obligation to conserve lagoon sites of European importance.

3.5 Gathering supporting information

Summaries of the resource and its distribution have been gathered for
England (Smith & Laffoley 1992), Scotland (Covey, Fortune & Thorpe in prep.)
and Wales (Sheader & Sheader 1989). The biology of saline lagoons is best
described by Barnes (1980) and Bamber et al. (1992).

Phase 1 mapping is often not required to determine the extent of the site since
site boundaries follow the lagoon edge. However, Phase 1 mapping is useful
in listing the habitats present and describing their distribution within the site as
a contribution to formulating the citation and subsequent management of the
site.

3.6 Selecting boundaries

Saline lagoons rely on continuation of the established water exchange with
the sea and freshwater input. With this in mind the selected area should
include the connection to the sea. In the case of lagoonal inlets and Billed
lagoons, this will be the bed of the connecting channel. With sluiced lagoons it
will include the pipeline or connection channel, and in the case of percolation
lagoons it will include the terrestrial shingle barrier necessary to maintain
seawater percolation. Isolated lagoon SSSI boundaries should include the
terrestrial area of land between the lagoon and the sea. The designated area
should include the bed of the lagoon, extending to a landward limit at the
height of maximum tidal influence. This will thus include fringing communities
such as Fucus muscoïdes in saltmarsh turf and lichen zone. Small scattered
lagoons which are linked within a coherent unit (such as a shingle structure or
flardic inlet) may best be considered as a single site. The surrounding land will
not normally be included, unless it is of terrestrial interest, although
connecting water channels should be included within the designated site.
3.7 Approval package

The standard package is used to submit requests to the appropriate country agency Council or Board for approval. These should be prepared as for other SSSIs using the MNCR codings and the standard Potentially Damaging Operations (PDO) (now Operations Likely to Damage - OLD - in England) list.

3.8 Land ownership

For saline lagoon habitats, land ownership issues are, in general, the same as for terrestrial habitats. Some of the general points made with regard to intertidal areas apply.

3.9 Detailed guidelines

3.9.1 Introduction The approach taken in this supplement to the Guidelines is based on selection units consisting of whole saline lagoons. Each lagoon typically consists of a body of water of varying salinity, including its connection with the adjacent open coast if it is directly connected by a channel. This approach corresponds with that taken for whole shores in the intertidal section of this supplement.

3.9.2 Criteria for selection The selection of SSSIs for saline lagoonal habitats, communities and species will be based on the approach outlined in Section 1 which closely follows the selection approach given in the Guidelines.

Sites which are selected for designation must satisfy some or all of the following criteria.

1. The site includes the best example of a particular habitat type with its associated communities within that AOS.

2. The site additionally contains good quality examples of specialised habitats such as bedrock exposures, tidal rapids or unusual features.

3. The site contains habitat or community features of a restricted nature on a national or international (north-east Atlantic) basis.

4. The site contains one or more of the marine species currently considered nationally rare or scarce, including those listed in schedules 5 and 8 of the Wildlife and Countryside Act 1981 (as amended).

5. The site exhibits a salinity gradient from fully marine seawater to low salinity brackish water or freshwater.
6. The site is a large area in extent as a single unit or as several units joined together by natural or man-made connections.

Species which are assessed as nationally rare or scarce are listed in Annex 2. Non-avian marine species, including saline lagoonal species, listed in Schedules 5 and 8 of the Wildlife and Countryside Act 1981 (as amended) are listed in Annex 3.

Normally one good quality example of each selection unit type, meeting one or more of the above criteria should be designated within an AOS, although several sites may be necessary to adequately represent the full range of communities present in each type of lagoon.

Assessment of importance will take account of whether the site has transitions inland to coastal terrestrial vegetation types, geological or geomorphological features or, seawards, to intertidal or subtidal marine community types which are of high interest. Sites which have such features will be more highly rated than otherwise identically rated locations.

3.10 Selection units and selection guidelines

Saline lagoons have been divided into five selection units and described on the basis of their physiographic characteristics, water exchange and consequent likely salinity. Within any one physiographic type, salinity is likely to differ from lagoon to lagoon and along gradients within a lagoon or lagoon system. The salinity regime within a particular lagoon type is therefore likely to subdivide physiographically defined selection units. Since the MNCR classification of saline lagoonal biotopes is not yet complete, descriptions of the types of communities present are given in general terms without reference to specific named biotopes.

(i) Isolated saline lagoon

These are pools which are completely isolated from the sea by a barrier of rock or sediment. No seawater enters the pool by percolation (see: ii Percolation saline lagoon), the only input of salt water occurring by limited groundwater seepage (such as in some dune pools), by overtopping of the barrier (sill) on extreme high water spring tides, or by salt water inundation during storms. Because of the limited water exchange, salinity may vary considerably with time, from near freshwater after heavy rainfall, to fully saline after recent inundation or even hyper-salinity following dry hot weather. Colonisation and recruitment are limited to chance factors because of the limited connection with the sea, and survival will be determined by the ability to survive the fluctuating conditions. Isolated lagoons are generally shallow (less than 2 m depth) and small in extent (less than 1 ha). Typically, isolated saline lagoons have muddy substrata dominated by ephemeral green algae
which show very rapid growth in summer followed by death and decay often leading to deoxygenation with associated effects on water quality. Where the sill is composed of rock, there may be communities of green algae and diatoms on rock. Particularly good examples, usually where conditions are stabilised by large size or regular inundation by seawater, may have beds of the tasselweed *Ruppia* spp. Biotope diversity and species richness are generally low. Because of the limited water exchange this type of saline lagoon is particularly susceptible to damage by run-off from surrounding land. Characteristic features include:

- complete separation from the open sea;
- species recruitment limited to chance events rather than through free connection with the open sea, hence low species richness;
- generally small, shallow and often transient.

**Percolation saline lagoon**

These pools are separated from the sea by a permeable barrier of shingle or pebbles and small boulders. Sea water exchange occurring through the barrier to varying degrees dependent on the permeability of the barrier. In highly permeable conditions (such as at Easdale in Argyll) tidal fluctuation matches that of the open coast and salinity is only marginally reduced from that of the open sea. At the other extreme, there is little fluctuation with rise in level occurring during spring tides and fall in level during neap tides. In these sites salinity may be substantially reduced. The communities present vary according to the degree of water exchange, but typically the bed of the lagoon is muddy with dense mats of green algae, amongst which may be a number of the specialist lagoonal species. The shingle bank, if stable, may be characterised by fucoid algae. Percolation pools are generally small (less than 2 ha) and shallow (less than 2 m). Because of the limited water exchange this type of lagoon is particularly susceptible to damage by run-off from surrounding land.

Characteristic features include:

- seawater exchange by percolation through a barrier;
- filtration effect of barrier impedes colonisation, hence low species richness;
- generally small, shallow and transient.
(iii) Sluiced saline lagoons

These are lagoons where the ingress and egress of water from the lagoon to the open sea is modified by human mechanical interference. This may take the form of a simple pipeline to culvert the water under a road, to a system of valves which restrict water flow as necessary to prevent tidal flooding. Sluiced saline lagoons vary enormously in their physiographic conditions. Many lagoons around the south-east coast of Britain have been sluiced to control water movement and prevent flooding of low-lying land. These lagoons are usually sediment basins, which are shallow (less than 2 m depth) and limited in extent (2 ha at most). This contrasts with some of the sluiced lagoonal systems in western Scotland, where the connecting channel to the sea has been run through a pipeline under a road. These lagoons are often rocky and may have many of the features of Billed ponds such as being relatively deep (up to 10 m) and may cover a large area (over 40 ha in some cases). Communities present in sluiced saline lagoons will vary according to the substratum types present and salinity. Much of the bed of the lagoon will be composed of sediment, with fringing halophytic vegetation and, in the Scottish examples, a fringe of rocky communities. Muddy areas are dominated by filamentous green algae amongst which may be colonies of rare charophytes such as Lamprothamnium papulosum. In some examples beds of the tasselweeds Ruppia spp. are present, whilst the deepest most stable examples have beds of the eelgrass Zostera marina. Fringing rocky areas may be dominated by green filamentous algae, or if salinity is close to that of seawater, beds of fucoid algae may be present.

Characteristic features include:

- managed seawater exchange often creates stable conditions ideal for specialist saline lagoonal species;
- exchange of seawater encourages recruitment, enhancing species richness
- vary in size and depth from small and shallow to large and deep

(iv) Silled saline lagoons

These are in many respects similar to some examples of sluiced lagoons. They are generally rocky basins which have a sill between mean high water of spring tides and mean low water of spring tides. This sill restricts water exchange with the open sea and maintains standing water within the lagoon at all states of the tide. The sill reduces tidal rise and fall to the vertical distance between the height of spring tide and the top of the sill. This can vary from negligible tidal variation in some cases where the sill is close to mean high water at spring tides, to a near full tidal range if the sill is close to mean low
water of spring tides. The height of the sill also affects water exchange, salinity and consequently the communities present. Silled saline lagoons vary from small pools of less than 0.5 ha to large areas of around 50 ha. They vary in depth from around 2 m maximum depth to around 10 m maximum depth. Larger and deeper lagoons often have less fluctuating environmental conditions and may therefore harbour the richest communities.

Where sites have a sill close to mean high water of spring tides, salinity is often low (around 15%). The basin of the lagoon is usually sediment filled, though generally fringed with rock. The sediment is usually dominated by ephemeral filamentous green algae, occasionally with beds of *Ruppia* spp. or, in very shallow depths, *Zostera noltii*. The fringing rock is colonised by further filamentous green algae and colonial diatoms. Amongst the weed in these lagoons may be a number of amphipod species and the three-spined stickleback *Gasterosteus aculeatus*. Habitat diversity is generally low in these sites and, with the stress of low salinity, usually leads to low species richness. The hydrographic regime of silled saline lagoons with a high sill creates conditions, and therefore communities, which may be similar to some percolation or isolated lagoons.

Rarely, saline lagoons with sills close to high water may be very deep. For example, Loch Obisary in the Hebrides reaches a depth of 45 m. In deep saline lagoons, seasonal thermoclines with associated deep haloclines may develop. Lack of water exchange between the separated water layers may result in deoxygenation, resulting in death and anoxic decay of the macro-biota below the thermocline. In shallower examples, around 10 m depth, wind-generated water-mixing prevents deoxygenation in all but the most calm sunny weather, and communities below the halocline may be characterised by a number of marine species which are tolerant of slightly reduced salinity, such as the ascidian *Ciona intestinalis*.

Where the sill is around mid-tide level, water exchange is generally good and salinity may reach around 30‰, close to that of full seawater. The intertidal zonation of these sites is compressed when compared to the adjacent open coast, resulting in narrow bands of fucoid algae, which may extend into the subtidal zone in sites where the salinity is reduced. These fucoid algae may include *Fucus ceranoides* which is only found in low salinity. In the subtidal areas of the lagoon, the cape form of the kelp *Laminaria saccharina* may form dense forests, often loose-lying over soft muddy sediment, along with other species typical of this environment such as *Codium fragile*, *Chorda filum* and *Phyllophora pseudoceranoides*. Beds of the eelgrasses *Zostera* spp. may also be present. The infauna of the sediment may be rich, including dense populations of bivalves such as the gaper *Mya arenaria* and a range of polychaetes including the lugworm *Arenicola marina*. Particularly outstanding examples may have populations of sea cucumbers living either on the sediment surface or attached to the fronds of kelps. The intertidal community
around the sill is often of high interest since the increased flow of water and permanent wetness encourage the growth of many species, such as sponges and ascidians, which do not normally occur in the littoral zone. These species are often attached to fucoid algae such as *Fucus serratus* or *Fucus vesiculosus*.

Where the sill is close to the level of mean low water of spring tide, water exchange with the open sea is usually good. Such lagoons may therefore have a salinity approaching that of full seawater. However, in calm conditions, the depth of the sill often means that water flowing in from the sea runs under a less dense surface layer of freshwater, allowing the development of a halocline. In this case communities in the intertidal and shallow subtidal may be subjected to reduced or variable salinity, whilst those of deeper water are fully saline. Communities present will be similar to those of sites with a mid-tide level sill, with forests of *Laminaria saccharina*, meadows of seagrasses and a rich associated fauna. As with mid-tide level sills, the intertidal communities of the sill may be of high interest due to the rich assemblage of species thriving in the increased water movement.

Characteristic features include:

- highly variable type of saline lagoon;

- complex (often rocky) basin leads to high habitat diversity and hence high community and species richness;

- often contain a number of species more characteristic of sheltered marine conditions;

- large size may lead to relative stability of environmental conditions.

(v) **Saline lagoon inlets**

These are saline lagoons where there is a permanent connection with the sea. Any sill which is present is subtidal. Water exchange with the open sea is limited by the restricted nature of the connecting channel, both in terms of width and any subtidal sill. Because of the reduced water exchange, conditions may become brackish due to freshwater input, and a halocline may develop. The communities present vary considerably. Some sites, where water exchange is high, have communities similar to other extremely sheltered areas, with no characteristic saline lagoonal species. Others, where connection with the sea is extremely limited and freshwater input is high, have a very restricted fauna amongst fucoid algae in a limited rocky intertidal and shallow subtidal zone, grading into sediment dominated by dense carpets of filamentous green algae, with *Ruppia* spp., *Zostera* spp. and possibly charophytes in particularly good examples. Lagoon inlets are frequently large...
(for instance, The Fleet in Dorset is about 480 ha) and may be deep (up to around 10 m). A particular feature of lagoon inlets are tidal rapids, caused by accelerated tidal movement of water through the restricted entrance channel in response to tidal rise and fall in the sea outside the lagoon. The communities of these rapids are often extremely rich, dominated by colonies of filter-feeding sponges and ascidians which thrive in the fast-moving water. The rocky bed of these channels is often dominated by pink encrusting coralline algae which may include rhodoliths attached to pebbles and/or free-living maerl. Larger boulders and bedrock may be colonised by species of Laminaria and support columns of the pod weed Halidrys siliquosa which in turn may be extensively colonised by sponges and ascidians.

Characteristic features include:

- good water exchange relative to other types;
- high habitat complexity leads to high species richness;
- tidal rapids in the connecting channel are the best developed in any of the types;
- large size leads to relative stability in environmental conditions. Further information

4 Further information

Further information on these guidelines and their application can be obtained from country agency marine specialists. Advice or survey information, species distributions or the intertidal biotope classification can be obtained from the Marine Nature Conservation Review, JNCC.

5 References


SUBJECT TO REVISION - For further information see http://jncc.defra.gov.uk/page-2303
NOTE: Dune grassland occurring inland is now covered by the revised Lowland Grassland chapter


6 Glossary

Biotope
The physical habitat and its associated community of species. In the field this refers to an area of the shore (which can be identified by ecological survey) with consistent habitat and species characteristics (allowing for local patchiness).

Chrysophyceae
Single-celled algae. A class of the Chrysophyta. The cells have a small number of the yellower-gold-brown chromatophores. The cells are flagellate or non-flagellate, solitary or colonial.

Community
A group of organisms occurring in a particular environment, presumably interacting with each other and with the environment, and identifiable by means of ecological survey from other groups.

Eulittoral zone
The area of shore between the supralittoral/littoral fringe (splash or lichen zones) and the sublittoral fringe (kelp zone), typically characterised by barnacles or fucoid brown algae. Sometimes called the mid-shore zone.

Fjardic sealoch
A marine inlet comprising a series of shallow basins connected to the sea via shallow and often intertidal sills. Fjards are found in areas of low-lying ground which have been subject to glacial roughening. They have a highly irregular outline, no main channel and lack the high relief and U-shaped cross-section of fjordic inlets.

Fjordic sealoch
A long, narrow-sided inlet of the sea having a shallow entrance sill. They are glacially over-deepened and may have a series of sills and basins, often having deep water at the head. They are commonly surrounded by high ground and in cross-section, have a deep 'U'-shape.

Guidelines
Habitat
The place in which a plant or animal lives. It is defined for the marine environment according to geographical location, physiographic features and the physical and chemical environment (including salinity, wave exposure, strength of tidal streams, geology, biological zone, substratum, ‘features’ (e.g. crevices, overhangs, rockpools) and 'modifiers' (e.g. sand-scour, wave-surge, substratum mobility).

Littoral zone
The area of the shore that is occupied by marine organisms which are adapted to, or need, alternating exposure to air and wetting by submersion, splash or spray. On rocky shores, the upper limit is marked by the top of the Littorina/Verrucaria belt and the lower limit by the top of the laminarian zone (Lewis 1964).

Littoral fringe
The lichen-dominated transitional zone between the supralittoral lichen zone above and the marine-dominated eulittoral zone below.

Ria
A drowned river valley found in south-west Britain. They are often much less influenced by freshwater input and more rocky than estuaries.

Saline lagoon
Areas of marine saline water, where the concentration of salts is reduced by ground or surface fresh-water input, or concentrated by evaporation. Connection with the open sea is limited by sediment, shingle or rocky barriers.

Sublittoral fringe
The zone immediately below the eulittoral, forming a transition between the intertidal and sublittoral zones. The upper limit is the top of the laminarian zone.

Supralittoral
The region of the shore immediately above the highest water level and subject to wetting by spray or wave splash. Characterised by lichens. Also known as the splash zone.
Annex 1 Nationally and more than nationally important communities

Marine intertidal communities which are considered by the MNCR to be of national or more than national importance are listed below. It is likely that changes or additions to the list will be made as further information on the extent of these and other communities becomes available.

For these communities, it is expected that all highly rated examples as assessed by the MNCR in as AOS should be included in SSSIs.

<table>
<thead>
<tr>
<th>Community or habitat type</th>
<th>Community &amp; habitat</th>
<th>MNCR biotype code</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chalk (upper shore caves &amp; cliffs)</td>
<td>Chrysophyceae on upper littoral fringe and supralittoral vertical chalk</td>
<td>LRK.CHR</td>
<td>These communities are restricted to the coastal chalk exposures between Flamborough Head, Yorkshire and Dorset. They often occur together at the same site. Some (particularly on chalk cliffs - a rare habitat in Europe) hold rare species of filamentous green algae. Examples with rare species are relevant here and all the locations which are not degraded by coastal defences should be notified.</td>
</tr>
<tr>
<td></td>
<td>Red and green velvety algal bands on upper littoral fringe of chalk caves</td>
<td>LRK.APP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mats of Blidingia spp. On littoral fringe vertical chalk</td>
<td>LRK.BLID</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Filamentous algae Ulothrix flacca and Urospora spp. On littoral fringe chalk</td>
<td>LRK.UU</td>
<td></td>
</tr>
<tr>
<td>Soft piddock-bored rock</td>
<td>Fucus serratus, piddocks and red algae on lower-eulittoral soft rock</td>
<td>LRK.FSE.PID</td>
<td>Present on chalk shores in south-east England and on limestone shores elsewhere.</td>
</tr>
<tr>
<td></td>
<td>Laminaria digitata and piddocks on sublittoral fringe soft rock</td>
<td>LRK.LDIG.PID</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Piddocks and Mytilus edulis on eulittoral form clay</td>
<td>LRK.PID.CLY</td>
<td>Known from the Irish Sea and East Anglian coastlines</td>
</tr>
<tr>
<td></td>
<td>Piddocks and a dense algal mat on fossilised peat outcrops</td>
<td>LRK.PID.PEAT</td>
<td>Known from north Norfolk</td>
</tr>
<tr>
<td>Extremely exposed fucoid algae</td>
<td>Fucus distichus subsp. anceps and Fucus spiralis f. nana on extremely exposed littoral fringe bedrock</td>
<td>LRK.FDIS</td>
<td>Restricted to north and west Scotland, particularly Shetland and offshore islands. In some areas, the community is particularly well developed and has been especially studies in Fair Isle. Also occurs in Norway</td>
</tr>
</tbody>
</table>

NOTE: Dune grassland occurring inland is now covered by the revised Lowland Grassland chapter
### Annex 1 continued

<table>
<thead>
<tr>
<th><strong>Tide-swept algae</strong></th>
<th><strong>Ascophyllum nodosum</strong>, sponges and ascidians on tide-swept mid-eulittoral rock</th>
<th><strong>LRK.ASC.T</strong></th>
<th>Found in the tide-swept narrows of sealochs in western Scotland. Communities much richer than non tide-swept fucoid communities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fucus serratus</strong>, sponges and ascidians on tide-swept lower-eulittoral rock</td>
<td><strong>LRK.FSE.T</strong></td>
<td><strong>Laminaria digitata</strong>, ascidians &amp; bryozoans on tide-swept sublittoral fringe rock</td>
<td><strong>LRK.LDIG.T</strong></td>
</tr>
<tr>
<td><strong>Sponges, ascidians and red algae on tide-swept lower-shore mixed substrata</strong></td>
<td><strong>LMXD.SAR</strong></td>
<td><strong>Variable or low salinity</strong></td>
<td>Balanus improvisus and sphaeromid isopods on eulittoral rock</td>
</tr>
<tr>
<td><strong>Sand-scoured rocks</strong></td>
<td><strong>Sabellaria alveolata reefs on mid-and lower-shore sand-abraded mixed substrata</strong></td>
<td><strong>LMXD.SAB</strong></td>
<td>Occurs on wave-exposed boulder scar grounds between the Solway and Cornwall</td>
</tr>
<tr>
<td><strong>Extreme shelter (sealochs)</strong></td>
<td><strong>Ascophyllum nodosum ecad mackaii beds on extremely sheltered, variable salinity, mixed substrata</strong></td>
<td><strong>LMXD.AMAC</strong></td>
<td>Restricted to Scottish sealochs, often covering extensive areas of shingle or muddy shore. This distinctive growth form of Ascophyllum nodosum is not recorded extensively elsewhere in the north-east Atlantic</td>
</tr>
<tr>
<td><strong>Muddy gravels</strong></td>
<td><strong>Carpet shell Venerupis senegalensis and blunt gaper Mya truncata in muddy gravel shores</strong></td>
<td><strong>LMGR.VEN</strong></td>
<td>Found in sealochs and rias</td>
</tr>
<tr>
<td></td>
<td><strong>Gaper Mya arenaria and polychaetes in reduced-salinity muds and muddy gravels</strong></td>
<td><strong>LMGR.MYA</strong></td>
<td></td>
</tr>
</tbody>
</table>
Annex 2  Nationally rare and scarce species – intertidal areas and lagoons

Rarity assessment for marine benthic species is currently underway and requires the examination and assessment of large quantities of data as well as consultation with many taxonomic experts. This process is currently incomplete. As such, the species list below is provisional and, although these species will invariably be of biological interest, they should not be regarded as definitively rare or scarce. Some species listed below are known to occur in the very shallow sublittoral and are included because it is conceivable that they may yet be found in the sublittoral fringe.

Nationally rare = recorded in 8 or fewer 10 km x 10 km squares of the Ordnance Survey National Grid.

Nationally scarce = recorded in 9 to 55 10 km x 10 km squares of the Ordnance Survey National Grid.

For further details and a discussion of assessment criteria see Sanderson (in prep.).

Species codes are from the Marine Conservation Society’s *Species directory* (Howson 1987). Species schedules under the Wildlife and Countryside Act 1981 and those included in British Red Data Books are indicated.

<table>
<thead>
<tr>
<th>Species directory code</th>
<th>Nationally rare</th>
<th>Nationally scarce</th>
<th>Scheduled in W&amp;C Act 1981 (as amended)</th>
<th>Included in British Red Data Books</th>
</tr>
</thead>
<tbody>
<tr>
<td>C0207  Thymosia guernei</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C0224  Suberites massa</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C0413  Adreus fascicularis</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Porifera (sponges)

Cnidaria (sea firs, sea anemones, soft and hard corals, sea fans, sea pens)

D0715  Hartlaubella gelatinosa  ●
D0720  Laomedea angulata  ●
D0729  Obelia bidentata  ●
D1121  Isozoanthus sulcatus  ●
D1203  Aiptasia mutabilis  ●
D1253  Phellia gausapata  ●
D1331  Nematostella vectensis  ●  ●
D1342  Edwardsia ivelli  ●  ●
D1344  Edwardsia timida  ●
D1350  Scolanthus callimorphus  ●
D1386  Hoplangi a durotrix  ●
D1404  Balanophyllia regia  ●

SUBJECT TO REVISION - For further information see http://jncc.defra.gov.uk/page-2303

NOTE: Dune grassland occurring inland is now covered by the revised Lowland Grassland chapter
<table>
<thead>
<tr>
<th>Species directory code</th>
<th>Nationally rare</th>
<th>Nationally scarce</th>
<th>Scheduled in W&amp;C Act 1981 (as amended)</th>
<th>Included in British Red Data Books</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Annelida (segmented worms)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P1524</td>
<td>Sternaspis scutata</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P1689</td>
<td>Ophelia bicornis</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>P1712</td>
<td>Armandia cirrhosa</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>P1892</td>
<td>Alkmaria romjini</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Crustacea (amphipods, isopods, crabs)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S0647</td>
<td>Pereionotus testudo</td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>S0773</td>
<td>Gammarus insensibilis</td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>S0783</td>
<td>Pectenogammarus planicrurus</td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>S1573</td>
<td>Synisoma lancifer</td>
<td></td>
<td></td>
<td>●</td>
</tr>
<tr>
<td><strong>Mollusca (chitons, snails, sea slugs, bivalves)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W0057</td>
<td>Leptochiton scabridus</td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>No code</td>
<td>Caecum armoricum</td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>W0375</td>
<td>Truncatella subcylindrica</td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>W0379</td>
<td>Palidinella littorina</td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>W1482</td>
<td>Tenellia adspersa</td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>W1557</td>
<td>Aeolidiella sanguinea</td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>W1853</td>
<td>Thyasira gouldi</td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td><strong>Bryozoa (sea mats)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y0176</td>
<td>Victorella pavida</td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Y0334</td>
<td>Watersipora complanata</td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Y0382</td>
<td>Porella alba</td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Y0566</td>
<td>Plesiothoa gigerium</td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Y0624</td>
<td>Turbicellepora magnicostata</td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Y0876</td>
<td>Bugula purpurotincta</td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td><strong>Echinodermata (starfish, urchins)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZB0369</td>
<td>Paracebtrotus lividus</td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td><strong>Asciidiacea (sea squirts)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZD0159</td>
<td>Phallusia mammillata</td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>ZD0258</td>
<td>Molgula oculata</td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td><strong>Pisces (fish)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZG0719</td>
<td>Gobius cobitis</td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>Species Name</td>
<td>Family</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>------------------------------------</td>
<td>---------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZM0218</td>
<td>Gelidium sesquipedale</td>
<td>Rhodophyta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZM0322</td>
<td>Callophyllis cristata</td>
<td>Rhodophyta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZM0546</td>
<td>Gracilaria bursa-pastoris</td>
<td>Rhodophyta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZM0547</td>
<td>Gracilaria multipartita</td>
<td>Rhodophyta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZM0760</td>
<td>Anotrichium barbatum</td>
<td>Rhodophyta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZM0780</td>
<td>Bornetia secundiflora</td>
<td>Rhodophyta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZM1091</td>
<td>Lophosiphonia reptobunda</td>
<td>Rhodophyta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Code</td>
<td>polysiphonia ceraniformis</td>
<td>Rhodophyta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZM1138</td>
<td>Pterosiphonia pennata</td>
<td>Rhodophyta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZR0159</td>
<td>Pseudolithoderma roscoffensis</td>
<td>Phaeophyta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZR0258</td>
<td>Halothrix lumbricalis</td>
<td>Phaeophyta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZR0513</td>
<td>Leblondiella densa</td>
<td>Phaeophyta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZR0549</td>
<td>Asperococcus compressus</td>
<td>Phaeophyta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZR0671</td>
<td>Asperococcus scaber</td>
<td>Phaeophyta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZR0671</td>
<td>Fucus distichus</td>
<td>Phaeophyta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZS0341</td>
<td>Clardophora battersii</td>
<td>Chlorophyta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZS0398</td>
<td>Derbesia tenuissima</td>
<td>Chlorophyta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Code</td>
<td>Lamprothamnium papulosum</td>
<td>Charophyceae</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Code</td>
<td>Tolypella nidifica</td>
<td>Charophyceae</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All cetaceans
*Odobenus rosmarus* (walrus)
*Lutra lutra* (otter)
All marine turtles (Dermochelyidae and Cheloniidae)
*Alosa alosa* (allis shad)
*Acipenser sturio* (sturgeon)
*Gammarus insensibilis* (lagoon sand shrimp)
*Victorella pavida* (trembling sea mat)
*Caecum armoricum* (De Folin’s lagoon snail)
*Paludinella littorina* (lagoon snail)
*Tenellia adspersa* (lagoon sea slug)
*Thyasira gouldi* (northern hatchet-shell)
*Alkmaria romijni* (tentacled lagoon worm)
*Armandia cirrhosa* (lagoon sand worm)
*Edwardsia ivelli* (Ivell’s sea anemone)
*Eunicella verrucosa* (pink sea fan)
*Nematostella vectensis* (starlet sea anemone)
*Lamprothamnium papulosum* (foxtail stonewort)