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

Guidelines for the selection of biological SSSIs
Part 2: Detailed guidelines for habitats and species groups

1c Saline lagoons

Note: this section has been extracted from the original Chapter 1, which also includes the original versions of the Coastlands (1a) and Marine Intertidal and Shallow Subtidal Habitats (1b) chapters. Chapters 1a and 1b have subsequently been revised. Chapter 1c is still under revision

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

1c Saline lagoons

To be re-numbered after review

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 "euryhaline 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%0. 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.*

Box 1 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**	Paracymus aenus**
Crustaccea	Idotea chelipes Sphaeroma hookeri Gammarus insesnibilis**(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 adspersa** 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 muscoides* 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.

(ii) 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 fur 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%0). 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 30700, 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.

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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
Refers to the Guidelines for selection of biological SSSIs published by the Nature Conservancy Council in 1989.

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.

Community or habitat type	Community & habitat	MNCR biotype code	Comments
Chalk (upper shore caves & cliffs	Chrysophyceae on upper littoral fringe and supralittoral vertical chalk	LRK.CHR	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 notifies
	Red and green velvety algal bands on upper littoral fringe of chalk caves	LRK.APP	
	Mats of *Blidingia* spp. On littoral fringe vertical chalk	LRK.BLID	
	Filamentous algae *Ulothrix flacca* and *Urospora* spp. On littoral fringe chalk	LRK.UU	
Soft piddock-bored rock	*Fucus serratus,* piddocks and red algae on lower-eulittoral soft rock	LRK.FSE.PID	Present on chalk shores in south-east England and on limestone shores elsewhere.
	Laminaria digitata and piddocks on sublittoral fringe soft rock	LRK.LDIG.PID	
	Piddocks and *Mytilus edulis* on eulittoral form clay	LRK.PID.CLY	Known from the Irish Sea and East Anglian coastlines
	Piddocks and a dense algal mat on fossilised peat outcrops	LRK.PID.PEAT	Known from north Norfolk
Extremely exposed fucoid algae	*Fucus distichus* subsp. *anceps* and *Fucus spiralis* f. *nana* on extremely exposed littoral fringe bedrock	LRK.FDIS	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

Annex 1 continued

Tide-swept algae	*Ascophyllum nodosum,* sponges and ascidians on tide-swept mid-eulittoral rock	LRK.ASC.T	Found in the tide-swept narrows of sealochs in western Scotland. Communities much richer than non tide-swept fucoid communities
	Fucus serratus, sponges and ascidians on tide-swept lower-eulittoral rock	LRK.FSE.T	
	Laminaria digitata, ascidians & bryozoans on tide-swept sublittoral fringe rock	LRK.LDIG.T	
	Sponges, ascidians and red algae on tide-swept lower-shore mixed substrata	LMXD.SAR	Found in estuaries and other inlets where currents are enhanced over low-shore stony sediments
Variable or low salinity	Balanus improvisus and sphaeromid isopods on eulittoral rock	-	Status to be confirmed
Sand-scoured rocks	Sabellaria alveolata reefs on mid-and lower-shore sand-abraded mixed substrata	LMXD.SAB	Occurs on wave-exposed boulder scar grounds between the Solway and Cornwall
Extreme shelter (sealochs)	Ascophyllum nodosum ecad mackaii beds on extremely sheltered, variable salinity, mixed substrata	LMXD.AMAC	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
Muddy gravels	Carpet shell Venerupis senegalensis and blunt gaper Mya truncata in muddy gravel shores	LMGR.VEN	Found in sealochs and rias
	Gaper Mya arenaria and polychaetes in reduced-salinity muds and muddy gravels	LMGR.MYA	

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 sublittorial 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.). 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.

Species directory code		**Nationally rare**	**Nationally scarce**	**Scheduled in W&C Act 1981 (as amended)**	**Included in British Red Data Books**
	Porifera (sponges)				
C0207	*Thymosia guernei*	•			
C0224	*Suberites massa*	•			
C0413	*Adreus fascicularis*		•		
	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	*Hoplangia 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

Species directory code		Nationally rare	Nationally scarce	Scheduled in W&C Act 1981 (as amended)	Included in British Red Data Books
	Annelida (segmented worms)				
P1524	*Sternaspis scutata*	•			
P1689	*Ophelia bicornis*	•		•	
P1712	*Armandia cirrhosa*	•	•	•	
P1892	*Alkmaria romijni*				
	Crustacea (amphipods, isopods, crabs)				
S0647	*Pereionotus testudo*	•			
S0773	*Gammarus insensibilis*		•	•	•
S0783	*Pectenogammarus planicrurus*	•			
S1573	*Synisoma lancifer*		•		
	Mollusca (chitons, snails, sea slugs, bivalves				
W0057	*Leptochiton scabridus*		•		
No code	*Caecum armoricum*	•		•	•
W0375	*Truncatella subcylindrica*	•			•
W0379	*Palidinella littorina*	•		•	•
W1482	*Tenellia adspersa*	•		•	•
W1557	*Aeolidiella sanguinea*	•			
W1853	*Thyasira gouldi*	•		•	
	Bryozoa (sea mats)				
Y0176	*Victorella pavida*	•		•	•
Y0334	*Watersipora complanata*	•			
Y0382	*Porella alba*	•			
Y0566	*Plesiothoa gigerium*	•			
Y0624	*Turbicellepora magnicostata*	•			
Y0876	*Bugula purpurotincta*	•			
	Echinodermata (starfish, urchins)				
ZB0369	*Paracebtrotus lividus*		•		
	Ascidiacea (sea squirts)				
ZD0159	*Phallusia mammillata*		•		
ZD0258	*Molgula oculata*		•		
	Pisces (fish)				
ZG0719	*Gobius cobitis*		•		

	Rhodophyta (red algae)				
ZM0218	*Gelidium sesquipedale*	•			
ZM0322	*Callophyllis cristata*		•		
ZM0546	*Gracilaria bursa-pastoris*		•		
ZM0547	*Gracilaria multipartita*		•		
ZM0760	*Anotrichium barbatum*	•			
ZM0780	*Bornetia secundiflora*	•			
ZM1091	*Lophosiphona reptobunda*	•			
No code	*polysiphonia ceraniformis*	•			
ZM1138	*Pterosiphonia pennata*		•		
	Phaeophyta (brown algae)				
ZR0159	*Pseudolithoderma roscoffensis*		•		
ZR0258	*Halothrix lumbricalis*	•			
ZR0513	*Leblondiella densa*	•			
ZR0549	*Asperococcus compressus*		•		
ZR0671	*Asperococcus scaber*	•			
ZR0671	*Fucus distichus*		•		
	Chlorophyta (green algae)				
ZS0341	*Clardophora battersii*	•			
ZS0398	*Derbesia tenuissima*	•			
	Charophycaea (stoneworts)				
No code	*Lamprothamnium papulosum*		•	•	•
No code	*Tolypella nidifica*	•			•

Annex 3 Marine species protected under schedule 5 and 8 of the 1981 Wildlife and Countryside Act.

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)