

## APPENDIX 4. BIOTOPE DESCRIPTIONS

Table 4.1 Biotope numbers and codes

Biotope number	Biotope code
1	SLR.Fspi
2	SLR.Fves
3	SLR.Asc
4	SLR.Pel
5	SLR.EphX
6	MLR.EntPor
7	LGS
8	LGS.Tal
9	LGS.BarSnd
10	LGS.AP
11	LGS.AP.Pon
12	LGS.Lan
13	LMS.PCer
14	LMU
15	LMU.Mu
16	LMU.HedMac
17	LMU.HedScr
18	IGS.FaS
19	IMS.FaMS
20	IMU.EstMu
21	IMX

### No. 1 SLR.Fspi *Fucus spiralis* on moderately exposed to very sheltered upper eulittoral rock

Moderately exposed to very sheltered upper eulittoral bedrock and boulders are typically characterised by a band of the spiral wrack *Fucus spiralis* overlying the black lichens *Verrucaria maura* and *V. mucosa*. Limpets *Patella vulgata*, winkles *Littorina* spp. and barnacles *Semibalanus balanoides* are usually present under the fucoid fronds and on open rock. During the summer months ephemeral green algae such as *Enteromorpha* spp. and *Ulva lactuca* may also be present. This zone usually lies below a *Pelvetia canaliculata* zone (Pel or PelB); occasional clumps of *Pelvetia* may be present (usually less than common) amongst the *F. spiralis*. In areas of extreme shelter, such as in Scottish sealochs, the *Pelvetia* and *F. spiralis* zones often merge together forming a very narrow band. Fspi occurs above the *Ascophyllum nodosum* (Asc) and/or *Fucus vesiculosus* (Fves) zones and these two fucoids may also occur, although *Fucus spiralis* always dominates. Vertical surfaces in this zone, especially on moderately exposed shores, often lack the fucoids and are characterised by a barnacle-*Patella* community (BPat.Sem).

### No. 2 SLR.Fves *Fucus vesiculosus* on sheltered mid eulittoral rock

Moderately exposed to sheltered mid eulittoral rock characterised by a dense canopy of large *Fucus vesiculosus* plants (typically abundant to superabundant). Beneath the algal canopy the rock surface has a sparse covering of barnacles (typically rare-frequent) and limpets, with mussels confined to pits and crevices. *Littorina littorea* and *Nucella lapillus* are also found beneath the algae, whilst *Littorina obtusata* and *Littorina mariae* graze on the fucoid fronds. The fronds may be epiphytised by the filamentous brown alga *Elachista fucicola* and the small calcareous tubeworm *Spirorbis spirorbis*. In areas of localised shelter, *Ascophyllum nodosum* may also occur, though never at high abundance (typically rare to occasional) - (compare with Asc). Damp cracks and crevices often contain patches of the red seaweeds *Osmundea* (*Laurencia*) *pinnatifida*, *Mastocarpus stellatus* and encrusting coralline algae. This biotope usually occurs between the *Fucus spiralis* (Fspi) and the *Fucus serratus* (Fser) zones; both of these fucoids may be present in this biotope, though never at high abundance (typically less than frequent). In some sheltered areas *Fucus vesiculosus* forms a narrow zone above the *A. nodosum* zone (Asc). Where freshwater runoff occurs on more gradually sloping shores *F. vesiculosus* may be replaced by *Fucus ceranoides* (Fcer).

### No. 3 SLR.Asc *Ascophyllum nodosum* on very sheltered mid eulittoral rock

Sheltered to very sheltered mid eulittoral rock with the knotted wrack *Ascophyllum nodosum*. Several variants of this biotope are described. These are: full salinity (Asc.Asc), tide-swept (Asc.T) and variable salinity (Asc.VS).

**No. 4 SLR.Pel *Pelvetia canaliculata* on sheltered littoral fringe rock**

Lower littoral fringe bedrock or stable boulders on sheltered shores are characterised by a dense cover of the furoid *Pelvetia canaliculata*. The furoid overgrows a crust of black lichens *Verrucaria maura* and *Verrucaria mucosa*, or *Hildenbrandia rubra* on very sheltered shores. This biotope lacks the density of barnacles found amongst the *Pelvetia* on more exposed shores (PelB). The littorinids *Littorina littorea* and *L. saxatilis* occur. The red alga *Catenella caespitosa* is characteristic of this biotope, as is the lichen *Lichina confinis*. Though not typical, this biotope may occur on moderately exposed shores where local topography provides shelter.

**No. 5 SLR.EphX Ephemeral green and red seaweeds on variable salinity or disturbed eulittoral mixed substrata**

Eulittoral mixed substrata (pebbles and cobbles overlying sand or mud) that is subject to variations in salinity and / or siltation are often characterised during the summer months by dense blankets of ephemeral green and red algae. The main species present are *Enteromorpha* spp., *Ulva lactuca* and *Porphyra* spp. Although furoid algae occur in these areas they are typically rare. Small numbers of other species such as barnacles *Semibalanus balanoides* and *Elminius modestus* and keel worms *Pomatoceros* spp. are confined to any larger cobbles and pebbles. This biotope may be a summer variation of BLit, in which ephemeral algal growth has exceeded the capacity of the grazing molluscs. In common with the other biotopes found on mixed substrata, patches of sediment are typically characterised by infaunal species including bivalves (*Cerastoderma edule* and *Macoma balthica*) and polychaetes (*Arenicola marina* and *Lanice conchilega*). Occasional clumps of *Mytilus edulis* may also occur, although at considerably lower density than in MytX.

**No. 6 MLR.EntPor *Porphyra purpurea* or *Enteromorpha* spp. on sand-scoured mid or lower eulittoral rock**

Moderately exposed mid-shore bedrock and boulders occurring adjacent to areas of sand which significantly affects the rock. As a consequence of sand-abrasion, furoids are scarce and the community is typically dominated by ephemeral algae, particularly *Porphyra purpurea* and *Enteromorpha* spp. Under the blanket of ephemeral algae, barnacles and limpets occur in the less scoured areas. Few other species are present. In areas where sand abrasion is less severe, the sand-binding red alga *Rhodothamniella floridula* occurs with other sand-tolerant algae and furoid algae (especially *Fucus serratus*) (Rho).

**No. 7 LGS Littoral gravels and sands**

Clean gravel and/or sand in the littoral zone (the area between high and low tides) with a particle diameter range from 16 mm to 0.063 mm; shingle shores comprising mobile cobbles, pebbles and coarse gravel are also included. The shore and substratum type can range from steep mobile shores that are typically of coarse material (gravel and coarse sand), through less steep shores of coarse, medium or fine sand to level sandflats of fine sand that remain water-saturated throughout the tidal cycle. Mud (particle diameter less than 0.063 mm) does not exceed 10%, and is usually totally absent.

**No. 8 LGS.Tal Talitrid amphipods in decomposing seaweed on the strand-line**

A community of talitrid amphipods may occur on any shore where decomposing seaweed accumulates on the extreme upper shore strand-line. The community occurs on a wide variety of sediment shores composed of shingle and mixed substrata through to fine sands, but may also occur on mixed and rocky shores in some circumstances. The decaying seaweed provides cover and humidity for *Talitrus saltator* and other components of the community. The amphipods *Orchestia* spp. are also often present, as well as enchytraeid oligochaetes. Polychaetes, molluscs and other crustaceans may be brought in on the tide, but are not necessarily associated with the infaunal community. Further analysis of the data may determine that *Orchestia* spp. are associated with a denser strand and that there are differences in the community dependant upon the substratum-type. *Talitrus saltator* may occur further down the shore, almost invariably accompanied by burrowing amphipods such as *Bathyporeia* spp. (LGS.AEur).

**No. 9 LGS.BarSnd Barren coarse sand shores**

Freely-draining coarse sandy beaches, particularly on the upper shore, which lack a macrofaunal community due to their continual mobility. Trial excavations are unlikely to reveal any macrofauna in

these typically steep beaches on exposed coasts. Burrowing amphipods *Bathyporeia* spp. or *Pontocrates* spp. and the isopod *Eurydice pulchra* may be found in extremely low abundances, but if present in any quantity should be classed as LGS.AEur. Other species that may be found in low abundance may be left behind by the ebbing tide.

#### **No. 10 LGS.AP Burrowing amphipods and polychaetes in clean sand shores**

Mid and lower shore clean sandy shores on wave-exposed or moderately wave-exposed coasts support a community of burrowing amphipods and polychaetes, sometimes with bivalves such as *Angulus tenuis*. The medium to fine-grained sand remains damp throughout the tidal cycle. The community consists of burrowing amphipods (*Pontocrates altamarinus*, *P. arenarius*, *Bathyporeia elegans*, *B. guilliamsoniana*, *B. pelagica*, *B. pilosa* and *B. sarsi*), the isopod *Eurydice pulchra*, the cumacean *Cumopsis goodsiri* and polychaetes (including *Nephtys cirrosa*, *Scolecopsis squamata*, *Paraonis fulgens* and *Arenicola marina*). The presence of polychaetes is seen as coloured burrows running down from the surface of the sediment. The sediment is often rippled and typically lacks an anoxic black sub-surface layer. This community differs from the community of burrowing amphipods (LGS.AEur) in its greater variety of polychaete species and the presence of bivalves. The two sub-types are LGS.AP.P and LGS.AP.Pon depending upon the proportion of amphipods and polychaetes and the specific species present in the sand. More stable sediment, such as is found in sandy inlets or extensive coastal sandflats are LMS.PCer or LMS.MacAre.

#### **No. 11 LGS.AP.Pon Burrowing amphipods *Pontocrates* spp. and *Bathyporeia* spp. in lower shore clean sand**

Lower shore clean sand on wave-exposed or moderately wave-exposed coasts support a community of burrowing amphipods and polychaetes. Amphipods make up the greater part of the community and are typically dominated by *Pontocrates altamarinus*, *P. arenarius*, *Bathyporeia elegans*, *B. pelagica*, *B. pilosa* the isopod *Eurydice pulchra* and the cumacean *Cumopsis goodsiri*. Polychaetes are dominated by *Nephtys cirrosa*, *Paraonis fulgens* and *Scolecopsis squamata*. *Angulus tenuis* is also frequently found in this biotope. Although the characterising species are not found very frequently, they are faithful to this biotope. The medium and fine sand remains damp throughout the tidal cycle and contains little organic matter. The presence of polychaetes may be seen as coloured burrows running down from the surface of the sediment. The sediment is often rippled and typically lacks an anoxic black sub-surface layer. LGS.AP.Pon is distinguished from LGS.AP.P as being less stable sediment with a community dominated by amphipods, particularly *Pontocrates altamarinus*, *Bathyporeia elegans* and *Cumopsis goodsiri* or the bivalve *Angulus tenuis*. This community differs from the community of burrowing amphipods (LGS.AEur) in its greater variety of polychaete and amphipod species. More stable sediment, found in sandy inlets or extensive coastal sandflats are considered to be LMS.PCer or LMS.MacAre, depending upon the community present.

#### **No. 12 LGS.Lan Dense *Lanice conchilega* in tide-swept lower shore sand**

Medium to fine sand, which is usually clean but may contain some fines and supports dense populations of *Lanice conchilega*, usually on the lower shore but also sometimes on water-logged mid shores. The biotope occurs under tide-swept conditions in sheltered straits, sounds and fully marine sealochs or on shores moderately exposed to wave action. The biotope is distinguished from others in sandy beaches by the presence of *Lanice conchilega* at levels of common and above or as the main polychaete component. Other polychaetes present are tolerant of sand scour or mobility of the surface levels of the sediment and include glycerid polychaetes, *Anaitides mucosa*, *Nephtys cirrosa*, *Nephtys hombergii* and *Pygospio elegans*. Few crustaceans are found regularly and the bivalve component is restricted to cockles *Cerastoderma edule* and more rarely *Macoma balthica*. Pebbles and cobbles may also be mixed in with lower shore tide-swept sand with dense *Lanice conchilega* between the cobbles, but the infaunal component is rarely sampled. The infaunal community under these circumstances, provided that the cobbles are not packed very close together, will be similar to that in areas of purer sand. Dense *L. conchilega* also occurs in shallow sublittoral sediments (IGS.Lcon).

#### **No. 13 LMS.PCer Polychaetes and *Cerastoderma edule* in fine sand or muddy sand shores**

Fine sand on extensive moderately wave-exposed and sheltered shores, where the sediment is sufficiently stable to accommodate populations of *Cerastoderma edule* (at least occasional) and other bivalves. The community is found mainly on the mid and lower shore where the sediment is water-saturated most of the time. Slightly muddy conditions at some sites are reflected in a reduced amphipod population and a wider range of polychaetes compared to Amphipod-polychaete biotopes (LGS.AP). The community consists of polychaetes *Nephtys hombergii*, *Scoloplos armiger*, *Pygospio elegans*, *Spio filicornis* and *Capitella capitata*, oligochaetes, the amphipod *Bathyporeia sarsi*, and the bivalves *Cerastoderma edule* and *Macoma balthica*. This biotope carries commercially viable stocks

of cockles *Cerastoderma edule*. It is therefore possible to find areas of this habitat where the infauna may have been changed through recent cockle dredging. Higher on the shore, adjacent to this biotope, LMS.BatCor is found with fewer polychaete and bivalve species due to the drier sediment found on the upper shore. LMS.PCer has broad transition areas with LMS.MacAre, LMU.HedMac.Pyg and LMU.HedMac.Are. LMS.MacAre and LMU.HedMac.Are are indicated by the presence of *Arenicola marina*, the latter also having *Hediste (Nereis) diversicolor*, oligochaetes and other species that indicate a more sheltered, muddy sand biotope. LMU.HedMac.Pyg has a greater proportion of the polychaetes *Hediste diversicolor*, *Pygospio elegans* and *Eteone longa*, oligochaetes and the amphipod *Corophium volutator*. The species richness of LMS.PCer, particularly for polychaetes and bivalves, is greater than the more wave-exposed biotopes LGS.AP.

#### **No. 14 LMU Littoral muds**

Shores of fine particulate sediment with a particle size less than 0.063 mm in diameter that typically forms extensive mudflats. Dry compacted mud can form steep and even vertical structures, particularly at the top of the shore adjacent to saltmarshes. Also included in this higher division are sandy muds which have between 20% and 70% sand, the remainder being made up of mud with a particle size less than 0.063 mm. Small amounts of gravel or pebbles may be found within mud, having little effect upon the structure of the associated communities. Littoral muds support communities characterised by polychaetes, certain bivalves and oligochaetes. The ragworm *Hediste (Nereis) diversicolor*, the Baltic tellin *Macoma balthica* and the furrow shell *Scrobicularia plana* are conspicuous members of muddy shore communities.

#### **No. 15 LMU.Mu Soft mud shores**

Shores of soft mud, typically with over 80% silt/clay fraction, giving very or extremely soft sediment shores. These are typically restricted to the upper reaches of estuaries and subject to variable, reduced or low salinity conditions. Although not very species-rich, with increasingly lower salinity conditions the mud supports even more impoverished communities, characterised by oligochaete worms.

#### **No. 16 LMU.HedMac *Hediste diversicolor* and *Macoma balthica* in sandy mud shores**

Littoral sandy mud and mud in sheltered, often estuarine, conditions with a community of polychaetes together with the bivalve *Macoma balthica*. The most abundant large polychaete is typically *Hediste (Nereis) diversicolor*, which can be readily seen when digging over the sediment. Other smaller polychaetes include *Eteone longa*, *Nephtys hombergii*, *Aphelochaeta marioni*, *Pygospio elegans*, *Arenicola marina* and *Manayunkia aestuarina*. Oligochaete worms (e.g. *Tubificoides benedii*, *T. pseudogaster* and enchytraeids) are common or abundant and the amphipod *Corophium volutator* may be abundant. The mud snail *Hydrobia ulvae* is often common, with individuals or their fine tracks visible on the mud surface. The bivalve *Macoma balthica* may be accompanied by *Cerastoderma edule*, *Abra tenuis* and *Mya arenaria*. The surface of the mud may be covered with green algae such as *Enteromorpha* spp. or *Ulva lactuca*. There is usually a black anoxic layer close to the sediment surface. LMU.HedStr is a similar biotope that is associated with muddier sediment in reduced salinity conditions with *Streblospio shrubsolii*, *Manayunkia aestuarina* or *Tharyx killariensis* and with fewer bivalves. Three variations of this biotope are recognised: HedMac.Are, HedMac.Pyg and HedMac.Mare.

#### **No. 17 LMU.HedScr *Hediste diversicolor* and *Scrobicularia plana* in reduced salinity mud shores**

Mid and upper shore sandy mud and mud that is subject to variable and reduced salinity is typically colonised by the polychaete *Hediste (Nereis) diversicolor* and the bivalve *Scrobicularia plana*. The polychaetes *Eteone longa*, *Pygospio elegans* and *Streblospio shrubsolii*, oligochaetes, particularly *Tubificoides benedii* and the isopod *Cyathura carinata* are all characteristic of the infaunal assemblage. Other bivalves, such as the Baltic tellin *Macoma balthica* and cockle *Cerastoderma edule*, are also frequently recorded. The mud snail *Hydrobia ulvae* is usually common. The green alga *Ulva lactuca* may colonise the surface of the mud in the summer months or it may be covered by a mat of filamentous algae such as *Enteromorpha* spp. Typically, the sediment is wet in appearance and has an anoxic layer below 1 cm depth. The surface of the mud has the distinctive 'crow's foot' pattern formed by *Scrobicularia plana*. The biotope LMU.HedStr is very similar, but with some differences in the polychaetes and bivalves recorded. In LMU.HedStr, the frequency and abundance of *Eteone longa* is lower, whilst the frequency of the polychaetes *Nephtys hombergii*, *Streblospio shrubsolii*, *Aphelochaeta marioni* and *Melinna palmata* is greater. The bivalve richness in LMU.HedScr is typically higher with a greater frequency of *Cerastoderma edule*, *Macoma balthica*, *Scrobicularia plana* and *Abra tenuis*. LMU.HedScr may be intermediate between LMU.HedStr and LMU.HedMac or

LMU.HedMac.Mare. It is muddier and is subject to a lower salinity level than LMU.HedMac. The diversity of species recorded is much greater than in LMU.HedOI.

**No. 18 IGS.FaS Shallow sand faunal communities**

Clean sands which occur in shallow water, either on the open coast or in tide-swept channels of marine inlets. The habitat typically lacks a significant seaweed component and is characterised by robust fauna, particularly venerid bivalves, amphipods and robust polychaetes.

**No. 19 IMS.FaMS Shallow muddy sand faunal communities**

Muddy sand habitats in the infralittoral zone, extending from the extreme lower shore down to more stable circalittoral zone at about 15-20 m. The habitat supports a variety of animal-dominated communities, particularly of polychaetes, bivalves and the urchin *Echinocardium cordatum*.

**No. 20 IMU.EstMu Estuarine sublittoral muds**

Shallow sublittoral muds, extending from the extreme lower shore to about 15 m depth in estuarine conditions. Such habitats typically support communities of oligochaetes, polychaetes, and bivalves such as *Aphelochaeta marioni*. In lowered salinity conditions the sediments may include a proportion of coarser material, where the silt content is sufficient to yield a similar community to that found in purer muds.

**No. 21 IMX Estuarine sublittoral mixed sediments**

Shallow sublittoral mixed sediments in estuarine conditions, often with surface shells or stones enabling the development of epifaunal communities, e.g. *Crepidula fornicata* (IMX.CreAph) and mussel *Mytilus edulis* beds (IMX.MytV), as well as infaunal communities. The habitat is therefore often quite species rich, compared with purer sediments.

