The Marine Habitat Classification for Britain and Ireland. Version 04.05

Infralittoral Rock Section

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IR Infralittoral rock (and other hard substrata)

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt), Reduced/low (0.5-30ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed, Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Very strong, Strong, Moderately strong, Weak, Very weak
Substratum:	Bedrock; boulders, cobbles; mixed substrata
Zone:	Sublittoral fringe, Infralittoral
Height band:	Lower shore
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m

Previous code

SR in part	96.7

Biotope description

Infralittoral rock includes habitats of bedrock, boulders and cobbles which occur in the shallow subtidal zone and typically support seaweed communities. The upper limit is marked by the top of the kelp zone whilst the lower limit is marked by the lower limit of kelp growth or the lower limit of dense seaweed growth. Infralittoral rock typically has an upper zone of dense kelp (forest) and a lower zone of sparse kelp (park), both with an understorey of erect seaweeds. In exposed conditions the kelp is *Laminaria hyperborea* whilst in more sheltered habitats it is usually *Laminaria saccharina*; other kelp species may dominate under certain conditions. On the extreme lower shore and in the very shallow subtidal (sublittoral fringe) there is usually a narrow band of dabberlocks *Alaria esculenta* (exposed coasts) or the kelps *Laminaria digitata* (moderately exposed) or *L. saccharina* (very sheltered). Areas of mixed ground, lacking stable rock, may lack kelps but support seaweed communities. In estuaries and other turbid-water areas the shallow subtidal may be dominated by animal communities, with only poorly developed seaweed communities.

IR.HIR High energy infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock & boulders
Zone:	Sublittoral fringe, Infralittoral
Height band:	Lower shore
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Rocky habitats in the infralittoral zone subject to exposed to extremely exposed wave action or strong tidal streams. Typically the rock supports a community of kelp *Laminaria hyperborea* with foliose seaweeds and animals, the latter tending to become more prominent in areas of strongest water movement. The depth to which the kelp extends varies according to water clarity, exceptionally (e.g. St Kilda) reaching 45 m. The sublittoral fringe is characterised by dabberlocks *Alaria esculenta*. Surge gullies and caves typically lack kelp, and in reduced light conditions lack red seaweeds and are dominated by communities of sponges, ascidians, bryozoans, mussels and barnacles.

IR.HIR.KFaR Kelp with cushion fauna, foliose red seaweeds or coralline crusts.

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock; stable boulders
Zone:	Sublittoral fringe, Infralittoral
Height band:	Lower shore
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m

Biotope description

Rocky habitats in the infralittoral zone subject to exposed to extremely exposed wave action or strong tidal streams. Typically the rock supports a community of kelp *Laminaria hyperborea* with foliose seaweeds and animals, the latter tending to become more prominent in areas of strongest water movement (LhypFa, LhypR and LhypR.Pk). In areas where *L. hyperborea* is removed by seasonal disturbance (such as winter storms) a mixed kelp forest of fast-growing opportunistic help *Saccorhiza polyschides* and *Laminaria saccharina* may occur (LsacSac). The depth to which the kelp extends varies according to water clarity, exceptionally (e.g. St Kilda) reaching 45 m. In some areas, there may be a band of dense foliose seaweeds (reds or browns) below the main kelp zone (FoR). The sublitttoral fringe is characterised by dabberlocks *Alaria esculenta* (Ala biotopes) or occasionally by the kelp *S. polyschides* (Sac). In very strong wave action the sublittoral fringe *A. esculenta* zone extends to 5 to 10 m depth, whilst at Rockall *A. esculenta* replaces *L. hyperborea* as the dominant kelp in the infralittoral zone (AlaAnCrSp).

Characterising species

	% Frequency	*Abundance (SACFOR)*
Alcyonium digitatum	••	Occasional
Urticina felina	••	Occasional
Sagartia elegans	••	Occasional
Corynactis viridis	••	Frequent
Pomatoceros triqueter	••	Occasional
Calliostoma zizyphinum	••	Occasional
Asterias rubens	•••	Occasional
Echinus esculentus	••	Occasional
Botryllus schlosseri	••	Occasional
Callophyllis laciniata	••	Occasional
Corallinaceae	••••	Common
Corallina officinalis	••	Frequent
Plocamium cartilagineum	•••	Frequent
Cryptopleura ramosa	•••	Frequent
Delesseria sanguinea	•••	Frequent
Dictyota dichotoma	•••	Frequent
Laminaria hyperborea	•••	Common
Alaria esculenta	•••	Common

IR.HIR.KFaR.Ala *Alaria esculenta* on exposed sublittoral fringe bedrock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed
Tidal streams:	Very strong, Strong, Moderately strong, Weak
Substratum:	Bedrock; very large boulders
Zone:	Sublittoral fringe
Height band:	Lower shore
Depth band:	0-5 m

Biotope description

Exposed sublittoral fringe bedrock with an *Alaria esculenta* forest and an encrusting fauna of the mussel *Mytilus edulis* and barnacles such as *Semibalanus balanoides*. The kelp *Laminaria digitata* can be part of the canopy. Underneath the canopy are red seaweeds such as *Mastocarpus* stellatus and *Palmaria palmata*, while encrusting coralline red algae such as *Lithothamnion graciale* covers the rock surface. The limpet *Patella vulgata* can be found grazing the rock surface, while the whelk Nucella lapillus is preying on the limpets, barnacles and mussels. Two variants of this biotope are described. In more wave exposed conditions *Laminaria digitata* is absent and the rock surface is often characterised by dense patches of mussels (Ala.Myt). In slightly less exposed sites the *A. esculenta* is mixed with *L. digitata* (Ala.Ldig).

Situation

This biotope is found in the sublittoral fringe on exposed shores, typically occupying the extreme lower shore down to 1 or 2 m depth, although it can also extend down to 15 m depth on very exposed coasts. It is generally found below the mussel-barnacle zone of the lower shore (MytB) or a narrow band of the seaweed-dominated biotopes featuring dense *Himanthalia elongata* or red seaweeds (Him, Mas). Below the *A. esculenta* zone, the upper infralittoral rock generally supports a *Laminaria hyperborea* kelp community (LhypFa, LhypR.Ft or Lhyp.Ft).

Temporal variation

Unknown

Similar biotopes

IR.HIR.KFaR.AlaAnCrSp	Occur on very exposed bedrock shores. Dense anthozoans including *Corynactis viridis* and *Phellia gausapata* and sponges such as *Haliclona urceolus* and *Myxilla fimbriata* can be present.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Semibalanus balanoides	●●●	Frequent	4
Patella vulgata	●●●	Common	8
Nucella lapillus	●●	Occasional	1
Mytilus edulis	●●●●	Common	14
Palmaria palmata	●●	Occasional	1
Corallinaceae	●●●	Abundant	6
Corallina officinalis	●●●●	Frequent	11
Lithothamnion glaciale	●●	Abundant	6
Mastocarpus stellatus	●●●	Frequent	2
Laminaria digitata	●●●	Common	5
Alaria esculenta	●●●●●	Abundant	32

IR.HIR.KFaR.Ala.Myt *Alaria esculenta*, *Mytilus edulis* and coralline crusts on very exposed sublittoral fringe bedrock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock
Zone:	Sublittoral fringe
Height band:	Lower shore
Depth band:	0-5 m

Previous code

LRK.AL	6.95

Biotope description

Very exposed sublittoral fringe bedrock characterised by the kelp *Alaria esculenta* and dense patches of small individuals of the mussel *Mytilus edulis*, both of which grow over a dense cover of encrusting coralline algae. Foliose red seaweeds may also be present, but the species composition and their abundance vary between sites. Species such as *Corallina officinalis* occur widely. The kelp *Laminaria digitata* is usually absent, although stunted plants may be present at a few sites. The limpet *Patella vulgata* and the barnacle *Semibalanus balanoides* are often common. Patches of anthozoans and the hydroid *Tubularia* spp. occur in more wave-surged areas. In extremely exposed areas the *A. esculenta* zone can extend as deep as 15 m, where it has less *S. balanoides*, *M. edulis* and greater densities of *Tubularia* spp. (e.g. Barra and shallow areas of Rockall).

Situation

This biotope is most commonly found beneath the mussel-barnacle zone (MytB) of very exposed shores and above the upper infralittoral *Laminaria hyperborea* forest (LhypR or LhypFa). It is at the extremely wave-surged sites, such as St Kilda, that LhypFa occurs below Ala.Myt. Occasionally, the *A. esculenta* zone occurs below a narrow but dense band of red seaweeds: typically *Mastocarpus stellatus* and/or *Palmaria palmata* and *Corallina officinalis* (Mas) or very occasionally *Himanthalia elongata* (Him). A dense turf of *C. officinalis* (Coff) occurs above the *A. esculenta* zone at a few extremely exposed sites, particularly on steep or vertical rock. On less exposed shores, however, an *A. esculenta* dominated zone may lie immediately above a narrow *L. digitata* zone (Ldig). Ala.Myt can also occur on less exposed steep or vertical shores, where wave-surge restricts the growth of *L. digitata* which generally dominates the sublittoral fringe rock on moderately exposed shores. On seasonally unstable boulders or sites subject to disturbance by strong wave-action, a mixed kelp canopy that characterises LsacSac may occur beneath the Ala.Myt zone instead of the ubiquitous *L. hyperborea* forest; this is most common on the Shetland Isles.

Temporal variation

At very exposed sites, *A. esculenta* may have been so wave-battered during the season as to be reduced to a tattered midrib with no blades, altering the general appearance of the biotope. Where Ala.Myt occurs on boulders and/or sites subject to disturbance during severe weather conditions, rock that is scoured clean may then be rapidly colonised by fast-growing green algae such as *Enteromorpha* spp. An assemblage of rapidly colonising species that characterise the disturbed Sac biotope may also develop in the sublittoral fringe. A species that can fluctuate in huge numbers at these sites is the starfish *Asterias rubens*, sometimes forming dense aggregations across the narrow *A. esculenta* band whilst feeding on the mussels.

Similar biotopes

IR.HIR.KFaR.Ala.Ldig	Occurs on less exposed shores. *A. esculenta* and *M. edulis* occurs at a lower abundance and *Lithothamnion* spp. is not usually present. *L. digitata* is

	present in high abundance and the diversity of red seaweeds are high.
IR.HIR.KFaR.AlaAnCrSp	Occur on very exposed bedrock shores. Dense anthozoans including *Corynactis viridis* and *Phellia gausapata* and sponges such as *Haliclona urceolus* and *Myxilla fimbriata* can be present. Ala.Myt is distinguished from the deep *A. esculenta* forest found on Rockall by its lack of short turf forming hydroids.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Semibalanus balanoides	●●●	Frequent	5
Patella vulgata	●●●●	Common	10
Mytilus edulis	●●●●	Abundant	19
Corallinaceae	●●	Abundant	3
Corallina officinalis	●●●●	Frequent	10
Lithothamnion	●●●●	Abundant	9
Alaria esculenta	●●●●●	Abundant	34

IR.HIR.KFaR.Ala.Ldig *Alaria esculenta* and *Laminaria digitata* on exposed sublittoral fringe bedrock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock
Zone:	Sublittoral fringe
Height band:	Lower shore
Depth band:	0-5 m
Other features:	On vertical and very steep rock, on moderately exposed shores

Previous code

LRK.LDIG.AL	6.95

Biotope description

Exposed sublittoral fringe bedrock characterised by a mixture of the kelps *Laminaria digitata* and *Alaria esculenta* with an understorey of red seaweeds including *Palmaria palmata* and *Corallina officinalis* with encrusting coralline algal on the rock surface. Anthozoans such as *Halichondria panicea*, the mussel *Mytilus edulis* and the barnacle *Semibalanus balanoides* can be found attached in cracks and crevices. The limpets *Patella vulgata* or on southern shores *Patella ulyssiponensis* can be found in their characteristic "scars" grazing the biofilm/algal crusts on the rock surface, while the limpet *Helcion pellucidum* is restricted to grazing the kelp fronds. Colonies of the bryozoan *Electra pilosa* can cover the red seaweeds *Mastocarpus stellatus* and *Chondrus crispus* or the rock surface.

Situation

Ala.Ldig represents an intermediate on the wave exposure gradient, with pure stands of *A. esculenta* (Ala.Myt) being found on more exposed shores and pure *L. digitata* (Ldig) on more sheltered shores. This biotope usually occurs immediately above a sublittoral *Laminaria hyperborea* forest (LhypR or Lhyp), although a narrow band of *L. digitata* (Ldig) may occur between these two zones, particularly on less exposed shores. In southwest England a zone of mixed kelp forest *L. hyperborea* and *Laminaria ochroleuca* may occur below the *A. esculenta* (Lhyp.Loch). A number of different biotopes can occur above Ala.Ldig; most commonly these are the mussel-barnacle zone (MytB), *Himanthalia elongata* (Him), a red algal turf or a *Fucus serratus*-red algal mosaic (Fser.R) on the less exposed shores. This biotope also occurs on steep and vertical shores of moderately exposed coasts where a localised increase in wave action restricts the growth of *L. digitata*. As a result of this increased wave action the *L. digitata* plants are usually small and often show signs of damage.

Temporal variation

There may be seasonal changes in the amount of ephemeral seaweeds due to disturbance caused by winter storms.

Similar biotopes

IR.HIR.KFaR.Ala.Myt	Occurs on more exposed shores. *A. esculenta* and *M. edulis* is abundant and *Lithothamnion* spp. is the dominant coralline crust. *L. digitata* is absent and the diversity of red seaweeds are lower.
IR.MIR.KR.Ldig.Ldig	Occurs on less exposed shores. *L. digitata* is the dominant kelp (Abundant), while the abundance of *A. esculenta* is low (Occasional).

Characterising species

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

			to similarity
Halichondria panicea	●●●	Occasional	2
Semibalanus balanoides	●●	Occasional	2
Patella ulyssiponensis	●●	Frequent	1
Patella vulgata	●●●	Frequent	2
Helcion pellucidum	●●●	Frequent	2
Mytilus edulis	●●●	Frequent	4
Umbonula littoralis	●●	Frequent	2
Electra pilosa	●●●	Frequent	1
Palmaria palmata	●●●	Frequent	3
Corallinaceae	●●●●	Abundant	10
Corallina officinalis	●●●●	Common	8
Mastocarpus stellatus	●●●	Frequent	4
Chondrus crispus	●●●	Occasional	2
Laminaria digitata	●●●●●	Abundant	22
Alaria esculenta	●●●●●	Common	20

IR.HIR.KFaR.AlaAnCrSp *Alaria esculenta* forest with dense anemones and crustose sponges on extremely exposed infralittoral bedrock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed
Tidal streams:	Weak
Substratum:	Bedrock
Zone:	Infralittoral
Depth band:	10-20 m, 20-30 m, 30-50 m
Other features:	Vertical, very steep rock and, upper faces

Previous code

EIR.AlaAnSC	97.06
EIR.AlaRAn	96.7
EIR.RAn	96.7

Biotope description

This biotope has only been recorded from Rockall, where *Alaria esculenta* appears to replace *Laminaria hyperborea* as the dominant kelp forest species on the extremely wave-exposed steep and vertical rock, a zone that extends from 14 m down to 35 m. Beneath the *A. esculenta* canopy, the rock surface is covered by a dense turf of anthozoans such as *Sagartia elegans*, *Phellia gausapata* and *Corynactis viridis*, encrusting sponges and coralline algae. The gastropod *Margarites helicinus* can be found grazing on the kelp fronds, whereas the crab *Cancer pagurus* can be found among the kelp stipes. The bryozoan *Tubularia indivisa* also occur, but it does not form such a dense turf as in more shallow waters, while the sea squirt *Botryllus leachi* is found encrusting the large brown seaweeds. *Cryptopleura ramosa* is the dominant red seaweed on horizontal surfaces. The kelp *Laminaria digitata* is reported to occur mixed with *A. esculenta* on the nearby Helen's reef.

Situation

Above the AlaAnSC zone (about 5 m to 13 m) *A. esculenta* still dominates, but it resembles more closely the typical sublittoral fringe *A. esculenta* biotope (Ala.Myt), though it has a very dense turf of small hydroids and few foliose algae. Towards the lower part of this *A. esculenta* forest (30 m to 35 m), the density of *A. esculenta* is reduced and the rock surface is characterised by a dense turf of red algae (FoR).

Temporal variation

Unknown

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Porifera indet crusts	●●●	Present	2
Tubularia indivisa	●●●●●	Frequent	8
Sagartia elegans	●●●●●	Frequent	11
Phellia gausapata	●●●●●	Frequent	10
Corynactis viridis	●●●●●	Common	15
AMPHIPODA	●●●●	Present	2
Cancer pagurus	●●●●	Occasional	5
Margarites helicinus	●●●●	Frequent	3
Didemnidae	●●●●	Present	4
Botrylloides leachi	●●●●	Frequent	6
Corallinaceae	●●●●	Present	3
Cryptopleura ramosa	●●●●	Frequent	7
Alaria esculenta	●●●●●	Abundant	14

IR.HIR.KFaR.LhypFa *Laminaria hyperborea* forest with a faunal cushion (sponges and polyclinids) and foliose red seaweeds on very exposed upper infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock; massive boulders
Zone:	Infralittoral - upper
Depth band:	0-5 m, 5-10 m, 10-20 m

Previous code

EIR.LhypFa.Ft	96.7

Biotope description

Very exposed and exposed, but wave-surged, upper infralittoral bedrock and massive boulders characterised by a dense forest of the kelp *Laminaria hyperborea* with a high diversity of seaweeds and invertebrates. The shallowest kelp plants are often short or stunted, while deeper plants are taller with heavily epiphytised stipes with foliose red seaweeds such as *Delesseria sanguinea*, *Cryptopleura ramosa* or *Plocamium cartilagineum* or even the brown seaweed *Dictyota dichotoma*. Also found on the stipes or on the rock below the canopy are red seaweeds including *Phycodrys rubens*, *Kallymenia reniformis*, *Callophyllis laciniata*, *Caryophyllia smithii*, and *Corallina officinalis*, while encrusting coralline algae can cover any bare patches of rock. At some sites the red seaweeds can be virtually mono-specific, while at other sites show considerable variation containing a dense mixed turf of a large variety of species. The red seaweed *Odonthalia dentata* can be present in the north. The faunal and floral under-storey is generally rich in species due, in part, to the relatively low urchin-grazing pressure in such shallow exposed conditions. The faunal composition of this biotope varies markedly between sites, but commonly occurring are the soft coral *Alcyonium digitatum* and the anthozoans *Sagartia elegans* and *Corynactis viridis*. Sponges form a prominent part of the community with variable amounts of the sponges *Halichondria panicea* and *Pachymatisma johnstonia* and several other species. The crab *Cancer pagurus* and the starfish *Asterias rubens* are normally present in small numbers foraging beneath the canopy, while the sea urchins *Echinus esculentus* and *Urticina felina* graze on the seaweeds. The hydroid Obelia geniculata, the ascidian Botryllus schlosseri and the bryozoan Membranipora membranacea compete for space on the kelp, whereas the bryozoan Electra pilosa also can be found on foliose red seaweeds.

Situation

This kelp forest most commonly occurs beneath a zone of *Alaria esculenta* and *Mytilus edulis* (Ala.Myt) and may contain small patches of *A. esculenta*. As the force of the wave-surge diminishes with increased depth, density of the faunal turf reduces and the kelp forest or park changes to one characterised by kelp and dense red seaweeds (LhypR.Ft or LhypR.Pk). In some areas of Shetland and St Kilda the lower infralittoral zone is characterised by a park of the kelp *Laminaria saccharina* and/or *Saccorhiza polyschides* (LsacSac). Where the *L. hyperborea* forest continues to depths of 15 m or greater it may give way to a zone of dense foliose red algae (FoR or For.Dic).

Temporal variation

Unknown.

Similar biotopes

IR.HIR.KFaR.LhypR.Ft	*L. hyperborea* kelp forest with very dense foliose red seaweeds. Although encrusting fauna are present it is less conspicuous than in LhypFa.
IR.MIR.KR.Lhyp.Pk	*L. hyperborea* kelp park with dense foliose red seaweeds; usually found beneath the kelp forest (LhypR.Ft) but can occur beneath LhypFa where

wave surge is reduced. Lacks the dense faunal turf of LhypFa.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pachymatisma johnstonia	●●●	Occasional	1
Obelia geniculata	●●●	Frequent	2
Alcyonium digitatum	●●●●●	Occasional	4
Urticina felina	●●●●	Occasional	2
Sagartia elegans	●●●●	Frequent	4
Corynactis viridis	●●●●	Common	4
Caryophyllia smithii	●●●	Occasional	1
Cancer pagurus	●●●	Occasional	1
Necora puber	●●●	Occasional	1
Calliostoma zizyphinum	●●●●	Occasional	3
Membranipora membranacea	●●●	Frequent	2
Electra pilosa	●●●	Frequent	1
Asterias rubens	●●●●●	Occasional	4
Echinus esculentus	●●●●	Occasional	3
Botryllus schlosseri	●●●	Occasional	2
Callophyllis laciniata	●●●●	Occasional	3
Kallymenia reniformis	●●●	Occasional	2
Corallinaceae	●●●●●	Frequent	5
Corallina officinalis	●●●	Occasional	1
Plocamium cartilagineum	●●●●	Frequent	3
Cryptopleura ramosa	●●●●	Frequent	3
Delesseria sanguinea	●●●●●	Frequent	5
Phycodrys rubens	●●●	Frequent	2
Dictyota dichotoma	●●●●	Frequent	3
Laminaria hyperborea	●●●●●	Abundant	12

IR.HIR.KFaR.LhypPar Sparse *Laminaria hyperborea* and dense *Paracentrotus lividus* on exposed infralittoral limestone

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed
Tidal streams:	Very weak
Substratum:	Bedrock
Zone:	Infralittoral - upper
Depth band:	0-5 m, 5-10 m
Other features:	Limestone platforms

Previous code

EIR.LhypFa.Par	96.7

Biotope description

This biotope is known from only one location, the Aran Islands, Co. Galway. Here, a limestone platform between 3 m and 6 m of depth is dominated by a dense population of the urchin *Paracentrotus lividus*, which heavily graze and burrow into the soft limestone. So intense is the grazing pressure that the rock appears completely bare, except for a coralline algal crust and occasional *Laminaria hyperborea* and *Saccorhiza polyschides*. The anthozoans *Sagartia elegans* and *Corynactis viridis* are also present, though at low abundance. The grazed kelp also extends deeper to 20 to 25 m further offshore. (Only one CB record within this biotope, hence contribution to similarity not applicable at present).

Situation

This rare biotope has only been recorded from one location and the neighbouring biotopes were not fully surveyed. In deeper water (30-40m) there is PhaAxi.

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Cliona celata	●●●●●	Occasional	N/a
Anemonia viridis	●●●●●	Frequent	N/a
Urticina felina	●●●●●	Rare	N/a
Sagartia elegans	●●●●●	Frequent	N/a
Corynactis viridis	●●●●●	Occasional	N/a
Paracentrotus lividus	●●●●●	Super-abundant	N/a
Laminaria hyperborea	●●●●●	Occasional	N/a
Saccorhiza polyschides	●●●●●	Occasional	N/a

IR.HIR.KFaR.LhypR *Laminaria hyperborea* with dense foliose red seaweeds on exposed infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed
Tidal streams:	Strong, Moderately strong, Weak, Very weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m

Biotope description

Very exposed to exposed infralittoral bedrock or large boulders characterised by the kelp *Laminaria hyperborea*, beneath which is a dense turf of foliose red seaweeds. Three variations of this biotope are described: the upper infralittoral kelp forest (LhypR.Ft), the kelp park below (LhypR.Pk) and a third type of kelp forest, confined to southern England, that is characterised by a mixture of *L. hyperborea* and *Laminaria ochroleuca* (LhypR.Loch). The fauna of these biotopes is markedly less abundant than kelp forests in areas of greater wave surge (LhypFa); sponges, anthozoans and polyclinid ascidians may be present, though never at high abundance. Beneath the under-storey of red seaweeds, the rock surface is generally covered with encrusting coralline algae.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	●●●	Frequent	1
Alcyonium digitatum	●●●	Occasional	2
Urticina felina	●●●	Occasional	1
Corynactis viridis	●●●	Frequent	2
Caryophyllia smithii	●●●	Occasional	1
Pomatoceros triqueter	●●●	Occasional	1
Gibbula cineraria	●●●	Occasional	1
Calliostoma zizyphinum	●●●	Occasional	2
Membranipora membranacea	●●●	Frequent	2
Electra pilosa	●●	Frequent	1
Asterias rubens	●●●	Occasional	3
Echinus esculentus	●●●●	Frequent	4
Botryllus schlosseri	●●●	Occasional	2
Callophyllis laciniata	●●●●	Frequent	3
Kallymenia reniformis	●●●	Occasional	2
Corallinaceae	●●●●	Frequent	5
Plocamium cartilagineum	●●●●	Frequent	4
Cryptopleura ramosa	●●●●	Frequent	5
Delesseria sanguinea	●●●●●	Frequent	7
Hypoglossum hypoglossoides	●●●	Occasional	1
Membranoptera alata	●●	Occasional	1
Heterosiphonia plumosa	●●●	Frequent	1
Dictyota dichotoma	●●●●	Frequent	5
Laminaria hyperborea	●●●●●	Abundant	15

IR.HIR.KFaR.LhypR.Ft *Laminaria hyperborea* forest with dense foliose red seaweeds on exposed upper infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock; large boulders
Zone:	Infralittoral - upper
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Very exposed to exposed upper infralittoral bedrock or large boulders characterised by a dense forest of the kelp *Laminaria hyperborea*. On the rock surface beneath the kelp canopy is a dense turf of red foliose seaweeds including *Cryptopleura ramosa*, *Plocamium cartilagineum*, *Phycodrys rubens* and *Callophyllis laciniata* as well as encrusting coralline algae and the foliose brown seaweed *Dictyota dichotoma*. The red algal turf can be virtually mono-specific, dominated by stands of *P. cartilagineum*, *C. ramosa* or *Heterosiphonia plumosa*, *Kallymenia reniformis* or in the north, *Odonthalia dentata*. Other sites may contain a dense mixed turf of these and other species. The dense turf is due, in part, to the relatively low grazing pressure from the urchin *Echinus esculentus* in such shallow exposed conditions. The shallowest kelp plants are often short or stunted, while deeper plants are taller and the stipes are heavily epiphytised by red seaweeds such as *Delesseria sanguinea* and *Membranoptera alata*. The bryozoan *Electra pilosa* can form colonies on the foliose red seaweeds, while the bryozoan *Membranipora membranacea* more often can be found on the *L. hyperborea* fronds along with the ascidian *Botryllus schlosseri* and the hydroid *Obelia geniculata*. The gastropods *Gibbula cineraria* and *Calliostoma zizyphinum* are found grazing among the kelp holdfasts, while a few individuals of the barnacle *Balanus crenatus* can present along with the white calcareous tubes of the polychaete *Pomatoceros triqueter*, where substratum is available. The starfish *Asterias rubens* can be found predating on polychaetes, mussels and small crustaceans. The soft coral *Alcyonium digitatum* can be present covering the rock surface as well as the anthozoan *Urticina felina*.

Situation

This kelp forest biotope most commonly occurs beneath a zone of *Alaria esculenta/Mytilus edulis* (Ala.Myt) and above a *L. hyperborea* park (LhypR.Pk). At very exposed sites, such as some areas of Shetland and St Kilda, the lower infralittoral zone is often characterised by a park of *Laminaria saccharina* and/or *Saccorhiza polyschides* (LsacSac). This zone presumably develops due to the mobility of nearby cobbles, boulders and sediment during winter storms, removing the slower growing *L. hyperborea*. Occasionally, a band of dense foliose seaweeds, with no kelp, occurs below the kelp forest (FoR or FoR.Dic).

Temporal variation

Unknown.

Similar biotopes

IR.HIR.KFaR.LhypFa	Occurs in areas with more wave-surge. The cushion fauna in this biotope is markedly more abundant than kelp forests in areas with less wave surge.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	••	Frequent	1
Alcyonium digitatum	•••	Occasional	1
Urticina felina	•••	Occasional	1
Pomatoceros triqueter	••••	Frequent	1
Balanus crenatus	••	Frequent	1
Gibbula cineraria	•••	Occasional	1
Calliostoma zizyphinum	•••	Occasional	1
Membranipora membranacea	•••	Frequent	2
Electra pilosa	•••	Frequent	2
Asterias rubens	•••	Occasional	2
Echinus esculentus	•••	Frequent	2
Botryllus schlosseri	•••	Occasional	2
Callophyllis laciniata	••••	Frequent	3
Kallymenia reniformis	••••	Occasional	1
Corallinaceae	••••	Frequent	5
Plocamium cartilagineum	••••	Frequent	5
Cryptopleura ramosa	••••	Frequent	6
Delesseria sanguinea	•••••	Frequent	6
Hypoglossum hypoglossoides	•••	Occasional	1
Membranoptera alata	•••	Occasional	2
Phycodrys rubens	••••	Frequent	4
Heterosiphonia plumosa	•••	Frequent	1
Dictyota dichotoma	••••	Frequent	4
Laminaria hyperborea	•••••	Abundant	18

IR.HIR.KFaR.LhypR.Pk *Laminaria hyperborea* park with dense foliose red seaweeds on exposed lower infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock; large boulders
Zone:	Infralittoral - lower
Depth band:	10-20 m, 20-30 m, 30-50 m

Previous code

EIR.LhypFa.Pk	96.7

Biotope description

Very exposed to exposed lower infralittoral bedrock or large boulders characterised by a kelp park of *Laminaria hyperborea* with a dense turf of foliose red seaweeds and encrusting coralline algae. These red seaweeds dominate kelp stipes and bedrock in a similar abundance and composition to the upper infralittoral kelp forest, the most commonly occurring species being *Callophyllis laciniata*, *Cryptopleura ramosa*, *Plocamium cartilagineum*, *Kallymenia reniformis*, *Delesseria sanguinea*, *Phycodrys rubens*, *Hypoglossum hypoglossoides*, *Heterosiphonia plumosa* and *Bonnemaisonia asparagoides*. In addition, moderate to high abundance of foliose brown seaweeds, such as *Dictyota dichotoma* are more common than in the kelp forest above. More upper circalittoral fauna occur in the park than in the kelp forest, such as the cup-coral *Caryophyllia smithii*. Some species more often present in the kelp park than the forest include the anthozoan *Alcyonium digitatum* and the featherstar *Antedon bifida*. The urchin *Echinus esculentus*, the gastropods *Gibbula cineraria* and *Calliostoma zizyphinum* and the starfish *Asterias rubens* are normally present underneath the canopy along with the anthozoans *Urticina felina* and *Corynactis viridis*. The sponge *Cliona celata* is also present often found boring into shells or soft rock where available. The bryozoan *Membranipora membranacea* can be found on the *L. hyperborea* fronds along with the hydroid *Obelia geniculata* and the ascidian *Botryllus schlosseri.* The polychaete *Pomatoceros* sp. is present on the rock surface.

Situation

This biotope usually occurs below the exposed kelp forests (LhypFa and LhypR.Ft). At some sites, a dense band of *D. dichotoma* may form a separate zone below (FoR). Where seasonally unstable cobbles and/or boulders are present adjacent to and/or below the bedrock supporting the *L. hyperborea* LsacSac may occur.

Temporal variation

In the late summer both the kelp and the foliose seaweeds can become heavily encrusted with the bryozoan crusts *Electra pilosa* and *Membranipora membranacea*. Temporal variation within the community structure is unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Cliona celata	●●●	Occasional	2
Obelia geniculata	●●●	Frequent	2
Alcyonium digitatum	●●●●	Occasional	4
Urticina felina	●●●	Occasional	2
Corynactis viridis	●●●	Frequent	4
Caryophyllia smithii	●●●●	Occasional	3
Pomatoceros triqueter	●●●	Occasional	2
Gibbula cineraria	●●●	Occasional	2

Calliostoma zizyphinum	●●●●	Occasional	3
Membranipora membranacea	●●●	Occasional	1
Antedon bifida	●●●	Frequent	2
Asterias rubens	●●●●	Occasional	4
Echinus esculentus	●●●●	Frequent	4
Botryllus schlosseri	●●●	Occasional	1
Bonnemaisonia asparagoides	●●●	Occasional	1
Callophyllis laciniata	●●●●	Frequent	3
Kallymenia reniformis	●●●●	Occasional	2
Corallinaceae	●●●●	Frequent	5
Plocamium cartilagineum	●●●●	Occasional	3
Acrosorium venulosum	●●●	Frequent	1
Cryptopleura ramosa	●●●●	Frequent	4
Delesseria sanguinea	●●●●●	Frequent	6
Hypoglossum hypoglossoides	●●●	Occasional	1
Phycodrys rubens	●●●	Frequent	1
Heterosiphonia plumosa	●●●	Frequent	1
Dictyota dichotoma	●●●●	Frequent	5
Laminaria hyperborea	●●●●●	Frequent	8

IR.HIR.KFaR.LhypR.Loch Mixed *Laminaria hyperborea* and *Laminaria ochroleuca* forest on exposed infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral
Depth band:	5-10 m, 10-20 m

Previous code

EIR.LhypFa.Loch	96.7

Biotope description

Mixed *Laminaria hyperborea* and *Laminaria ochroleuca* forests on upper infralittoral exposed rock with a dense community of foliose red seaweeds such as *Cryptopleura ramosa*, and *Plocamium cartilagineum* as well as small filamentous red seaweeds including *Bonnemaisonia asparagoides*, *Heterosiphonia plumosa*, *Pterosiphonia parasitica* and *Brongniartella byssoides*. *L. hyperborea* has a rough stipe which allow dense assemblages of epiphytic red seaweeds to form including the foliose *Callophyllis laciniata*, *Delesseria sanguinea* and *Hypoglossum hypoglossoides*. Unlike *L. hyperborea*, however, *L. ochroleuca* has a smooth stipe and so it lacks dense assemblages of epiphytic seaweeds *L. ochroleuca* has a smooth stipe. Encrusting coralline algae often cover much of the rock surface along with a few brown seaweeds including *Dictyota dichotoma*, *Dictyopteris polypodioides* and *Desmarestia aculeata* present as well. In mixed kelp forest *L. ochroleuca* may predominate with *L. hyperborea* more common at shallower depths. Whilst foliose red seaweeds dominate the upward-facing rock beneath the kelp canopy, much of the fauna is restricted to crevices or vertical faces, possibly due to grazing pressure. Echinoderms are often common in this biotope, in particular the sea urchin *Echinus esculentus* and the starfish *Asterias rubens* and *Marthasterias glacialis*. Verticals are colonised by anthozoans including the anthozoans *Corynactis viridis*, *Caryophyllia smithii*, *Actinothoe sphyrodeta* and *Alcyonium digitatum*, while the bryozoan *Membranipora membranacea* colonise the *Laminaria* sp. fronds. This biotope is restricted to the coast of Cornwall and the Isles of Scilly. *L. ochroleuca* occurs at low abundance in other kelp biotopes (sheltered through to exposed) from Dorset to Lundy Island. In such cases, records should be treated as regional variations of these biotopes. Records should only be assigned to the LhypR.Loch biotope when the canopy is dominated by *L. ochroleuca* alone, or (more usually) by a mixture of both *L. hyperborea* and *L. ochroleuca* (at similar abundance). Both this biotope and Lhyp.Loch are common on the Brittany and Normandy coasts.

Situation

Since *L. ochroleuca* is less tolerant of wave action than *L. hyperborea* this biotope commonly occurs below exposed kelp forests (LhypR.Ft). On occasion it is found below *Alaria esculenta* in the sublittoral fringe (Ala.Myt or Ala.Ldig). At some sites a band of dense foliose seaweeds, with no kelp, occurs below the kelp forest (FoR or For.Dic) whilst at other sites *L. hyperborea* kelp park occurs below (LhypR.Pk).

Temporal variation

Unknown.

Similar biotopes

IR.HIR.KFaR.LhypR.Ft	Occur at a similar wave exposure. Superficially, this widespread *L. hyperborea* biotope looks similar to the *L. ochroleuca* forest (LhypR.Loch), containing a similar suite of dense foliose red seaweeds such as *Phycodrys rubens*, *Plocamium cartilagineum*, *Callophyllis laciniata* and *Delesseria sanguinea* beneath the kelp canopy. *L. ochroleuca* is only present at low

	abundance, if present at all.
IR.LIR.KFaR.LhypLoch	Occur on sheltered to moderately exposed shores. *L. hyperborea* is less abundant (Occasional) due to the lower wave exposure and *Laminaria saccharina* is usually present (Frequent).

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Actinothoe sphyrodeta	●●●	Frequent	2
Corynactis viridis	●●	Frequent	1
Caryophyllia smithii	●●●	Occasional	2
Pomatoceros	●●	Occasional	1
Membranipora membranacea	●●●	Frequent	2
Asterias rubens	●●	Frequent	1
Marthasterias glacialis	●●●●	Occasional	2
Echinus esculentus	●●●●●	Occasional	7
Bonnemaisonia asparagoides	●●●	Frequent	2
Callophyllis laciniata	●●●●	Frequent	3
Kallymenia reniformis	●●●	Frequent	3
Corallinaceae	●●●	Common	4
Plocamium cartilagineum	●●●●	Frequent	3
Cryptopleura ramosa	●●●●	Frequent	3
Delesseria sanguinea	●●●●	Frequent	4
Hypoglossum hypoglossoides	●●●	Frequent	2
Erythroglossum laciniatum	●●	Common	1
Heterosiphonia plumosa	●●●	Present	1
Brongniartella byssoides	●●●	Occasional	2
Pterosiphonia parasitica	●●●	Frequent	1
Dictyopteris membranacea	●●●●	Frequent	3
Dictyota dichotoma	●●●●●	Common	6
Desmarestia aculeata	●●●	Occasional	1
Laminaria hyperborea	●●●●●	Abundant	13
Laminaria ochroleuca	●●●●●	Common	10

IR.HIR.KFaR.FoR Foliose red seaweeds on exposed lower infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock; large boulders
Zone:	Infralittoral - lower
Depth band:	5-10 m, 10-20 m, 20-30 m

Previous code

MIR.FoR	96.7
EIR.FoR	97.06

Biotope description

A dense turf of foliose red seaweeds on exposed or moderately exposed lower infralittoral rock, generally, at or below the lower limit of the kelp. Most of the red seaweeds are common to the kelp zone above, while the faunal component of the biotope is made up of species that are found either in the kelp zone or the animal-dominated upper circalittoral below. Foliose species commonly present include *Dilsea carnosa*, *Hypoglossum hypoglossoides*, *Schottera nicaeensis*, *Cryptopleura ramosa* and *Delesseria sanguinea*. The red seaweed species composition varies considerably; at some sites a single species may dominate (particularly *Plocamium cartilagineum*). Small filamentous red seaweeds can be found here as well. These include species such as *Heterosiphonia plumosa*, *Brongniartella byssoides.* As well as a varied red seaweed component, this biotope may also contain occasional kelp plants and patches of the brown foliose seaweed *Dictyota dichotoma*. Coralline crusts covers the bedrock beneath the seaweeds. The fauna generally comprises low-encrusting forms such as the tubeworms *Pomatoceros* spp., anthozoans including *Alcyonium digitatum*, *Urticina felina* and *Caryophyllia smithii*) and occasional sponge crusts such as *Cliona celata*, *Esperiopsis fucorum*, *Scypha ciliata* and *Dysidea fragilis*. More mobile fauna include the gastropod *Calliostoma zizyphinum*, the echinoderms *Echinus esculentus* as well as the starfish *Asterias rubens* and *Marthasterias glacialis* and lastly, the crab *Cancer pagurus*. Bryozoan crusts such as *Electra pilosa* can be found fronds on the foliose red seaweeds while scattered hydroids such as *Nemertesia antennina* form colonies on shells, cobbles and available rock. At some sites erect bryozoans *Crisia* spp. and *Bugula* spp. are present. Ascidians such as *Clavelina lepadiformis* and *Clavelina lepadiformis* may also be common. In the north the foliose red seaweed *Callophyllis laciniata* may occur.

Situation

This biotope is generally found at or below the lower limit of the kelp, below either kelp forest or park (LhypR.Ft and LhypR.Pk).

Temporal variation

Many of the red seaweeds, which occur in this biotope, have annual fronds, which tend to die back in the autumn and regenerate again in the spring. This produces a seasonal change in the density of the seaweed cover, which is substantially reduced over winter months and reaches its most dense between April to September.

Similar biotopes

IR.HIR.KFaR.FoR.Dic	This biotope occurs in similar depth and conditions as FoR but is confined to SW coasts. The abundance of the brown seaweeds *Dictyopteris membranacea* (Frequent) and *D. dichotoma* is higher (Common) with the Occasional presence of the kelps *Laminaria hyperborea* and *Laminaria saccharina*.
IR.MIR.KR.XFoR	This biotope occurs on shallow, silted infralittoral bedrock and boulders in areas of turbid water dominated by dense red seaweeds, with the notable absence of kelp. Individual species of red seaweeds such as *Plocamium cartilagineum* or *Calliblepharis ciliata* often dominate. The fauna is both less

	diverse and has a lower abundance.
IR.HIR.KFaR.EphR	This biotope occurs on mixed, mobile substrata and is characterised by red seaweeds such as *Halarachnion ligulatum*, *Lomentaria orcadensis*, *Naccaria wiggii* and *Compsothamnion thuyoides* which thrive in these conditions.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Scypha ciliata	••	Occasional	1
Cliona celata	•••	Occasional	2
Esperiopsis fucorum	••	Occasional	1
Dysidea fragilis	••	Occasional	1
Nemertesia antennina	•••	Occasional	2
Alcyonium digitatum	•••	Occasional	3
Urticina felina	•••	Occasional	2
Caryophyllia smithii	••	Occasional	1
Pomatoceros triqueter	••	Occasional	3
Cancer pagurus	•••	Rare	1
Calliostoma zizyphinum	•••	Occasional	2
Electra pilosa	••	Frequent	1
Asterias rubens	••••	Frequent	7
Marthasterias glacialis	•••	Occasional	2
Echinus esculentus	•••	Occasional	3
Clavelina lepadiformis	••	Occasional	1
Dilsea carnosa	••	Occasional	1
Callophyllis laciniata	••	Occasional	1
Corallinaceae	••••	Frequent	7
Schottera nicaeensis	••	Frequent	1
Plocamium cartilagineum	••••	Frequent	8
Cryptopleura ramosa	•••	Frequent	2
Delesseria sanguinea	••••	Frequent	10
Hypoglossum hypoglossoides	•••	Occasional	2
Heterosiphonia plumosa	•••	Frequent	2
Brongniartella byssoides	•••	Frequent	1
Dictyota dichotoma	•••	Frequent	3

IR.HIR.KFaR.FoR.Dic Foliose red seaweeds with dense *Dictyota dichotoma* and/or *Dictyopteris membranacea* on exposed lower infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock; large boulders
Zone:	Infralittoral - lower
Depth band:	10-20 m, 20-30 m

Previous code

EIR.Dic	96.7

Biotope description

A dense turf of foliose red seaweeds mixed with a dense turf of the foliose brown seaweeds *Dictyota dichotoma* and/or *Dictyopteris membranacea* on exposed and moderately exposed lower infralittoral rock, generally at or below the lower limit of the kelp zone. In some areas the lower infralittoral is subject to a moderate amount of scour from nearby sand. *D. dichotoma* is relatively tolerant of such scour and in such areas a zone forms with other sand-tolerant seaweeds. *D. membranacea* is confined to south-western coasts. Typically brown seaweeds dominate the seabed or are at least in equal abundance to the red seaweeds, some of which may also form dense stands such as *Plocamium cartilagineum, Calliblepharis ciliata, Cryptopleura ramosa, Bonnemaisonia asparagoides, Heterosiphonia plumosa, Delesseria sanguinea* and *Brongniartella byssoides*. The urchin *Echinus esculentus* can be found grazing the rock surface which can be covered in coralline algae. The anthozoans *Caryophyllia smithii* and *Alcyonium digitatum* are usually present in this biotope along with the tube-building worm *Pomatoceros* sp. which is more common in sand-scoured areas. The starfish *Asterias rubens* and *Henricia* sp. and sponge crusts including *Cliona celata* can also be found here. *D. dichotoma* also occurs in the kelp park, and records should only be assigned to this biotope where kelp such as *Laminaria hyperborea* is sparse or absent and a relatively high density of *D. dichotoma* and/or *D. membranacea* is present.

Situation

This biotope usually occurs at or below the lower limit of kelp *L. hyperborea* (LhypR.Pk or Lhyp). In south-west England a zone of mixed kelp forest *L. hyperborea* and *Laminaria ochroleuca* may occur above the dense foliose algae (LhypR.Loch). FoR.Dic marks the lower limit of the lower infralittoral zone.

Temporal variation

Like many of the red seaweeds found in this biotope the dominant brown seaweeds *D. membranacea* and *D. dichotoma* have annual fronds which tend to die back in the autumn and regenerate again in the spring. This produces a seasonal change in the density of the seaweed cover, which is substantially reduced over winter months and reaches its most dense between April and September.

Similar biotopes

IR.HIR.KFaR.FoR	This biotope occurs at similar depth and conditions as FoR.Dic. The abundance of the brown seaweeds *Dictyopteris membranacea* (Occasional) and *D. dichotoma* is higher (Frequent) without the presence of the kelps *Laminaria hyperborea* and *Laminaria saccharina*.
IR.MIR.KR.XFoR	This biotope occurs on shallow, silted infralittoral bedrock and boulders in areas of turbid water dominated by dense red seaweeds, with the notable absence of kelp. Individual species of red seaweeds such as *Plocamium cartilagineum* or *Calliblepharis ciliata* often dominate. The fauna is both less

	diverse and at lower abundance.
IR.HIR.KSed.EphR	This biotope occurs on mixed, mobile substrata and is characterised by red seaweeds such as *Halarachnion ligulatum*, *Lomentaria orcadensis*, *Naccaria wiggii* and *Compsothamnion thuyoides* which thrive in these conditions.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Cliona celata	●●●	Occasional	2
Alcyonium digitatum	●●	Occasional	3
Caryophyllia smithii	●●●●	Occasional	2
Pomatoceros triqueter	●●	Occasional	1
Henricia oculata	●●●	Occasional	2
Asterias rubens	●●●●	Occasional	4
Echinus esculentus	●●●	Occasional	2
Bonnemaisonia asparagoides	●●	Occasional	1
Corallinaceae	●●●	Frequent	2
Plocamium cartilagineum	●●●●	Frequent	5
Calliblepharis ciliata	●●	Occasional	2
Cryptopleura ramosa	●●●	Frequent	2
Delesseria sanguinea	●●●●●	Frequent	7
Heterosiphonia plumosa	●●●●	Frequent	6
Brongniartella byssoides	●●●●	Frequent	6
Dictyopteris membranacea	●●●●●	Frequent	11
Dictyota dichotoma	●●●●●	Common	15
Laminaria hyperborea	●●●	Occasional	

IR.HIR.KFaR.LhypRVt *Laminaria hyperborea* and red seaweeds on exposed vertical rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Vertical rock.

Previous code

SCAs.ByH in part	97.06
CorMetAlc in part	97.06

Biotope description

On exposed coasts with moderately strong to weak tidal currents generally at depths of 0-10m, vertical rock communities dominated by frequent *Laminaria hyperborea* and its commonly associated red seaweeds *Delesseria sanguinea*, *Cryptopleura ramosa* and *Plocamium cartilagineum* can be found. Within this biotope the jewel anemone *Corynactis viridis* is frequently found in dense aggregations attached to the vertical rock surface. This biotope contains 5 sub-biotopes, distinguished by their biogeography. On the west coast of Scotland, the Northern Isles and the Isle of Man on extremely exposed coasts a variant of this biotope characterised by frequent *Metridium senile* and occasional *Sagartia elegans* can be found. Further south on the west coast of Ireland, southern Scotland, Wales, and south west England a second variant characterised by frequent *Alcyonium digitatum* and occasional *Cliona celata* can be distinguished. A third variant has been recorded from Northern Ireland characterised by the red seaweeds *Lithophyllum* and *Ptilota gunneri*, the sea squirt *Dendrodoa grossularia* and the bryozoan *Membranipora membranacea*. South from the Isle of Man, on the Welsh Coast, and on the south west and southern English coasts a fourth variant of this biotope is found, which is characterised by the barnacle *Balanus crenatus*, which may be more frequent in this sub-biotope, and the rarity of *Alcyonium digitatum*, a species which is more frequent in other variants. This variant has mainly been recorded in shallow water (0-5m). The final biogeographic variant of this biotope is, as with the previous variant, found on the coasts of Wales and south west England. It can be distinguished from the previous variant by the frequent *Diplosoma listerianum* and occasional *Lissoclinum perforatum*, although these species are not always present.

Situation

Open rocky coasts of the south-west, west and north-west.

Temporal variation

No temporal data available

Similar biotopes

MIR.LhypVt	Much more species poor, with red algae sparse or absent.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Pachymatisma johnstonia	●●●	Occasional	1	
Halichondria panicea	●●	Occasional	1	
Esperiopsis fucorum	●●	Occasional	1	
Dysidea fragilis	●●●	Occasional	2	
Alcyonium digitatum	●●●	Occasional	3	
Sagartia elegans	●●●	Occasional	2	
Corynactis viridis	●●●●	Frequent	5	
Caryophyllia smithii	●●●	Occasional	3	
Cancer pagurus	●●●	Rare	2	
Calliostoma zizyphinum	●●●	Occasional	1	
Crisiidae	●●	Frequent	1	
Asterias rubens	●●●	Occasional	2	
Marthasterias glacialis	●●●	Occasional	1	
Echinus esculentus	●●	Occasional	1	
Clavelina lepadiformis	●●●	Occasional	2	
Botryllus schlosseri	●●●	Occasional	2	
Callophyllis laciniata	●●●	Occasional	2	
Kallymenia reniformis	●●●	Occasional	1	
Corallinaceae	●●●	Frequent	2	
Corallina officinalis	●●	Occasional	1	
Phyllophora crispa	●●	Occasional	1	
Plocamium cartilagineum	●●●●	Occasional	5	
Cryptopleura ramosa	●●●●	Frequent	4	
Delesseria sanguinea	●●●●	Frequent	5	
Hypoglossum hypoglossoides	●●●	Occasional	2	
Erythroglossum laciniatum	●●	Frequent	1	
Dictyota dichotoma	●●●	Frequent	3	
Laminaria hyperborea	●●●●	Frequent	5	

IR.HIR.KSed Sand or gravel-affected or disturbed kelp and seaweed communities

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock; unstable boulders and cobbles: often nearby coarse sediment
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Disturbed or sediment-affected

Previous code

SedK	97.06

Biotope description

Infralittoral rock habitats, subject to disturbance through mobility of the substratum (boulders or cobbles) or abrasion/covering by nearby coarse sediments or suspended particulate matter (sand). The associated communities can be quite variable in character, depending on the particular conditions, which prevail. The typical *Laminaria hyperborea* and red seaweed communities of stable open coast rocky habitats (IR.MIR.KR) are replaced by those, which include more ephemeral species or those tolerant of sand and gravel abrasion. As such *Laminaria saccharina*, *Saccorhiza polyschides* or *Halidrys siliquosa* may be prominant components of the community.

Characterising species

	% Frequency	*Abundance (SACFOR)*
Alcyonium digitatum	••	Occasional
Urticina felina	•••	Occasional
Pomatoceros triqueter	•••	Frequent
Balanus crenatus	••	Frequent
Cancer pagurus	••	Occasional
Gibbula cineraria	•••	Occasional
Electra pilosa	••	Frequent
Asterias rubens	•••	Occasional
Clavelina lepadiformis	••	Occasional
Botryllus schlosseri	•••	Occasional
Dilsea carnosa	•••	Occasional
Corallinaceae	•••	Frequent
Corallina officinalis	••	Occasional
Chondrus crispus	•••	Occasional
Plocamium cartilagineum	••••	Frequent
Halarachnion ligulatum	••	Occasional
Cryptopleura ramosa	•••	Occasional
Delesseria sanguinea	•••	Occasional
Hypoglossum hypoglossoides	•••	Occasional
Phycodrys rubens	••	Occasional
Heterosiphonia plumosa	•••	Frequent
Brongniartella byssoides	•••	Frequent
Rhodomela confervoides	••	Occasional
Dictyota dichotoma	•••	Occasional
Desmarestia aculeata	••	Occasional
Laminaria hyperborea	•••	Frequent
Laminaria saccharina	•••	Frequent
Halidrys siliquosa	•••	Frequent

IR.HIR.KSed.Sac *Saccorhiza polyschides* and other opportunistic kelps on disturbed sublittoral fringe rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock; boulders
Zone:	Sublittoral fringe, Infralittoral - upper
Height band:	Lower shore
Depth band:	0-5 m
Other features:	Disturbed (by storms or sand scour)

Previous code

MIR.Spol	96.7
LRK.SPOL	6.95

Biotope description

Exposed low-lying reefs in the sublittoral fringe or upper infralittoral (generally above 5m depth), mainly in the southwest and west, dominated by the kelp *Saccorhiza polyschides*. This opportunistic coloniser replaces *Laminaria digitata* or *Laminaria hyperborea* as the dominant kelp, following 'disturbance' of the canopy. This may be the result of storms, when loose sediment and even cobbles or boulders are mobilised, scouring most seaweeds and animals from the surrounding rock. As *S. polyschides* is essentially a summer annual (occasionally it lasts into a second year), it is also particularly common close to rock/sand interfaces which become too scoured during winter months to prevent the longer-living kelps from surviving. As a result of the transient nature of this biotope, its composition is varied; it may contain several other kelp species, including *L. digitata*, *Laminaria saccharina* and *Alaria esculenta*, at varying abundances. *Laminaria* spp. sporelings can also be a prominent feature of the site. Beneath the kelp, (scour-tolerant) red seaweeds including *Corallina officinalis*, *Kallymenia reniformis*, *Plocamium cartilagineum*, *Chondrus crispus*, *Dilsea carnosa* and encrusting coralline algae are often present. Foliose red seaweeds such as *Callophyllis laciniata*, *Cryptopleura ramosa* and *Palmaria palmata* also occur in this biotope. *P. palmata* and *Delesseria sanguinea* often occur as epiphytes on the stipes of *L. hyperborea*, when it is present. The foliose green seaweed *Ulva* spp. is fast to colonise newly cleared areas of rock and is often present along with the foliose brown seaweed *Dictyota dichotoma*. Due to the disturbed nature of this biotope, fauna are generally sparse, being confined to encrusting bryozoans and/or sponges, such as *Halichondria panicea* and the gastropod *Gibbula cineraria*.

Situation

On some shores (for example in Cornwall and south-west Ireland), *S. polyschides* competes so effectively with the other laminarians that it forms a well-defined zone in shallow water, between the *L. digitata* (Ldig) and *L. hyperborea* zones (LhypR and Lhyp). Elsewhere, it is found at sites that have been physically disturbed, removing areas of established kelp (*L. hyperborea*) thus allowing this opportunistic biotope to develop over a short space of time.

Temporal variation

There may be significant variations in this biotope over time, as by its very nature, it is dominated by many fast-growing annual seaweeds. The foliose green seaweed *Ulva* sp. is fast to colonise newly cleared areas of rock and can be present as a dense growth on the rock around the *Saccorhiza polyschides*. Similarly, large patches of *Laminaria* spp. sporelings may be present at times.

Similar biotopes

IR.HIR.KFaR.LsacSac	This biotope occurs in deeper water and often forms a mixed kelp canopy of *L. saccharina*, *L. hyperborea* and *S. polyschides*. Although *S. polyschides* can occur in equal abundance to the other kelps it may be absent altogether from

some sites. It supports a slightly richer faunal community of species commonly found in deeper water, such as *Alcyonium digitatum*, *Caryophyllia smithii* and encrusting bryozoans.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	••	Occasional	1
Gibbula cineraria	•••	Frequent	3
Palmaria palmata	••	Frequent	2
Dilsea carnosa	••	Frequent	2
Callophyllis laciniata	••	Frequent	1
Kallymenia reniformis	••	Frequent	1
Corallinaceae	••••	Frequent	10
Corallina officinalis	••	Frequent	2
Plocamium cartilagineum	•••	Occasional	3
Cryptopleura ramosa	•••	Frequent	4
Delesseria sanguinea	••	Frequent	1
Dictyota dichotoma	••	Frequent	2
Laminaria digitata	••	Common	3
Laminaria hyperborea	••	Common	3
Laminaria saccharina	•••	Frequent	4
Saccorhiza polyschides	•••••	Abundant	30
Alaria esculenta	••	Occasional	2
Ulva lactuca	••	Frequent	2

IR.HIR.KSed.LsacSac *Laminaria saccharina* and/or *Saccorhiza polyschides* on exposed infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock; boulders and cobbles
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m
Other features:	Often (but not always) disturbance due to scour or seasonal instability of substratum

Previous code

EIR.LsacSpol	96.7

Biotope description

A forest or park of the fast-growing, opportunistic kelps *Laminaria saccharina* and/or *Saccorhiza polyschides* often occurs on seasonally unstable boulders or sand/pebble scoured infralittoral rock. The substratum varies from large boulders in exposed areas to smaller boulders and cobbles in areas of moderate wave exposure or nearby bedrock. In these cases, movement of the substratum during winter storms prevents a longer-lived forest of *Laminaria hyperborea* from becoming established. This biotope also develops on bedrock where it is affected by its close proximity to unstable substrata. Other fast-growing brown seaweeds such as *Desmarestia viridis*, *Desmarestia aculeata*, *Cutleria multifida* and *Dictyota dichotoma* are often present. Some *L. hyperborea* plants may occur in this biotope, but they are typically small since the plants do not survive many years. The kelp stipes are usually epiphytised by red seaweeds such as *Delesseria sanguinea* and *Phycodrys rubens*. Other red seaweeds present beneath the kelp canopy include *Plocamium cartilagineum*, *Nitophyllum punctatum*, *Callophyllis laciniata* and *Cryptopleura ramosa*. Encrusting algae often form a prominent cover on the rock surfaces, including red, brown and coralline crusts. Faunal richness and diversity is generally low compared to the more stable *L. hyperborea* kelp forest and park communities (LhypR). Where some protection is afforded the anthozoan *Alcyonium digitata* can occur in addition to the more robust species such as the tube-building worm *Pomatoceros triqueter*. Mobile species include the to shell *Gibbula cineraria* and *Calliostoma zizyphinum* and the sea urchin *Echinus esculentus*. The hydroid *Obelia geniculata* and the bryozoan *Membranipora membranacea* can often be found colonising the kelp fronds.

Situation

This biotope can be found below the *L. hyperborea* zone (LhypFa or LhypR), especially where close to a rock/ sand interface (where it is subject to sand/pebble scour in winter). Where this biotope occurs on bedrock, not scoured by mobile sediment, it is thought to occur as a result of intense wave action in winter storms which is too severe to allow *L. hyperborea* to develop and remain in shallow water.

Temporal variation

Due to the disturbed nature of this biotope there can be significant changes in the structure of the community. Coralline and brown algal crusts with sparse kelp plants generally dominate areas that have been recently disturbed. Diversity is low and a few species of fast-growing seaweeds can dominate the seabed. A longer established community will have larger, mixed kelp plants and a greater diversity of red seaweeds.

Similar biotopes

IR.HIR.KFaR.DesFilR	Occurs at similar conditions but at slightly less exposed coasts. The brown seaweed *Desmarestia aculeata* has a higher abundance (Abundant) than in LsacSac, while the kelp *L. saccharina* has a lower abundance (Occasional).

The kelp *S. polyschides* rarely occurs.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	••	Frequent	2
Alcyonium digitatum	•••	Occasional	2
Pomatoceros triqueter	••	Frequent	2
Gibbula cineraria	•••	Occasional	4
Calliostoma zizyphinum	•••	Occasional	2
Membranipora membranacea	••	Frequent	2
Asterias rubens	••••	Occasional	5
Echinus esculentus	••••	Occasional	8
Callophyllis laciniata	•••	Frequent	2
Corallinaceae	•••••	Common	12
Plocamium cartilagineum	•••	Frequent	2
Cryptopleura ramosa	•••	Frequent	2
Delesseria sanguinea	••••	Occasional	5
Nitophyllum punctatum	•••	Occasional	1
Phycodrys rubens	•••	Occasional	2
Cutleria multifida	••	Frequent	2
Dictyota dichotoma	•••	Frequent	2
Desmarestia aculeata	••	Occasional	1
Desmarestia viridis	••	Occasional	1
Laminaria hyperborea	•••	Common	15
Laminaria saccharina	•••••	Common	5
Saccorhiza polyschides	••••	Common	4

IR.HIR.KSed.LsacChoR *Laminaria saccharina*, *Chorda filum* and dense red seaweeds on shallow unstable infralittoral boulders or cobbles

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Moderately strong
Substratum:	Boulders, cobbles, pebbles and gravel
Zone:	Infralittoral - upper
Depth band:	0-5 m
Other features:	Shallow, seasonally unstable substrata

Biotope description

Seasonally disturbed unstable boulders and cobbles in very shallow water dominated by the fast-growing brown seaweed *Chorda filum* together with the kelp *Laminaria saccharina*. The brown seaweed *Desmarestia aculeata* is also typical of this disturbed environment as well encrusting coralline algae and brown crusts. Beneath the prolific growth of *C. filum*, red and brown seaweeds densely cover many of the boulders, cobbles and pebbles. Other sediment-tolerant seaweeds such as species from the Ectocarpales (brown filamentous seaweeds) and the red seaweeds *Chondrus crispus*, *Phyllophora pseudoceranoides*, *Dilsea carnosa* and *Corallina officinalis* is normally present. Other red seaweeds which can be found here include *Chondria dasyphylla*, *Brongniartella byssoides*, *Polysiphonia elongata*, *Ceramium nodolosum*, *Cystoclonium purpureum*, *Heterosiphonia plumosa*, *Rhodomela confervoides* and *Plocamium cartilagineum*. The brown seaweeds *Punctaria* sp. and *Cladostephus spongiosus* are generally present. The faunal component of this biotope is typically sparse - the starfish *Asterias rubens* and the crabs *Pagurus bernhardus* and *Necora puber* are amongst the most conspicuous animals. The bryozoan crust *Electra pilosa* colonise many of the algae along with the ascidian *Botryllus schlosseri*. Occasional the polychaete *Lanice conchilega* may occur in the sand between pebbles, and the anthozoan *Urticina felina* may be found amongst pockets of gravel along with the gastropod *Gibbula cineraria*. At some sites the rock beneath the algae can be occupied by the tube-building polychaete *Pomatoceros triqueter*. This biotope is also present at other open coast sites around the UK where suitable shallow, seasonally stable boulders, cobbles and pebbles occur. Typical examples of this biotope occur on the shallowest areas of the Sarns in Cardigan Bay, Wales, where reef crests are formed by embedded and mobile boulders, together with cobbles and pebbles in between (typically at 2-3m depth).

Situation

This biotope occurs in shallow water, often on the crest of an infralittoral boulder/cobble bank and as such will not have any biotope 'above' it. More mobile areas of smaller boulders, cobbles and pebbles nearby may support dense ephemeral red seaweeds (EphR) or robust scour-tolerant red seaweeds on sand-covered rock (ProtAhn). The *Halidrys siliquosa* biotope XKHal also thrives under similar conditions, extending deeper than the shallow LsacChoR biotope. Deeper still in the circalittoral zone encrusting fauna is found on highly mobile mixed substrata (PomB). At a few sites, this biotope can occur within more extensive maerl beds (SS.SMP.Mrl) but more commonly is surrounded by sandy sediments (SS.SSa).

Temporal variation

This biotope will change markedly with the seasons. During the winter months boulders and cobbles will be storm battered and overturned and much of the biota dislodged from the rocks. During more stable conditions in the late spring and summer months the fast-growing seaweeds that characterise this biotope (*C. filum* and *L. saccharina* in particular) will be quick to re-establish, growing at a

phenomenal rate. The seasonal disturbance of the substratum prevents a stable *Laminaria hyperborea* forest from developing.

Similar biotopes

IR.HIR.KSed.XKHal	Tide-swept biotope dominated by *H. siliquosa* (>Common) with mixed kelp species. Although *C. filum* may occur it is generally only Occasional.
IR.HIR.KSed.EphR	Lacks the larger kelp and dense *C. filum* associated with LsacChoR and is generally found in deeper water (below 10m depth compared to LsacChoR usually above 5m depth).
IR.MIR.KT.XKTX	Typically occurs on boulders, cobbles and pebbles in sheltered but tide-swept shallow water (such as found in tidal-rapids). *L. saccharina* is the dominant kelp, although *L. hyperborea* does occurs (Frequent). *C. filum*, when present is less dense (Common).

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Urticina felina	●●●	Occasional	1
Lanice conchilega	●●●	Occasional	2
Pagurus bernhardus	●●	Frequent	1
Gibbula cineraria	●●●	Occasional	2
Electra pilosa	●●●	Frequent	1
Electra pilosa	●●●	Frequent	2
Asterias rubens	●●●●	Frequent	6
Botryllus schlosseri	●●●	Occasional	1
Dilsea carnosa	●●●	Occasional	2
Corallinaceae	●●●	Occasional	2
Corallina officinalis	●●	Occasional	1
Phyllophora pseudoceranoides	●●●	Frequent	2
Chondrus crispus	●●●	Frequent	3
Plocamium cartilagineum	●●●●	Frequent	3
Cystoclonium purpureum	●●●	Frequent	4
Heterosiphonia plumosa	●●●	Occasional	2
Brongniartella byssoides	●●●●	Frequent	6
Chondria dasyphylla	●●●	Occasional	2
Polysiphonia elongata	●●●	Frequent	1
Rhodomela confervoides	●●●	Frequent	3
Ectocarpaceae	●●●	Frequent	3
Cladostephus spongiosus	●●●	Frequent	2
Desmarestia aculeata	●●	Frequent	3
Punctaria	●●	Frequent	1
Chorda filum	●●●●●	Abundant	17
Laminaria saccharina	●●●	Common	5

IR.HIR.KSed.DesFilR Dense *Desmarestia* spp. with filamentous red seaweeds on exposed infralittoral cobbles, pebbles and bedrock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock & boulders
Zone:	Sublittoral fringe, Infralittoral - upper
Depth band:	5-10 m

Biotope description

Wave-exposed seasonally mobile substrata (pebbles, cobbles) dominated by dense stands of the brown seaweed *Desmarestia aculeata* and/or *Desmarestia ligulata*. Infralittoral pebbles and cobbles that are scoured through mobility during storms, but become stable in the summer allowing the growth of such algae as *Desmarestia* spp. Filamentous red seaweeds such *as Bonnemaisonia asparagoides* and *Brongniartella byssoides* are usually present. Stunted individuals of the kelp such as *Laminaria hyperborea* and *Laminaria saccharina* may be present where bedrock is available. A variety of foliose red seaweeds such as *Cryptopleura ramosa, Chondrus crispus, Plocamium cartilagineum, Hypoglossum hypoglossoides* and *Nitophyllum punctatum* may on occasion be present underneath the kelp canopy. Other red algae including *Corallina officinalis, Rhodomela confervoides* and coralline crusts including *Lithothamnion* spp. may be present as well as well as the foliose brown seaweed *Dictyota dichotoma* and the green *Enteromorpha intestinalis*. Due to the nature of this biotope the faunal component is very impoverished though the gastropod *Gibbula cineraria* can be found among the cobbles.

Situation

Often a narrow zone on mixed substrata below a stable zone of kelp on bedrock. Where seasonally mobile substrata affect nearby bedrock this biotope may occur in place of kelp forest.

Temporal variation

See biotope description

Similar biotopes

IR.HIR.KFaR.Sac	Occurs on bedrock at slightly more exposed coasts. The kelp *Saccorhiza polyschides* has a higher abundance (Abundant), while the brown seaweed *D. aculeata* has a lower abundance (Occasional) than in DesFilR.
IR.HIR.KFaR.LsacSac	Occurs at similar conditions but at slightly more exposed coasts. The two kelps *Laminaria saccharina* and *S. polyschides* has a higher abundance (both Common), while the brown seaweed *D. aculeata* has a lower abundance (Occasional) than in DesFilR.
IR.FIR.SG.CC.Mo	Occurs in similar conditions as DesFilR but has a very low species diversity and lacks the brown seaweed *D. aculeata*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Urticina felina	••	Occasional	3
Pomatoceros triqueter	••	Occasional	3
Gibbula cineraria	•••	Frequent	2

RHODOPHYCOTA	••	Frequent	2
Bonnemaisonia asparagoides	••	Occasional	9
Corallinaceae	••	Frequent	2
Corallina officinalis	••	Occasional	2
Lithothamnion	••	Common	3
Chondrus crispus	•••	Frequent	1
Plocamium cartilagineum	•••	Frequent	4
Cryptopleura ramosa	••	Occasional	3
Delesseria sanguinea	••	Rare	1
Hypoglossum hypoglossoides	•••	Rare	3
Nitophyllum punctatum	••	Occasional	1
Brongniartella byssoides	••••	Frequent	9
Rhodomela confervoides	••	Occasional	1
Dictyota dichotoma	•••	Frequent	6
Desmarestia aculeata	•••••	Common	24
Desmarestia ligulata	••	Frequent	3
Laminaria	••	Frequent	3
Laminaria hyperborea	••	Occasional	1
Laminaria saccharina	•••	Occasional	4
Enteromorpha	••	Occasional	1

IR.HIR.KSed.XKScrR Mixed kelps with scour-tolerant and opportunistic foliose red seaweeds on scoured or sand-covered infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Close proximity to sand

Previous code

MIR.LsacScrR	96.7
MIR.XK	96.7

Biotope description

Bedrock and boulders, often in tide-swept areas, that are subject to scouring or periodic burial by sand, characterised by a canopy of mixed kelps such as *Laminaria saccharina*, *Laminaria hyperborea* and *Saccorhiza polyschides* and the brown seaweed *Desmarestia aculeata*; there may also be an understorey of foliose seaweeds that can withstand scour such as *Plocamium cartilagineum, Chondrus crispus, Dilsea carnosa, Callophyllis laciniata* as well as the filamentous *Heterosiphonia plumosa* and the foliose brown seaweed *Dictyota dichotoma*. The perennial red seaweed *Brongniartella byssoides* re-grows in the summer months. The *L. hyperborea* stipes often support a growth of epiphytes, such as *Delesseria sanguinea*, *Phycodrys rubens* and *Cryptopleura ramosa*. The scour can reduce the rock surface to bare coralline crusts at times; sponge crusts and the colonial ascidian *Botryllus schlosseri* can also grow on the stipes and holdfasts. The faunal diversity on the rock is usually low and restricted to robust, low-profile animals such as the tube-building polychaete *Pomatoceros triqueter*, the barnacle *Balanus crenatus*, encrusting bryozoans such as *Membranipora membranacea*, the anthozoan *Urticina felina*, the starfish *Asterias rubens* and the urchin *Echinus esculentus*. Deeper sites support more hydroids and bryozoans, particularly *Bugula* spp. Where this biotope occurs in very shallow water *Laminaria digitata* may be found in combination with the other kelp species. Other species present only in shallow water include the red algae *Corallina officinalis* and the sand-binding alga *Rhodothamniella floridula*.

Situation

This biotope often occurs below a *L. hyperborea* forest (LhypR.Ft, Lhyp.Ft or LhypT.Ft), close to a rock-sediment boundary. It is also found on low-lying rock outcrops surrounded by sand or mixed sediment and nearby biotopes on mixed substrata may include EphR, ProtAhn or in very shallow water LsacChoR. A *Flustra foliacea* community (FluCoAs) often dominates deeper sand-scoured circalittoral rock.

Temporal variation

During late autumn and winter seaweeds are sparse, leaving predominantly kelp and encrusting coralline algae. This is due in part to periods of intense scouring during stormy months, which may strip off all but the most tenacious seaweeds. In addition there will be the natural die back of many of the seaweeds such as *B. byssoides* and *C. ciliata* during the winter months which become conspicuous again during the summer months.

Similar biotopes

IR.HIR.KSed.XKHal	A tide-swept biotope dominated by *Halidrys siliquosa* (typically greater than Common) with mixed kelp species that is subject to greater scour than XKScrR.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Urticina felina	●●●	Occasional	1
Pomatoceros triqueter	●●●	Frequent	2
Balanus crenatus	●●	Frequent	2
Gibbula cineraria	●●●	Frequent	3
Membranipora membranacea	●●	Frequent	2
Asterias rubens	●●●	Occasional	3
Echinus esculentus	●●	Occasional	1
Botryllus schlosseri	●●	Occasional	1
Dilsea carnosa	●●●	Occasional	3
Callophyllis laciniata	●●●	Occasional	2
Corallinaceae	●●●	Frequent	5
Corallina officinalis	●●	Occasional	1
Chondrus crispus	●●●	Occasional	1
Plocamium cartilagineum	●●●●	Frequent	6
Cryptopleura ramosa	●●●	Frequent	4
Delesseria sanguinea	●●●	Occasional	3
Phycodrys rubens	●●●	Frequent	2
Heterosiphonia plumosa	●●●	Frequent	2
Brongniartella byssoides	●●●	Occasional	2
Dictyota dichotoma	●●●	Frequent	3
Desmarestia aculeata	●●	Occasional	1
Laminaria hyperborea	●●●●	Common	10
Laminaria saccharina	●●●●	Frequent	9
Saccorhiza polyschides	●●●	Frequent	2

IR.HIR.KSed.XKHal *Halidrys siliquosa* and mixed kelps on tide-swept infralittoral rock with coarse sediment

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock, boulders or cobbles with coarse sediment
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Sediment abrasion

Previous code

MIR.HalXK	97.06
MIR.HalXK.Ft	96.7
MIR.HalXK.Pk	96.7

Biotope description

Tide-swept boulders and cobbles, often with a mobile component to the substrata (pebbles, gravel and sand), characterised by dense stands of the brown seaweed *Halidrys siliquosa*. It is can be mixed with the foliose brown seaweed *Dictyota dichotoma* and kelp such as *Laminaria saccharina* and *Laminaria hyperborea*. Below the canopy is an undergrowth of red seaweeds that are tolerant of sand-scour such as *Phyllophora crispa*, *Phyllophora pseudoceranoides*, *Rhodomela confervoides*, *Corallina officinalis* and *Chondrus crispus*. Other red seaweeds such as *Plocamium cartilagineum*, *Calliblepharis ciliata*, *Cryptopleura ramosa*, *Delesseria sanguinea*, *Heterosiphonia plumosa*, *Dilsea carnosa*, *Hypoglossum hypoglossoides* and *Brongniartella byssoides* may be locally abundant, particularly in the summer months. There may be a rich epibiota on *H. siliquosa*, including the hydroid *Aglaophenia pluma*, ascidians such as *Botryllus schlosseri*. There is generally a sparse faunal component colonising the boulders and cobbles, comprising the tube-building polychaete *Pomatoceros triqueter*, the crab *Cancer pagurus*, the starfish *Asterias rubens*, the gastropod *Gibbula cineraria* and the sea anthozoan *Urticina felina*. The bryozoan *Electra pilosa* can form colonies on the kelp.

Situation

XKHal can occur below the tide-swept *Laminaria digitata* zone of the sublittoral fringe bedrock or boulders (LdigT). Less stable substrata of boulders, cobbles or pebbles may support kelp and *Chorda filum* in the shallows (LsacChoR) or dense ephemeral seaweeds (EphR). Sand-influenced rocky outcrops in deeper water may support a *Flustra foliacea* community (FluCoAs). This biotope is widespread and is found on the open coast in Wales, the south-west and the English Channel as well as more sheltered tidal rapids in the Scottish sealochs. It can form extensive forests or parks in certain areas (Dorset, Sarns). In Wales, the south-west and west of England the red seaweeds *Spyridia filamentosa* and *Halarachnion ligulatum* and brown seaweeds *Dictyopteris membranacea* and *Taonia atomaria* are frequent. In Scotland, kelp occur at a greater proportion of sites, solitary ascidians such as *Ascidiella* spp. are more common and the featherstar *Antedon bifida* and brittlestars *Ophiothrix fragilis* are found.

Temporal variation

Higher diversity of red seaweeds during the summer.

Similar biotopes

IR.HIR.KSed.XKScrR	This biotope is distinguished from XKHal by its greater scour.
IR.MIR.KT.XKT	This biotope is distinguished from XKHal by occurring at more sheltered shores and by the occurrence of species like the urchin *Echinus esculentus*, the brittlestar *Ophiothrix fragilis* and the crab *Carcinus maenas* (all typical abundance of Occasional).
IR.MIR.KT.XKTX	Usually at more sheltered shores with a mixed substratum, variable salinity and stronger tidal streams. Species like the urchin *E. esculentus*, the brittlestar *Ophiothrix fragilis* and the crab *C. maenas* and encrusting red algae *Lithothamnion graciale* (Frequent) occurs in this biotope.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Aglaophenia pluma	••	Frequent	1
Urticina felina	•••	Occasional	1
Pomatoceros triqueter	••••	Frequent	3
Cancer pagurus	•••	Occasional	1
Gibbula cineraria	•••	Occasional	2
Electra pilosa	•••	Frequent	2
Asterias rubens	••••	Frequent	3
Botryllus schlosseri	••••	Frequent	3
Dilsea carnosa	••••	Occasional	2
Corallinaceae	•••	Frequent	3
Corallina officinalis	•••	Occasional	1
Phyllophora crispa	•••	Occasional	1
Phyllophora pseudoceranoides	•••	Frequent	2
Chondrus crispus	•••	Occasional	2
Plocamium cartilagineum	••••	Frequent	4
Calliblepharis ciliata	•••	Occasional	2
Cryptopleura ramosa	•••	Occasional	2
Hypoglossum hypoglossoides	•••	Occasional	1
Heterosiphonia plumosa	••••	Frequent	3
Brongniartella byssoides	••••	Frequent	3
Rhodomela confervoides	•••	Occasional	2
Dictyota dichotoma	••••	Frequent	4
Laminaria hyperborea	••	Frequent	1
Laminaria saccharina	•••	Occasional	2
Halidrys siliquosa	•••••	Common	15

IR.HIR.KSed.ProtAhn *Polyides rotundus*, *Ahnfeltia plicata* and *Chondrus crispus* on sand-covered infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock, cobbles and pebbles with mobile sand
Zone:	Infralittoral
Depth band:	5-10 m
Other features:	Sand-covered rock

Previous code

MIR.PolAhn	97.06

Biotope description

Low-lying rock surrounded by mobile sand and often subject to burying by the sand, with a turf of resilient red seaweeds *Chondrus crispus, Polyides rotundus* and *Ahnfeltia plicata* typically protruding through the sand on the upper surfaces of the rock. Other scour-tolerant seaweeds include *Rhodomela confervoides*, *Phyllophora pseudoceranoides*, *Phyllophora crispa*, *Furcellaria lumbricalis*, *Gracilaria gracilis, Ceramium rubrum, Plocamium cartilagineum, Heterosiphonia plumosa, Cryptopleura ramosa* and *Dilsea carnosa*. Coralline crusts typically cover the rock, while scattered individuals of the brown seaweeds *Halidrys siliquosa, Cladostephus spongiosus, Dictyota dichotoma* and *Laminaria saccharina* can be present. The large anthozoan *Urticina felina* can occur in this biotope but there are few other conspicuous animals.

Situation

This biotope occurs on shallow sand-covered rock, often below bedrock and boulders supporting kelp forest, which is above the effect of, sand scour (Lhyp) or abutting sand-scoured kelp on bedrock (XKScrR). It may also be found adjacent to the shallow kelp and *Chorda filum* biotope (LsacChoR) and similarly can be surrounded by a variety of sediment biotopes.

Temporal variation

Unknown.

Similar biotopes

IR.HIR.KSed.XKHal	Lack of large boulders or prominent bedrock in ProtAhn prevents dominance by *H. siliquosa* or kelps.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Urticina felina	••	Occasional	1
Dilsea carnosa	•••	Occasional	6
Corallinaceae	••••	Frequent	9
Gracilaria gracilis	••	Frequent	1
Ahnfeltia plicata	•••	Frequent	6
Phyllophora crispa	•••	Occasional	3
Phyllophora pseudoceranoides	•••	Frequent	3
Chondrus crispus	•••••	Frequent	15
Polyides rotundus	••••	Frequent	10
Plocamium cartilagineum	•••	Occasional	2
Furcellaria lumbricalis	•••	Occasional	4
Ceramium nodulosum	••	Frequent	1
Cryptopleura ramosa	•••	Occasional	3
Heterosiphonia plumosa	•••	Frequent	3
Rhodomela confervoides	•••	Frequent	3
Cladostephus spongiosus	••	Occasional	1
Dictyota dichotoma	••	Occasional	2
Laminaria saccharina	•••	Occasional	4
Halidrys siliquosa	••	Occasional	1
Ulva	••	Occasional	1

IR.MIR Moderate energy infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock and stable boulders
Zone:	Sublittoral fringe, Infralittoral
Height band:	Lower shore
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

This habitat complex occurs on predominantly moderately wave-exposed bedrock and boulders, subject to moderately strong to weak tidal streams. On the bedrock and stable boulders there is typically a narrow band of kelp *Laminaria digitata* in the sublittoral fringe which lies above a *Laminaria hyperborea* forest and park. Associated with the kelp are communities of seaweeds, predominantly reds and including a greater variety of more delicate filamentous types than found on more exposed coasts (KFaR).

IR.MIR.KR Kelp with red seaweeds (moderate energy infralittoral rock)

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock & boulders
Zone:	Sublittoral fringe, Infralittoral
Height band:	Lower shore
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Infralittoral rock subject to moderate wave exposure, or moderately strong tidal streams on more sheltered coasts. On bedrock and stable boulders there is typically a narrow band of kelp *Laminaria digitata* in the sublittoral fringe which lies above a *Laminaria hyperborea* forest and park. Associated with the kelp are communities of seaweeds, predominantly reds and including a greater variety of more delicate filamentous types than found on more exposed coasts (KFaR). The faunal component of the understorey is also less prominant than in KFaR.

Characterising species

	% Frequency	*Abundance (SACFOR)*
Scypha ciliata	•	Occasional
Halichondria panicea	••	Occasional
Obelia geniculata	••	Frequent
Alcyonium digitatum	••	Occasional
Urticina felina	•••	Occasional
Sagartia elegans	••	Occasional
Caryophyllia smithii	••	Occasional
Pomatoceros triqueter	•••	Occasional
Balanus crenatus	••	Frequent
Pagurus bernhardus	••	Occasional
Cancer pagurus	••	Rare
Necora puber	••	Occasional
Gibbula cineraria	•••	Occasional
Calliostoma zizyphinum	••	Occasional
Membranipora membranacea	••	Frequent
Electra pilosa	••	Frequent
Bryozoa indet crusts	••	Frequent
Antedon bifida	•	Occasional
Asterias rubens	•••	Occasional
Ophiothrix fragilis	••	Occasional
Echinus esculentus	•••	Frequent
Clavelina lepadiformis	••	Occasional
Botryllus schlosseri	••	Occasional
Palmaria palmata	••	Frequent
Dilsea carnosa	••	Occasional
Callophyllis laciniata	••	Occasional
Corallinaceae	•••	Common
Corallina officinalis	••	Frequent
Chondrus crispus	••	Occasional
Plocamium cartilagineum	•••	Frequent
Cryptopleura ramosa	••	Frequent
Delesseria sanguinea	•••	Frequent
Hypoglossum hypoglossoides	••	Occasional

Membranoptera alata	••	Occasional
Phycodrys rubens	•••	Frequent
Dictyota dichotoma	••	Frequent
Laminaria digitata	•••	Abundant
Laminaria hyperborea	••••	Common
Laminaria saccharina	••	Occasional

IR.MIR.KR.Ldig *Laminaria digitata* on moderately exposed sublittoral fringe rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock; boulders
Zone:	Sublittoral fringe
Height band:	Lower shore
Depth band:	0-5 m

Previous code

LRK.LDIG	6.95

Biotope description

Exposed to moderately exposed sublittoral fringe rock characterised by the kelp *Laminaria digitata* with coralline crusts covering the rock beneath the kelp canopy. Foliose red seaweeds such as *Palmaria palmata*, *Membranoptera alata*, *Chondrus crispus* and *Mastocarpus stellatus* are often present along with the calcareous *Corallina officinalis*. The brown seaweed *Fucus serratus* and the green seaweeds *Cladophora rupestris* and *Ulva lactuca* can be present as well. The sponge *Halichondria panicea* can be found among the kelp holdfasts or underneath overhangs. Also present on the rock are the tube-building polychaete *Pomatoceros triqueter*, the gastropods *Patella vulgata* and *Gibbula cineraria*. The bryozoan *Electra pilosa* can form colonies on especially *C. crispus*, *M. stellatus* and *F. serratus* while the hydroid *Dynanema pumila* are more common on the kelp. Three variants of this biotope are described: *L. digitata* forest on rocky shores (Ldig.Ldig). *L. digitata* on boulder shores (Ldig.Bo) and soft rock supporting *L. digitata*, such as the chalk found in south-east England (Ldig.Pid). For *L. digitata* in sheltered, tide-swept conditions see LdigT.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	●●●	Occasional	3
Dynamena pumila	●●	Occasional	1
Pomatoceros triqueter	●●●	Occasional	2
Patella vulgata	●●	Occasional	1
Gibbula cineraria	●●●	Frequent	2
Electra pilosa	●●●	Occasional	3
Palmaria palmata	●●●●	Frequent	5
Corallinaceae	●●●●	Abundant	12
Corallina officinalis	●●●	Occasional	3
Mastocarpus stellatus	●●●	Frequent	4
Chondrus crispus	●●●●	Frequent	5
Lomentaria articulata	●●	Occasional	1
Membranoptera alata	●●●	Occasional	2
Laminaria digitata	●●●●●	Abundant	27
Fucus serratus	●●●	Occasional	3
Ulva lactuca	●●	Occasional	1
Cladophora rupestris	●●	Occasional	1

IR.MIR.KR.Ldig.Ldig *Laminaria digitata* on moderately exposed sublittoral fringe rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock; boulders
Zone:	Sublittoral fringe
Height band:	Lower shore
Depth band:	0-5 m

Previous code

LRK.LDIG.LDIG	6.95

Biotope description

Exposed to sheltered sublittoral fringe bedrock or boulders dominated by a dense canopy of *Laminaria digitata* often with a wide range of filamentous and foliose red seaweeds beneath. The most frequently occurring red seaweeds are *Palmaria palmata*, *Corallina officinalis*, *Mastocarpus stellatus*, *Chondrus crispus*, *Lomentaria articulata* and *Membranoptera alata*. Generally the rocky substratum is covered by encrusting coralline algae, on which occasional limpets *Patella vulgata* and topshells *Gibbula cineraria* graze. A wide variety of fauna occurs, some of the most commonly occurring species being the sponge *Halichondria panicea*, the tube-building polychaete *Pomatoceros triqueter* and occasional . Kelp holdfasts provide a refuge for a varied assemblage of species such as sponges and the limpet *Helcion pellucidum*, while encrusting bryozoans such as *Electra pilosa* more often are found on the fronds of foliose red seaweeds. Solitary ascidians may be locally abundant where overhanging or vertical rock occurs, while the hydroid *Dynamena pumila* can be abundant on *Fucus serratus* and *Laminaria* sp. fronds. On exposed, wave-surged shores, the robust red seaweeds *M. stellatus*, *C. crispus* and *C. officinalis* can form a dense turf beneath the kelp along with the occasional green seaweed *Ulva lactuca*. Similarly on such shores the mussel *Mytilus edulis* can occur in extremely dense aggregations on the rock, beneath the kelp canopy.

Situation

This biotope is usually found on the extreme low shore below the *Fucus serratus* zone (Fser) and above the truly sublittoral *Laminaria hyperborea* zone (Lhyp).

Temporal variation

Unknown

Similar biotopes

IR.HIR.KFaR.Ala.Ldig	*Alaria esculenta* is generally at least Common in this biotope and/or of similar abundance to *L. digitata*, with dense mussels and barnacles overgrowing coralline-encrusted rock.
IR.MIR.KR.Ldig.Bo	*L. digitata* on moderately exposed boulder shores and occasionally on exposed or sheltered shores. Other canopy-forming kelps such as *A. esculenta* and *Laminaria saccharina* are not present in this biotope.
IR.MIR.KR.Ldig.Pid	*L. digitata* and rock-boring animals such as piddocks (*Barnea candida*, *Pholas dactylus* and *Petricola pholadiformis*), the bivalve *Hiatella arctica* and worms *Polydora* spp. on soft littoral fringe rock.
IR.MIR.KR.Ldig.Ldig	*L. saccharina* and *L. digitata* generally occur in equal abundance on silted, sheltered rock. Kelps often 'cape-form'. Fewer faunal species and fewer red seaweeds is present, but *Chorda filum* often present.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	●●●	Occasional	3
Dynamena pumila	●●	Occasional	1
Pomatoceros triqueter	●●●	Occasional	1
Patella vulgata	●●	Occasional	2
Helcion pellucidum	●●	Occasional	1
Gibbula cineraria	●●●	Occasional	2
Mytilus edulis	●●	Occasional	1
Electra pilosa	●●●	Occasional	3
Palmaria palmata	●●●●	Frequent	5
Corallinaceae	●●●●	Abundant	13
Corallina officinalis	●●●	Occasional	4
Mastocarpus stellatus	●●●	Frequent	4
Chondrus crispus	●●●●	Frequent	4
Lomentaria articulata	●●	Occasional	1
Membranoptera alata	●●●	Occasional	2
Laminaria digitata	●●●●●	Abundant	29
Fucus serratus	●●●	Occasional	3
Ulva lactuca	●●	Occasional	1

IR.MIR.KR.Ldig.Bo *Laminaria digitata* and under-boulder fauna on sublittoral fringe boulders

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Boulders
Zone:	Sublittoral fringe
Height band:	Lower shore
Depth band:	0-5 m
Other features:	Under-boulder habitats

Previous code

MIR.Ldig.Bo	96.7
LRK.BSP in part	6.95
MIR.Ldig.Ldig.Bo	97.06

Biotope description

This *Laminaria digitata* biotope is found predominantly on moderately exposed boulder shores and occasionally also on exposed or sheltered shores. Upper surfaces of the boulders are colonised by dense *L. digitata* though other kelp such as *Laminaria hyperborea* and *Laminaria saccharina* or the wrack *Fucus serratus* can be present at lower abundance. The kelp fronds can be colonised by the bryozoan *Membranipora membranacea*. Beneath the kelp canopy are a variety of red seaweeds such as *Mastocarpus stellatus, Chondrus crispus, Palmaria palmata, Membranoptera alata, Corallina officinalis* and coralline crusts. Green seaweeds include *Cladophora rupestris* and *Ulva lactuca*. Where space is available beneath the boulders (i.e. they are not buried in sediment) there may be a rich assemblage of animals. Characteristic species include the crabs *Porcellana platycheles, Pisidia longicornis* and juvenile *Cancer pagurus*. Also present beneath the boulders are often high densities of the barnacle *Balanus crenatus*, the tube-building polychaete *Pomatoceros triqueter*, spirorbid worms, the polychaete *Harmotho‰* sp., gammarid amphipods and a few gastropods such as *Gibbula cineraria*. The encrusting bryozoans *Electra pilosa* and *Umbonula littoralis* and encrusting colonies of the sponges *Halichondria panicea* and *Halisarca dujardini* are also typical of this habitat. The richest examples also contain a variety of echinoderms such as *Asterias rubens*, colonial ascidians such as *Botryllus schlosseri* and small hydroids.

Situation

This biotope is found in a similar situation to Ldig.Ldig, usually beneath the *Fucus serratus* zone (Fser.Bo or Fser.R) and above the *Laminaria hyperborea* zone (Lhyp). Many of the animals found under boulders in the lower shore in Fser.Bo are also found under boulders in the sublittoral fringe (Ldig.Bo), particularly the sponges and crabs. Similarly, many of the seaweeds present on the lower shore are also present in the shallow sublittoral fringe.

Temporal variation

Unknown

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	●●●●●	Occasional	5
Halisarca dujardini	●●●	Occasional	1
Harmothoe	●●●	Occasional	1
Pomatoceros triqueter	●●●●	Occasional	4
Spirorbidae	●●●	Frequent	2
Balanus crenatus	●●●	Frequent	2
Pisidia longicornis	●●	Occasional	1
Porcellana platycheles	●●	Occasional	1

Cancer pagurus	●●●	Rare	1
Gibbula cineraria	●●●●	Occasional	3
Umbonula littoralis	●●	Frequent	1
Membranipora membranacea	●●●	Occasional	1
Electra pilosa	●●●●	Occasional	4
Asterias rubens	●●●	Occasional	1
Botryllus schlosseri	●●●	Occasional	2
Palmaria palmata	●●●●	Frequent	4
Corallinaceae	●●●●●	Common	10
Corallina officinalis	●●●●	Occasional	2
Mastocarpus stellatus	●●●	Frequent	2
Chondrus crispus	●●●●●	Frequent	6
Membranoptera alata	●●●	Occasional	1
Laminaria digitata	●●●●●	Abundant	15
Laminaria hyperborea	●●●	Occasional	1
Laminaria saccharina	●●●	Occasional	1
Fucus serratus	●●●●	Occasional	2
Ulva lactuca	●●●	Occasional	1
Cladophora rupestris	●●●	Frequent	2

IR.MIR.KR.Ldig.Pid *Laminaria digitata* and piddocks on sublittoral fringe soft rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock
Zone:	Sublittoral fringe
Height band:	Lower shore
Other features:	Soft rock such as chalk and limestone

Previous code

LRK.LDIG.PID	6.95

Biotope description

Soft rock, such as chalk, in the sublittoral fringe characterised by *Laminaria digitata* and rock-boring animals such as piddocks *Barnea candida* and *Pholas dactylus*, the bivalve *Hiatella arctica* and worms *Polydora* spp. Beneath the kelp forest, a wide variety of foliose red seaweeds occur such as *Palmaria palmata*, *Chondrus crispus*, *Membranoptera alata* and *Halurus flosculosus*. Filamentous red seaweeds often present are *Polysiphonia fucoides* and *Ceramium nodulosum*, while coralline crusts cover available rock surface. The bryozoan *Membranipora membranacea* and the hydroid *Dynanema pumila* can form colonies on the kelp fronds, while the bryozoan *Electra pilosa* more often occur on the foliose red seaweeds. Empty piddock burrows are often colonised by the polychaete *Sabellaria spinulosa* or in more shaded areas the sponges *Halichondria panicea* and *Hymeniacidon perleve*. The undersides of small chalk boulders are colonised by encrusting bryozoans, colonial ascidians and the tube-building polychaete *Pomatoceros lamarcki*. The boulders and any crevices within the chalk provide a refuge for small crustaceans such as *Carcinus maenas*, the mussel *Mytilus edulis* or the barnacle *Semibalanus balanoides*. The echinoderm *Asterias rubens* is present as well.

Situation

This biotope occurs on moderately exposed soft rock where Ldig.Ldig would normally occur. Above it may lie a zone of *Fucus serratus* on similarly bored soft rock (Fser.Pid) or a variant of one of the *F. serratus* biotopes (Fser.R or Fser.Fser). Lower shore sites influenced by sand may have more *Mytilus edulis* beneath the seaweed canopy (MytFR) or the sand-binding red seaweed *Rhodothamniella floridula* (Rho). Below the Ldig.Pid biotope a variety of biotopes can occur such as LsacChoR on unstable infralittoral cobbles and boulders or even MCR.Pid in the turbid waters of south-east England where the kelp generally extends to less than 4m BCD.

Temporal variation

The under-storey of foliose and filamentous seaweeds will diminish towards the autumn and regrow in the spring. Since the soft rock does not provide a strong hold for the seaweeds they are easily dislodged during storm periods. After such an event the green seaweeds *Enteromorpha* spp. and *Ulva* spp. and/or the red seaweed *P. palmata* may temporarily cover much of the rock. Eventually a more diverse range of seaweeds and associated animals will re-establish on the rock.

Similar biotopes

IR.MIR.KR.Ldig.Ldig	Dense canopy of *L. digitata* on exposed to sheltered sublittoral fringe bedrock or boulders often with a wide range of filamentous and foliose red seaweeds beneath. Without the rock-boring fauna such as piddocks *B. candida*, *P. dactylus* and *P. pholadiformis*, the bivalve *H. arctica* and worms *Polydora* spp. associated soft rock biotopes.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	••••	Occasional	3
Hymeniacidon perleve	••••	Occasional	2
Dynamena pumila	••••	Occasional	4
Polydora	•••••	Abundant	9
Sabellaria spinulosa	•••	Common	1
Pomatoceros lamarcki	••••	Occasional	1
Semibalanus balanoides	••••	Occasional	2
AMPHIPODA	••••	Common	3
Carcinus maenas	•••	Occasional	1
Mytilus edulis	••••	Occasional	2
Hiatella arctica	•••••	Frequent	5
Pholas dactylus	••••	Common	5
Barnea	•••	Common	1
Membranipora membranacea	•••	Occasional	2
Electra pilosa	•••••	Common	7
Asterias rubens	••••	Occasional	1
Palmaria palmata	••••	Common	4
Corallinaceae	•••	Abundant	2
Corallina officinalis	•••	Common	2
Chondrus crispus	••••	Common	3
Ceramium nodulosum	••	Common	1
Polysiphonia fucoides	••••	Frequent	3
Laminaria digitata	•••••	Abundant	14

IR.MIR.KR.LhypT *Laminaria hyperborea* on tide-swept, infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Strong, Moderately strong
Substratum:	Bedrock & boulders
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Wave exposed to moderately wave exposed, tide-swept bedrock and boulders with *Laminaria hyperborea*, characterised by a rich under-storey and stipe flora of foliose seaweeds including the brown seaweed *Dictyota dichotoma*. The kelp stipes support epiphytes such as *Cryptopleura ramosa* and *Phycodrys rubens*. At some sites, instead of being covered by red seaweeds, the kelp stipes are heavily encrusted by the ascidian *Botryllus schlosseri*. Epilithic seaweeds *Delesseria sanguinea*, *Plocamium cartilagineum Heterosiphonia plumosa*, *Hypoglossum hypoglossoides*, *Callophyllis laciniata*, *Kallymenia reniformis*, *Brongniartella byssoides* and crustose seaweeds commonly occur beneath the kelp. The kelp fronds are often covered with growth of the hydroid *Obelia geniculata* or the bryozoan *Membranipora membranacea*. On the rock surface, a rich fauna comprising the bryozoan *Electra pilosa*, the sponge *Pachymatisma johnstonia*, anthozoans such as *Alcyonium digitatum*, *Sagartia elegans* and *Urticina felina*, colonial ascidians such as *Clavelina lepadiformis*, the calcareous tubeworm *Pomatoceros triqueter* and the barnacle *Balanus crenatus* occur. More mobile species include the gastropod *Calliostoma zizyphinum*, the crab *Cancer pagurus* and the echinoderms *Asterias rubens* and *Echinus esculentus*. Two variants have been described: Tide-swept kelp forest (LhypT.Ft) and tide-swept kelp park (LhypT.Pk).

Situation

This biotope occurs below *Alaria esculenta* (Ala) at exposed sites or *L. digitata* (Ldig.Ldig) at moderately exposed locations. With increasing depth the kelp density diminishes to become tide-swept kelp park (LhypT.Pk).

Temporal variation

Unknown

Similar biotopes

HIR.LhypFa	On very exposed coasts subject to weaker tidal currents. The fauna turf is characterised by a higher abundance of anthozoans such as *Corynactis viridis* and *Sargartia elegans*, but topshells such *Calliostoma zizyphi*num and *Gibbula cineraria* are also common. Red seaweeds are present but less dense than LhypT.Ft.
MIR.LhypTX	Occurs under similar wave exposure and tidal stream conditions, but on mixed substrata.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pachymatisma johnstonia	●●●	Occasional	1
Obelia geniculata	●●	Frequent	1

Alcyonium digitatum	●●●	Occasional	2
Urticina felina	●●●	Occasional	1
Sagartia elegans	●●	Occasional	1
Pomatoceros triqueter	●●	Occasional	1
Balanus crenatus	●●●	Frequent	2
Cancer pagurus	●●●	Occasional	1
Calliostoma zizyphinum	●●●	Occasional	1
Membranipora membranacea	●●●	Frequent	2
Electra pilosa	●●	Frequent	1
Asterias rubens	●●●●	Occasional	3
Echinus esculentus	●●●	Occasional	2
Clavelina lepadiformis	●●●	Occasional	2
Botryllus schlosseri	●●●	Occasional	1
Callophyllis laciniata	●●●	Occasional	2
Kallymenia reniformis	●●●	Occasional	1
Corallinaceae	●●●●	Frequent	5
Plocamium cartilagineum	●●●●	Frequent	6
Cryptopleura ramosa	●●●●	Frequent	3
Delesseria sanguinea	●●●●	Frequent	6
Hypoglossum hypoglossoides	●●●	Occasional	2
Phycodrys rubens	●●●	Frequent	3
Heterosiphonia plumosa	●●●	Frequent	2
Brongniartella byssoides	●●●	Occasional	2
Dictyota dichotoma	●●●●	Frequent	3
Laminaria hyperborea	●●●●●	Common	13

IR.MIR.KR.LhypT.Ft *Laminaria hyperborea* forest, foliose red seaweeds and a diverse fauna on tide-swept upper infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Strong, Moderately strong
Substratum:	Bedrock; boulders
Zone:	Infralittoral - upper
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Exposed to moderately exposed, tide-swept bedrock and boulders, with dense *Laminaria hyperborea* forest, characterised by a rich under-storey and stipe flora of foliose seaweeds. The kelp stipes support epiphytes such as *Callophyllis laciniata*, *Corallina officinalis*, *Cryptopleura ramosa*, *Membranoptera alata*, and *Phycodrys rubens.* At some sites, instead of being covered by red seaweeds, the kelp stipes are heavily encrusted by the ascidians *Botryllus schlosseri* and in the south-west *Distomus variolosus.* Epilithic seaweeds (*Dilsea carnosa*, *Hypoglossum hypoglossoides*, *Delesseria sanguinea*, *Plocamium cartilagineum*, *Brongniartella byssoides*, and *Dictyota dichotoma*) and crustose seaweeds commonly occur beneath the kelp. The kelp fronds are often covered with growth of the hydroid *Obelia geniculata* or the bryozoan *Membranipora membranacea.* Although these species are also found in most kelp forests, in this biotope they are particularly dense. On the rock surface, a rich fauna comprising of the sponges *Pachymatisma johnstonia*, *Halichondria panicea*, *Esperiopsis fucorum* and *Dysidea fragilis*, anthozoans such as *Urticina felina*, *Alcyonium digitatum* and *Caryophilia smithii*, the barnacle *Balanus crenatus*, colonial ascidians such as *Clavelina lepadiformis*, and the gastropods *Calliostoma zizyphinum* and *Gibbula cineraria*, occur. Also found on the rock is the echinoderm *Asterias rubens* and the crab *Cancer pagurus*.

Situation

This biotope occurs below *Alaria esculenta* (Ala) at exposed sites or *L. digitata* (Ldig.Ldig) at moderately exposed locations. With increasing depth the kelp density diminishes to become tide-swept kelp park (LhypT.Pk).

Temporal variation

Unknown

Similar biotopes

HIR.LhypFa	On very exposed coasts subject to weaker tidal currents. The fauna turf is characterised by a higher abundance of anthozoans such as *Corynactis viridis* and *Sargartia elegans*, but topshells such *C. zizyphi*num and *Gibbula cineraria* are also common. Red seaweeds are present but less dense than LhypT.Ft.
MIR.LhypT.Pk	Found in similar tide-swept conditions, often forming a zone below the kelp forest (LhypT.Ft) in deeper water where the kelp is less dense and more upper circalittoral species occurs.
MIR.Lhyp.Ft	Found in areas similar wave exposure but not subject to accelerated tidal currents and lacks therefore a prominent filter feeder community. The large variety of sponges such as *H. panicea* and *Esperiopsis fucorum*, the bryozoans *A. diaphanum* and *Flustra foliacea* and the barnacle *Balanus balanus* are not found in great abundance in the kelp forest.
MIR.LhypTX.Ft	Found in similar tide swept conditions, but on mixed substrata.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pachymatisma johnstonia	●●●	Occasional	2
Halichondria panicea	●●	Occasional	1
Esperiopsis fucorum	●●	Occasional	1
Dysidea fragilis	●●	Occasional	2
Obelia geniculata	●●●	Frequent	1
Alcyonium digitatum	●●●	Occasional	2
Urticina felina	●●●	Occasional	1
Caryophyllia smithii	●●	Occasional	1
Balanus crenatus	●●	Occasional	1
Cancer pagurus	●●●	Present	1
Membranipora membranacea	●●●	Present	2
Asterias rubens	●●●●	Present	3
Clavelina lepadiformis	●●●	Occasional	2
Botryllus schlosseri	●●●	Occasional	3
Dilsea carnosa	●●●	Occasional	2
Callophyllis laciniata	●●●	Occasional	2
Corallinaceae	●●●●	Frequent	3
Corallina officinalis	●●	Occasional	1
Plocamium cartilagineum	●●●●	Frequent	6
Cryptopleura ramosa	●●●●	Frequent	3
Delesseria sanguinea	●●●●	Frequent	4
Hypoglossum hypoglossoides	●●	Frequent	1
Membranoptera alata	●●●	Occasional	1
Phycodrys rubens	●●●●	Frequent	3
Brongniartella byssoides	●●●	Occasional	2
Dictyota dichotoma	●●●	Frequent	2
Laminaria hyperborea	●●●●●	Abundant	10

IR.MIR.KR.LhypT.Pk *Laminaria hyperborea* park with hydroids, bryozoans and sponges on tide-swept lower infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Strong, Moderately strong
Substratum:	Bedrock and boulders
Zone:	Infralittoral - lower
Depth band:	5-10 m, 10-20 m

Biotope description

Exposed to moderately wave-exposed, strongly tide-swept, rock with *Laminaria hyperborea* park characterised by a rich under-storey and stipe flora of foliose seaweeds such as *Phycodrys rubens*, *Plocamium cartilagineum*, *Hypoglossum hypoglossoides*, *Kallymenia reniformis*, *Cryptopleura ramosa* and *Delesseria sanguinea*. The red seaweed *Heterosiphonia plumosa* can be present. The foliose brown seaweed *Dictyota dichotoma* and coralline crust are often present as well. Amongst the red seaweeds is a rich fauna comprising sponges (*Pachymatisma johnstonia*, *Stelligera rigida*, *Esperiopsis fucorum* and *Dysidea fragilis*), anthozoans (*Alcyonium digitatum* and *Caryophyllia smithii*), hydroids (*Aglaophenia pluma* and *Nemertesia antennina*), colonial ascidians (*Clavelina lepadiformis* and *Morchellium argus*) and bryozoans such as *Electra pilosa*. Both the flora and fauna of this biotope are similar to the wave exposed kelp park (LhypR.Pk), but LhypT.Pk has a greater faunal component including the barnacle *Balanus crenatus*, the echinoderm *Asterias rubens* and the crab *Necora puber*.

Situation

This biotope generally occurs below a tide-swept *L. hyperborea* kelp forest (LhypT.Ft). As this biotope occurs over such a range of wave exposures a variety of circalittoral biotopes can occur beneath it: for example, Exposed, tide-swept rock (FaT) or moderately exposed tide-swept rock (EcCr).

Temporal variation

Unknown

Similar biotopes

MIR.Lhyp.Pk	Found in areas of similar wave exposure but not subject to accelerated tidal currents. Although similar red seaweeds dominate these kelp forests the faunal component is more conspicuous in the tide-swept biotope (higher diversity of sponges, hydroids and anthozoans).
MIR.LhypT	Found in similar tide-swept conditions, often forming a zone above the kelp forest (LhypT.Ft) in shallower water with higher abundance of *L. hyperborea*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pachymatisma johnstonia	●●●	Occasional	3
Stelligera rigida	●●	Occasional	1
Esperiopsis fucorum	●●	Occasional	1

Dysidea fragilis	●●●	Occasional	3
Aglaophenia pluma	●●	Occasional	2
Nemertesia antennina	●●●	Occasional	2
Alcyonium digitatum	●●●	Occasional	1
Caryophyllia smithii	●●●	Occasional	1
Balanus crenatus	●●●	Common	2
Necora puber	●●	Occasional	2
Electra pilosa	●●	Frequent	1
Asterias rubens	●●●	Occasional	2
Clavelina lepadiformis	●●●	Occasional	1
Morchellium argus	●●	Frequent	1
Kallymenia reniformis	●●●	Occasional	2
Corallinaceae	●●●●●	Frequent	5
Plocamium cartilagineum	●●●●●	Frequent	5
Cryptopleura ramosa	●●●●	Frequent	3
Delesseria sanguinea	●●●●●	Frequent	6
Hypoglossum hypoglossoides	●●●	Occasional	2
Phycodrys rubens	●●●	Frequent	1
Heterosiphonia plumosa	●●●●	Frequent	3
Dictyota dichotoma	●●●●	Frequent	5
Laminaria hyperborea	●●●●●	Frequent	7

IR.MIR.KR.LhypTX *Laminaria hyperborea* on tide-swept, infralittoral mixed substrata.

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed, Sheltered
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Boulders, cobbles, pebbles and gravel
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m

Biotope description

Wave-exposed through to wave-sheltered, tide-swept infralittoral mixed substrata with *Laminaria hyperborea* forest/park and other kelp species such as *Laminaria saccharina*. The rich under-storey and stipe flora is characterised by foliose seaweeds including the brown algae *Dictyota dichotoma*. The kelp stipes support epiphytes such as *Cryptopleura ramosa*, *Callophyllis laciniata* and *Phycodrys rubens*. At some sites, instead of being covered by red seaweeds, the kelp stipes are heavily encrusted by the ascidians *Botryllus schlosseri* and the bryozoan *Alcyonidium diaphanum*. Epilithic seaweeds such as *Desmerestia aculeata*, *Odonthalia dentate*, *Delesseria sanguinea*, *Plocamium cartilagineum*, *Callophyllis laciniata*, and crustose seaweeds commonly occur beneath the kelp. The kelp fronds are often covered with growths of the hydroid *Obelia geniculata* or the bryozoan *Membranipora membranacea*. On the rock surface, a rich fauna comprising anthozoans such as *Alcyonium digitatum* and *Urticina felina*, colonial ascidians such as *Clavelina lepadiformis* and the calcareous tubeworm *Pomatoceros triqueter* occurs. More mobile species include the gastropods *Gibulla cineria* and *Calliostoma zizyphinum*, the crab *Cancer pagurus* and the echinoderms *Crossaster papposus*, *Henricia oculata*, *Asterias rubens* and *Echinus esculentus*. Two variants are described; tide-swept kelp forest on upper infralittoral mixed substrata (LhypTX.Ft) and tide-swept kelp park on lower infralittoral mixed substrata (LhypTX.Pk).

Similar biotopes

IR.MIR.KR.LhypT	Found under similar wave exposure and tidal stream conditions, but on bedrock and boulder substratum.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	••	Present	1
Alcyonium digitatum	•••	Present	1
Urticina felina	•••	Rare	1
Pomatoceros triqueter	•••	Present	2
Cancer pagurus	•••	Present	2
Gibbula cineraria	•••	Present	2
Calliostoma zizyphinum	••••	Present	4
Alcyonidium diaphanum	•••	Present	2
Membranipora membranacea	••	Present	1
Crossaster papposus	•••	Present	1
Henricia oculata	••	Present	1
Asterias rubens	••••	Present	4
Echinus esculentus	••••	Present	5
Clavelina lepadiformis	••	Present	1
Botryllus schlosseri	•••	Present	2

Callophyllis laciniata	●●●	Present	2
Lithophyllum	●●●	Present	2
Plocamium cartilagineum	●●●●	Present	4
Cryptopleura ramosa	●●●	Present	2
Delesseria sanguinea	●●●●	Present	4
Phycodrys rubens	●●●●	Present	3
Odonthalia dentata	●●●	Present	2
Dictyota dichotoma	●●●	Present	2
Desmarestia aculeata	●●	Present	1
Laminaria hyperborea	●●●●●	Present	6

IR.MIR.KR.LhypTX.Ft *Laminaria hyperborea* forest and foliose red seaweeds on tide-swept, upper infralittoral mixed substrata.

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	Strong, Moderately strong, Weak, Very weak
Substratum:	Bedrock, boulders, cobbles, pebbles and gravel
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Moderately wave-exposed to wave sheltered, tide-swept mixed substrata, with dense *Laminaria hyperborea* forest and sparser *Laminaria saccharina*, characterised by an under-storey and stipe flora of foliose seaweeds. The kelp stipes support epiphytes such as *Palmaria palmata Callophyllis laciniata*, *Cryptopleura ramosa*, *Membranoptera alata*, and *Phycodrys rubens.* At some sites, instead of being covered by red seaweeds, the kelp stipes are heavily encrusted by the ascidians *Botryllus schlosseri* and in the south-west *Distomus variolosus.* Epilithic seaweeds (*Delesseria sanguinea*, *Plocamium cartilagineum*, *Odonthalia dentata*, *Dictyota dichotoma* and *Desmarestia aculeata*) and crustose seaweeds commonly occur beneath the kelp. The kelp fronds are often covered with growth of the hydroid *Obelia geniculata* or the bryozoan *Membranipora membranacea.* Although these species are also found in most kelp forests, in this biotope they are particularly dense. On the rock surface, a rich fauna comprising anthozoans such as *Urticina felina*, the barnacle *Balanus crenatus*, the calcareous tubeworm *Pomatoceros triqueter*, colonial ascidians such as *Clavelina lepadiformis*, the gastropods *Calliostoma zizyphinum* and *Gibbula cineraria*, and the bryozoans *Electra pilosa* and *Alcyonidium diaphanum* occur. Also found on the rock are the echinoderms *Echinus esculentus*, *Asterias rubens and Ophiothrix fragilis*, and the crabs *Cancer pagurus*, *Pagurus bernhardus* and *Necora puber*.

Similar biotopes

MIR.LhypTX.Pk	Found in more tide-swept conditions, often forming a zone below the kelp forest (LhypTX.Ft) in deeper water where the kelp is less dense and more upper circalittoral species occurs.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	●●●	Present	2
Urticina felina	●●●	Present	2
Pomatoceros triqueter	●●●	Present	2
Balanus crenatus	●●	Occasional	1
Pagurus bernhardus	●●	Present	1
Cancer pagurus	●●●	Present	3
Necora puber	●●●	Present	2
Gibbula cineraria	●●●●	Present	3
Calliostoma zizyphinum	●●●●	Present	4
Alcyonidium diaphanum	●●●	Present	1
Membranipora membranacea	●●●	Present	2
Electra pilosa	●●●	Present	2
Asterias rubens	●●●●	Present	5
Ophiothrix fragilis	●●	Present	1

Echinus esculentus	●●●●	Present	5
Clavelina lepadiformis	●●●	Present	2
Botryllus schlosseri	●●●	Present	2
Palmaria palmata	●●●	Present	1
Callophyllis laciniata	●●●	Present	2
Lithophyllum	●●●	Present	1
Plocamium cartilagineum	●●●●	Present	3
Cryptopleura ramosa	●●●	Present	2
Delesseria sanguinea	●●●●	Present	3
Membranoptera alata	●●●	Present	2
Phycodrys rubens	●●●●	Present	3
Odonthalia dentata	●●●	Present	3
Dictyota dichotoma	●●●	Present	1
Desmarestia aculeata	●●●	Present	3
Laminaria hyperborea	●●●●●	Present	5
Laminaria saccharina	●●●●	Present	4

IR.MIR.KR.LhypTX.Pk *Laminaria hyperborea* park and foliose red seaweeds on tide-swept, lower infralittoral mixed substrata.

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Very strong, Strong, Moderately strong
Substratum:	Boulders, cobbles, pebbles & gravel
Zone:	Infralittoral - lower
Depth band:	10-20 m, 20-30 m

Biotope description

Exposed to moderately wave-exposed, tide-swept, Infralittoral mixed substrata with *Laminaria hyperborea* park characterised by an under-storey and stipe flora of foliose seaweeds such as *Phycodrys rubens*, *Plocamium cartilagineum*, *Hypoglossum hypoglossoides*, *Kallymenia reniformis*, *Cryptopleura ramosa* and *Delesseria sanguinea*. Epilithic seaweeds (*Bonnemaisonia asparagoides*, *Callophyllis laciniata*, *Lomentaria orcadensis* and *Brongniartella byssoides*) and crustose seaweeds commonly occur beneath the kelp. The foliose brown seaweed *Dictyota dichotoma* is often present as well. Amongst the red seaweeds is a fairly diverse fauna comprising sponges (*Scypha ciliate*), anthozoans (*Alcyonium digitatum*, *Urticina felina* and *Caryophyllia smithii*), hydroids (*Tubularia indivisa*, *Halecium halecinum*, *Sertularia argentea* and *Nemertesia antennina*), colonial ascidians (*Botryllus schlosseri*) and bryozoans such as *Alcyonium diaphanum*. On the rock surface, the calcareous tubeworm *Pomatoceros triqueter*, the crab *Cancer pagurus* and the gastropods *Gibbula cineraria* and *Calliostoma zizyphinum* may be found. A diverse range of echinoderms are also found in this biotope: *Crossaster papposus*, *Henricia oculata*, *Asterias rubens*, *Echinus esculentus* and *Ophiothrix fragilis*.

Similar biotopes

MIR.LhypT.Pk	Occurs over similar range of tidal streams but found on bedrock and boulders.
MIR.LhypTX.Ft	Occurs on similar substrata but in shallower water depths in the upper infralittoral kelp forest zone.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Scypha ciliata	●●●	Present	1
Tubularia indivisa	●●●	Present	1
Halecium halecinum	●●●	Present	1
Nemertesia antennina	●●●	Present	2
Sertularia argentea	●●●	Present	1
Alcyonium digitatum	●●●	Present	3
Urticina felina	●●	Rare	1
Caryophyllia smithii	●●●	Present	2
Pomatoceros triqueter	●●●	Present	2
Cancer pagurus	●●●	Present	2
Gibbula cineraria	●●●	Rare	2
Calliostoma zizyphinum	●●●●	Present	4
Alcyonidium diaphanum	●●●	Present	2
Crossaster papposus	●●●	Present	2
Henricia oculata	●●●	Present	1
Asterias rubens	●●●●	Present	4

Ophiothrix fragilis	●●●	Present	1
Echinus esculentus	●●●●●	Present	6
Botryllus schlosseri	●●	Present	1
Bonnemaisonia asparagoides	●●	Present	1
Callophyllis laciniata	●●●●	Present	2
Kallymenia reniformis	●●●	Present	1
Plocamium cartilagineum	●●●●	Present	4
Lomentaria orcadensis	●●●	Present	1
Cryptopleura ramosa	●●●	Present	2
Delesseria sanguinea	●●●●	Present	4
Hypoglossum hypoglossoides	●●●	Present	1
Phycodrys rubens	●●●	Present	2
Brongniartella byssoides	●●●	Present	1
Dictyota dichotoma	●●●	Present	1
Laminaria hyperborea	●●●●●	Present	6

IR.MIR.KR.Lhyp *Laminaria hyperborea* and foliose red seaweeds on moderately exposed infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Moderately exposed infralittoral bedrock and boulders characterised by a canopy of the kelp *Laminaria hyperborea* beneath which is an under-storey of foliose red seaweeds and coralline crusts. Some red seaweeds can be found as epiphytes on the kelp stipes and include *Delesseria sanguinea* and *Phycodrys rubens*. Other red seaweeds present include the *Plocamium cartilagineum*, *Callophyllis laciniata*, *Cryptopleura ramosa* and the brown seaweeds *Dictyota dichotoma* and *Cutleria multifida*. The kelp fronds can be colonised by the hydroid *Obelia geniculata* or the bryozoans *Membranipora membranacea*. The echinoderm *Antedon bifida*, the ascidian *Clavelina lepadiformis*, the tube-building polychaete *Pomatoceros triqueter*, the anthozoans *Alcyonium digitatum* and *Urticina felina* can be found on the rock beneath the canopy. Mobile species often present include the gastropods *Gibbula cineraria* and *Calliostoma zizyphinum* and the echinoderms *Echinus esculentus* and *Asterias rubens*. Five variants has been described: Kelp forest (Lhyp.Ft), kelp park (Lhyp.Pk), grazed kelp forest (Lhyp.GzFt), grazed kelp park (Lhyp.GzPk) and kelp with *Sabellaria spinulosa* reefs (Lhyp.Sab). This suite of biotopes differs from the wave exposed *L. hyperborea* biotopes (KFaR) by having a lower diversity of cushion-forming faunal species. The foliose red seaweed component of the two suites of biotopes may also differ in composition with a tendency for Lhyp to include some more delicate filamentous species.

Temporal variation

Not known

Similar biotopes

IR.HIR.KFaR.LhypFa	*L. hyperborea* forest with a faunal cushion (sponges and polyclinids) and foliose red seaweeds on very exposed upper infralittoral rock. Both have dense red algae communities, but Lhyp lacks the dense cushion forming fauna associated with the more exposed biotopes.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	••	Frequent	1
Alcyonium digitatum	•••	Occasional	2
Pomatoceros triqueter	•••	Frequent	3
Gibbula cineraria	•••	Occasional	3
Membranipora membranacea	••	Frequent	1
Antedon bifida	••	Frequent	1
Asterias rubens	••••	Occasional	5
Echinus esculentus	••••	Frequent	6
Clavelina lepadiformis	••	Occasional	1
Callophyllis laciniata	•••	Occasional	2

Corallinaceae	●●●●	Common	9
Plocamium cartilagineum	●●●	Frequent	4
Delesseria sanguinea	●●●	Frequent	4
Phycodrys rubens	●●●	Frequent	4
Cutleria multifida	●●	Frequent	1
Dictyota dichotoma	●●●	Frequent	2
Laminaria hyperborea	●●●●●	Abundant	19

IR.MIR.KR.Lhyp.Ft *Laminaria hyperborea* forest and foliose red seaweeds on moderately exposed upper infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock; large boulders
Zone:	Infralittoral - upper
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Moderately exposed upper infralittoral bedrock and boulders characterised by a dense forest of *Laminaria hyperborea* with dense foliose red seaweeds beneath the canopy. These include *Callophyllis laciniata, Plocamium cartilagineum, Cryptopleura ramosa* and *Delesseria sanguinea*. Kelp stipes are usually covered in a rich mixture of red seaweeds of which *Palmaria palmata, Phycodrys rubens* and *Membranoptera alata* are often present. Small kelp plants can also be found on the larger kelp stipes. Kelp fronds may be covered with a hydroid growth of *Obelia geniculata* or the bryozoans *Membranipora membranacea* and *Electra pilosa*. The kelp holdfasts can be colonised by bryozoans *Scrupocellaria* spp. and/or crisiids and colonial ascidians such as *Botryllus schlosseri*. The rock surface between the kelp plants is generally covered by encrusting coralline algae, often with sponge crusts *Halichondria panicea.* Small vertical surfaces within the kelp forest generally lack kelp plants, instead being characterised by foliose red seaweeds such as *Dictyota dichotoma*, the anthozoans *Alcyonium digitatum, Urticina felina* and *Caryophyllia smithii*, the tube-building polychaete *Pomatoceros triqueter* and gastropods including *Calliostoma zizyphinum* and *Gibbula cineraria*. Many grazers are found in the kelp forest, the most commonly occurring being the gastropods *Gibbula cineraria* and *Calliostoma zizyphinum* and the echinoderm *Echinus esculentus*. Other echinoderms present include *Asterias rubens* and *Antedon bifida* which can be locally abundant, particularly in the north-west.

Situation

This biotope occurs over a wide geographic area and is generally found below the sublittoral fringe *Laminaria digitata* zone (Ldig) and above the *L. hyperborea* park (Lhyp.Pk). In the north, Shetland in particular, LsacSac can occur in the lower infralittoral; where grazing influence is present the abundance of red seaweeds may be much reduced (Lhyp.GzPk). In turbid water kelp park is often absent and dense foliose seaweed cover may occur instead (XFoR). In areas affected by scour, such as the rock-sediment interface at the base of bedrock slopes, a mixed kelp canopy can develop below the kelp forest (XKScrR).

Temporal variation

The under-storey of foliose and filamentous seaweeds will diminish towards the autumn and regrow in the spring. Otherwise this biotope is not known to vary markedly over time. Certain areas are prone to urchin grazing and this can substantially alter the community structure of the biotope, such that any site subject to intensive urchin grazing should be recorded as Lhyp.GzFt.

Similar biotopes

IR.LIR.K.LhypCape	Occurs in very and extremely sheltered silted sites. Ascidians such as *Ascidia mentula, Ascidiella aspersa, Ascidiella scabra* and *Clavelina lepadiformi* are more common and foliose red seaweeds such as *Callophyllis laciniata, Plocamium cartilagineum, Cryptopleura ramosa* and *Delesseria sanguinea* form a silted understorey on the rock. The filamentous red seaweed

Bonnemaisonia hamifera may carpet the seabed.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	••	Frequent	2
Urticina felina	•••	Occasional	2
Pomatoceros triqueter	•••	Frequent	3
Gibbula cineraria	••••	Frequent	4
Calliostoma zizyphinum	•••	Occasional	1
Membranipora membranacea	•••	Frequent	2
Electra pilosa	••	Frequent	1
Asterias rubens	••••	Occasional	3
Echinus esculentus	•••	Occasional	3
Botryllus schlosseri	•••	Occasional	3
Palmaria palmata	••	Frequent	1
Callophyllis laciniata	•••	Occasional	2
Corallinaceae	••••	Common	6
Plocamium cartilagineum	••••	Frequent	5
Cryptopleura ramosa	•••	Frequent	3
Delesseria sanguinea	••••	Frequent	5
Membranoptera alata	•••	Occasional	2
Phycodrys rubens	••••	Frequent	4
Dictyota dichotoma	•••	Frequent	2
Laminaria hyperborea	•••••	Abundant	22

IR.MIR.KR.Lhyp.Pk *Laminaria hyperborea* park and foliose red seaweeds on moderately exposed lower infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral - lower
Depth band:	5-10 m, 10-20 m

Biotope description

Below the dense kelp forest (Lhyp.Ft) on moderately exposed lower infralittoral bedrock and boulders, the kelp thins out to form a park. Beneath the kelp, the rock and kelp stipes are covered by an often dense turf of foliose red seaweeds such as *Callophyllis laciniata*, *Plocamium cartilagineum*, *Delesseria sanguinea*, *Hypoglossum hypoglossoides*, *Cryptopleura ramosa*, *Callophyllis laciniata* and *Phycodrys rubens*. Coralline crusts are often present on the rock surface. Many species of red seaweed found in this biotope occur at greater abundance in the shallower kelp forest. Other seaweeds, such as the red seaweeds *Bonnemaisonia asparagoides* and *Hypoglossum hypoglossoides* as well as the brown seaweed *Dictyota dichotoma* are more abundant in this zone than the upper infralittoral. The faunal component of this biotope is similar to that found below the kelp in the upper infralittoral zone and include the hydroid *Obelia geniculata*, the ascidian *Clavelina lepadiformis*, the anthozoans *Urticina felina*, *Alcyonium digitatum* and *Caryophyllia smithii*, the tube-building polychaete *Pomatoceros triqueter* and the gastropods *Calliostoma zizyphinum* and *Gibbula cineraria*. The gastropods *Gibbula cineraria* and *Calliostoma zizyphinum* and the echinoderm *Echinus esculentus* can be found grazing on the rock. Other echinoderms present include *Asterias rubens* and *Antedon bifida* which can be locally abundant, particularly in the north-west.

Situation

This biotope generally occurs below *L. hyperborea* forest (Lhyp.Ft) and marks the lower limit of the infralittoral rock. Occasionally a narrow band of foliose seaweeds (FoR) may occur below the kelp park but generally circalittoral biotopes are found.

Temporal variation

The under-storey of foliose and filamentous seaweeds will diminish towards the autumn and regrow in the spring. When grazing urchins (predominantly *E. esculentus*) reach a large number in the kelp park their voracious grazing can substantially alter the community structure of the biotope, removing most of the seaweeds and leaving only coralline crusts on the rock. This is common around the coast of Scotland, particularly in Shetland and such sites should be recorded as Lhyp.GzFt.

Similar biotopes

IR.HIR.KFaR.LhypR.Pk	Found in areas of greater wave exposure and has a greater faunal component (cushion sponges, anthozoans: *Sagartia elegans*, *Corynactis viridis* and *Actinothoe sphyrodeta*, more bryozoans such as *Crisia* spp. and epilithic bryozoan crusts).
IR.MIR.KR.Lhyp.Ft	Found above the kelp park and has a greater abundance of kelps but similar species composition.
IR.MIR.KR.LhypT.Pk	Occurs in sites subject to accelerated tidal currents, generally with a more prominent filter feeder community. A larger variety of sponges such as *Halichondria panicea* and *Esperiopsis fucorum*, the bryozoans *Alcyonidium diaphanum* and *Flustra foliacea* and the barnacle *Balanus balanus* are found

	in greater abundance in the tide-swept kelp park.
IR.MIR.KR.Lhyp.GzPk	Lacks the dense understorey of red seaweeds beneath the kelp canopy with the brown seaweeds *D. dichotoma* and *Desmarestia* spp. more prominent on the rock. The kelp stipes may still be covered with dense seaweeds but can also be bare from grazing.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	••	Frequent	2
Alcyonium digitatum	•••	Occasional	2
Urticina felina	•••	Occasional	1
Caryophyllia smithii	•••	Occasional	2
Pomatoceros triqueter	••••	Frequent	4
Gibbula cineraria	•••	Occasional	2
Antedon bifida	•••	Frequent	2
Asterias rubens	••••	Occasional	5
Echinus esculentus	••••	Occasional	5
Clavelina lepadiformis	•••	Occasional	2
Bonnemaisonia asparagoides	•••	Occasional	2
Callophyllis laciniata	•••	Occasional	2
Corallinaceae	••••	Frequent	7
Plocamium cartilagineum	••••	Frequent	5
Cryptopleura ramosa	••	Occasional	1
Delesseria sanguinea	•••••	Frequent	8
Hypoglossum hypoglossoides	•••	Occasional	1
Phycodrys rubens	••••	Frequent	4
Dictyota dichotoma	••••	Frequent	5
Laminaria hyperborea	•••••	Frequent	12

IR.MIR.KR.Lhyp.GzFt Grazed *Laminaria hyperborea* forest with coralline crusts on upper infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak
Substratum:	Bedrock; large boulders
Zone:	Infralittoral - upper
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Urchin grazing

Biotope description

Exposed to moderately exposed *Laminaria hyperborea* forest is in some areas intensely grazed by the urchin *Echinus esculentus*. The rock surface lacks a significant turf of foliose seaweeds and generally looks bare, though encrusting algae cover the rock. In addition to these encrusting coralline algae, non-calcareous crusts such as *Cruoria pellita* and brown algal crusts also occur. The kelp stipes may or may not be grazed; in the most extremely grazed areas, the stipes are also devoid of seaweeds. More usually, however, the stipes offers a refuge from grazing, and are characterised by dense turfs of red seaweeds, especially *Phycodrys rubens, Callophyllis laciniata, Plocamium cartilagineum* and *Delesseria sanguinea*. The hydroid *Obelia geniculata* and the bryozoan *Membranipora membranacea* colonise the kelp fronds. On the rock itself certain brown seaweeds such as *Cutleria multifida* may persist in this grazed environment. Fast-growing species such as the kelp *Laminaria saccharina* may be present at sites recovering from grazing, opportunistically colonising the rock surfaces that have been cleared by grazing. The fauna within a grazed kelp forest is also relatively sparse and is mostly confined to cracks, crevices and under-boulders. Species such as the ascidian *Clavelina lepadiformis* can often be found on vertical rock. Also found on the rock surface are the anthozoans *Urticina felina* and *Alcyonium digitatum*. Encrusting species such as the tube-building polychaete *Pomatoceros triqueter* are resistant to grazing and may occur in abundance. The grazers present include the echinoderm *Echinus esculentus* and the gastropods *Calliostoma zizyphinum* and *Gibbula cineraria*. Other echinoderms present include *Asterias rubens* and *Antedon bifida* which can be abundant in the north-west. Moderate grazing occurs within many kelp forests; records should only be assigned to this biotope where the community has been intensively grazed leaving algal-encrusted rock with very few epilithic algae.

Situation

With increasing depth, the kelp forest grades into a grazed kelp park (Lhyp.GzPk), the lower limit of which is often abrupt, representing the balance point between urchin-grazing pressure and kelp growth capabilities. In wave-exposed steep rocky areas, the shallowest water may be characterised by a forest of kelp with red seaweeds (LhypR.Ft), with a grazed kelp forest beneath. This effect may be a result of the increased wave action in shallower water, which regularly dislodges the urchins thereby reducing their grazing impact. Lhyp.GzFt is prevalent in the north of the UK where *E. esculentus* populations reach high densities. Although *E. esculentus* is widely distributed around the UK it occurs in greatest abundance in Scotland and north-east England where urchin grazing can substantially affect infralittoral communities.

Temporal variation

Fluctuations in *E. esculentus* numbers may give foliose seaweeds a chance to re-grow periodically. Further information is required on the temporal variation within these grazed forests and the changes in community structure when grazing pressure decreases.

Similar biotopes

IR.MIR.KR.Lhyp.GzPk	Found beneath the kelp forest and has a lower abundance of kelps but similar species composition to kelp forest.
IR.HIR.KSed.XKScrR	Bare rock surfaces beneath the kelp canopy may also be caused by sand-scour and should not be confused with the barren appearance of a community decimated (reduced) by grazing.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	••	Frequent	1
Alcyonium digitatum	•••	Occasional	2
Urticina felina	•••	Occasional	1
Pomatoceros triqueter	•••	Frequent	5
Gibbula cineraria	•••	Occasional	2
Calliostoma zizyphinum	•••	Occasional	2
Membranipora membranacea	••	Frequent	1
Antedon bifida	••	Occasional	1
Asterias rubens	••••	Occasional	5
Echinus esculentus	•••••	Common	15
Corallinaceae	••••	Abundant	12
Plocamium cartilagineum	••	Frequent	1
Delesseria sanguinea	•••	Occasional	1
Phycodrys rubens	••••	Frequent	4
Cutleria multifida	••	Common	3
Laminaria hyperborea	•••••	Abundant	20

IR.MIR.KR.Lhyp.GzPk Grazed *Laminaria hyperborea* park with coralline crusts on lower infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Exposed, Moderately exposed
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral - lower
Depth band:	10-20 m
Other features:	Urchin grazing

Biotope description

Exposed to moderately exposed *Laminaria hyperborea* kelp park in some areas is intensively grazed by the urchin *Echinus esculentus*. The rock surface lacks a significant turf of foliose seaweeds and generally looks bare, though coralline algal crusts and some grazing-resistant animals such as the tube-building polychaete *Pomatoceros triqueter* cover it. The kelp stipes may or may not be grazed; in the most extremely grazed areas, the stipes are also devoid of seaweeds. More usually, however, the stipes offers a refuge from grazing, and are characterised by dense turfs of red seaweeds, especially *Phycodrys rubens* and *Delesseria sanguinea*. Brown seaweeds present include *Cutleria multifida*, *Laminaria saccharina* and *Dictyota dichotoma*. The fauna within a grazed kelp park is also relatively sparse, though some species will survive in cracks and crevices or under boulders including the ascidian *Clavelina lepadiformis*. The encrusting bryozoan *Parasmittina trispinosa* and the anthozoans *Alcyonium digitatum*, *Urticina felina* and *Caryophyllia smithii* often characterise vertical or overhanging rock. Mobile species include the gastropods *Gibbula cineraria* and *Calliostoma zizyphinum* and the hermit crab *Pagurus bernhardus* The echinoderms *Ophiocomina nigra*, *Ophiothrix fragilis* and *Crossaster papposus*, generally absent from the kelp forest, can be found in these kelp parks along with *Asterias rubens* and *Antedon bifida*.

Situation

This biotope generally occurs below a grazed kelp forest (Lhyp.GzFt) but can also occur below ungrazed kelp forests on exposed sites where wave action can dislodge urchins from shallow rock. The grazed circalittoral biotope FaAlCr often occurs on the bedrock or boulders below.

Temporal variation

Fluctuations in the numbers of *E. esculentus* may give foliose seaweeds a chance to re-grow periodically. Further information is required on the temporal variation within these grazed kelp parks and the changes in community structure when grazing pressure decreases.

Similar biotopes

IR.MIR.KR.Lhyp.GzFt	Found above the kelp park and has a higher abundance of kelps but similar species composition to the park (Lhyp.GzPk).
IR.HIR.KSed.XKScrR	Bare rock surfaces beneath the kelp canopy may also be caused by sand-scour and should not be confused with the barren appearance of a community decimated (reduced) by grazing.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Alcyonium digitatum	••••	Occasional	3
Urticina felina	•••	Occasional	2
Caryophyllia smithii	•••	Occasional	1
Pomatoceros triqueter	••••	Frequent	5
Pagurus bernhardus	••	Occasional	1
Gibbula cineraria	••••	Occasional	4
Calliostoma zizyphinum	•••	Occasional	3
Parasmittina trispinosa	•••	Occasional	1
Antedon bifida	•••	Occasional	3
Crossaster papposus	•••	Rare	1
Asterias rubens	••••	Occasional	5
Ophiothrix fragilis	•••	Occasional	2
Ophiocomina nigra	••	Occasional	2
Echinus esculentus	•••••	Common	14
Clavelina lepadiformis	•••	Occasional	2
Corallinaceae	•••••	Abundant	12
Delesseria sanguinea	•••	Occasional	1
Phycodrys rubens	•••	Occasional	3
Cutleria multifida	••	Frequent	4
Dictyota dichotoma	•••	Occasional	2
Laminaria hyperborea	•••••	Frequent	9
Laminaria saccharina	••	Occasional	1

IR.MIR.KR.Lhyp.Sab *Sabellaria spinulosa* with kelp and red seaweeds on sand-influenced infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m
Other features:	Sand-scoured

Previous code

MIR.SabKR	97.06
MIR.SabR	96.7

Biotope description

Laminaria hyperborea kelp forest on shallow infralittoral bedrock and boulders characterised by encrustations of *Sabellaria spinulosa* tubes which cover much of the rock, together with sand-tolerant red seaweeds such as *Phyllophora pseudoceranoides*, *Dilsea carnosa* and *Polysiphonia elongata* and *Polysiphonia fucoides*. Red seaweeds such as *Plocamium cartilagineum* and *Delesseria sanguinea* may also be found beneath the kelp canopy, although typically low in abundance. They can be colonised by the ascidian *Botryllus schlosseri*. The cowrie *Trivia arctica* can also be found here. Much of the available rock is covered with encrusting coralline algae together with patches of the encrusting sponge *Halichondria panicea* and the anthozoan *Urticina felina.* More mobile fauna include the echinoderms *Asterias rubens*, *Henricia sanguinolenta*, *Echinus esculentus*, and *Ophiothrix fragilis*, the gastropod *Gibbula cineraria* and the hermit crab *Pagurus bernhardus*. The scouring effect of mobile sand adjacent to the rock maintains a reduced underflora and fauna compared to the association of species found in non-scoured kelp forests (Lhyp.Ft). Scour-resistant fauna such as the barnacle *Balanus crenatus* can be locally abundant on the rock, while the bivalve *Pododesmus patelliformis* can be found seeking shelter underneath the cobbles. Above the effect of scour, kelp stipes may be densely colonised by red seaweeds such as *Phycodrys rubens*, *Palmaria palmata* and *Membranoptera alata*, together with some sponges and ascidians.

Situation

This biotope is found in the sand-laden waters of north-east England in conditions in which *S. spinulosa* is able to thrive. Nearby circalittoral rock is often also dominated by *S. spinulosa* (Sspi) but lacks the kelp and red seaweeds. As this biotope is not commonly recorded in the UK there is a scarcity of information relating to the surrounding biotopes.

Temporal variation

Unknown.

Similar biotopes

CR.MCR.CSab.Sspi	A similar biotope is found in the circalittoral zone, where it lacks the algal component.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	●●●	Common	2
Urticina felina	●●●●	Frequent	4
Sabellaria spinulosa	●●●●●	Abundant	20
Balanus crenatus	●●	Occasional	1
Pagurus bernhardus	●●●●	Occasional	3
Gibbula cineraria	●●●●	Frequent	4
Trivia arctica	●●●	Occasional	2
Pododesmus patelliformis	●●	Frequent	1
Electra pilosa	●●●	Frequent	1
Henricia sanguinolenta	●●●	Occasional	2
Asterias rubens	●●●●●	Frequent	6
Ophiothrix fragilis	●●●	Occasional	2
Echinus esculentus	●●●●	Occasional	3
Botryllus schlosseri	●●●	Frequent	1
Dilsea carnosa	●●●	Occasional	1
Corallinaceae	●●●●	Frequent	3
Phyllophora pseudoceranoides	●●	Frequent	1
Plocamium cartilagineum	●●●●●	Frequent	6
Delesseria sanguinea	●●●	Frequent	3
Polysiphonia elongata	●●●	Common	3
Polysiphonia fucoides	●●	Occasional	1
Laminaria hyperborea	●●●●●	Abundant	15

IR.MIR.KR.XFoR Dense foliose red seaweeds on moderately exposed, silted, stable infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed
Tidal streams:	Moderately strong
Substratum:	Bedrock; boulders & cobbles
Zone:	Infralittoral
Depth band:	5-10 m, 10-20 m
Other features:	In turbid conditions

Biotope description

Upward-facing surfaces of shallow, infralittoral bedrock and boulders in areas of turbid water dominated by dense red seaweeds, with the notable absence of kelp. The stable rock, which can be cobbles or boulders but is more typically bedrock, is usually silted. Individual species of foliose red seaweeds such as *Plocamium cartilagineum* or *Calliblepharis ciliata* often dominate. Other red seaweeds likely to be present include *Phyllophora crispa*, *Rhodymenia holmesii*, *Halurus flosculosus*, *Cryptopleura ramosa*, *Hypoglossum hypoglossoides*, *Heterosiphonia plumosa* and coralline crusts. The brown seaweed *Dictyota dichotoma* is sometimes present, although never abundant. This biotope does not generally occur below kelp park but rather occurs on shallow, silted rock on which kelp would normally grow in less turbid conditions. The fauna can be variable but is generally typified by the presence of silt-tolerant animals such as encrusting sponges, particularly *Dysidea fragilis* and *Halichondria panicea*, the hydroid *Tubularia indivisa*, bryozoan crusts and scattered *Sabellaria spinulosa* and *Balanus crenatus*. In the summer months the seaweeds can become heavily encrusted with the bryozoan *Electra pilosa* and the ascidian *Molgula manhattensis* which can also form dense mats on the rock. The polychaete *Lanice conchilega* can be present, where sandy and muddy patches occur. Where this biotope occurs on chalk bedrock, such as off the Sussex coast, the piddock *Pholas dactylus* is often found bored into the rock. This biotope is recorded from the English Channel, off Kent, Sussex and the Isle of Wight. Please notice that individual sites of this biotope can vary significantly in the species composition.

Situation

This biotope generally occurs on discrete bedrock outcrops surrounded by areas of mixed sediment or mobile sand. Off Sussex, it occurs on the horizontal chalk bedrock forming the tops of cliffs (2-3m in height).

Temporal variation

The seaweeds die back in late autumn and summer leaving, silted, coralline-encrusted rock with a sparse fauna of sponges, *S. spinulosa* and occasional hydroids and bryozoans. The bryozoan *Amathia lendigera* can also become abundant amongst the seaweeds during the summer months.

Similar biotopes

IR.HIR.KFaR.FoR	This biotope occurs in deeper water below the kelp park with a higher diversity of sponges like *H. panicea* and *D. fragilis*.
IR.HIR.KFaR.FoR.Dic	This biotope occurs in deeper water below the kelp park with a high abundance of the brown seaweeds *Dictyopteris membranacea* (Frequent) and *D. dichotoma* (Common). It also has a higher diversity of sponges like *H. panicea* and *D. fragilis*.
IR.HIR.KSed.EphR	This biotope occurs on mixed, mobile substrata and is characterised by red seaweeds such as *Halarachnion ligulatum*, *Lomentaria orcadensis*, *Naccaria wiggii* and *Compsothamnion thuyoides* that thrive in these conditions.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Porifera indet crusts	••	Rare	4
Tubularia indivisa	••	Rare	2
Lanice conchilega	••	Occasional	3
AMPHIPODA	••	Abundant	4
Caprellidae	••	Common	2
Mytilus edulis	••	Present	1
Electra pilosa	•••	Frequent	15
Molgula manhattensis	••	Rare	1
Corallinaceae	••	Occasional	4
Phyllophora crispa	••	Occasional	3
Plocamium cartilagineum	•••	Frequent	14
Calliblepharis ciliata	••	Common	2
Halurus flosculosus	•••	Frequent	11
Cryptopleura ramosa	••	Common	3
Hypoglossum hypoglossoides	•••	Occasional	9
Heterosiphonia plumosa	••	Frequent	3
Foliose red algae	•••	Abundant	5
Dictyota dichotoma	••	Occasional	1

IR.MIR.KR.LhypVt *Laminaria hyperborea* on moderately exposed vertical rock.

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed, Sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Vertical rock.

Previous code

CorMetAlc in part	97.06
AlcByH in part	97.06

Biotope description

LhypVt is found on moderately exposed coasts in moderately strong to weak tidal streams generally in 0-20m water depth. It is characterised by the kelp *Laminaria hyperborea*, the soft coral *Alcyonium digitatum* and crinoid *Antedon bifida*. This biotope is relatively species poor when compared to similar biotopes in more exposed environments e.g. LhypRVt. The urchin *Echinus esculentus may be frequently observed grazing the vertical rock face. This biotope may have 2 sub-biotopes. One is characterised by the frequent occurrence of the sea squirt* Clavelina lepadiformis *and the red seaweeds* Phycodrys rubens *and* Cryptopleura ramosa. *The brown seaweed* Dictyota dichotoma *may also be frequent in this sub-biotope. The second sub-biotope is more species poor than the previous one and is characterised by the common occurrence of* Alcyonium digitatum, *which is only occasional in the other variant.*

Situation

Open rocky coasts in northern Britain, particularly North Sea coasts.

Temporal variation

No temporal data avialable

Similar biotopes

HIR.LhypRVt	Much richer; red seaweeds component usually denser.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Alcyonium digitatum	••••	Frequent	8
Urticina felina	•••	Occasional	3
Sagartia elegans	••	Occasional	1
Caryophyllia smithii	•••	Occasional	2
Pomatoceros triqueter	•••	Frequent	4
Cancer pagurus	••	Rare	1
Necora puber	••	Occasional	1
Gibbula cineraria	•••	Occasional	2
Calliostoma zizyphinum	•••	Occasional	2
Antedon bifida	•••	Frequent	3
Henricia	•••	Occasional	1
Asterias rubens	••••	Occasional	8
Echinus esculentus	•••••	Frequent	10
Clavelina lepadiformis	••••	Occasional	4
Botryllus schlosseri	••	Occasional	1
Corallinaceae	•••	Common	5
Plocamium cartilagineum	••	Occasional	2
Cryptopleura ramosa	•••	Frequent	2
Delesseria sanguinea	••	Occasional	2
Phycodrys rubens	•••	Frequent	2
Dictyota dichotoma	••	Frequent	2
Laminaria hyperborea	••••	Frequent	9

IR.MIR.KR.HiaSw *Hiatella arctica* with seaweeds on vertical limestone / chalk.

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Vertical limestone.

Previous code

AlcByH.Hia in part	97.06

Biotope description

This biotope is found in the infralittoral zone on moderately exposed vertical limestone/chalk surfaces in weak tidal streams, and has been recorded most frequently between 0-10m. This biotope is characterised by abundant *Hiatella arctica* and a rich sponge community including *Cliona celata*, *Dysidea fragilis* and *Pachymatisma johnstonia*. Other species that may be frequent in this biotope are the crab *Necora puber*, the sea squirt *Clavelina lepadiformis*, and the top shell *Calliostoma zizyphinum*, although these species are found in other vertical rock biotopes, however in lesser abundance.

Situation

Shallow rocky coasts with vertical limestone faces.

Temporal variation

No temporal data available

Similar biotopes

MCR.Hia	Similar vertical limestone/chalk habitat, but lacks seaweed component.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Dercitus bucklandi	••••	Frequent	1
Pachymatisma johnstonia	••••	Frequent	2
Tethya aurantium	••••	Frequent	1
Cliona celata	•••••	Common	4
Halichondria panicea	•••	Frequent	1
Esperiopsis fucorum	•••	Frequent	1
Dysidea fragilis	•••••	Frequent	4
HYDROZOA	•••	Common	2
Alcyonium digitatum	•••••	Abundant	4
Urticina felina	••••	Frequent	2
Sagartia elegans	•••	Frequent	1
Corynactis viridis	••••	Occasional	1
Caryophyllia smithii	••••	Frequent	2
POLYCHAETA	••••	Common	2
Pomatoceros triqueter	•••	Common	1
Balanus crenatus	•••	Common	1
Maja squinado	•••••	Occasional	2
Cancer pagurus	•••••	Occasional	3
Necora puber	•••••	Frequent	3

Calliostoma zizyphinum	●●●●●	Frequent	3
Mytilus edulis	●●●	Occasional	1
Hiatella arctica	●●●●	Abundant	3
Membranipora membranacea	●●●	Frequent	1
Bugula	●●●●	Frequent	2
Bryozoa indet crusts	●●●●	Common	2
Asterias rubens	●●●●	Occasional	1
Aslia lefevrei	●●●●	Frequent	2
Clavelina lepadiformis	●●●●●	Frequent	4
Morchellium argus	●●●●	Frequent	2
Aplidium punctum	●●●●	Occasional	1
Didemnidae	●●●●	Frequent	1
Polycarpa scuba	●●●	Abundant	1
Botryllus schlosseri	●●●●	Frequent	2
Corallinaceae	●●●●	Occasional	1
Phyllophora crispa	●●●	Abundant	2
Cryptopleura ramosa	●●●●	Common	2
Brongniartella byssoides	●●●	Common	1
Laminaria hyperborea	●●●	Common	1

IR.MIR.KT Tide-swept kelp and seaweed communities (sheltered infralittoral rock)

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Bedrock, boulders and cobbles
Zone:	Sublittoral fringe, Infralittoral
Height band:	Lower shore
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Sheltered infralittoral rock exposed to strong tidal streams. In the sublittoral fringe dense *Laminaria digitata* is found together with erect seaweeds, sponges, ascidians and bryozoans (LdigT). Below this, on bedrock and stable boulders a canopy of mixed kelp (primarily *Laminaria hyperborea* and *Laminaria saccharina*) occurs with foliose red seaweeds, sponges and ascidians (XKT). This biotope is typically found in the sheltered narrows and sills of Scottish sealochs. Mixed substrata of boulders, cobbles, pebbles and gravel, that also occurs in the tidal rapids of Scottish sealochs, supports a reduced kelp canopy (*L. hyperborea* and *L. saccharina*; typically Frequent), with a rich red seaweed component and maerl at some sites (XKTX). In south-west Britain, sheltered, tide-swept rock is restricted to estuarine conditions where variable salinity and increased turbidity of the water have a significant effect on the biota, limiting the infralittoral zone to very shallow depths. Unlike the tide-swept channels in sealochs, the rock in these estuaries is characterised by a relatively low abundance of *L. saccharina* (< Common) with foliose red seaweeds, sponges and ascidians (LsacT). *L. hyperborea* is rarely present. Mixed substrata in these conditions is also colonised by *L. saccharina* (typically Frequent) with a range of seaweeds characteristic of scoured/mobile conditions and interspersed with infaunal species (LsacTX).

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	●●●	Frequent	6
Anemonia viridis	●●	Occasional	1
Urticina felina	●●	Occasional	1
Pomatoceros triqueter	●●●	Frequent	4
Balanus crenatus	●●	Frequent	2
Carcinus maenas	●●●	Occasional	4
Gibbula cineraria	●●●	Occasional	2
Asterias rubens	●●●	Occasional	3
Ophiothrix fragilis	●●	Occasional	1
Echinus esculentus	●●	Occasional	2
Clavelina lepadiformis	●●	Occasional	1
Botryllus schlosseri	●●●	Occasional	2
Corallinaceae	●●●	Frequent	4
Corallina officinalis	●●	Occasional	1
Lithothamnion glaciale	●●	Frequent	1
Chondrus crispus	●●●	Occasional	2
Hypoglossum hypoglossoides	●●	Frequent	1
Dictyota dichotoma	●●	Occasional	2
Laminaria digitata	●●	Common	2
Laminaria hyperborea	●●●	Common	4
Laminaria saccharina	●●●●	Frequent	7
Halidrys siliquosa	●●●	Occasional	2

Ulva lactuca	●●●	Occasional	3

IR.MIR.KT.LdigT *Laminaria digitata*, ascidians and bryozoans on tide-swept sublittoral fringe rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Very strong, Strong, Moderately strong
Substratum:	Bedrock; boulders and cobbles
Zone:	Sublittoral fringe
Height band:	Lower shore
Depth band:	0-5 m

Previous code

LRK.LDIG.T	6.95

Biotope description

Sheltered bedrock, boulders and cobbles that are subject to moderate to strong tidal water movement characterised by dense *Laminaria digitata*, coralline crusts and sponges such as *Halichondria panicea*. Other seaweeds present include the foliose red *seaweeds Chondrus crispus, Palmaria palmata, Cryptopleura ramosa* and *Mastocarpus stellatus* as well as the calcareous *Corallina officinalis*. Green seaweeds present include *Ulva lactuca, Enteromorpha intestinalis* and *Cladophora rupestris*. The increased water movement encourages several filter-feeding faunal groups to occur. The sponges *Leucosolenia* spp., *Scypha ciliata* and *Hymeniacidon perleve* frequently occur on steep and overhanging rock faces. The bryozoans *Electra pilosa*, *Membranoptera membranipora* and *Alcyonidium hirsutum* encrust the kelp and other foliose seaweeds. In addition, ascidians such as *Ascidiella scabra*, *Dendrodoa grossularia* and colonial ascidians *Botryllus byssoides* and *Botryllus leachi* often thrive in this environment encrusting both the rock and the seaweeds. The tube-building polychaete *Pomatoceros triqueter* can be found on the rock and on the kelp holdfasts along with the barnacle *Balanus crenatus*. More mobile species such as the gastropods *Gibbula cineraria* and *Calliostoma zizyphinum*, the crab *Carcinus maenas* and the starfish *Asterias rubens* are also common. Areas where increased tidal movement influences this community can be found in the narrows and/or intertidal sills of sealochs.

Situation

This biotope often occurs immediately below the tide-swept *Fucus serratus* biotope (SLR.Fserr.T) consequently, some *F. serratus* may occur in this biotope (typically only Occasional). The sublittoral fringe of similarly sheltered shores that are not tide-swept are generally characterised by mixed *Laminaria saccharina* and *L. digitata* (Lsac.Ldig) or *L. saccharina* (Lsac). Below LdigT, at these sheltered, tide-swept sites, a canopy of mixed kelp species often occurs (see XKT and XKTX).

Temporal variation

Unknown.

Similar biotopes

IR.MIR.KR.Ldig	Occur in non tide-swept areas and lacks the characteristic community of filter-feeders, though the individual species may be present.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	••••	Frequent	5
Dynamena pumila	•••	Occasional	2
Pomatoceros triqueter	••••	Occasional	3

Spirorbidae	●●●	Frequent	2
Balanus crenatus	●●	Occasional	1
Carcinus maenas	●●●●	Rare	2
Gibbula cineraria	●●●	Occasional	2
Calliostoma zizyphinum	●●●	Rare	1
Alcyonidium hirsutum	●●●	Frequent	2
Membranipora membranacea	●●●	Occasional	2
Bryozoa indet crusts	●●●	Frequent	2
Asterias rubens	●●●	Occasional	1
Ascidiella scabra	●●	Frequent	1
Dendrodoa grossularia	●●●	Occasional	1
Botryllus schlosseri	●●●●	Occasional	3
Botrylloides leachi	●●	Rare	1
Palmaria palmata	●●●	Occasional	3
Corallinaceae	●●●●	Common	8
Corallina officinalis	●●●	Occasional	2
Mastocarpus stellatus	●●	Occasional	1
Chondrus crispus	●●●	Occasional	3
Cryptopleura ramosa	●●●	Occasional	1
Laminaria digitata	●●●●●	Abundant	20
Fucus serratus	●●●	Occasional	3
Enteromorpha	●●●	Occasional	1
Ulva lactuca	●●●●	Occasional	3
Cladophora rupestris	●●	Frequent	1

IR.MIR.KT.XKT Mixed kelp with foliose red seaweeds, sponges and ascidians on sheltered, tide-swept infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Very strong, Strong, Moderately strong
Substratum:	Bedrock, boulders and cobbles
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m

Previous code

Lsac.T (in part)	97.06

Biotope description

Stable, tide-swept rock characterised by dense kelp *Laminaria hyperborea* and/or *Laminaria saccharina* forest on scoured, coralline-encrusted rock. This biotope occurs in the sheltered narrows and sills of Scottish sealochs, where there is an increase in tidal flow. Although *L. hyperborea* (typically Common) generally occurs in greater abundance than *L. saccharina* (Frequent), either kelp may dominate, sometimes to the exclusion of the other. (This biotope should not be confused with sheltered, but silted LhypLsac). Large stands of the brown seaweed *Halidrys siliquosa* may also occur amongst the kelp along with *Dictyota dichotoma* on bedrock and boulders. In contrast to the scoured rock surface the kelp stipes themselves often support prolific growths of foliose red seaweeds such as *Phycodrys rubens, Membranoptera alata, Delesseria sanguinea* and *Plocamium cartilagineum*. Other foliose seaweeds may be present among the kelp holdfasts include *Chondrus crispus and Dilsea carnosa*. The scoured rock surface is characterised by encrusting coralline algae, barnacles *Balanus crenatus* and the tube-building polychaete *Pomatoceros triqueter*. The sponge *Halichondria panicea*, anthozoans *Urticina felina*, *Anemonia viridis* and *Sagartia elegans* can also occur on the scoured rock. Sponges, particularly *Halichondria panicea* and colonial and solitary ascidians *Botryllus schlosseri* and *Ascidiella aspersa* encrust the stipes, whilst hydroid growth of *Obelia geniculata* and seamats *Membranoptera membranacea* can cover the fronds, optimising the increased tidal flow. Mobile species such as the gastropod *Gibbula cineraria* can often be found on and around the kelp. The echinoderms *Asterias rubens*, *Ophiothrix fragilis* and *Echinus esculentus* can be found underneath the kelp canopy on the rock along with the crab *Carcinus maenas*. Where some protection is afforded from the scour anthozoans may occur on the rock such as *Alcyonium digitatum* or *Metridium senile*.

Situation

This biotope may be fringed by tide-swept kelp *Laminaria digitata* in shallower water (LdigT). Where mixed substrata occurs adjacent to the stable bedrock and boulders the kelp will usually diminish in density (typically Frequent), but a greater diversity of species will be found compared to the scoured bedrock, in particular there is an increase in red seaweeds and a greater infaunal component (XKTX). Maerl rhodoliths may be present amongst the bedrock and boulders of XKT in small amounts, and at some sites may form extensive beds surrounding the bedrock outcrops (Phy.R and Lgla).

Temporal variation

Unknown.

Similar biotopes

IR.MIR.KR.LhypT.Ft	Tide-swept rock on the open coast supports a similar community of *L. hyperborea* kelp forest. LhypT.Ft generally occurs at a greater depth (6-10m below chart datum compared to the shallow XKT, which is generally above 5m chart datum). The kelp composition in XKT is generally mixed compared to the dense monospecific *L. hyperborea* canopy of LhypT.Ft. The faunal composition differs with a higher diversity of sponges and anthozoans in the

	open coast sites, which lack the often dense aggregations of solitary ascidians that occur at the sheltered, shallow sites of XKT.
IR.MIR.KT.XKTX	Tidal rapids with a higher percentage of mixed substrata which support a higher abundance of red algae like *Lithothamnion* spp. and *L. graciale* but also the brown seaweed *Chorda filum* is present. Filterfeeders like the sponge *Halichondria panicea*, hydroids (*Obelia geniculata*) and anthozoans like *Urticina felina* and *Sargartia elegans* are usually absent due to the more unstable substrata of this biotope compared to XKT.
IR.HIR.KSed.XKHal	Occurs on the open, more exposed coast and is not tide-swept.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	••••	Frequent	4
Obelia geniculata	•••	Frequent	2
Anemonia viridis	••	Occasional	1
Urticina felina	•••	Occasional	1
Sagartia elegans	••	Occasional	1
Pomatoceros triqueter	••••	Frequent	4
Balanus crenatus	••	Frequent	1
Carcinus maenas	•••	Occasional	3
Gibbula cineraria	•••	Frequent	2
Asterias rubens	••••	Occasional	4
Ophiothrix fragilis	•••	Occasional	1
Echinus esculentus	••••	Occasional	3
Ascidiella aspersa	••	Occasional	1
Botryllus schlosseri	•••	Occasional	2
Dilsea carnosa	•••	Occasional	1
Corallinaceae	••••	Common	5
Chondrus crispus	•••	Occasional	2
Plocamium cartilagineum	•••	Occasional	1
Delesseria sanguinea	•••	Frequent	2
Membranoptera alata	•••	Occasional	1
Phycodrys rubens	•••	Frequent	1
Dictyota dichotoma	•••	Occasional	2
Laminaria hyperborea	••••	Common	10
Laminaria saccharina	••••	Frequent	6
Halidrys siliquosa	••••	Occasional	4

IR.MIR.KT.XKTX Mixed kelp and red seaweeds on infralittoral boulders, cobbles and gravel in tidal rapids

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Very strong, Strong, Moderately strong
Substratum:	Boulders, cobbles and gravel
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m

Previous code

Lsac.T (in part)

Biotope description

Mixed substrata of boulders, cobbles, pebbles and gravel, typically found in tidal rapids with kelp *Laminaria saccharina* and *Laminaria hyperborea* and red seaweeds. *L. saccharina* usually dominates this habitat although *L. hyperborea* may occur in equal abundance at some sites. The kelp in these tidal rapids does not form the same dense canopies associated with stable tide-swept bedrock, but generally occurs at lower abundance (Frequent). Other brown seaweeds occur in significant amounts in these tidal rapids including *Dictyota dichotoma*, *Halidrys siliquosa* and *Chorda filum*. These mixed substrata support a greater diversity of species than scoured bedrock narrows (XKT). In particular, there is an increase in red algal species such as *Corallina officinalis, Bonnemaisonia hamifera* and *Ceramium nodulosum*, although none occur in any great abundance. Red seaweeds common to both XKT and this biotope include *Chondrus crispus, Delesseria sanguinea, Plocamium cartilagineum* and *Phycodrys rubens*. Good examples of this biotope often have maerl gravel (*Lithothamnion* sp.) or rhodoliths between cobbles and boulders. Where maerl dominates, the biotope should be recorded as a maerl bed (SS.SMP.Mrl). The sponges associated with more stable, tide-swept conditions are generally absent, but the anthozoan *Anemonia viridis* might be present. Cobbles and pebbles are encrusted by the ubiquitous polychaete *Pomatoceros triqueter* and provide shelter for scavenging crabs such as *Carcinus maenas* and the hermit crab *Pagurus bernhardus*, gastropods such as *Gibbula cineraria* and echinoderms such as *Echinus esculentus, Asterias rubens, Ophiocomina nigra* and *Ophiothrix fragilis* which favour these sites of increased water movement. Additional infaunal species, inhabiting the sediment pockets, include *Lanice conchilega* and *Sabella pavonina*, which can be locally abundant.

Situation

Where stable rock fringes the shallows the tide-swept *Laminaria digitata* biotope often occurs (LdigT). Adjacent areas of stable bedrock or boulders in these sheltered, tide-swept narrows can support a similar kelp community, often with a greater percentage of *L. hyperborea* (XKT). Maerl fragments are often found amongst the mixed substrata of XKTX and this biotope may abut more extensive areas of maerl bed (Phy & Lgla).

Temporal variation

Unknown.

Similar biotopes

IR.HIR.KSed.XKHal	This biotope occurs on the open coast in deeper water.
IR.MIR.KT.XKT	Stable, tide-swept rock in the sheltered narrows and sills of Scottish sealochs, characterised by a dense kelp forest of *L. hyperborea* (Common) and/or *Laminaria saccharina* (Frequent) on scoured, coralline-encrusted rock. The brown seaweed *Chorda filum* is not present. Filterfeeders like the sponge *Halichondria panicea*, hydroids (*Obelia geniculata*) and anthozoans like *Urticina felina* and *Sargartia elegans* are present (Frequent-Occasional) due

to the more stable substrata of this biotope compared to XKTX.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Anemonia viridis	●●●	Occasional	2
Pomatoceros triqueter	●●●●	Frequent	10
Pagurus bernhardus	●●●	Occasional	3
Carcinus maenas	●●●	Frequent	5
Gibbula cineraria	●●●	Frequent	1
Asterias rubens	●●●●	Occasional	6
Ophiothrix fragilis	●●	Occasional	1
Ophiocomina nigra	●●●	Common	4
Echinus esculentus	●●●	Occasional	2
Bonnemaisonia hamifera	●●	Frequent	2
Corallinaceae	●●●	Frequent	3
Corallina officinalis	●●●	Occasional	2
Lithothamnion	●●●●●	Common	9
Chondrus crispus	●●●●	Rare	3
Ceramium nodulosum	●●●	Rare	2
Delesseria sanguinea	●●●	Occasional	1
Phycodrys rubens	●●●	Occasional	3
Rhodophycota indet.(non-calc.crusts)	●●	Frequent	1
Dictyota dichotoma	●●●	Frequent	3
Laminaria hyperborea	●●	Frequent	1
Laminaria saccharina	●●●●●	Frequent	11
Halidrys siliquosa	●●	Occasional	1
Ulva lactuca	●●●	Occasional	4

IR.MIR.KT.LsacT *Laminaria saccharina* with foliose red seaweeds and ascidians on sheltered, tide-swept infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Strong, Moderately strong
Substratum:	Boulders, bedrock and gravel
Zone:	Infralittoral - upper
Depth band:	0-5 m

Previous code

Lsac.T (in part)	97.06

Biotope description

Sheltered, tide-swept rock in south-western Britain tends to be restricted to estuarine conditions, where variable salinity and increased turbidity have a significant effect on the biota. Due to the turbidity of the water, the infralittoral zone is restricted to very shallow depths. Unlike the tide-swept channels in sealochs, which support a mixed kelp canopy, the rock in these estuaries is characterised by *Laminaria saccharina* occurring in relatively low abundance (Frequent). The brown alga *Desmarestia ligulata* can occur in this biotope, though never dense, along with the non-native brown seaweed *Sargassum muticum*. Beneath the sparse kelp, cobbles and boulders, often surrounded by sediment, are encrusted by fauna and often a dense turf of red seaweed. The foliose red seaweeds associated with this biotope include *Callophyllis laciniata*, *Nitophyllum punctatum*, *Kallymenia reniformis*, *Gracilaria gracilis*, *Gymnogongrus crenulatus*, *Hypoglossum hypoglossoides*, *Rhodophyllis divaricata*, *Chylocladia verticillata*, *Cryptopleura ramosa* and *Erythroglossum laciniatum* as well as the filamentous *Ceramium nodulosum* and *Pterothamnion plumula*. Green seaweeds *Ulva lactuca*, *Bryopsis plumosa* and *Cladophora* spp. may be locally abundant. The dominating faunal species vary from site to site but include sponges such as *Halichondria panicea*, *Esperiopsis fucorum*, *Dysidea fragilis* and *Hymeniacidon perleve* as well as ascidians, particularly *Dendrodoa grossularia* and *Morchellium argus*, which can cover the rocks. Also present is the anthozoan *Anemonia viridis*, the barnacle *Balanus crenatus* and the tube-building polychaete *Pomatoceros triqueter*. The hydroid Plumularia setacea can cover rocks and seaweed fronds The range of solitary ascidians found in the north-west are limited to *Ascidiella aspersa* in these south-western inlets. There is also a general absence of echinoderms. Where soft rock allows, such as the limestone in Plymouth Sound, rock-boring organisms such as *Polydora* spp. may be locally abundant. Sheltered, tide-swept rock is generally restricted to the narrows or tidal rapids of marine inlets. The clear tide-swept waters of Scottish sealochs are considerably different to the marine inlets of south-west Britain. This biotope deals with the latter.

Situation

This biotope generally occurs on rocky outcrops interspersed by sediment areas. Where the rock extends into deeper water, beyond the limit of kelp, sponges and ascidians tend to dominate these sheltered, tide-swept circalittoral sites (CuSpH); also *Alcyonium digitatum* with sponges and *Nemertesia antennina* (ByErSp).

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	●●●	Occasional	3
Hymeniacidon perleve	●●●	Frequent	3
Dysidea fragilis	●●	Occasional	1
Plumularia setacea	●●	Occasional	2
Anemonia viridis	●●	Occasional	1
Pomatoceros triqueter	●●	Occasional	2
Balanus crenatus	●●	Occasional	2
Morchellium argus	●●	Frequent	1
Dendrodoa grossularia	●●●	Abundant	4
Callophyllis laciniata	●●	Occasional	2
Kallymenia reniformis	●●	Occasional	2
Gracilaria gracilis	●●	Occasional	1
Rhodophyllis divaricata	●●●	Occasional	3
Chylocladia verticillata	●●	Rare	1
Ceramium nodulosum	●●●	Frequent	4
Pterothamnion plumula	●●	Occasional	1
Cryptopleura ramosa	●●	Frequent	3
Hypoglossum hypoglossoides	●●●	Occasional	3
Nitophyllum punctatum	●●●	Occasional	3
Desmarestia ligulata	●●	Rare	1
Laminaria saccharina	●●●●●	Frequent	23
Sargassum muticum	●●	Occasional	2
Ulva lactuca	●●●	Frequent	5
Bryopsis plumosa	●●	Occasional	1

IR.MIR.KT.FilRVS Filamentous red seaweeds, sponges and *Balanus crenatus* on tide-swept variable-salinity infralittoral rock

Habitat classification

Salinity:	Variable (18-35ppt)
Wave exposure:	Extremely sheltered
Tidal streams:	Moderately strong
Substratum:	Bedrock; boulders
Zone:	Infralittoral
Depth band:	0-5 m
Other features:	Heavily silted / turbid water

Previous code

SIR.Lsac.FiR	96.7

Biotope description

Tide-swept infralittoral rock subject to variable salinity and turbid waters occurs in the mid to upper reaches of the rias of south-west Britain, where riverine freshwater input reduces the salinity. Very shallow rock under these conditions is characterised by a covering of filamentous red seaweed such as *Callithamnion* spp., *Antithamnion* spp., *Ceramium* spp., *Griffithsia devoniensis*, *Pterothamnion plumula* and *Polysiphonia fucoides* as well as the filamentous green seaweed *Cladophora* spp. Foliose red seaweeds such as *Hypoglossum hypoglossoides*, *Cryptopleura ramosa* and *Erythroglossum laciniatum* commonly occur, as does the foliose green seaweed *Ulva lactuca*. Although *Laminaria saccharina* is often present it is usually in low abundance (Occasional). The fluctuating salinity limits the number of species able to exist in this habitat. The animal community is dominated by the sponges *Halichondria panicea* and *Hymeniacidon perleve* and the barnacle *Balanus crenatus*. The ascidians *Clavelina lepadiformis* and *Dendrodoa grossularia* can be locally abundant at some sites. The crab *Carcinus maenas* is usually present along with the bivalve *Mytilus edulis*. The bryozoan *Bugula plumosa* can occur attached to the rock.

Situation

This biotope is usually found amidst sediment or rock and as such there is no defined zonation of the surrounding biotopes. Shallow sediments nearby may support seagrass beds (*Zostera* spp.) or infaunal-dominated sediments (SS.SCS.ICS). Nearby, deeper tide-swept rock may support circalittoral communities dominated by sponges, hydroids and ascidians on stable rock (CuSpH.As) or dense bryozoans on mixed substrata (SpNemAdia & FluHocu).

Temporal variation

Unknown.

Similar biotopes

IR.MIR.KT.LsacT	This biotope occurs at similar conditions as FilRVS. The species diversity is also similar between the to biotopes, but LsacT have a higher abundance of the kelp *L. saccharina* (Common) and of the ascidian *Dendrodoa grossularia* (Abundant). FilRVS have a higher abundance of the sponge *H. panicea.*

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	••••	Common	8
Hymeniacidon perleve	•••	Frequent	4
Balanus crenatus	••••	Occasional	3
Carcinus maenas	•••	Occasional	4

Mytilus edulis	••	Occasional	2
Bugula plumosa	••	Occasional	1
Clavelina lepadiformis	••	Frequent	1
Dendrodoa grossularia	••	Occasional	1
Antithamnion	••	Occasional	2
Callithamnion	•••	Frequent	6
Ceramium nodulosum	••	Occasional	1
Griffithsia devoniensis	••	Frequent	2
Pterothamnion plumula	••••	Frequent	14
Cryptopleura ramosa	••	Common	1
Hypoglossum hypoglossoides	•••••	Frequent	18
Erythroglossum laciniatum	•••	Frequent	8
Polysiphonia fucoides	••	Occasional	3
Laminaria saccharina	••	Occasional	1
Ulva lactuca	••	Occasional	2
Cladophora	••	Occasional	2

IR.LIR Low energy infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered, Ultra sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock, boulders and cobbles
Zone:	Sublittoral fringe, Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Infralittoral rock in wave and tide-sheltered conditions, supporting silty communities with *Laminaria hyperborea* and/or *Laminaria saccharina* (K). Associated seaweeds are typically silt-tolerant and include a high proportion of delicate filamentous types. In turbid-water estuarine areas, the kelp and seaweeds (KVS) may be replaced by animal-dominated communities (FaVS) whilst stable hard substrata in lagoons support distinctive communities (Lag).

IR.LIR.K Silted kelp (stable rock)

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock, boulders, cobbles and mixed substrata
Zone:	Sublittoral fringe, Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Infralittoral rock in wave and tide-sheltered conditions, supporting silty communities with *Laminaria hyperborea* and/or *Laminaria saccharina*. Associated seaweeds are typically silt-tolerant and include a high proportion of delicate filamentous types. Some areas, particularly in the lower infralittoral zone, are subject to intense grazing by urchins and chitons and may have poorly developed seaweed communities.

IR.LIR.K.LhypLoch Mixed *Laminaria hyperborea* and *Laminaria ochroleuca* forest on moderately exposed or sheltered infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Moderately exposed, Sheltered
Tidal streams:	Weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral - upper
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Mixed *Laminaria hyperborea* and *Laminaria ochroleuca* forest on upper infralittoral moderately exposed or sheltered rock is restricted to the coast of Cornwall and the Isles of Scilly. Unlike *L. hyperborea*, however, *L. ochroleuca* has a smooth stipe and it lacks the epiphytic growth of seaweeds. The bryozoan *Membranipora membranacea* may encrust the very lower part of the stipe but the rest of the stipe is characteristically bare. The fronds too are generally free of encrusting hydroids, bryozoans and grazing gastropods as compared to *L. hyperborea*. *L. ochroleuca* holdfasts, however, are often encrusted with sponges and colonial ascidians. A large variety of foliose and filamentous red seaweeds are often present underneath the canopy. These include *Callophyllis laciniata, Plocamium cartilagineum, Cryptopleura ramosa, Delesseria sanguinea, Dilsea carnosa Bonnemaisonia asparagoides, Erythroglossum laciniatum, Sphaerococcus coronopifolius, Polyneura bonnemaisonii* and *Corallina officinalis*. The foliose brown seaweed *Dictyota dichotoma* is frequently found in this biotope along with the occasional kelp such as *Saccorhiza polyschides* and *Laminaria saccharina*. The faunal composition of the biotope as a whole is often sparse. The anthozoans *Corynactis viridis* and *Caryophyllia smithii* are common on vertical surfaces with scattered bryozoan turf species such as Crisiidae. Grazers such as the gastropod *Gibbula cineraria* and the urchin *Echinus esculentus* are often present. *L. ochroleuca* occurs across a wide range of wave exposures (in common with *L. hyperborea*) and consequently it occurs at low abundance in other kelp biotopes (sheltered through to exposed) that occur in the South-West between Dorset to Lundy. In such cases, records should be considered as regional variations of the usual kelp biotopes. Records should only be assigned to this biotope when the canopy is dominated by *L. ochroleuca* alone, or by a mixture of both *L. hyperborea* and *L. ochroleuca* (though the latter is usually at greater abundance). *L. ochroleuca* commonly occurs on the Brittany and Normandy coasts.

Situation

On moderately exposed to sheltered rock *Laminaria ochroleuca* can form a dense forest below the *L. hyperborea* forest (Lhyp.Ft). At other sites *L. hyperborea* park (Lhyp.Pk) occurs below Lhyp.Loch. A band of dense foliose seaweeds can also dominate the lower infralittoral zone below the kelp zone (FoR or FoR.Dic). More data is required to establish further trends in neighbouring biotopes.

Temporal variation

The under-storey of foliose and filamentous seaweeds will diminish towards the autumn and regrow in the spring. Otherwise, this biotope is not known to change significantly over time.

Similar biotopes

IR.HIR.KFaR.LhypR.Loch	This biotope is similar to the mixed *L. hyperborea* and *L. ochroleuca* biotope found on exposed coasts (LhypR.Loch), though the latter generally occurs in slightly deeper water (often below the *L. hyperborea*-forest LhypR.Ft) as *L. ochroleuca* is less tolerant of strong wave action at its northern limit of distribution.

IR.MIR.KR.Lhyp

Superficially, the *L. ochroleuca* biotope looks similar to a moderately exposed *L. hyperborea* forest, containing a similar suite of foliose and filamentous red seaweeds beneath the canopy. *L. ochroleuca* is not usually present in this biotope.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Corynactis viridis	●●●	Occasional	2
Caryophyllia smithii	●●●	Frequent	2
Gibbula cineraria	●●	Occasional	1
Crisiidae	●●	Frequent	1
Echinus esculentus	●●●	Occasional	1
Bonnemaisonia asparagoides	●●	Occasional	1
Dilsea carnosa	●●●	Occasional	2
Callophyllis laciniata	●●●●	Frequent	4
Corallinaceae	●●●●	Frequent	5
Corallina officinalis	●●	Frequent	1
Chondrus crispus	●●●	Occasional	1
Plocamium cartilagineum	●●●	Occasional	2
Sphaerococcus coronopifolius	●●●	Occasional	1
Cryptopleura ramosa	●●●	Frequent	3
Delesseria sanguinea	●●●	Occasional	3
Polyneura bonnemaisonii	●●●	Frequent	3
Erythroglossum laciniatum	●●●	Frequent	2
Dictyota dichotoma	●●●●	Frequent	4
Laminaria hyperborea	●●●●●	Occasional	10
Laminaria ochroleuca	●●●●●	Abundant	26
Laminaria saccharina	●●●	Frequent	3
Saccorhiza polyschides	●●●	Frequent	2

IR.LIR.K.LhypLsac Mixed *Laminaria hyperborea* and *Laminaria saccharina* on sheltered infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Mixed *Laminaria hyperborea* and *Laminaria saccharina* on bedrock and boulders in sheltered infralittoral habitats. Typically subject to weak tidal streams and rather silty conditions. Beneath the kelp is an associated under-storey flora of foliose red seaweeds including *Plocamium cartilagineum, Cryptopleura ramosa* and *Callophyllis laciniata* as well as the brown seaweeds *Dictyota dichotoma, Cutleria multifida* and *Desmarestia aculeata*. The stipes of *L. hyperborea* may be densely covered with red seaweeds such as *Phycodrys rubens* and *Delesseria sanguinea* as well as the solitary ascidian *Clavelina lepadiformis* and the featherstar *Antedon bifida*. The fronds are often epiphytised by the hydroid *Obelia geniculata* and the bryozoan *Membranipora membranacea*. Beneath the kelp canopy, the faunal component is generally less diverse than the more exposed kelp forests, dominated by the echinoderms *Echinus esculentus* and *Asterias rubens*, but the tops shells *Gibbula cineraria* and *Calliostoma zizyphinum* can be common as well. The crab *Necora puber* and the brittlestar *Ophiothrix fragilis* can be found in cracks and crevices, while the tube-building polychaete *Pomatoceros triqueter* and coralline crusts are present on the rock surface. Although there is a reduced number of species by comparison to the more exposed *L. hyperborea* forests (Lhyp.Ft), there are considerably more algae species than occur in the more sheltered *L. saccharina* forests (Lsac.Ft). This biotope is predominately found in the shelter of fjordic sealochs in Scotland. Where it does occur in south-west Britain the mixed kelp forest may also include the southern kelp *Laminaria ochroleuca*. Three variants has been described: The kelp forest in the upper infralittoral (LhypLsac.Ft), grading to a kelp park with increasing depth (LhypLsac.Pk) as well as a grazed variant (LhypLsac.Gz).

Temporal variation

Unknown

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	●●●	Occasional	2
Pomatoceros triqueter	●●●●	Frequent	6
Necora puber	●●●	Occasional	1
Gibbula cineraria	●●●●	Frequent	5
Calliostoma zizyphinum	●●●	Occasional	2
Membranipora membranacea	●●	Occasional	1
Asterias rubens	●●●●	Occasional	4
Ophiothrix fragilis	●●	Occasional	1
Echinus esculentus	●●●●	Occasional	5
Clavelina lepadiformis	●●●	Occasional	2
Callophyllis laciniata	●●●	Occasional	1
Corallinaceae	●●●●	Common	6
Plocamium cartilagineum	●●●	Occasional	3
Cryptopleura ramosa	●●●	Occasional	1

Delesseria sanguinea	●●●	Occasional	3
Phycodrys rubens	●●●	Frequent	3
Cutleria multifida	●●	Frequent	1
Dictyota dichotoma	●●●	Occasional	1
Desmarestia aculeata	●●	Occasional	1
Laminaria hyperborea	●●●●●	Common	15
Laminaria saccharina	●●●●●	Frequent	10

IR.LIR.K.LhypLsac.Ft Mixed *Laminaria hyperborea* and *Laminaria saccharina* forest on sheltered upper infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral - upper
Depth band:	0-5 m, 5-10 m
Other features:	Siltation

Biotope description

Sheltered, often silted, upper infralittoral bedrock and boulder slopes with mixed kelps *Laminaria hyperborea* and *Laminaria saccharina* and red seaweeds beneath. The kelp at these sheltered sites often has large `cape-form' fronds, which form a dense canopy over the seabed and are often epiphytised by the hydroid *Obelia geniculata* and the bryozoan *Membranipora membranacea*. Beneath the kelp, red seaweeds such as *Delesseria sanguinea* and *Cryptopleura ramosa* occur on top of encrusting coralline algae. Often, a dense algal turf of *Bonnemaisonia hamifera* (tetrasporophyte) carpets the rock. The stipes of *L. hyperborea* may be densely covered with seaweeds such as *Phycodrys rubens*, *Plocamium cartilagineum* and *Porphyropsis coccinea*. There can also be a prominent faunal component on the stipes including the solitary ascidian *Clavelina lepadiformis* and the colonial ascidian *Botryllus schlosseri*. Brown seaweeds, occurring here in low abundance, include *Dictyota dichotoma*. The kelp *Saccorhiza polyschides* may also occur but rarely in equal abundance to *L. hyperborea* or *L. saccharina*. Beneath the kelp canopy, the faunal component is generally less diverse than the more exposed kelp forests (Lhyp). The silted rock supports a sparse fauna of gastropods *Gibbula cineraria* and *Calliostoma zizyphinum*, the tube-building polychaete *Pomatoceros triqueter* and occasional starfish *Asterias rubens* and the urchin *Echinus esculentus*. Steeper, less silted rock, may have the anthozoans *Caryophyllia smithii* and *Alcyonium digitatum*.Sheltered, often silted, upper infralittoral bedrock and boulder slopes with mixed kelps *Laminaria hyperborea* and *Laminaria saccharina* and red seaweeds beneath. The kelp at these sheltered sites often has large `cape-form' fronds, which form a dense canopy over the seabed and are often epiphytised by the hydroid *Obelia geniculata* and the bryozoan *Membranipora membranacea*. Beneath the kelp, red seaweeds such as *Delesseria sanguinea* and *Cryptopleura ramosa* occur on top of encrusting coralline algae. Often, a dense algal turf of *Bonnemaisonia hamifera* (tetrasporophyte) carpets the rock. The stipes of *L. hyperborea* may be densely covered with seaweeds such as *Phycodrys rubens*, *Plocamium cartilagineum* and *Porphyropsis coccinea*. There can also be a prominent faunal component on the stipes including the solitary ascidian *Clavelina lepadiformis* and the colonial ascidian *Botryllus schlosseri*. Brown seaweeds, occurring here in low abundance, include *Dictyota dichotoma*. The kelp *Saccorhiza polyschides* may also occur but rarely in equal abundance to *L. hyperborea* or *L. saccharina*. Beneath the kelp canopy, the faunal component is generally less diverse than the more exposed kelp forests (Lhyp). The silted rock supports a sparse fauna of gastropods *Gibbula cineraria* and *Calliostoma zizyphinum*, the tube-building polychaete *Pomatoceros triqueter* and occasional starfish *Asterias rubens* and the urchin *Echinus esculentus*. Steeper, less silted rock, may have the anthozoans *Caryophyllia smithii* and *Alcyonium digitatum*.

Situation

This biotope occurs below *Laminaria digitata* on the sheltered sublittoral fringe (Ldig.Ldig) or a mix of *L. saccharina* and *L. digitata* in very sheltered conditions (Lsac.Ldig). It can also be found on isolated rock exposures amid a sediment seabed (VirOphPmax or PhiVir). Where suitable substrata allow, the kelp thins out with increased depth to form a park below the forest (LhypLsac.Pk).

Temporal variation

Unknown.

Similar biotopes

IR.LIR.K.LhypLsac.Pk	Found in deeper water below the kelp forest and has a lower abundance of kelp and red seaweeds. The abundance of *Laminaria* spp. in the kelp park is typically only Frequent. The fauna remains much the same as the forest, unless there is a greater fraction of mixed substrata in the deeper park, in which case there may be an increase in infaunal species, brittlestars and starfish. The assemblage of red seaweeds does not differ greatly from that of the forest.
IR.LIR.K.Lsac.Ft	Generally occurs in more sheltered, siltier conditions and lacks *L. hyperborea*.
IR.LIR.K.LhypLsac.Gz	A greater number of grazing echinoderms reduce the abundance of foliose red seaweeds and kelp (Common-Frequent).
IR.LIR.K.LhypCape	Cape-form of *L. hyperborea* on very silted rock (particularly in extremely sheltered sealochs of western Scotland). *L. saccharina* can be present but does not co-dominant as in LhypLsac.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	●●●	Occasional	2
Alcyonium digitatum	●●	Occasional	1
Caryophyllia smithii	●●	Occasional	1
Pomatoceros triqueter	●●●●	Frequent	5
Necora puber	●●●	Occasional	1
Gibbula cineraria	●●●●	Frequent	5
Calliostoma zizyphinum	●●●	Occasional	1
Membranipora membranacea	●●●	Occasional	2
Asterias rubens	●●●●	Occasional	3
Echinus esculentus	●●●●	Occasional	3
Clavelina lepadiformis	●●●	Occasional	1
Botryllus schlosseri	●●●	Occasional	1
Bonnemaisonia hamifera	●●	Occasional	1
Callophyllis laciniata	●●●	Occasional	1
Corallinaceae	●●●●	Common	7
Plocamium cartilagineum	●●●●	Frequent	4
Cryptopleura ramosa	●●●	Occasional	1
Delesseria sanguinea	●●●●	Occasional	3
Phycodrys rubens	●●●	Occasional	3
Rhodophycota indet.(non-calc.crusts)	●●	Frequent	1
Dictyota dichotoma	●●●	Occasional	2
Laminaria hyperborea	●●●●●	Common	15
Laminaria saccharina	●●●●●	Common	13

IR.LIR.K.LhypLsac.Pk Mixed *Laminaria hyperborea* and *Laminaria saccharina* park on sheltered lower infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered
Tidal streams:	Weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral - lower
Depth band:	5-10 m, 10-20 m
Other features:	Siltation

Biotope description

Sheltered silted, bedrock and boulders with a park of mixed *Laminaria hyperborea* and *Laminaria saccharina*. Both kelp species are sparse in the park (Frequent). Beneath the often 'cape-form' kelp canopy, foliose red seaweeds such as *Delesseria sanguinea*, *Cryptopleura ramosa*, *Heterosiphonia plumosa* and *Brongniartella byssoides* are often present at high densities on the silted rock. Other red seaweeds such as encrusting coralline algae, *Phycodrys rubens*, *Callophyllis laciniata*, *Bonnemaisonia asparagoides* and *Plocamium cartilagineum* can be present. Other brown seaweeds include *Dictyota dichotoma* and *Desmarestia aculeata*. The animal component of this biotope is generally richer than the upper infralittoral mixed kelp forest (LhypLsac.Ft). A variety of hydroids such as *Obelia geniculata* grow epiphytically on the kelp fronds along with the bryozoan *Membranipora membranacea*. The echinoderm *Antedon bifida* and ascidians such as *Clavelina lepadiformis* attach to the kelp stipes, above the silted rock. The rock itself supports anthozoans such as *Caryophyllia smithii* and *Urticina felina* as well as the tube-building polychaete *Pomatoceros triqueter* and the crap *Necora puber*. Grazers include the prominent echinoderm *Echinus esculentus* and the gastropods *Gibbula cineraria* and *Calliostoma zizyphinum*. Where pockets of sediment occur, there may be an increase in infaunal species such as the burrowing anthozoan *Cerianthus lloydii*, the brittlestar *Ophiura albida*, and starfish *Asterias rubens*. Although there is a decrease in the number of algal species in the kelp park, the abundance remains relatively high.

Situation

These mixed kelp parks are generally found below the mixed kelp forest (LhypLsac.Ft) where there is a continuation of suitable hard substrata present. These sheltered kelps are also frequently found on bedrock or boulder exposures (XFa) adjacent to sediment seabed characterised by infaunal species. Where silted, circalittoral rock occurs below the kelp park a variety of biotopes may be found characterised by varying amounts of featherstars, anthozoans, solitary ascidians and sponge communities (e.g. AntAsH, LgAsSp, AmenCio, NeoPro and ModHAs).

Temporal variation

Unknown.

Similar biotopes

IR.LIR.K.LhypLsac.Ft	Found in shallower water, above the kelp park where both kelp species and red seaweeds occur in greater abundance. The fauna is generally less diverse in the forest than in the park.
IR.LIR.K.LhypLsac.Gz	Found in shallower water above the kelp park, but this biotope has a lower abundance of foliose red seaweeds due to the presence of more grazing echinoderms. The kelps *L. hyperborea* and *L. saccharina* has a typically abundance of Common.
IR.LIR.K.Lsac.Pk	Generally occurs in more sheltered, siltier conditions and lacks *L.*

hyperborea

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	●●●	Frequent	2
Urticina felina	●●	Occasional	1
Caryophyllia smithii	●●●	Occasional	1
Pomatoceros triqueter	●●●	Frequent	4
Necora puber	●●●	Occasional	2
Gibbula cineraria	●●●	Frequent	3
Calliostoma zizyphinum	●●●	Occasional	2
Membranipora membranacea	●●	Frequent	1
Antedon bifida	●●	Frequent	1
Asterias rubens	●●●●	Occasional	5
Echinus esculentus	●●●●	Frequent	7
Clavelina lepadiformis	●●●	Occasional	1
Bonnemaisonia asparagoides	●●●	Occasional	2
Callophyllis laciniata	●●●	Occasional	2
Corallinaceae	●●●	Frequent	3
Plocamium cartilagineum	●●●●	Occasional	4
Rhodophyllis divaricata	●●	Occasional	1
Cryptopleura ramosa	●●●	Occasional	1
Delesseria sanguinea	●●●●	Occasional	5
Phycodrys rubens	●●	Occasional	1
Heterosiphonia plumosa	●●●	Occasional	2
Brongniartella byssoides	●●	Frequent	1
Dictyota dichotoma	●●●●	Frequent	3
Desmarestia aculeata	●●●	Occasional	2
Laminaria hyperborea	●●●●●	Frequent	14
Laminaria saccharina	●●●●	Frequent	6

IR.LIR.K.LhypLsac.Gz Grazed, mixed *Laminaria hyperborea* and *Laminaria saccharina* on sheltered infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock & boulders
Zone:	Infralittoral - upper
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Silted infralittoral rock with mixed *Laminaria hyperborea* and *Laminaria saccharina* kelp forest, intensively grazed by the echinoderm *Echinus esculentus* and the gastropods *Gibbula cineraria* and *Calliostoma zizyphinum*. Although both kelp species can occur in equal abundance (Common), *L. hyperborea* usually dominates. The grazing-resistant brown seaweed *Desmarestia aculeata* and *Cutleria multifida* may be present. A similar variety of red seaweeds to those found in the ungrazed kelp forest (LhypLsac.Ft) may occur beneath the kelp canopy, but in much lower abundance. As grazing intensity increases the seaweed cover decreases - and some sites are reduced to the bare appearance of encrusting brown and coralline algae beneath the kelp canopy. The *L. hyperborea* stipes generally support more seaweeds than the rock beneath, including *Cryptopleura ramosa*, *Delesseria sanguinea*, *Phycodrys rubens* and *Bonnemaisonia hamifera*. The stipes may also support sometimes dense ascidians *Clavelina lepadiformis* and *Ciona intestinalis* and the echinoderm *Antedon bifida*. The kelp fronds are often densely covered by the hydroid *Obelia geniculata*. At the most intensively grazed sites even the kelp stipes are bare. Although the rock appears bare, between boulders and in crevices there are often the brittlestar *Ophiothrix fragilis* and the crabs *Necora puber* and *Pagurus bernhardus*. The tube-building *Pomatoceros triqueter* and bryozoan crusts are commonly found on any vertical surfaces.

Situation

This biotope can be found in similar conditions as LhypLsac.Ft and LhypLsac.Pk but where the numbers of grazers present are in high enough numbers to cause substantially community impoverishment through grazing. Generally occurs on isolated rock, surrounded by sediment biotopes. Although it has been recorded from sites astride the ungrazed kelp biotopes (LhypLsac.Ft and LhypLsac.Pk) it is more usually found on bedrock or boulder exposures (XFa) adjacent to sediment seabed characterised by infaunal species.

Temporal variation

If the grazing pressure is reduced (i.e. a decrease in the number of grazing echinoderms present) the community will eventually re-establish itself as a mixed kelp forest or park (LhypLsac).

Similar biotopes

IR.MIR.KR.Lhyp.GzFt	Found in more wave-exposed conditions, it has a greater range of sponges, hydroids and colonial ascidians. *L. hyperborea* is typically dense (Abundant) with L. *saccharina* (Occasional). NB notice the few records for this biotope.
IR.LIR.K.LhypLsac.Ft	Has a greater abundance of foliose red seaweeds and fewer grazing echinoderms with a high abundance of the kelp *L. hyperborea* (Abundant) and *L. saccharina* (Abundant).

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	●●●	Occasional	1
Pomatoceros triqueter	●●●●	Frequent	7
Pagurus bernhardus	●●●	Occasional	2
Necora puber	●●●	Occasional	1
Gibbula cineraria	●●●●	Frequent	5
Calliostoma zizyphinum	●●●	Occasional	2
Antedon bifida	●●	Occasional	1
Asterias rubens	●●●●	Occasional	6
Ophiothrix fragilis	●●●	Occasional	2
Echinus esculentus	●●●●●	Frequent	10
Clavelina lepadiformis	●●●	Occasional	1
Bonnemaisonia hamifera	●●	Occasional	1
Corallinaceae	●●●●	Abundant	7
Cryptopleura ramosa	●●	Frequent	1
Delesseria sanguinea	●●●	Occasional	2
Phycodrys rubens	●●●	Frequent	2
Cutleria multifida	●●●	Frequent	4
Desmarestia aculeata	●●●	Frequent	2
Laminaria hyperborea	●●●●●	Common	14
Laminaria saccharina	●●●●	Common	7

IR.LIR.K.Lsac *Laminaria saccharina* on very sheltered infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Very sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m
Other features:	Silty

Biotope description

Very sheltered infralittoral rock dominated by the kelp *Laminaria saccharina*. Typically very silty and often with few associated seaweeds due to siltation, grazing or shading from the dense kelp canopy. The most commonly occurring red seaweeds are *Delesseria sanguinea*, *Phycodrys rubens*, *Bonnemaisonia hamifera* and coralline crusts. In addition to the kelp the brown seaweed *Chorda filum* and Ectocarpaceae are often present. As well as lacking *Laminaria hyperborea*, the Lsac biotopes have fewer foliose and filamentous red seaweed species by comparison to LhypLsac biotopes. A depauperate assemblage of animals is present (by comparison to Lhyp.Ft and Lhyp.Pk) predominantly consisting of the encrusting polychaetes *Pomatoceros triqueter*, the crabs *Carcinus maenas* and *Pagurus bernhardus* and the ubiquitous gastropod *Gibbula cineraria*. The echinoderms *Antedon bifida*, starfish *Asterias rubens*, brittlestar *Ophiothrix fragilis* and urchin *Echinus esculentus* occur in low abundance. Ascidians are commonly found in all the Lsac biotopes, but the large solitary ascidian *Ascidia mentula* are most prolific in very sheltered conditions of *L. saccharina* forests (Lsac.Ft). This biotope is most commonly associated with the sheltered fjordic sealochs of Scotland where sublittoral hard substrata can be found at the sheltered head of the lochs. Similarly the sheltered loughs of Ireland (Lough Hyne, Strangford Lough and Carlingford Lough). It is also found where suitable hard substrata exist in the sheltered inlets of south-west Britain, such as Milford Haven or Plymouth Sound. 4 variants has been described: A mixture of *L. saccharina* and *Laminaria digitata* (Lsac.Ldig), dense *L. saccharina* forest in the upper infralittoral (Lsac.Ft), sparse *L. saccharina* in the lower infralittoral (Lsac.Pk) and urchin-grazed (Lsac.Gz).

Temporal variation

Unknown

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pomatoceros triqueter	●●●	Frequent	4
Pagurus bernhardus	●●	Occasional	2
Carcinus maenas	●●	Occasional	2
Gibbula cineraria	●●●	Occasional	4
Asterias rubens	●●●	Occasional	5
Ophiothrix fragilis	●●	Occasional	1
Echinus esculentus	●●●	Occasional	4
Clavelina lepadiformis	●●	Occasional	1
Ascidia mentula	●●	Occasional	2
Bonnemaisonia hamifera	●●	Frequent	1
Corallinaceae	●●●	Frequent	8
Delesseria sanguinea	●●	Occasional	1
Phycodrys rubens	●●	Frequent	3
Ectocarpaceae	●●	Frequent	1

Chorda filum	●●●	Occasional	3
Laminaria saccharina	●●●●●	Common	30
Ulva lactuca	●●	Occasional	1

IR.LIR.K.Lsac.Ldig *Laminaria saccharina* and *Laminaria digitata* on sheltered sublittoral fringe rock

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders and cobbles
Zone:	Sublittoral fringe
Height band:	Lower shore
Depth band:	0-5 m

Previous code

LRK.LDIG.LSAC	6.95

Biotope description

Sheltered bedrock and boulders in the sublittoral fringe characterised by a mixed canopy of the kelp *Laminaria digitata* (usually in its broad-fronded cape-form) and *Laminaria saccharina* - both species are generally Frequent or greater. Beneath the kelp canopy, the understorey of red seaweeds often includes *Chondrus crispus*, *Dumontia contorta*, *Bonnemaisonia hamifera* and *Plocamium cartilagineum*. The surface of the rock is usually covered with encrusting coralline algae as well as non-calcified red crusts and the tube-building polychaete *Pomatoceros triqueter*. The brown seaweeds *Chorda filum*, Ectocarpaceae and *Fucus serratus* can be present along with the green seaweeds *Ulva lactuca* and *Enteromorpha intestinalis*. Patches of the sponge *Halichondria panicea* can frequently be found in cracks and crevices. Beneath and between boulders a variety of mobile crustaceans such as *Carcinus maenas*, the gastropod *Gibbula cineraria* and the starfish *Asterias rubens* are common.

Situation

Where hard substrata occur on the shore, this biotope will be found below the *F. serratus* zone (Fser.Fser, Fser or FserX on mixed substrata). With such sheltered shores, the transition between sublittoral fringe and the true sublittoral zone may not be distinct; this biotope therefore extends into the shallow sublittoral kelp forest below (LhypLsac.Ft, Lsac.Ft or LhypCape).

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	••	Occasional	2
Pomatoceros triqueter	•••	Frequent	3
Carcinus maenas	•••	Rare	1
Gibbula cineraria	••••	Occasional	5
Asterias rubens	•••	Occasional	2
Bonnemaisonia hamifera	••	Frequent	1
Dumontia contorta	••	Occasional	1
Corallinaceae	•••	Frequent	6
Chondrus crispus	•••	Frequent	4
Plocamium cartilagineum	••	Occasional	1
Rhodophycota indet.(non-calc.crusts)	••	Frequent	2
Ectocarpaceae	•••	Frequent	2
Chorda filum	•••	Occasional	2
Laminaria digitata	•••••	Common	19
Laminaria saccharina	•••••	Frequent	19
Fucus serratus	•••	Occasional	2

Enteromorpha intestinalis	••	Frequent	2
Ulva lactuca	•••	Frequent	4

IR.LIR.K.Lsac.Ft *Laminaria saccharina* forest on very sheltered upper infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders and cobbles
Zone:	Sublittoral fringe, Infralittoral - upper
Height band:	Lower shore
Depth band:	0-5 m

Previous code

LRK.LSAC	6.95

Biotope description

Sheltered to extremely sheltered sublittoral fringe and infralittoral bedrock, boulders and cobbles characterised by a dense canopy of the kelp *Laminaria saccharina*. In such sheltered conditions, a distinct sublittoral fringe is not always apparent and this biotope often extends from below the *Fucus serratus* zone (Fserr) into the upper infralittoral zone, though there may be a mixed *L. saccharina* and *Laminaria digitata* zone (Lsac.Ldig) in between. There is a relatively low species diversity and species density due to a combination of heavy siltation of the habitat and the lack of light penetrating through the dense kelp canopy. Only a few species of red seaweeds are present compared with Lsac.Ldig or LhypLsac. The most commonly occurring red seaweeds are *Delesseria sanguinea*, *Phycodrys rubens*, *Bonnemaisonia hamifera* and coralline crusts. Brown seaweeds are also sparse and generally comprise *Chorda filum* and Ectocarpaceae. At extremely sheltered sites, where there is a heavy silt cover on the rock and the kelp fronds, the sub-flora is reduced to a few specialised species able to tolerate these conditions such as the cartilaginous seaweeds *Polyides rotundus* and *Chondrus crispus*. Ascidians such as *Clavelina lepadiformis*, *Ascidiella aspersa* and *Ascidia mentula* can remain prominent in such conditions, often occurring on steeper rock subject to less siltation. The variety of red seaweeds is further reduced where grazers such as the urchin *Echinus esculentus* and the top shell *Gibbula cineraria* are present. The tube-building polychaete *Pomatoceros triqueter*, the crab *Carcinus maenas* and the hermit crab *Pagurus bernhardus* can be present. Geographical variations: Northern sites: In sheltered sealochs the most conspicuous fauna in these forests are the large solitary ascidians *Ciona intestinalis*, *Ascidiella* spp. and *A. mentula* which occur in greater abundance than in the mixed kelp forests (LhypLsac). In common with mixed forests, echinoderms are consistently present in low abundance: the featherstar *Antedon bifida*, common starfish *Asterias rubens*, the brittlestar *Ophiothrix fragilis* and the urchin *Echinus esculentus* are typically present. Oysters *Pododesmus patelliformis* and chitons *Tonicella marmorea* may occur in high abundance at some sites. The anthozoan *Anemonia viridis* is often more prevalent at the extremely sheltered sites. The communities of the sheltered voes and sounds of Shetland and Orkney are similar to those present in the mainland sealochs. Southern sites: Sheltered infralittoral rock is not commonly found outside of the fjordic sealochs. In south-west Britain, where sublittoral rock does occur in shallow marine inlets, the waters are more turbid than in the sealochs, generally limiting kelp to the sublittoral fringe. Echinoderms are rare or absent from the south-western *L. saccharina* forests. A far greater diversity of red seaweeds is associated with the south-western sites: *Palmaria palmata*, *Gracilaria gracilis*, *Phyllophora pseudoceranoides*, *Cystoclonium purpureum*, *Rhodophyllis divaricata*, *Ceramium nodulosum* and *Polyneura bonnemaisonii* typically occur.

Situation

Although this biotope may occur below a mixed kelp canopy that occupies the sublittoral fringe (Lsac.Ldig or Ldig.Ldig) at some sites it extends directly into the sublittoral fringe and abuts the *F. serratus* zone (Fser.Fser, Fserr or FserX on mixed substrata). Where suitable hard substrata are available, the *L. saccharina* diminishes in abundance (typically Frequent) with increasing depth to form kelp park (Lsac.Pk).

Temporal variation

Unknown

Similar biotopes

IR.LIR.K.Lsac.Pk	*L. saccharina* is sparse (Occasional) and far fewer red seaweeds occur, also in low abundance.
IR.LIR.K.LhypLsac.Ft	This biotope occurs in similar conditions as Lsac.Ft, but is generally less silted. It is dominated by the kelp *L. hyperborea* (Abundant) and has a lower abundance of *L. saccharina* (Common) than Lsac.Ft. There tends to be a greater variety of species, particularly more red seaweeds in LhypLsac.Ft.
IR.LIR.K.Lsac.Gz	The variety of red seaweeds is reduced where grazers such as the urchin *E. esculentus* (Frequent) and the brittlestar *Ophiothrix fragilis* (Occasional) are present in high numbers. Grazing pressure can reduce the rock beneath the kelp canopy to coralline encrusted rock, with only a few tufts of foliose seaweeds present.
IR.LIR.KVS.LsacPsaVS	This biotope occurs at slightly more sheltered shores (Very to Extremely sheltered) with reduced salinity. The depauperate coralline-encrusted rock supports few foliose red seaweeds due to the high numbers of the urchins *E. esculentus* and *Psammechinus miliaris.*
IR.LIR.KVS.LsacPhyVS	Reduced salinity with filamentous green seaweeds.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pomatoceros triqueter	●●●	Frequent	3
Pagurus bernhardus	●●	Occasional	1
Carcinus maenas	●●●	Occasional	2
Gibbula cineraria	●●●	Frequent	4
Asterias rubens	●●●	Occasional	4
Echinus esculentus	●●●	Occasional	3
Clavelina lepadiformis	●●	Occasional	2
Ascidiella aspersa	●●	Occasional	1
Ascidia mentula	●●	Occasional	2
Bonnemaisonia hamifera	●●	Frequent	1
Corallinaceae	●●●	Frequent	6
Delesseria sanguinea	●●	Frequent	1
Phycodrys rubens	●●	Frequent	2
Ectocarpaceae	●●	Frequent	1
Chorda filum	●●●	Occasional	5
Laminaria saccharina	●●●●●	Abundant	36
Ulva lactuca	●●	Occasional	1

IR.LIR.K.Lsac.Pk *Laminaria saccharina* park on very sheltered lower infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders and cobbles
Zone:	Infralittoral - lower
Depth band:	5-10 m, 10-20 m

Biotope description

Silty bedrock or boulders with a *Laminaria saccharina* park (often the cape-form). Beneath the canopy, the rock is covered by encrusting coralline algae, and the urchin *Echinus esculentus* is often present. Due to the amount of silt cover on the rock and the reduced light intensity beneath the broad-fronded kelp, only a few red seaweeds are present, the most common species being *Phycodrys rubens, Delesseria sanguinea, Bonnemaisonia spp.* and *Brongniartella byssoides*. The brown seaweeds *Dictyota dichotoma* and *Cutleria multifida* may be present in low abundance. Compared to the sheltered kelp forest (Lsac.Ft) both the kelp and other seaweeds are sparse (Occasional). The most conspicuous animals in this biotope are large solitary ascidians, particularly *Ascidia mentula*, *Ciona intestinalis* and *Clavelina lepadiformis*. In general, the faunal component of this biotope is similar to many of the other sheltered kelp biotopes and includes a variety of mobile crustaceans such *Carcinus maenas* and *Pagurus bernhardus*), tube worms such as *Pomatoceros* spp. and Terebellidae, echinoderms *Asterias rubens, Ophiothrix fragilis* and the featherstar *Antedon bifida*. The hydroid *Kirchenpauria pinnata*, although only rare is often found in the kelp park along with the top shell Gibbula cineraria and the barnacle *Balanus crenatus*.

Situation

L. saccharina park can be found below a similar forest (Lsac.Ft) where suitable hard substrata exist or on isolated rock exposures surrounded by sediment communities. It may also occur below a zone of mixed *Laminaria hyperborea* and *L. saccharina* forest (LhypLsac). *L. saccharina* can also form a band below *L. hyperborea* forest (Lhyp.Ft) where some shelter from wave-action is afforded with depth (*L. saccharina* is not tolerant of surge), or more likely where *L. hyperborea* has been grazed out (below Lhyp.GzFt) since *L. saccharina* grows far quicker than *L. hyperborea*. Where such a narrow band occurs it is generally less silted than that found below Lsac.Ft in much more sheltered conditions. A range of sheltered circalittoral biotopes may occur on any deeper rock below (e.g. AntAsH, AmenCio and ModHAs).

Temporal variation

Unknown.

Similar biotopes

IR.LIR.K.LhypLsac.Pk	*L. saccharina* and *L. hyperborea* co-dominantes this biotope (both Frequent). Generally less silted than Lsac.Pk and there tends to be a greater variety of species, particularly more red seaweeds.
IR.LIR.K.Lsac.Ft	Occurs in shallower water where *L. saccharina* is typically Abundant and there is a greater variety and higher abundance of red seaweeds.
IR.LIR.K.Lsac.Gz	This biotope is very impoverished even compared to Lsac.Pk and the kelp may be absent altogether. The diversity of red seaweeds are much lower than in the park with a dominance of Corallinacea (Common) even though small turf of foliose red seaweeds and brown seaweeds like *Desmarestia* spp. and

Chorda filum may occur. *Halichondria panicea* (Rare) is the likely to be only sponge present compared to Lsac.Pk, which have a higher diversity of sponges (Porifera).

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Kirchenpaueria pinnata	••	Occasional	1
Caryophyllia smithii	••	Occasional	1
Terebellidae	••	Occasional	1
Pomatoceros triqueter	•••	Frequent	3
Balanus crenatus	••	Frequent	1
Pagurus bernhardus	•••	Occasional	4
Carcinus maenas	••	Occasional	1
Gibbula cineraria	•••	Occasional	2
Antedon bifida	••	Occasional	2
Asterias rubens	••••	Occasional	6
Ophiothrix fragilis	•••	Occasional	2
Echinus esculentus	••••	Occasional	8
Clavelina lepadiformis	••	Occasional	2
Ciona intestinalis	••	Occasional	1
Ascidia mentula	•••	Occasional	5
Bonnemaisonia asparagoides	••	Occasional	1
Bonnemaisonia hamifera	••	Common	2
Corallinaceae	••••	Frequent	9
Delesseria sanguinea	••	Occasional	2
Phycodrys rubens	••	Frequent	2
Brongniartella byssoides	••	Occasional	2
Cutleria multifida	••	Frequent	1
Dictyota dichotoma	••	Occasional	2
Laminaria saccharina	•••••	Occasional	18

IR.LIR.K.Lsac.Gz Grazed *Laminaria saccharina* with *Echinus*, brittlestars and coralline crusts on sheltered infralittoral rock

Habitat classification

Salinity:	Variable (18-35ppt)
Wave exposure:	Very sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock & boulders
Zone:	Sublittoral fringe, Infralittoral - upper
Depth band:	0-5 m, 5-10 m

Biotope description

Coralline encrusted rock with scattered tufts of red seaweed and a relatively high abundance of grazing echinoderms which typically include the urchin *Echinus esculentus* and/or the brittlestars *Ophiothrix fragilis* or *Ophiocomina nigra*. The rock often looks bare, with few conspicuous species present although *Laminaria saccharina* may occur it is generally in low abundance (Rare or Occasional). The red seaweeds, reduced to small tufts through grazing, include *Phycodrys rubens*, *Delesseria sanguinea* and *Brongniartella byssoides* and although these seaweeds also occur in Lsac.Pk they are far less frequent in this biotope. Brown seaweeds, such as *Desmarestia viridis*, *Chorda filum* and *Cutleria multifida*, may be present. Grazing molluscs, such as *Gibbula cineraria* and can be common. Under-boulder habitats can harbour the crabs Necora puber and *Pagurus bernhardus*, terebellid polychaetes and the polychaete *Pomatoceros* spp. with ascidians *Ascidia mentula*. and *Clavelina lepadiformis* on the open rock along with the echinoderm *Asterias rubens* and the hydroids *Kirchenpauria pinnata* and *Obelia dichotoma*.

Situation

This biotope generally occurs on rock below a dense kelp forest of *L. saccharina* (Lsac.Ft) or mixed kelp (LhypLsac.Ft).

Temporal variation

If the grazing pressure is reduced (i.e. a decrease in the number of grazing echinoderms present) a richer kelp community may develop (Lsac.Pk or LhypLsac.Pk).

Similar biotopes

IR.LIR.K.Lsac.Pk	This biotope a higher diversity and abundance of red seaweeds. Lsac.Pk also have a notable presence of sponges (Porifera), which are usually absent in Lsac.Gz.
CR.MCR.EcCr.FaAlCr	Occurs in deeper more exposed sites and has a similar grazed crustose appearance but lacks the red and brown seaweeds of Lsac.Gz.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Kirchenpaueria pinnata	●●●	Present	3
Obelia dichotoma	●●	Present	2
Terebellidae	●●●	Rare	1
Pomatoceros	●●●	Frequent	9
Pagurus bernhardus	●●●	Occasional	3
Necora puber	●●●	Rare	2
Gibbula cineraria	●●●	Occasional	5

Asterias rubens	●●●●	Occasional	6
Ophiothrix fragilis	●●●	Rare	4
Ophiocomina nigra	●●●	Present	3
Echinus esculentus	●●●●●	Occasional	11
Ascidia mentula	●●●	Present	3
Corallinaceae	●●●●	Common	12
Delesseria sanguinea	●●	Present	2
Phycodrys rubens	●●●	Rare	4
Brongniartella byssoides	●●	Present	2
Filamentous red algae	●●	Present	1
Cutleria multifida	●●	Frequent	1
Desmarestia viridis	●●	Occasional	1
Chorda filum	●●●	Present	2
Laminaria saccharina	●●●●●	Occasional	12

IR.LIR.K.LhypCape Silted, cape-form *Laminaria hyperborea* on very sheltered, infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock & boulders
Zone:	Infralittoral - upper
Depth band:	0-5 m, 5-10 m

Biotope description

Cape-form of the kelp *Laminaria hyperborea* on very silted rock, particularly in extremely sheltered sealochs of western Scotland. Below the huge kelp fronds (which often trail onto the seabed) foliose seaweeds form a silted understorey on the rock including *Phycodrys rubens, Delesseria sanguinea, Cryptopleura ramosa* and *Plocamium cartilagineum* as well as coralline crusts. At some sites the filamentous red seaweed *Bonnemaisonia hamifera, Heterosiphonia plumosa* and *Brongniartella byssoides* may carpet the seabed. Ascidians, particularly *Ascidiella aspersa, Ascidia mentula, Ciona intestinalis* and *Clavelina lepadiformis* thrive well in these conditions. The echinoderms *Antedon bifida, Echinus esculentus* and *Asterias rubens* are often present along with the gastropod *Gibbula cineraria*. An abundant growth of the hydroid *Obelia geniculata* can cover the silted kelp fronds along with the bryozoan *Membranipora membranacea*. The anthozoan *Caryophyllia smithii* can be present among the kelp holdfasts. The tube-building polychaete *Pomatoceros triqueter* can be present on the rock surface along with the crab *Necora puber*. This biotope generally occurs on shallow bedrock or boulder slopes or isolated rocks protruding through muddy sediment.

Situation

This biotope is often present on rocky outcrops surrounded by muddy sediments (such as VirOphPmax). Deeper, nearby rock, beyond the limit of foliose seaweeds, is often dominated by solitary ascidians (AmenCio).

Temporal variation

Unknown.

Similar biotopes

IR.MIR.KR.Lhyp.Ft	Occurs on moderately exposed rock and supports a dense understorey of foliose red seaweeds beneath the kelp canopy. *L. hyperborea* is not found in cape-form. A more diverse range of fauna such as sponges and anthozoans are also present in Lhyp.Ft.
IR.LIR.K.LhypLsac.Ft	*L. saccharina* and *L. hyperborea* generally occur together in predominantly "sheltered" sites. Large solitary ascidians (*Ascidiella* spp.) are more prevalent in LhypCape.
IR.LIR.K.Lsac.Ft	Occurs in similar sheltered conditions but there are fewer species present in Lsac.Ft, particularly fewer red seaweeds and no *L. hyperborea*.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Obelia geniculata	●●●	Frequent	2
Caryophyllia smithii	●●●	Occasional	2

Pomatoceros triqueter	••••	Frequent	3
Necora puber	•••	Rare	1
Gibbula cineraria	••••	Occasional	4
Membranipora membranacea	••	Occasional	1
Antedon bifida	•••	Occasional	3
Asterias rubens	••••	Occasional	4
Echinus esculentus	••••	Occasional	4
Clavelina lepadiformis	••••	Frequent	4
Ciona intestinalis	•••	Occasional	1
Ascidiella aspersa	•••	Occasional	3
Ascidia mentula	•••••	Frequent	6
Bonnemaisonia asparagoides	•••	Occasional	2
Corallinaceae	•••	Common	3
Plocamium cartilagineum	•••	Frequent	1
Cryptopleura ramosa	••	Occasional	1
Delesseria sanguinea	••••	Occasional	3
Phycodrys rubens	••••	Occasional	5
Heterosiphonia plumosa	••	Occasional	1
Brongniartella byssoides	••	Frequent	1
Dictyota dichotoma	•••	Occasional	2
Desmarestia aculeata	••	Occasional	1
Laminaria hyperborea	•••••	Abundant	18

IR.LIR.K.Sar *Sargassum muticum* on shallow slightly tide-swept infralittoral mixed substrata

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong
Substratum:	Mixed substrata
Zone:	Sublittoral fringe, Infralittoral - upper
Depth band:	0-5 m

Biotope description

Mixed substrata from the sublittoral fringe to 5m below chart datum dominated by the brown seaweed *Sargassum muticum*. This invasive non-native brown seaweed can form a dense canopy on areas of mixed substrata (typically 0-10% bedrock on 90-100% sandy sediment). The substrate on which this *S. muticum*-dominated community is able to develop is highly variable, but particularly prevalent on broken rock and pebbles anchored in sandy sediment. The pebbles, cobbles and broken bedrock provide a substrate for alga such as the kelp *Laminaria saccharina*. During the spring, *S. muticum* has large quantities of epiphytic ectocarpales and may also support some epifauna e.g. the hydroid *Obelia geniculata* commonly found on kelp. The brown seaweed *Chorda filum*, which thrives well on these mixed substrata, is also commonly found with *S. muticum* during the summer months. In Strangford Lough, where this biotope occurs, the amphipod *Dexamine spinosa* has been recorded to dominate the epiphytic fauna (this is known to be commonly found in *Zostera* spp. beds). *S. muticum* is also found on hard, bedrock substrates within *L. saccharina* canopies. *S. muticum* plants on hard substrate area, under a dense *L. saccharina* canopy, are typically smaller and at a much lower density, especially where a lush, under-storey exists with red seaweeds such as *Ceramium nodolosum, Gracilaria gracilis, Chylocladia verticillata, Pterosiphonia plumula* and *Polysiphonia elongata* and the green seaweeds *Cladophora sp., Ulva lactuca* and *Bryopsis plumosa*. The anthozoan *Anemonia viridis* and the crab *Necora puber* can be present. More information is necessary to validate this description.

Situation

Where there is a greater proportion of bedrock or boulders (15-100%) *L. saccharina* will typically dominate the canopy. Areas with pebble cover on a hard substrate are colonised by *S. muticum*, but individuals quickly become peripatetic and are lost.

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Cliona celata	••	Present	1
Anemonia viridis	•••	Rare	3
Necora puber	••	Occasional	1
Gracilaria gracilis	••••	Frequent	13
Chylocladia verticillata	•••	Occasional	4
Ceramium nodulosum	••••	Occasional	9
Pterothamnion plumula	••	Occasional	1
Polysiphonia elongata	••	Rare	1
Chorda filum	••	Occasional	2
Laminaria saccharina	••••	Frequent	13
Sargassum muticum	•••••	Common	33

Cystoseira baccata	••	Occasional	1
Ulva lactuca	•••	Frequent	3
Cladophora	••	Occasional	1
Bryopsis plumosa	••	Occasional	2

IR.LIR.KVS Kelp in variable salinity conditions

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt), Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered, Ultra sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock, boulders & cobbles
Zone:	Sublittoral fringe, Infralittoral
Depth band:	0-5 m, 5-10 m

Biotope description

Very wave-sheltered bedrock, boulders and cobbles subject to only weak tidal streams in the sublittoral fringe and infralittoral zone, in areas of variable/low salinity. This biotope complex is characterised by the kelp *Laminaria saccharina* and coralline crusts such as *Lithothamnion glaciale*. Grazers such as the urchins *Psammechinus miliaris* and *Echinus esculentus*, and the gastropods *Gibbula cineraria* and *Buccinum undatum* may be recorded. The tube-dwelling polychaete *Pomatoceros triqueter*, the tunicates *Ciona intestinalis*, *Corella parallelogramma* and *Ascidiella scabra*, the barnacle *Balanus crenatus*, the starfish *Asterias rubens* and the brittlestar *Ophiothrix fragilis* may also be recorded. Red algal communities are composed primarily of *Phycodrys rubens*. The crabs *Carcinus maenas* and *Pagurus bernhardus*, and the bivalve *Modiolus modiolus* may also be observed.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pomatoceros triqueter	••••	Frequent	10
Balanus crenatus	••	Occasional	1
Pagurus bernhardus	•••	Occasional	3
Carcinus maenas	••••	Occasional	4
Gibbula cineraria	••	Frequent	2
Buccinum undatum	•••	Occasional	2
Modiolus modiolus	••	Occasional	1
Asterias rubens	••••	Frequent	7
Ophiothrix fragilis	••	Frequent	2
Psammechinus miliaris	••••	Frequent	12
Echinus esculentus	••	Occasional	2
Ciona intestinalis	•••	Occasional	2
Corella parallelogramma	••	Occasional	2
Ascidiella scabra	••	Occasional	1
Corallinaceae	•••	Common	7
Lithothamnion glaciale	••	Common	3
Phycodrys rubens	•••	Occasional	4
Laminaria saccharina	•••••	Common	20

IR.LIR.KVS.Cod *Codium* spp. with red seaweeds and sparse *Laminaria saccharina* on shallow, heavily-silted, very sheltered infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Sheltered, Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Boulders, cobbles, bedrock
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m
Other features:	Heavy siltation

Previous code

SIR.Lsac.CodR	96.7

Biotope description

Very shallow, heavily-silted infralittoral rock characterised by dense stands of *Codium* spp. with silt-tolerant red seaweeds, the green seaweed *Ulva* spp. and often sparse kelp *Laminaria saccharina*. This biotope appears to have a restricted distribution, being recorded to date from only the sheltered voes of Shetland and the harbours of south-west England. Dense *Codium* spp. can occur at very sheltered sites, on cobbles or boulders, often in dense patches interspersed with filamentous red seaweeds *Bonnemaisonia hamifera, Antithamnionella spirographidis* and *Ceramium spp.* Where sediment is present the red seaweed *Polyides rotundus* is commonly found along the rock-sediment interface, and the sponge *Dysidea fragilis* often occurs on the rock. Other red seaweeds that may be present include *Chondrus crispus, Callophyllis laciniata, Gelidium latifolium, Corallina officinalis* and coralline crusts. The brown seaweeds *Halidrys siliquosa, Desmarestia viridis* or *Chorda filum* may be present in high abundance and although kelp *L. saccharina* may occur, it is usually sparse. There are no conspicuous fauna that typify this biotope, through polychaetes such as Terebellidae and Spirorbidae may occur. The opisthobranch *Elysia viridis* may be locally abundant on the seaweeds and is known to favour *Codium fragilis* in particular. In south-west England, Cod has only been recorded from Portland Harbour, Dorset. Large stands of *Codium* sp. (generally Common abundance) are accompanied by red seaweeds such as *G. latifolium, C. laciniata* and *A. spirographidis* on the rock beneath. Cod has been reported to occur in the shallows of The Fleet, Bembridge Ledges, Pagham Harbour and Jersey (Tittley et al. 1985). In Ireland, species-poor shallow, silted bedrock in the North Water of Mulroy Bay, Co. Donegal, is characterised by *Griffithsia corallinoides* (Common) and *Codium tomentosum* (Frequent) forming a narrow band below the kelp zone (Lsac.Ft). Cod has not been described from any other sites in Ireland. If *Codium* spp. is less than Common amongst dense *L. saccharina* and *Chorda filum*, it should not be recorded as Cod.

Situation

This biotope occurs on bedrock below a sublittoral fringe of mixed kelp *L. saccharina* and *Laminaria digitata* (Lsac.Ldig) or below a *L. saccharina* forest (Lsac.Ft) or else on isolated boulders on sediment. Further information on which species of *Codium* is present and on fauna is required on Cod.

Temporal variation

Unknown.

Similar biotopes

IR.LIR.K.Lsac.Ft	In Cod *L. saccharina* is replaced in abundance by *Codium* spp.
IR.LIR.K.LsacPsaVS	Lower diversity of red and brown seaweeds.
IR.LIR.K.LsacPhyVS	Reduced salinity and lower diversity of red and brown seaweeds.
IR.LIR.Lag.FChoG	Dense *Codium* spp. can occur in the saline lagoons of Scotland amongst fucoids and *C. filum.*

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Terebellidae	••	Frequent	2
Spirorbidae	••	Occasional	2
Carcinus maenas	•••	Occasional	3
Bonnemaisonia hamifera	•••	Frequent	9
Gelidium latifolium	••	Frequent	2
Callophyllis laciniata	••	Occasional	2
Corallinaceae	•••	Frequent	4
Corallina officinalis	••	Occasional	2
Chondrus crispus	••	Frequent	1
Polyides rotundus	••	Occasional	1
Antithamnionella spirographidis	••	Frequent	1
Ceramium	••	Common	1
Ceramium nodulosum	••	Occasional	1
Ectocarpaceae	••	Occasional	1
Desmarestia viridis	••	Frequent	3
Chorda filum	•••	Frequent	3
Laminaria saccharina	•••	Abundant	4
Halidrys siliquosa	••	Occasional	1
Ulva lactuca	•••	Occasional	3
Cladophora	••	Occasional	1
Codium	•••••	Common	32

IR.LIR.KVS.LsacPsaVS *Laminaria saccharina* and *Psammechinus miliaris* on variable salinity grazed infralittoral rock

Habitat classification

Salinity:	Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Very sheltered, Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders and cobbles
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m
Other features:	Heavily urchin-grazed

Previous code

SIR.LsacRS.Psa	97.06

Biotope description

Sheltered bedrock, boulders and cobbles, in areas of reduced salinity, with kelp *Laminaria saccharina*, and depauperate coralline-encrusted rock supporting few foliose seaweeds but many grazing urchins *Psammechinus miliaris* and *Echinus esculentus*. The coralline crusts are typically *Lithothamnion glaciale*, while the brown crusts can be *Pseudolithoderma extensum*. Encrusting polychaetes *Pomatoceros triqueter*, resistant to the grazing, are also present on most of the rock. The grazing fauna are a significant component of this biotope; large numbers of *P. miliaris* are typically present, although where absent the brittlestar *Ophiothrix fragilis* may occur. Other grazers prevalent on the rock include the chiton *Tonicella marmorea*, the limpet *Tectura testudinalis* and the gastropod *Gibbula cineraria*. A combination of grazing pressure and lowered salinity maintains a low diversity of species in this biotope, with foliose and filamentous seaweeds generally absent or reduced to small tufts by grazing. In stark contrast to the range of seaweeds present in the *L. saccharina* forests (Lsac.Ft) the only red seaweed consistently found in this biotope is *Phycodrys rubens*. The range of fauna is similarly low, with a conspicuous absence of hydroids and bryozoans. Bedrock and boulders provide a firm substrate on which ascidians *Ciona intestinalis* and *Ascidia mentula* and the bivalve *Modiolus modiolus* can attach. The crabs *Pagurus bernhardus* and *Carcinus maenas* can usually be found here, though *Necora puber* typically is absent due to the brackish conditions. The starfish *Asterias rubens* along with the whelk *Buccinum undatum* can be present. The substratum on which this biotope occurs varies from bedrock to boulders or cobbles on sediment. The kelp band is relatively narrow and shallow (upper 5 m) compared to Lsac.Ft, although the grazed coralline encrusted rock extends deeper. This depth limit becomes shallower towards the heads of the sealochs. Geographical distribution This biotope is restricted to the west coast of Scotland, usually near the head of fjordic sealochs, which are influenced by freshwater run-off.

Situation

Where circalittoral rock occurs below this biotope, it often supports a brachiopod/anthozoan community (NeoPro); where mixed substrata occurs below or adjacent, beds of *Modiolus modiolus* are common (ModHAs or ModHo).

Temporal variation

If the grazing pressure is reduced (i.e. a decrease in the number of grazing echinoderms present) there may be an increase in filamentous and foliose seaweeds although the diversity will remain low compared to full saline sites.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pomatoceros	●●●●●	Frequent	12
Pagurus bernhardus	●●●	Occasional	3

Carcinus maenas	●●●	Occasional	3
Tectura testudinalis	●●	Occasional	1
Gibbula cineraria	●●●	Frequent	2
Buccinum undatum	●●●	Occasional	2
Modiolus modiolus	●●●	Occasional	2
Asterias rubens	●●●●	Occasional	4
Ophiothrix fragilis	●●●	Occasional	2
Psammechinus miliaris	●●●●●	Frequent	18
Echinus esculentus	●●●	Occasional	2
Ciona intestinalis	●●●	Occasional	2
Corallinaceae	●●●	Common	7
Lithothamnion glaciale	●●●	Common	4
Phycodrys rubens	●●●	Occasional	2
Pseudolithoderma extensum	●●	Abundant	2
Laminaria saccharina	●●●●●	Common	18

IR.LIR.KVS.LsacPhyVS *Laminaria saccharina* with *Phyllophora* spp. and filamentous green seaweeds on variable or reduced salinity infralittoral rock

Habitat classification

Salinity:	Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Sheltered, Very sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders and cobbles
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m

Previous code

SIR.LsacRS.Phy	97.06

Biotope description

Shallow infralittoral bedrock or boulder slopes, in reduced or low salinity conditions, characterised by the kelp *Laminaria saccharina* with dense stands of silted filamentous green seaweeds and red seaweeds *Phyllophora crispa*, *Phyllophora pseudoceranoides* and *Phycodrys rubens*. The filamentous green seaweeds e.g. *Chaetomorpha melagonium* and *Cladophora* spp. can form a blanket cover amongst the *L. saccharina* in the upper zone, which is under greater influence of freshwater input. In deeper water the green seaweeds are replaced by red seaweed *Phyllophora* spp. or *Polysiphonia fucoides* which may form a distinct sub-zone in the biotope. Coralline crust can be present. The solitary ascidians *Corella parallelogramma* and *Ascidiella scabra* are often epiphytic on the seaweed (particularly *Phyllophora* spp.) and dominate the animal community along with the starfish *Asterias rubens*. The small ascidian *Dendrodoa grossularia*, the barnacle *Balanus crenatus* and the tube-building polychaete *Pomatoceros triqueter* occur on the rock surface. More mobile species include the crab *Carcinus maenas*, the hermit crab *Pagurus bernhardus* and the whelk *Buccinum undatum*. Bryozoans *Electra pilosa* and *Spirorbis* sp. may cover kelp fronds. The red seaweed *Odonthalia dentata* may be present in the north.

Situation

The ascidians found in LsacPhyVS may continue onto the circalittoral rock below where dense colonies of anthozoans and brachiopods can also be found (NeoPro.Den). Where tidal streams are increased, sponge and hydroid communities may occur below (HbowEud).

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Pomatoceros triqueter	●●●	Occasional	2
Balanus crenatus	●●●	Occasional	3
Pagurus bernhardus	●●●	Occasional	3
Carcinus maenas	●●●●●	Occasional	8
Buccinum undatum	●●	Occasional	1
Eucratea loricata	●●●	Occasional	3
Electra pilosa	●●●	Common	3
Asterias rubens	●●●●●	Frequent	12
Corella parallelogramma	●●●●	Frequent	8
Ascidiella scabra	●●●	Frequent	5
Dendrodoa grossularia	●●	Occasional	1
Corallinaceae	●●	Common	2
Phyllophora crispa	●●●●	Frequent	6

Phyllophora pseudoceranoides	••••	Frequent	9
Phycodrys rubens	••••	Occasional	6
Odonthalia dentata	••	Occasional	2
Polysiphonia fucoides	••	Occasional	1
Laminaria saccharina	•••••	Frequent	12
Filamentous green algae	••	Occasional	1

IR.LIR.IFaVS Estuarine faunal communities (shallow rock/mixed substrata)

Habitat classification

Salinity:	Variable (18-35ppt), Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Very sheltered, Extremely sheltered, Ultra sheltered
Tidal streams:	Strong, Moderately strong, Weak, Very weak
Substratum:	Bedrock, shells, mud, artificial and other
Zone:	Infralittoral
Depth band:	0-5 m

Previous code

SIR.EstFa	97.06

Biotope description

Shallow subtidal rocky habitats which support fauna-dominated communities, with seaweed communities only poorly developed or absent. In some sealochs dense mussel *Mytilus edulis* beds (MytRS) develop in tide-swept channels, whilst upper estuarine rocky habitats in the south-west coast rias may support particular brackish-water tolerant faunas (CcasEle; HarCon).

Temporal variation

Unknown

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	••	Common	3
Metridium senile	••	Frequent	2
Balanus crenatus	•••	Frequent	8
Carcinus maenas	•••	Occasional	6
Mytilus edulis	•••••	Abundant	65
Ascidiella aspersa	••	Occasional	1
Ectocarpaceae	••	Frequent	2

IR.LIR.IFaVS.MytRS *Mytilus edulis* beds on reduced salinity infralittoral rock

Habitat classification

Salinity:	Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Very sheltered, Extremely sheltered
Tidal streams:	Strong, Moderately strong, Weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral
Depth band:	0-5 m
Other features:	May occur on vertical rock.

Biotope description

This biotope occur in shallow, often tide-swept, reduced salinity conditions. Dense beds of the mussel *Mytilus edulis* with the occasional barnacle *Balanus crenatus*. A wide variety of epifaunal colonisers on the mussel valves, including seaweeds, hydroids and bryozoans can be present. Predatory starfish *Asterias rubens* can be very common in this biotope. This biotope generally appears to lack large kelp plants, although transitional examples containing mussels and kelps plants may also occur. More information needed to validate this description.

Situation

Occurs in tide-swept entrance channels in very enclosed basins of sealochs where the basins are typically of lowered salinity. Also occurs in very sheltered subtidal rock (often vertical) in lagoons.

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Balanus crenatus	●●●●●	Common	85	
Mytilus edulis	●●●●●	Abundant	9	
Asterias rubens	●●●●●	Frequent	1	

IR.LIR.IFaVS.CcasEle *Cordylophora caspia* and *Electra crustulenta* on reduced salinity infralittoral rock

Habitat classification

Salinity:	Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Very sheltered, Extremely sheltered
Tidal streams:	Strong, Moderately strong
Substratum:	Boulders; cobbles
Zone:	Infralittoral
Depth band:	0-5 m

Previous code

SCR.HarCon in part	96.7

Biotope description

Shallow sublittoral rock in the upper estuary of one of the south-west inlets (Tamar) with very high turbidity and therefore no seaweeds. The brackish-water hydroid *Cordylophora caspia* and small colonies of the encrusting bryozoan *Electra crustulenta* and a few *Balanus crenatus* characterise this biotope. More information required to validate this description.

Situation

Insufficient information to describe neighbouring biotopes.

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Cordylophora caspia	●●●●●	Occasional	98
Balanus crenatus	●●●	Rare	1
Electra crustulenta	●●●	Frequent	1

IR.LIR.IFaVS.HarCon *Hartlaubella gelatinosa* and *Conopeum reticulum* on low salinity infralittoral mixed substrata

Habitat classification

Salinity:	Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Very sheltered, Extremely sheltered
Tidal streams:	Moderately strong
Substratum:	Boulders, cobbles and mixed sediments
Zone:	Infralittoral
Depth band:	0-5 m

Previous code

SCR.HarCon in part	96.7

Biotope description

Upper estuarine mixed hard substrata colonised by very sparse communities of animals with low species richness and with a few seaweeds in very shallow water. In the Tamar estuary the hydroid *Hartlaubella gelatinosa* and bryozoan *Conopeum reticulum* are found on stones. In the River Dart the bryozoan *Bowerbankia imbricata* is most abundant. The mussel *Mytilus edulis*, the crab *Carcinus maenas* and the hydroid *Obelia dichotoma* can be present. A similar brackish-water rocky biotope is recorded from the Bann Estuary, Northern Ireland. There are considerable differences in species composition between sites, but all occur in brackish turbid-water conditions. More information required to validate this description.

Situation

Insufficient information to describe neighbouring biotopes.

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Hartlaubella gelatinosa	●●●●●	Frequent	33
Obelia dichotoma	●●●●●	Rare	22
Carcinus maenas	●●●●●	Occasional	11
Mytilus edulis	●●●●●	Rare	11
Bowerbankia imbricata	●●●●●	Present	11
Conopeum reticulum	●●●●●	Present	11

IR.LIR.Lag Submerged fucoids, green and red seaweeds (lagoonal rock)

Habitat classification

Salinity:	Full (30-35ppt), Low (<18ppt)
Wave exposure:	Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock, boulders, cobbles, pebbles
Zone:	Infralittoral
Depth band:	0-5 m

Biotope description

Very shallow submerged rocky habitats in lagoons, subject to variable or permanently reduced salinity conditions. These particular habitat conditions lead to a variety of seaweed-dominated communities, which include fucoids and green filamentous species. The fucoids, more typical of intertidal habitats, penetrate into the subtidal under the reduced salinity conditions, which are not tolerated by kelps.

Temporal variation

Unknown

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Mysidae	••	Frequent	5
Carcinus maenas	••	Occasional	4
Littorina littorea	••	Frequent	3
Mytilus edulis	••	Occasional	2
Corallinaceae	••	Occasional	2
Mastocarpus stellatus	••	Occasional	1
Chondrus crispus	••	Occasional	1
Polyides rotundus	••	Frequent	2
Ectocarpaceae	••	Frequent	8
Chorda filum	••	Frequent	3
Ascophyllum nodosum	••	Occasional	3
Fucus ceranoides	••	Common	14
Fucus serratus	•••	Common	13
Fucus vesiculosus	••	Frequent	7
Enteromorpha intestinalis	••••	Frequent	12
Cladophora rupestris	••	Frequent	3

IR.LIR.Lag.AscSpAs *Ascophyllum nodosum* with epiphytic sponges and ascidians on variable salinity infralittoral rock

Habitat classification

Salinity:	Variable (18-35ppt), Reduced/low (0.5-30ppt)
Wave exposure:	Extremely sheltered
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; boulders and cobbles
Zone:	Infralittoral
Depth band:	0-5 m

Previous code

SLR.AscSAs

Biotope description

Dense subtidal stands of *Ascophyllum nodosum*, heavily epiphytised by sponges and ascidians in lagoon-like habitats. The wracks *Fucus vesiculosus* and *Fucus serratus* can be present along with the brown seaweed *Chorda filum* and the red seaweed *Polyides rotundus*. The crab *Carcinus maenas* can be present between the *A. nodosum* holdfasts along with the shrimps Mysidae.

Situation

Nearby rock often supports similar biotopes of submerged fucoids and green seaweeds (FChoG). Slightly deeper rock often supports *Laminaria saccharina* (Lsac.Ft), usually surrounded by more extensive areas of sediment. Seagrass beds thrive well in the muddy sand of these lagoons and often cover large areas. They include both *Ruppia maritima* and *Zostera marina* (Rup and Zmar).

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Mysidae	●●●	Occasional	3
Carcinus maenas	●●●●●	Occasional	21
Polyides rotundus	●●●	Frequent	7
Chorda filum	●●●	Frequent	4
Ascophyllum nodosum	●●●●●	Frequent	40
Fucus serratus	●●●	Frequent	4
Fucus vesiculosus	●●●●	Frequent	4

IR.LIR.Lag.FChoG Mixed fucoids, *Chorda filum* and green seaweeds on reduced salinity infralittoral rock

Habitat classification

Salinity:	Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Extremely sheltered
Tidal streams:	Very weak
Substratum:	Bedrock; boulders, cobbles and pebbles
Zone:	Infralittoral
Depth band:	0-5 m

Biotope description

Permanently submerged mixed fucoids on rock in lagoons. The main species are the wracks *Fucus serratus* and *Fucus vesiculosus*, but the brown seaweeds *Chorda filum*, *Ascophyllum nodosum* and Ectocarpaceae can be present as well. Red seaweeds are normally present and include *Mastocarpus stellatus*, *Polyides rotundus*, *Chondrus crispus*, *Ceramium* spp. and coralline crusts. A variety of green seaweeds is also present and include *Enteromorpha* spp., while dense patches of *Cladophora rupestris* may occur on vertical rock faces. The faunal component is restricted to the mussel *Mytilus edulis*, the polychaete *Arenicola marina* and the crab *Carcinus maenas*. Opossum shrimps Mysidae can be present as well. The kelp *Laminaria saccharina* is absent, possibly due to the low salinity conditions.

Situation

Nearby rock often supports similar biotopes of submerged fucoids (AscSpAs and FcerEnt) or where salinity is further reduced ProtFur can occur. Slightly deeper rock often supports *Laminaria saccharina* (Lsac.Ft), usually surrounded by more extensive areas of sediment. Seagrass beds thrive well in the muddy sediments of the lagoons and often cover large areas. They include both *Ruppia* spp. and *Zostera marina* and some locations in the Outer Hebrides support dense beds of the nationally rare stonewort *Lamprothamnion papulosum* (Rup and Zmar). The sublittoral mud, which abuts most of the submerged rock, can become anoxic and covered by a bacterial mat of *Beggiatoa* spp. (Beg).

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Arenicola marina	••	Occasional	2
Mysidae	••	Frequent	3
Carcinus maenas	••	Occasional	3
Littorina littorea	•••	Frequent	6
Mytilus edulis	••	Occasional	3
Corallinaceae	••	Occasional	2
Mastocarpus stellatus	••	Occasional	2
Chondrus crispus	••	Occasional	1
Polyides rotundus	••	Occasional	2
Ectocarpaceae	•••	Frequent	9
Chorda filum	••	Occasional	3
Ascophyllum nodosum	••	Occasional	3
Fucus serratus	••••	Common	30
Fucus vesiculosus	•••	Frequent	12
Enteromorpha	••	Occasional	2

Enteromorpha intestinalis	••	Frequent	3
Cladophora rupestris	••	Frequent	3

IR.LIR.Lag.ProtFur *Polyides rotundus* and/or *Furcellaria lumbricalis* on reduced salinity infralittoral rock

Habitat classification

Salinity:	Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Very sheltered, Extremely sheltered
Tidal streams:	Very weak
Substratum:	Bedrock; boulders, cobbles and pebbles
Zone:	Infralittoral
Depth band:	0-5 m

Previous code

SLR.PolFur	97.06

Biotope description

Bedrock and boulders characterised by a dense turf of the red seaweeds *Polyides rotundus* and/or *Furcellaria lumbricalis*, often with a dense mat of filamentous brown and green seaweeds including Ectocarpaceae and *Cladophora* spp. Other red seaweeds presents include *Chondrus crispus*, *Gracilaria gracilis* and coralline crusts as well as the odd brown seaweed *Chorda filum* or *Laminaria* spp. Associated with these seaweeds are a variety of ascidians including *Clavelina lepadiformis*, *Ascidiella aspersa*, *Ascidiella scabra* and *Ciona intestinalis* as well as the anemones *Anemonia viridis* and *Actinia equina* and the sponge *Halichondria panicea*. More mobile fauna include the starfish *Asterias rubens*, the crab *Carcinus maenas*, the hermit crab *Pagurus bernhardus*, the opossum shrimps Mysidae and the gastropod *Littorina littorea*. Attached to the rock or cobbles are spirorbid polychaetes and the mussel *Mytilus edulis*. Please notice that part of this diversity is due to large differences between sites.

Situation

Nearby rock (AscSpAs and FChoG) and seagrass *Ruppia maritima* dominating much of the surrounding muddy sediment (Rup). Mixed sediment supports filamentous green seaweeds e.g. *Cladophora* spp. and *Derbesia marina* on (FiG).

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	••	Occasional	1
Actinia equina	••	Occasional	2
Anemonia viridis	••	Frequent	2
Spirorbidae	••	Frequent	3
Mysidae	•••	Occasional	5
Pagurus bernhardus	••	Frequent	1
Carcinus maenas	•••	Frequent	6
Littorina littorea	••	Frequent	1
Mytilus edulis	••	Frequent	1
Asterias rubens	••••	Occasional	7
Clavelina lepadiformis	••	Frequent	2
Ciona intestinalis	•••	Frequent	5
Ascidiella aspersa	•••	Frequent	5
Ascidiella scabra	••	Occasional	1
Corallinaceae	••••	Occasional	6
Gracilaria gracilis	••	Frequent	1
Chondrus crispus	••	Occasional	2

Polyides rotundus	●●●	Common	10
Furcellaria lumbricalis	●●●	Common	11
Ectocarpaceae	●●	Occasional	3
Chorda filum	●●●	Frequent	5
Laminaria	●●	Frequent	1
Enteromorpha	●●●	Occasional	3
Cladophora	●●	Frequent	2
Cladophora rupestris	●●	Occasional	2

IR.LIR.Lag.FcerEnt *Fucus ceranoides* and *Enteromorpha* spp. on low salinity infralittoral rock

Habitat classification

Salinity:	Reduced (18-30ppt), Low (<18ppt)
Wave exposure:	Extremely sheltered
Tidal streams:	Very weak
Substratum:	Bedrock; boulders, cobbles and mixed sediment
Zone:	Infralittoral
Depth band:	0-5 m

Biotope description

Permanently submerged lagoon fringes with dense communities of the wrack *Fucus ceranoides* and the green seaweed *Enteromorpha* spp. There is typically a very limited associated biota due to low salinity conditions, and may include the opossum shrimps Mysidae and the freshwater/brackish gastropod *Potamopyrgus antipodarum*.

Situation

Insufficient information to describe neighbouring biotopes.

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Mysidae	••	Frequent	2
Potamopyrgus antipodarum	••	Common	4
Fucus ceranoides	•••••	Common	67
Enteromorpha	•••	Common	11
Enteromorpha intestinalis	••	Common	7

IR.FIR Features of infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock
Zone:	Sublittoral fringe, Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Two biotope complexes are currently found within the infralittoral rock features habitat complex: Surge Gulleys (SG) and Infralittoral Fouling communities (IFou). Surge Gulleys features are found throughout the infralittoral rock zone, and usually consist of vertical bedrock walls, occasionally with overhanging faces, and support communities, which reflect the degree of wave surge they are subject to and any scour from mobile substrata on the cave/gully floors. The larger cave and gully systems, such as found in Shetland, Orkney, the Western Isles and St Kilda, typically show a marked zonation from the entrance to the rear of the gully/cave as wave surge increases and light reduces. Infralittoral Fouling communities are found on wave-sheltered artificial substrata (usually steel wrecks), subject to weak tidal streams, in the upper infralittoral zone. Infralittoral fouling communities are characterised by filamentous and foliose algae.

IR.FIR.SG Robust faunal cushions and crusts (surge gullies and caves)

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock (boulders, cobbles, pebbles or coarse sediment in gully floors)
Zone:	Sublittoral fringe, Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Wave surge; vertical (and overhanging rock)

Previous code

EIR.SG	97.06

Biotope description

Infralittoral rocky habitats subject to strong wave surge conditions, as found in surge gullies and shallow caves, and typically colonised by faunal communities of encrusting or cushion sponges, colonial ascidians, short turf-forming bryozoans, anthozoans, barnacles and, where there is sufficient light, red seaweeds. These features usually consist of vertical bedrock walls, occasionally with overhanging faces, and support communities, which reflect the degree of wave surge they are subject to and any scour from mobile substrata on the cave/gully floors. The larger cave and gully systems, such as found in Shetland, Orkney, the Western Isles and St Kilda, typically show a marked zonation from the entrance to the rear of the gully/cave as wave surge increases and light reduces. This is reflected in communities of anthozoans, ascidians, bryozoans and red seaweeds near the entrance, leading to sponge crust-dominated communities and finally barnacle and spirorbid worm communities in the most severe surge conditions. Gully/cave floors usually have mobile boulders, cobbles, pebbles or coarse sediment. The mobile nature of the gully/cave floors leads to communities of encrusting species, tolerant of scour and abrasion or fast summer-growing ephemeral species. The lower zone of the gully side walls are also often scoured, and typically colonised by coralline crusts and barnacles.

Temporal variation

Not known

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Clathrina coriacea	●●●	Frequent	6
Pachymatisma johnstonia	●●	Occasional	2
Halichondria panicea	●●●	Frequent	5
Esperiopsis fucorum	●●	Occasional	1
Myxilla incrustans	●●	Occasional	1
Porifera indet crusts	●●	Occasional	2
Tubularia indivisa	●●	Occasional	3
Alcyonium digitatum	●●	Occasional	2
Urticina felina	●●●	Occasional	4
Metridium senile	●●	Frequent	1
Sagartia elegans	●●●	Occasional	5
Corynactis viridis	●●	Frequent	2
Pomatoceros triqueter	●●	Occasional	2
Balanus crenatus	●●●	Frequent	7
Cancer pagurus	●●●	Occasional	5
Calliostoma zizyphinum	●●	Occasional	1
Bryozoa indet crusts	●●	Frequent	1
Henricia	●●	Occasional	1

Asterias rubens	●●●	Occasional	3
Echinus esculentus	●●	Occasional	1
Polyclinum aurantium	●●	Frequent	1
Didemnidae	●●	Frequent	2
Dendrodoa grossularia	●●	Common	5
Botryllus schlosseri	●●	Occasional	2
Corallinaceae	●●●	Frequent	7

IR.FIR.SG.FoSwCC Foliose seaweeds and coralline crusts in surge gully entrances

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock; boulders
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Boulder-scoured and wave-surged

Previous code

EIR.SG.FoSwCC	97.06

Biotope description

This biotope is found on steep wave-surged entrances to gullies and caves and on unstable boulders in the entrance to caves and gullies. The rock may be abraded by the movement of the boulders and cobbles in heavy surge and tends to be dominated by dense foliose seaweeds that grow rapidly in the calmer summer months. Beneath the foliose seaweeds the rock surface is typically covered with coralline crusts, which are longer-lived, and tolerant of abrasion. The flora of this biotope is relatively varied, depending upon the amount of light and degree of abrasion or rock mobility with red seaweeds such as *Cryptopleura ramosa*, *Plocamium cartilagineum*, *Odonthalia dentata*, *Callophyllis laciniata*, *Phycodrys rubens*, *Hypoglossum hypoglossoides*, *Phyllophora crispa* and *Corallina officinalis*. The brown seaweed *Dictyota dichotoma* also occurs in these conditions, since it is tolerant of some sand scour. During the summer months small fast-growing kelp plants can arise in this biotope, although the mobility of the substratum prevents the kelp from forming a kelp forest. Dense swathes of very young kelp such as *Laminaria hyperborea* are, however, not uncommon. The faunal community consist of the anemone *Urticina felina*, the sponge *Halichondria panicea* and the ascidian *Dendrodoa grossularia*. More mobile fauna include the echinoderms *Asterias rubens* and *Echinus esculentus*, the top shell *Gibbula cineraria* and the crab *Cancer pagurus*.

Situation

Further into the cave or gully, beyond the dense red seaweeds of FoSwCC, the vertical rock grades to either an ascidian and sponge dominated community or sponge crusts and anthozoans (CrSpAsAn/CrSpAsDenB). Further into the cave or gully the floor and any boulders or cobbles are generally scoured clean or may support coralline encrusting algae (CC.Mo). Above the red seaweeds, steep rock surfaces often support a kelp community (LhypR or Lhyp) or in shallower water *Alaria esculenta* is usually present (Ala.Myt).

Temporal variation

Unknown.

Similar biotopes

HIR.LsacSac	This biotope occurs in a similar depth and conditions as FoSwCC, though LsacSac often occurs further away from the cave / gully entrance on larger boulders. As such, the greater (relative) stability of the boulders allows the opportunistic kelps to survive long enough to form a forest.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Halichondria panicea	••	Occasional	2	
Urticina felina	•••	Occasional	5	
Cancer pagurus	••	Occasional	1	
Gibbula cineraria	•••	Frequent	3	
Asterias rubens	•••	Occasional	3	
Echinus esculentus	••	Occasional	1	
Dendrodoa grossularia	••	Frequent	3	
Callophyllis laciniata	•••	Occasional	3	
Corallinaceae	•••••	Abundant	21	
Corallina officinalis	••	Occasional	1	
Phyllophora crispa	••	Occasional	1	
Plocamium cartilagineum	•••	Frequent	8	
Cryptopleura ramosa	••••	Frequent	10	
Hypoglossum hypoglossoides	•••	Occasional	3	
Phycodrys rubens	••	Occasional	3	
Odonthalia dentata	•••	Occasional	5	
Dictyota dichotoma	••	Occasional	4	
Laminaria hyperborea	••	Occasional	1	

IR.FIR.SG.CrSpAsAn Anemones, including *Corynactis viridis*, crustose sponges and colonial ascidians on very exposed or wave surged vertical infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m, 20-30 m
Other features:	Wave surged vertical rock; in surge gullies and caves.

Previous code

IR.FaSwV.CorMetAlc in part	97.06
EIR.SG.SCAs.ByH in part	97.06
EIR.SG.SCAn	97.06

Biotope description

Vertical very exposed and exposed bedrock gullies, tunnels and cave entrances subject to wave-surge dominated by sponge crusts such as *Clathrina coriacea*, *Myxilla incrustans*, *Pachymatisma johnstonia* and *Halichondria panicea* and anthozoans such as *Sagartia elegans*, *Urticina felina*, *Alcyonium digitatum*, *Corynactis viridis* and dwarf *Metridium senile* generally dominate the area; the anthozoans often appearing to protrude through the sponge layer. There may be dense aggregations of the hydroid *Tubularia indivisa*, the cup coral *Caryophyllia smithii* and the colonial ascidians *Botrylloides leachi* and *Polyclinum aurantium*. There may be a short crisiid turf, interspersed with *Scrupocellaria reptans*. Encrusting coralline algae may occur on well-illuminated rock faces. The echinoderms *Asterias rubens*, *Marthasterias glacialis*, *Echinus esculentus*, *Antedon bifida* and *Ophiothrix fragilis*, the topshell *Calliostona zizphinum* and the calcareous tubeworm *Pomatoceros triqueter* may also be present on the rock face. The crabs *Cancer pagurus* and *Necora puber* may also be recorded. Due to the wave-surged nature and vertical orientation of these biotopes, kelps are rare and certainly never dominate.

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Clathrina coriacea	••••	Occasional	3	
Pachymatisma johnstonia	••	Occasional	3	
Halichondria panicea	•••	Frequent	1	
Myxilla incrustans	•••	Frequent	2	
Porifera indet crusts	•••	Frequent	2	
Tubularia indivisa	••••	Frequent	4	
Alcyonium digitatum	••••	Occasional	5	
Urticina felina	•••	Occasional	1	
Metridium senile	•••	Frequent	4	
Sagartia elegans	••••	Frequent	5	
Corynactis viridis	•••••	Common	14	
Caryophyllia smithii	•••	Occasional	2	
Pomatoceros triqueter	••	Occasional	1	
Cancer pagurus	••••	Occasional	3	
Necora puber	•••	Occasional	1	
Calliostoma zizyphinum	••••	Occasional	4	

Crisiidae	●●●	Frequent	2
Scrupocellaria reptans	●●●	Common	2
Bryozoa indet crusts	●●●	Frequent	3
Antedon bifida	●●●	Occasional	1
Asterias rubens	●●●●	Occasional	4
Marthasterias glacialis	●●●	Occasional	1
Ophiothrix fragilis	●●	Occasional	1
Echinus esculentus	●●●	Occasional	2
Polyclinum aurantium	●●●	Frequent	1
Didemnidae	●●	Frequent	2
Botrylloides leachi	●●●	Occasional	2
Corallinaceae	●●●	Frequent	3

IR.FIR.SG.CrSpAsDenB Crustose sponges and colonial ascidians with *Dendrodoa grossularia* or barnacles on wave-surged infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Extremely exposed, Very exposed, Exposed, Moderately exposed
Tidal streams:	Strong, Moderately strong, Weak, Very weak
Substratum:	Bedrock
Zone:	Sublittoral fringe, Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Surge gullies and caves

Previous code

EIR.SG.SCAs in part	97.06
EIR.SG.SCAs.ByH in part	97.06
EIR.SG.SCAn.Tub in part	97.06

Biotope description

Vertical and overhanging, exposed to moderately exposed bedrock gullies, tunnels and cave entrances subject to wave surge, and dominated by the crustose sponges *Halichondria panicea*, *Myxilla incrustans*, *Clathrina coriacea*, *Leucosolenia botryoides*, Esperiopsis fucorum *and* Grantia compressa. *There may also be dense aggregations of the anthozoan* Sagartia elegans, *dwarf* Metridium senile, Alcyonium digitatum, *and* Urticina felina, *and a dense covering of the barnacle* Balanus crenatus *on the bare rock face. Dense aggregations of the robust hydroid* Tubularia indivisa *may be recorded, growing through the sponge crust. Colonial ascidians such as* Polyclinum aurantium, Botryllus schlosseri, Botrylloides leachi, Aplidium nordmanni *and the solitary ascidian* Dendrodoa grossularia *may all be recorded. The echinoderms* Asterias rubens, Echinus esculentus, Henricia *sp., the crab* Cancer pagurus *and the calcareous tubeworm* Pomatoceros triqueter *may also be present on the rock face, along with encrusting coralline algae.*

Temporal variation

Unknown.

Similar biotopes

FIR.CrSpAsAn
FIR.DenCcor

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Clathrina coriacea	●●●	Frequent	3	
Leucosolenia botryoides	●●	Occasional	1	
Grantia compressa	●●	Frequent	1	
Halichondria panicea	●●●●	Frequent	6	
Esperiopsis fucorum	●●	Frequent	1	
Myxilla incrustans	●●●●	Occasional	4	
Tubularia indivisa	●●●	Frequent	5	
Alcyonium digitatum	●●●	Occasional	3	
Urticina felina	●●●	Occasional	2	
Metridium senile	●●●	Occasional	4	
Sagartia elegans	●●●●	Frequent	7	
Pomatoceros triqueter	●●●	Frequent	3	
Balanus crenatus	●●●●	Frequent	7	

CAPRELLIDEA	••	Common	2
Cancer pagurus	••••	Occasional	4
Bryozoa indet crusts	••	Frequent	1
Henricia	••	Occasional	1
Asterias rubens	•••	Occasional	3
Echinus esculentus	•••	Occasional	1
Polyclinum aurantium	•••	Frequent	5
Aplidium nordmanni	••	Occasional	2
Didemnidae	••	Frequent	1
Dendrodoa grossularia	•••	Frequent	2
Botryllus schlosseri	••••	Occasional	4
Botrylloides leachi	••	Occasional	4
Corallinaceae	•••	Frequent	3

IR.FIR.SG.DenCcor *Dendrodoa grossularia* and *Clathrina coriacea* on wave-surged vertical infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	Weak, Very weak
Substratum:	Bedrock
Zone:	Sublittoral fringe, Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Wave-surged gullies or caves;, vertical and overhanging rock

Previous code

EIR.SCAs.DenCla	97.06

Biotope description

Vertical or overhanging infralittoral rock subject to considerable wave-surge, especially in the middle or back of caves but also in gullies and tunnels, and dominated by dense sheets of the ascidian *Dendrodoa grossularia*, together with variable quantities of the sponge *Clathrina coriacea*. At some sites *D. grossularia* forms continuous sheets, with few other species present. Other sponges such as *Esperiopsis fucorum*, *Pachymatisma johnstonia*, *Leucosolenia botryoides*, *Scypha ciliata* and *Halichondria panicea* regularly occur in this biotope, though generally at low abundance. Other ascidians, especially *Polyclinum aurantium*, *Diplosoma* spp. and other didemnids may also occur, though only *P. aurantium* is ever as abundant as *D. grossularia*. Being characteristically found in the middle or towards the backs of the caves mean that there is generally insufficient light to support any foliose seaweeds, although encrusting coralline algae are not uncommon. More scoured areas may also contain the anemone *Urticina felina*, whilst *Sagartia elegans* is often present in low numbers. Mobile fauna are often limited to the starfish *Asterias rubens* and *Henricia* spp., the brittlestar *Ophiopholis aculeata* and crabs *Cancer pagurus* and *Necora puber*. The barnacle *Balanus crenatus* can occur, usually in low densities.

Situation

Where this biotope develops in a cave or tunnel it can occur anywhere from the entrance to the rear of the system. Typically, it will give way to sponge crust or barnacle and encrusting tubeworm communities at the rear of the cave, where surge forces are amplified (CrSp or CC.BalPom). The vertical rock below the DenCla zone, abutting the cave/gully floor, is likely to be severely scoured, colonised by the robust CC.BalPom biotope. The cave or gully floor is generally scoured clean by boulders and/or cobbles (CC.Mo). The cave or gully entrance has more available light for algal growth so dense foliose seaweeds usually dominate the rock walls at the entrance, abutting the *D. grossularia* - *C. coriacea* zone further into the cave (FoSwCC). This dense seaweed growth may also extend to the upward-facing surfaces of boulders around the entrance. Where DenCla occurs in a gully situation, the rock tends to be colonised by dense *Alaria esculenta* in the sublittoral fringe (Ala) or by *Laminaria hyperborea* forest in the shallow infralittoral (LhypR.Ft).

Temporal variation

Unknown.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Clathrina coriacea	●●●●●	Common	16	
Leucosolenia complicata	●●	Frequent	2	
Scypha ciliata	●●	Occasional	1	
Grantia compressa	●●	Occasional	1	

Pachymatisma johnstonia	●●●	Frequent	3
Halichondria panicea	●●●	Frequent	4
Porifera indet crusts	●●	Occasional	1
Urticina felina	●●●	Occasional	2
Sagartia elegans	●●	Occasional	2
Spirorbidae	●●	Frequent	1
Balanus crenatus	●●●●	Frequent	3
Cancer pagurus	●●●	Occasional	4
Necora puber	●●	Rare	1
Henricia	●●	Occasional	2
Asterias rubens	●●	Occasional	2
Ophiopholis aculeata	●●	Occasional	2
Polyclinum aurantium	●●	Occasional	1
Didemnidae	●●	Occasional	1
Dendrodoa grossularia	●●●●●	Abundant	32
Botryllus schlosseri	●●	Occasional	1
Corallinaceae	●●	Occasional	1

IR.FIR.SG.CrSp Sponge crusts on extremely wave-surged infralittoral cave or gully walls

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed
Tidal streams:	Weak, Very weak
Substratum:	Bedrock; massive boulders
Zone:	Sublittoral fringe, Infralittoral - upper
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Extreme wave surge and scour on, vertical and overhanging rock

Previous code

EIR.SC	97.06

Biotope description

Walls, or massive boulders, in caves or gullies that are subject to severe wave-surge and characterised by extensive thin crusts of the sponge *Halichondria panicea* with smaller patches of other sponges such as *Esperiopsis fucorum* or *Clathrina coriacea*. Small turfs of robust hydroids, such as *Diphasia rosacea* and *Ventromma halecioides*, and patches of the barnacle *Balanus crenatus*, coralline crusts and tube-building spirorbid polychaetes may be present. The starfish *Henricia* spp., the brittlestar *Ophiopholis aculeata* and the crabs *Cancer pagurus* and *Necora puber* can be present. The anemones *Sagartia elegans, Urticina* felina *and* Actinia equina *can be found in cracks and crevices or under boulders. The mussel* Mytilus edulis *may be present in low densities.*

Situation

This surge-tolerant biotope of low-growing fauna is typically confined to the mid or rear section of caves (or the narrowest part of gullies) where the wave-surge is intensified. It generally abuts the less surged ascidian-sponge communities (CrSpAsAn, DenCcor and CrSpAsDenB). A highly scoured zone of barnacles and calcareous tubeworms often form a zone below, abutting the cave/gully floor (CC.BalPom).

Temporal variation

Unknown.

Similar biotopes

FIR.CrSpAsAn
FIR.CrSpAsDenB

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Clathrina coriacea	●●●	Frequent	6	
Leuconia nivea	●●	Common	4	
Pachymatisma johnstonia	●●●	Occasional	5	
Halichondria panicea	●●●	Abundant	20	
Porifera indet crusts	●●	Occasional	4	
Actinia equina	●●	Occasional	2	
Urticina felina	●●	Occasional	3	
Sagartia elegans	●●	Frequent	2	
Spirorbidae	●●	Common	8	
Balanus crenatus	●●	Frequent	4	

Cancer pagurus	●●	Occasional	3
Necora puber	●●	Occasional	3
Henricia	●●	Occasional	7
Ophiopholis aculeata	●●	Frequent	3
Dendrodoa grossularia	●●	Occasional	3
Corallinaceae	●●●	Frequent	13

IR.FIR.SG.CC Coralline crust in surge gullies and scoured infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock
Zone:	Sublittoral fringe, Infralittoral - upper
Depth band:	0-5 m, 5-10 m

Biotope description

Scoured bedrock in wave-surged caves, tunnels or gullies often look bare, but are characterised by a limited scour-tolerant fauna of *Balanus crenatus* and/or *Pomatoceros triqueter* with spirorbid polychaetes. In areas where sufficient light is available, encrusting coralline algae and non-calcareous crusts cover the rock surface, giving a pink appearance. This biotope most commonly occurs at the bottom of walls in caves and gullies, where abrasion by cobbles and stones is severe, especially during winter. In some gullies, extreme scouring and abrasion produces a narrow band of bare coralline algal crust at the very bottom of the walls, with a band of *P. triqueter* and or *B. crenatus* immediately above. Other scour-tolerant species, such as encrusting bryozoans may also be common. Crevices and cracks in the rock provide a refuge for sponge crusts such as *Halichondria panicea* and occasional *Urticina felina* and *Sagartia elegans*. More mobile fauna is usually restricted to the echinoderms *Asterias rubens* and *Echinus esculentus* as well as the crab *Cancer pagurus*. Two variants has been identified: Wave-surged crusts with coralline crust, *B. crenatus* and *P. triqueter* (CC.BalPom) and coralline crusts on mobile boulders in severely scoured caves (CC.Mo).

Situation

Generally occurring at the base of walls in caves and gullies. Immediately above this zone a variety of biotopes may occur depending on the proximity to the cave/gully entrance. Typically sponge crusts and ascidians with a hydroid-bryozoan turf will occur in the outer to mid section (CrSpAsAn, CrSpAsDenB); sponge crusts and dense ascidians in the outer to rear section (DecCcor); and low-growing sponge crusts at the rear of caves (CrSp). At some sites, CC.BalPom can form a zone towards the rear of the cave, beyond the sponge crust zone.

Temporal variation

Unknown

Similar biotopes

IR.FIR.SG.FoSwCC	This biotope occurs in surge gully entrances on bedrock. It is less scoured which allows foliose seaweeds develop.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*
Halichondria panicea	••	Occasional	3
Porifera indet crusts	••	Occasional	2
Urticina felina	••	Frequent	6
Sagartia elegans	••	Occasional	4
Pomatoceros triqueter	•••	Frequent	13
Spirorbidae	••	Abundant	2
Balanus crenatus	•••	Common	17

Cancer pagurus	●●●	Occasional	7
Asterias rubens	●●	Occasional	5
Echinus esculentus	●●	Occasional	2
Corallinaceae	●●●	Abundant	17

IR.FIR.SG.CC.BalPom *Balanus crenatus* and/or *Pomatoceros triqueter* with spirorbid worms and coralline crusts on severely scoured vertical infralittoral rock

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Bedrock
Zone:	Sublittoral fringe, Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Scoured vertical or overhanging, rock

Previous code

EIR.SG.CC.BalPom	97.06
EIR.CCPom	96.7
EIR.BcreSpi	96.7

Biotope description

Severely scoured bedrock in wave-surged caves, tunnels or gullies often looks rather bare, and may be characterised by a limited scour-tolerant fauna of *Balanus crenatus* and/or *Pomatoceros triqueter* with spirorbid polychaetes. In areas where sufficient light is available, encrusting coralline algae and non-calcareous crusts cover the rock surface, giving a pink appearance. This biotope most commonly occurs at the bottom of walls in caves and gullies, where abrasion by cobbles and stones is severe, especially during winter. In some gullies, extreme scouring and abrasion produces a narrow band of bare coralline algal crust at the very bottom of the walls, with a band of *P. triqueter* and or *B. crenatus* immediately above. In some caves extreme wave surge at the back of the cave leads to a zone of this biotope which may also be dominated solely by sprorbids or by the barnacle *Verruca stroemia*. Other scour-tolerant species, such as encrusting bryozoans may also be common. Crevices and cracks in the rock provide a refuge for sponge crusts, small *Mytilus edulis* and occasional *Actinia equina*, *Urticina felina* and *Sagartia elegans*. More mobile fauna is usually restricted to the echinoderm *Asterias rubens* and the crab *Cancer pagurus*. During periods of relative stability in the summer, small quantities of foliose red seaweeds and opportunistic kelps may occur where sufficient light is available; the seaweeds however do not dominate (compare with FoSwCC).

Situation

Generally occurs at the base of walls in caves and gullies, but in extreme surge may occur as a zone at the back of caves. Immediately above this zone a variety of biotopes may occur depending on the proximity to the cave/gully entrance. Typically sponge crusts and ascidians with a hydroid-bryozoan turf will occur in the outer to mid section (CrSpAsAn, CrSpAsDenB); sponge crusts and dense ascidians in the outer to rear section (DenCcor); and low-growing sponge crusts at the rear of caves (CrSp). At some sites, CC.BalPom can form a zone towards the rear of the cave, beyond the sponge crust zone.

Temporal variation

Unknown.

Similar biotopes

FIR.CC.Mo	Coralline crusts and crustaceans on mobile boulders or cobbles in surge gullies. Occurs on mobile boulders on gully/cave floors.
FIR.FoSwCC	This biotope occurs in surge gully entrances on bedrock. It is less scoured which allows foliose seaweeds develop.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Porifera indet crusts	••	Occasional	3	
Urticina felina	•••	Frequent	4	
Sagartia elegans	••	Occasional	3	
Pomatoceros triqueter	•••	Common	11	
Spirorbidae	•••	Abundant	5	
Balanus crenatus	••••	Abundant	33	
Cancer pagurus	•••	Occasional	6	
Bryozoa indet crusts	••	Common	2	
Asterias rubens	••	Occasional	3	
Corallinaceae	•••	Common	17	

IR.FIR.SG.CC.Mo Coralline crusts and crustaceans on mobile boulders or cobbles in surge gullies

Habitat classification

Salinity:	Full (30-35ppt)
Wave exposure:	Very exposed, Exposed, Moderately exposed
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Boulders, cobbles, often with pebbles or gravel
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m
Other features:	Mobile substrata

Previous code

EIR.SG.CC.Mob	97.06
EIR.Bcre	96.7

Biotope description

Highly mobile and scoured boulders and cobbles found on cave and gully floors and which often appear bare. Where there is sufficient light and stability, however, the boulders are encrusted by coralline algal crusts. Barnacles *Balanus crenatus* and keelworms *Pomatoceros triqueter* may survive in areas protected from severe abrasion. Crabs such as *Cancer pagurus* and *Carcinus maenas* may occur, often beneath and between the rocks, along with the gastropod *Calliostoma zizyphinum*. The anemone *Actinia equina* may be present in low numbers.

Situation

The slightly less-scoured walls often found above this biotope in caves and gullies are generally characterised by a similar, but richer community of scour-tolerant *Balanus crenatus*, *Pomatoceros triqueter*, coralline crusts and spirorbid worms (CC.BalPom). This impoverished biotope may form an intermediate between barren gravel and slightly more stable larger pebbles and cobbles which are covered by algae that are often found in the mouths of caves (FoSwCC).

Temporal variation

Winter storms periodically mobilise the boulders and cobbles, causing abrasion to any seasonal biota that may have developed over the calmer summer months.

Similar biotopes

HIR.DesFilR	Occurs in similar conditions as CC.Mob but has a higher species diversity and has a high abundance of the brown seaweed *Desmarestia aculeata*.
FIR.CC.BalPom	Severely scoured vertical infralittoral rock with *B. crenatus* and/or *P. triqueter* with spirorbid worms and coralline crusts. Often occurs on nearby vertical rock.
FIR.FoSwCC	This biotope occurs in surge gully entrances on bedrock. The less scoured, more stable substrata allow foliose seaweeds develop.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m ^{2})*
Urticina felina	••	Occasional	12	
Cancer pagurus	••	Occasional	11	
Carcinus maenas	••	Rare	23	
Calliostoma zizyphinum	••	Occasional	13	
Corallinaceae	••	Common	23	
Rhodophycota indet.(non-calc.crusts)	••	Frequent	18	

IR.FIR.IFou Infralittoral fouling communities

Habitat classification

Salinity:	Full (30-35ppt), Variable (18-35ppt)
Wave exposure:	Moderately exposed, Sheltered, Very sheltered, Extremely sheltered, Ultra sheltered
Tidal streams:	Moderately strong, Weak, Very weak
Substratum:	Artificial
Zone:	Infralittoral
Depth band:	0-5 m, 5-10 m, 10-20 m

Biotope description

Moderately exposed to wave-sheltered artificial substrata (such as steel wrecks/concrete pilings/cable debris etc) subject to moderately strong to weak tidal streams in the infralittoral zone. This biotope complex is characterised by a dense covering of filamentous and foliose algae on vertical as well as the upper faces of the substrata. Although there are no biotopes currently defined under this biotope, due to the low number of records, it is suspected that this has been highly 'under-recorded', and that additional records will be added in the near future, leading to the definition of biotopes.

Characterising species

	% Frequency	*Abundance (SACFOR)*	*%Contribution to similarity*	*Abundance (nos / m^2)*
Plocamium cartilagineum		Common		
Ceramium		Frequent		
Nitophyllum punctatum		Occasional		
Phycodrys rubens		Frequent		
Brongniartella byssoides		Frequent		
Polysiphonia		Frequent		
Pterosiphonia parasitica		Frequent		
Filamentous red algae		Abundant		
Foliose red algae		Abundant		
Eudesme virescens		Common		
Cutleria multifida		Rare		
Desmarestia viridis		Occasional		
Laminaria		Occasional		
Filamentous brown algae		Abundant		
Foliose brown algae		Abundant		
Filamentous green algae		Abundant		
Foliose green algae		Abundant		

Infralittoral Rock: Hierarchy Structure Diagram

Infralittoral Rock
IR

High energy Infralittoral Rock HIR		Moderate energy Infralittoral Rock MIR		Low energy Infralittoral Rock LIR				Features of Infralittoral Rock FIR	
Kelp with cushion fauna and/or foliose red seaweeds KFaR	Sediment-affected or disturbed kelp and seaweed communities KSed	Kelp and red seaweeds KR	Kelp and seaweed communities in tide-swept sheltered conditions KT	Kelp in silted conditions K	Kelp in variable or reduced salinity KVS	Infralittoral fauna in variable or reduced salinity IFaVS	Submerged fucoids, green or red seaweeds (low salinity infralittoral rock - lagoonal communities) Lag	Infralittoral surge gullies and caves SG	Infralittoral fouling communities IFou
Ala	Sac	Ldig	LdigT	LhypLoch	Cod	MytRS	AscSpAs	FoSwCC	
Ala.Myt	LsacSac	Ldig.Ldig	XKT	LhypLsac	LsacPsaVS	CcasEle	FChoG	CrSpAsAn	
Ala.Ldig	LsacChoR	Ldig.Bo	XKTX	LhypLsac.Ft	LsacPhyVS	HarCon	ProtFur	CrSpAsDenB	
AlaAnCrSp	DesFilR	Ldig.Pid	LsacT	LhypLsac.Pk			FcerEnt	DenCcor	
LhypFa	XKScrR	LhypT	FilRVS	LhypLsac.Gz				CrSp	
LhypPar	XKHal	LhypT.Ft		Lsac				CC	
LhypR	ProtAhn	LhypT.Pk		Lsac.Ldig				CC.BalPom	
LhypR.Ft		LhypTX		Lsac.Ft				CC.Mo	
LhypR.Pk		LhypTX.Ft		Lsac.Pk					
LhypR.Loch		LhypTX.Pk		Lsac.Gz					
FoR		Lhyp		LhypCape					
FoR.Dic		Lhyp.Ft		Sar					
LhypRVt		Lhyp.Pk							
		Lhyp.GzFt							
		Lhyp.GzPk							
		Lhyp.Sab							
		XFoR							
		LhypVt							
		HiaSw							