UK Biodiversity Action Plan
Priority Habitat Descriptions

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UK BIODIVERSITY ACTION PLAN: PRIORITY HABITAT DESCRIPTIONS

Introduction

After two years of work involving in excess of 500 people, the proposed UK List of Priority Species and Habitats was presented in a UK BAP website report in June 2007. Following recommendation from the Priorities Species and Habitats Review Working Group and the Priorities Review Group, the Governments of all four UK administrations adopted the recommendations of experts and published the UK list of Priority Species and Habitats in August 2007.

This list contains 1149 species and 65 habitats that have been listed as priorities for conservation action under the UK Biodiversity Action Plan (UK BAP). This was the first full review of the UK BAP priority list and provided an opportunity to take account of emerging and continued priorities for action, conservation successes, and new information gathered since the original list of UK BAP priorities was established.

This document describes each of the 65 UK BAP priority habitats, which span terrestrial, freshwater and marine environments. It is anticipated that these definitions will be described in more detail in due course, albeit that their overall scope will not be significantly affected by this. Even as this report is being published some of the terrestrial, freshwater and marine habitat definitions are being refined.

For those habitats for which pre-existing Habitat Action Plans are available, as written in 1995 (see http://www.ukbap.org.uk/Habitats.aspx), and where the scope of the habitat description remains unchanged, a weblink is provided to the relevant action plan; these should be read with consideration that they reflect the original status of the habitats when the plans were first written in 1995. In addition, a summary of each definition, derived from the HAP, is included in this document.

For those terrestrial and freshwater habitats which are either new priorities or where changes have been made to the original habitat scope (as given in the 1995 action plan), the nature of the changes is outlined or the new description is given in full. This information has been taken from Annex 5 of the UK BAP Species and Habitats Review Report which provides the detail and reasoning behind the changes (available at http://www.ukbap.org.uk/bapgrouppage.aspx?id=112).

The UK BAP Marine Steering Group is still finalising the descriptions of the newly recognised priority marine habitats; detail on these will be provided in due course.

Habitat Descriptions

Aquifer Fed Naturally Fluctuating Water Bodies

The definition of this habitat remains unchanged from the pre-existing Habitat Action Plan (http://www.ukbap.org.uk/UKPlans.aspx?ID=24) a summary of which appears below.

Physical and chemical status

This habitat category consists of natural water bodies which have an intrinsic regime of extreme fluctuation in water level, with periods of complete or almost complete drying out as part of the natural cycle. They have no inflow or outflow streams at the surface, except at times of very high water level, when temporary out-flows may develop. Instead, they are directly connected to the underlying groundwater system and periodically empty and are recharged via swallow holes or smaller openings in their beds.

There are two known variants of the habitat in the UK: turloughs, found over Carboniferous limestone in Northern Ireland and Wales, and fluctuating meres, which occur over chalk in the Norfolk Breckland. Turloughs are distinguished by winter flooding and a dry floor, apart from small residual pools, in summer. Under one definition, a water body qualifies as a turlough only if winter flooding exceeds a depth of 0.5m. There may be underground connections between neighbouring turloughs. The fluctuating meres of Norfolk do not have a regular annual rhythm of emptying and recharge. Instead, there is a complex pattern of drying out and refilling, sometimes with a stretch of several years during which a mere may remain dry, followed by a prolonged period when water is constantly present, although its depth may vary from a few centimetres to 6 metres. The water level in both turloughs and meres reflects the height of the water table, which periodically rises above the surface of the bed. The response to groundwater fluctuations in turloughs is rapid, whereas that in the meres is highly lagged, with each mere having an individual periodicity.

This is naturally a very rare habitat, both in the UK and internationally, although the Republic of Ireland has at least 60 unmodified turloughs 10 ha or more in extent. Three intact turloughs have so far been found in Co. Fermanagh, Northern Ireland, possibly the most northerly water bodies of this kind in Europe, and a single example (Pant-y-llyn) has been recognised in South Wales. Six fluctuating meres have been identified in the Norfolk Breckland, but some of the smaller pools nearby may also be fluctuating meres. There have been suggestions that aquifer fed naturally fluctuating water bodies may occur elsewhere in the UK, including Scotland, but none has yet been positively identified. Conversely, there are probably a number of aquifer fed water bodies which were once naturally fluctuating but have been deliberately modified and so have lost most of their biological interest.

Taking the area of maximum inundation, the total extent of the nine UK waters at present known to fit the definition of aquifer fed naturally fluctuating water bodies is approximately 10 ha in Northern Ireland, 1 ha in Wales and 20 ha in England.

The nutrient status of these lakes varies from area to area and the water quality reflects that of the groundwater. The water of turloughs and fluctuating meres is hard because the underlying rock is calcareous. The Irish and Welsh turloughs lie naturally in the middle of the trophic range for the UK (mesotrophic) and the Breckland meres are somewhat richer (mildly eutrophic).

Biological status

The concentric zonation of vegetation in these lakes is strikingly obvious, especially when they are in their dry phase. Then their basins are partly or completely occupied by grassland, often with silverweed *Potentilla anserina* abundant, although turloughs in Northern Ireland retain some permanent swampy pools. Water chickweed *Myosoton aquaticum* and stinging nettle *Urtica dioica* are typical of the damp centre of Breckland mere basins, with a broad band of reed canary grass *Phalaris arundinacea* at a slightly higher level. Woodland and scrub - mainly willow, birch, alder, ash or hazel - grows around the margins of most of the meres and turloughs.

As a result of the fluctuating water levels, aquatic vegetation is absent (or, in Northern Ireland, restricted to residual pools) at some periods in the cycle of these lakes and abundant at others. An element common to both turloughs and meres is the prevalence of aquatic and semi-aquatic mosses such as *Fontinalis antipyretica* and *Cinclidotus fontinaloides*, which are more resistant to desiccation than higher (vascular) aquatic plants. Rare plants of the inundation zone include the moss *Physcomitrium erystomum* in the meres and the rare fen violet *Viola persicifolia* in the turloughs of Northern Ireland. Although some permanent pools in the Northern Irish turloughs support white water lily *Nymphaea alba* and other water plants, in the Breckland meres, where deep flooding can occur for long periods, aquatic vegetation becomes better established and more diverse than in most turloughs. Water plants typical of the meres are shining pondweed *Potamogeton lucens* and various-leaved pondweed *Potamogeton gramineus*, sometimes accompanied by their hybrid, long-leaved pondweed *Potamogeton x zizii*, which is scarce nationally.

The aquatic fauna of these fluctuating water bodies is adapted to intermittent desiccation. Fish are generally absent, but a range of amphibians can be found, including the protected great crested newt *Triturus cristatus* in the Breckland. Invertebrates include many insect species such as dragonflies, water boatmen and diving beetles, which are highly mobile and are therefore able colonisers. Typically, there is also a rich assemblage of micro-crustaceans such as water fleas, which have resting stages that can remain viable in the soil during dry phases. Snails such as the marsh snail *Lymnaea palustris*, which breathe air and can persist during periods of drought under stones and in damp vegetation, are common in both turloughs and meres. Numerous rare invertebrates have been recorded, including the large mussel-shrimp (ostracod) *Cypris bispinosa*, the small diving beetle *Bidessus unistriatus* and the scarce emerald damselfly *Lestes dryas* from the Breckland meres. During their wet phase the meres support breeding coot *Fulica atra*, tufted duck *Aythya fuligula*, mallard *Anas platyrhynchos*, shelduck *Tadorna tadorna*, pochard *Aythya ferina* and gadwall *Anas strepera*.

Arable Field Margins

The definition of this priority habitat has been amended from the pre-existing Habitat Action Plan for cereal field margins (http://www.ukbap.org.uk/UKPlans.aspx?ID=8).

Arable field margins are herbaceous strips or blocks around arable fields that are managed specifically to provide benefits for wildlife. The arable field must be in a crop rotation which includes an arable crop, even if in certain years the field is in temporary grass, set-aside or fallow. Arable field margins are usually sited on the outer 2-12m margin of the arable field, although when planted as blocks they occasionally extend further into the field centre.

In general terms, the physical limits of the arable field margin priority habitat are defined by the extent of any management undertaken specifically to benefit wildlife. Single payment cross-compliance margins are considered as part of the boundary habitat and are not part of the arable field margin habitat.

The outer edge refers to the edge closest to the field boundary. Where there is a living field boundary (hedgerow or line of trees), any herbaceous vegetation within 2m from the centre of the living boundary is considered to be part of the living boundary habitat. The arable field margin outer boundary starts at the edge of this boundary habitat. Where the boundary is a ditch or other water body, any herbaceous vegetation within 2m from the centre of the water body (or one metre from the edge of the water body if this extends further into the field) is considered to be part of the boundary habitat. The arable field margin outer boundary starts at the edge of this boundary habitat. Where the boundary is non-living (e.g. a fence or wall), the outer edge is defined by the extent of any management undertaken specifically to benefit wildlife. Where the habitat comprises a block of, for example, wild bird seed mixture, it has only an outer edge.

The inner edge refers to the edge closest to the centre of the field. In all cases, the inner edge is defined by the extent of any management undertaken specifically to benefit wildlife.

The following margin types are included:

- Cultivated, low-input margins. These are areas within arable fields that are cultivated periodically, usually annually or biennially, but are not sprayed with spring/summer insecticides and not normally sprayed with herbicides (except for the control of injurious weeds or problem grasses such as creeping thistle, black grass, sterile brome or wild oat). Cultivated, low-input margins include conservation headlands and land managed specifically to create habitat for annual arable plants.
- Margins sown to provide seed for wild birds. These are margins or blocks sown with plants that are allowed to set seed and which remain in place over the winter. They may be sown with cereals and/or small-seeded broad-leaved plants or grasses but areas sown with maize are excluded as they are of lower value for wild birds.
- Margins sown with wild flowers or agricultural legumes and managed to allow flowering to provide pollen and nectar resources for invertebrates.
- Margins providing permanent, grass strips with mixtures of tussocky and fine-leaved grasses. Areas of grass established as cross compliance requirements (see below) are excluded from this definition, but all other strips of grassland created by sowing or natural regeneration, such as field margins or beetle banks, are included.

Separate targets will be set for each margin-type, reflecting the varying priorities for conservation action.

The following margin types are excluded:

- Although set-aside, biomass and organic crops can have incidental benefits for wildlife in arable fields, these areas are not managed specifically for wildlife and are therefore excluded from the definition.
- Margins established as cross compliance requirements under the Single Payment Scheme (in England and Scotland) or as mandatory requirements of an Entry-Level Agri-environment Scheme (in Wales and likely in Northern Ireland) are excluded. These margins, where present, would be included as part of the priority hedgerow habitat, where put in place to protect the hedgerow.
- Whole-field options such as over-wintered stubbles (with or without a fallow) and in-field options such as skylark plots are currently excluded from the definition of priority habitat, although their value for wildlife is acknowledged and their status will be reviewed in due course.

Discussions to develop a more detailed definition continue in 2008 and may include:

Areas of arable land that meet one or more of the following criteria:

- Hosting a Nationally Scarce or Rare arable plant species.
- Having a mean within-crop plant species richness of (say) >18 per 100m square (upper quartile, CS 2000 arable field margin plots).
- Regularly supporting a breeding population of the following crop-nesting bird species with a restricted distribution: corn bunting, reed bunting or lapwing.
- Regularly supporting a breeding population of the following bird species with a restricted distribution which nest in hedges or grass margins and feed within the arable field: grey partridge, tree sparrow, turtle dove.
- Used for foraging by any of the following bumblebee species: Shrill Carder bee, Common Carder bee, Large Garden Bumblebee, Great Yellow Bumblebee (Scotland).

Blanket Bog

The definition of this habitat remains unchanged from the pre-existing Habitat Action Plan (http://www.ukbap.org.uk/UKPlans.aspx?ID=21) a summary of which appears below.

The term blanket 'bog' strictly applies only to that portion of a blanket 'mire' which is exclusively rain-fed. However, for the purposes of this plan the terms 'bog' and 'mire' will be regarded as more or less synonymous. Blanket bog is a globally restricted peatland habitat confined to cool, wet, typically oceanic climates. It is, however, one of the most extensive semi-natural habitats in the UK and ranges from Devon in the south to Shetland in the north. Peat depth is also very variable, with an average of 0.5-3 m being fairly typical but depths in excess of 5 m not unusual. There is no agreed minimum depth of peat which can support blanket bog vegetation. It includes the EC Habitats Directive priority habitat 'active' blanket bog, the definition of active being given as 'still supporting a significant area of vegetation that is normally peat forming'.

Although most widespread in the wetter west and north, blanket bog also occurs in eastern upland areas. Blanket bog peat accumulates in response to the very slow rate at which plant material decomposes under conditions of waterlogging. It is not, however, confined to areas of poor drainage but rather can cloak whole landscapes, even developing on slopes of up to 30Â°. The period over which blanket peat has been accumulating and the depth it can attain are very variable and not necessarily related. Studies indicate that most blanket peat development began 5000-6000 years ago, but the range extends from 9000 - 1500 years ago. There is evidence to suggest that some areas of blanket bog began to form following clearance of the original forest cover by early man, but the relative significance of this activity and changing climate on the historical and contemporary extent of the resource has yet to be determined.

The principal vegetation (NVC) types covered by this plan are M1, M2, M3, M15, M17, M18, M19, M20 and M25, together with their intermediates. Other communities, such as flush, fen and swamp types, also form an integral part of the blanket bog landscape. Many of the typical blanket mire species, such as heather *Calluna vulgaris*, cross-leaved heath *Erica tetralix*, deer grass T*richophorum cespitosum*, cotton grass *Eriophorum* species and several of the bog moss Sphagnum species, occur throughout much of the range of the habitat, although their relative proportions vary across the country. Thus criteria for the assessment of habitat condition based on species assemblage and relative abundance must be determined locally. Some other species have requirements which limit their distribution more dramatically. For example, cloudberry *Rubus chamaemorus* is typically, although not exclusively, confined to high altitude bogs, alpine bearberry Arctostaphylos alpinus to northern bogs, and black bog rush *Schoenus nigricans*, as an ombrotrophic species, to western bogs. Even the various bog moss Sphagnum species, which are a constant element of most blanket bog communities, are not entirely cosmopolitan and indeed are largely replaced by woolly hair moss *Racomitrium lanuginosum* over extensive areas in the north and west, particularly in the Western Isles. Recent research suggests that *Racomitrium* may be an entirely natural component of blanket bog in the west.

This plan encompasses all areas of blanket bog supporting semi-natural blanket bog vegetation, whether or not it may be defined as 'active'. It excludes areas which no longer support such vegetation, except where the restoration of such areas is necessary for the protection and/or enhancement of adjacent bog. The total extent of blanket peat in the UK amounts to just under 1.5 million ha. There is no agreed figure for the extent of blanket bog vegetation. In terms of national cover of blanket peat soil (in the main >0.5 m deep) England supports some 215,000 ha, Scotland approximately 1,060,000 ha, and Wales has around 70,000 ha. Northern Ireland has approximately 140,000 ha of blanket bog vegetation. Significant proportions of peat soil, probably in excess of 10%, no longer support blanket bog vegetation.

Comprehensive data for changes to the total UK resource are lacking, but studies in Scotland (where most of the resource lies and where it accounts for some 13% of the land area) suggest a 21% reduction in the extent of blanket mire between the 1940s and the 1980s. The greatest single cause of this reduction (51%) is afforestation, and substantial losses to forestry are reported from Wales. Further losses of extent and condition can be attributed to drainage and heavy grazing, peat cutting and atmospheric pollution, resulting in significant habitat change in, for example, mid and south Wales and the Pennines.

The presence, extent and type of surface patterning is another important feature of blanket bogs. This can range from a relatively smooth surface, with the only irregularities being those created by vegetation features (e.g. *Eriophorum vaginatum* tussocks and Sphagnum hummocks) to the extreme patterning associated with suites of bog pools and the intervening ridges. As with floristic composition, there would appear to be a relationship between geographical location and the nature of the surface pattern. In general, the intensity and complexity of patterning increases towards the north and west.

The range of erosion features associated with many areas of blanket bog is another aspect of this structural diversity and an as yet unknown extent of this appears to be natural in origin.

Blanket bogs support a very wide range of terrestrial and aquatic vertebrates and invertebrates. As with plant species, some of these are widespread and common, some are much more local, and quite a number are of international interest for either their rarity or for the densities of their breeding populations on blanket bogs, for example red-throated diver *Gavia stellata* and Eurasian golden plover *Pluvialis apricaria*. Studies of the invertebrate fauna of blanket bogs are extremely patchy and merit collation and synthesis. Blanket bogs also fulfil an important role as repositories of archaeological and palaeoecological material and have functional values as agricultural rough grazing, sporting estate and water catchments. In the context of climate change the role of blanket bogs as a carbon store is also now considered significant.

The extensive nature of blanket bog is such that certain other habitats, although distinctive, are probably most appropriately considered as integral components of the wider blanket bog assemblage of habitats for management purposes. This would include some areas classed as 'intermediate bog' (i.e. sharing features of both raised and blanket bog) together with examples of spring, flush and poor fen, a range of oligotrophic water bodies whose catchment is largely or entirely blanket bog, and those relatively small areas of heath and grassland which occur on better drained slopes and by the many streams and rivers which drain areas dominated by blanket bog. Not only are all such areas in hydrological connection with the surrounding peat mass, they frequently contribute to the overall habitat requirements of the peatland fauna. Several of these habitats are also the subject of their own habitat action plans.

Blue Mussel Beds on Sediment

Correspondence with existing habitats

- UK BAP broad habitat: Littoral sediment, Sublittoral sediment
- May be a component part of Annex 1 habitats
- LS.LBR.LMus;LS.LMX.LMus.Myt;LS.LMX.LMus.Myt.Mx;LS.LMX.LMus.Myt.Sa; LS.LMX.LMus.Myt.Mu; LS.LSa.St.MytFab; SS.SBR.SMus.MytSS

Description

This habitat includes intertidal and subtidal beds of the blue mussel *Mytilus edulis* on a variety of sediment types and in a range of conditions from open coasts to estuaries, marine inlets and deeper offshore habitats. Blue mussel beds plays an important part of a healthy functioning marine ecosystem, having a role in coastal sediment dynamics, acting as a food source for over-wintering waders, and providing an enhanced area of biodiversity in an otherwise sediment-dominated environment.

Intertidal mussel beds occur on a variety of sediment substrata such as sand, cobbles and pebbles, muddy sand and mud. Mussel aggregations in this habitat are dense, and can support various age classes. The wrack *Fucus vesiculosus* is often present, attached to the cobbles or mussel shells, and the shells themselves are often encrusted with various barnacles and bryozoans. The spaces between the mussels can provide refuges for a diverse community of organisms, prominent amongst which are the winkles *Littorina littorea* and *L. saxatilis* and small shore crabs, *Carcinus maenas*. The infauna of the underlying sediment (except where this is anoxic mud) may feature the gastropod *Hydrobia ulvae,* the bivalves *Macoma balthica* and *Cerastoderma edule,* the isopods *Corophium volutator, Crangon crangon* and *Jaera forsmani* and polychaetes such as the sandmason *Lanice conchilega*, the lugworm *Arenicola marina* and ragworm *Hediste diversicolor*. Further infaunal sampling has indicated a diverse range of nematodes, oligochates and polychaetes.

In the subtidal, dense mussel beds can form on the upper faces of tide-swept sediment dominated substrates, almost to the exclusion of almost all other species. The common starfish *Asterias rubens* is often locally abundant as it feeds on mussels, along with other predators such as the crabs *Necora puber*, *Carcinus maenas, Maja squinado* and *Cancer pagurus*. Anemones such as *Sagartiogeton undatus*, the dahlia anemone *Urticina equina* and the daisy anemone *Cereus pedunculatus* can be found on gravel patches and amongst the mussels themselves. The hydroid *Kirchenpaueria pinnata* and others characteristic of strong tides and a little scour, such as *Sertularia argentea* and *Tubularia indivisa*, may also be present. Ascidians such as *Molgula manhattensis* and *Polycarpa* spp. can also feature on subtidal mussel beds, particularly in silty conditions. Infaunal species include the amphipod *Gammarus salinus* and oligochaetes of the genus Tubificoides. The polychaetes *Harmothoe* spp. *Kefersteinia cirrata* and *Heteromastus filiformis* are also characteristic of this habitat.

Note that the habitat only covers 'natural' beds on a variety of sediment types, and excludes artificially created mussel beds, and mussel beds which occur on rock and boulders.

Summary of environmental preferences:

Salinity	Fully marine - reduced
Wave exposure	Exposed to extremely sheltered
Tidal streams	Weak - strong
Substratum	Cobbles and pebbles; mixed sediments; sand; mud
Zone/depth	Mid eulittoral to circalittoral

Blue mussel beds are distributed around the UK coast, both intertidally and sublittorally.

Illustrative biotopes

- LS.LBR.LMus – Littoral mussel beds on sediment
- LS.LBR.LMus.Myt – *Mytilus edulis* beds on littoral sediments
- LS.LBR.LMus.Myt.Mx - *Mytilus edulis* beds on littoral mixed substrata
- LS.LBR.LMus.Myt.Sa - *Mytilus edulis* beds on littoral sand
- LS.LBR.LMus.Myt.Mu - *Mytilus edulis* beds on littoral mud
- LS.LSa.St.MytFab - *Mytilus edulis* and *Fabricia sabella* in littoral mixed sediment
- SS.SBR.SMus.MytSS - *Mytilus edulis* beds on sublittoral sediment

Current and potential threats

- *Commercial fisheries:* Targeted removal of mussels, physical damage and smothering from use of mobile fishing gear.
- *Water Quality: Mytilus edulis* bioaccumulates pollutants in seawater which may lead to sublethal, and in some cases, lethal responses.
- *Coastal developments:* Physical damage and displacement from infrastructure development, dredging, trenching and cable/pipe-laying.
- *Anchoring:* Physical damage can arise from sustained anchoring and mooring chains.
- *Bait digging*: Removal of mussels as fishing bait and physical damage from associated trampling in the intertidal.

Blue mussel, *Mytilus edulis* on intertidal sediment (Photo: CCW).

Author Aethne Cooke, CCW

Calaminarian Grasslands

Correspondence with existing habitat/s

- UK BAP broad habitat: Inland rock
- Phase 1: I1.2 Scree *pp*; I2.2 Spoil *pp*
- NVC: OV37 and other un-described types, i.e. not fully covered by NVC
- Annex I: synonymous with H6130 Calaminarian grasslands of the *Violetalia calaminariae* (see http://www.jncc.gov.uk/ProtectedSites/SACselection/habitat.asp?FeatureIntCode=H6130)

Description

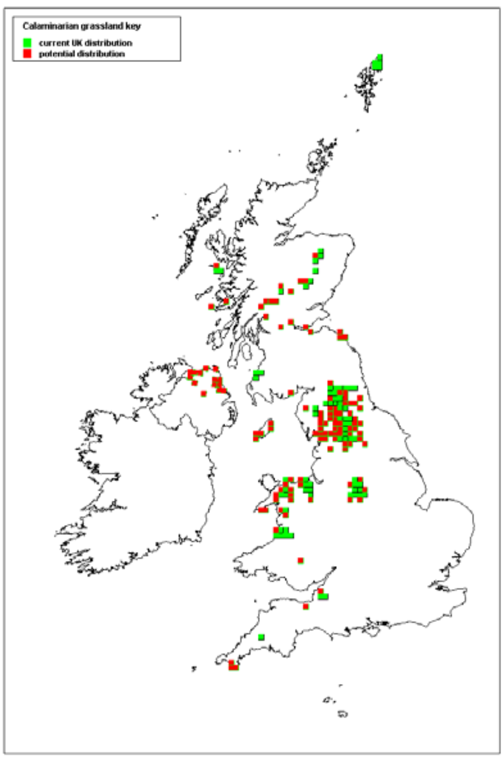
Calaminarian grasslands include a range of semi-natural and anthropogenic sparsely vegetated habitats on substrates characterised by high levels of heavy metals such as lead, chromium and copper, or other unusual minerals. These are associated with outcrops of serpentine and river gravels rich in heavy metals, as well as with artificial mine workings and spoil heaps. Seral succession is slowed or arrested by the toxicity of the substrate. Open-structured plant communities, sometimes known as 'Calaminarian grasslands', typically occur, composed of ruderal/metallophyte species of lichens, bryophytes and vascular plants, such as spring sandwort *Minuartia verna*, alpine pennycress *Thlaspi arvense*, and genetically adapted races of species such as thrift *Armeria maritima* and bladder campion *Silene maritima*. Notable species include *Epipactis youngiana*, *Asplenium septentrionale, Ditrichum cornubicum, Marsupella profunda, Cephaloziella nicholsonii* and *Ditrichum plumbicola.* In northern parts of the UK there are local populations of boreal species which characterise these habitat conditions in Scandinavia, such as Scottish sandwort *Arenaria norvegica* and the endemic Shetland mouse-ear *Cerastium nigrescens*.

Vegetation on metalliferous substrates is found in three distinct settings in the UK:

- Near-natural substrates;
- Mine spoil, in situations where naturally occurring metalliferous outcrops have been quarried away;
- Metalliferous river gravels, sometimes derived from washed-out mine workings. In many localities the metalliferous outcrops which would have been the natural habitat for the species referred to above have been quarried away but the mine spoil still provides suitable habitat.

Although this habitat occurs widely across the north and west of the UK, its extent is restricted because of the limited occurrence of suitable rock types. Near-natural examples are highly localised on outcrops and scree of serpentine and related rock types, mostly in the Scottish Highlands and Islands. Metalliferous mine spoil and river gravels are more widespread, but still local, in certain urban and post-industrial areas, particularly in parts of England and Wales. A map of known and potential distribution of the Annex I type 6130 is given below.

H6130 Calaminarian grasslands of the Violetalia calaminariae



No comprehensive data are available on the UK extent, but estimates are given in the table below: This is based mainly on NVC and Phase 1 surveys undertaken over the last 15-20 years, but accurate survey data are lacking for many areas. A total of 326 ha is thought to occur in SACs. Forms referable to the *Festuca ovina - Minuartia verna* community (OV37) are estimated to cover less than 100 ha in Britain (David Stevens, pers. comm.). In Scotland, most of the resource appears to occur within SSSIs (Dave Horsfield, pers. comm.).

Map 1: UK distribution of Annex I type 6130 Calaminarian grasslands of the *Violetalia* *calaminariae*. Current distribution shown in green (from Rodwell and others. 2007) The European Context of British Lowland Grasslands. JNCC Report in press). The potential distribution shown in red is an amalgamation of the distributions of indicator species *Minuartia verna*, *Thlaspi caerulescens*, *Lychnis alpina*, *Cerastium nigrescens* (Preston and others, 2002) and *Ditrichum plumbicola* (Hill and others., 1992).

Extent of H6130 Calaminarian grasslands of the *Violetalia calaminariae* in the UK:

	Area (ha)	Reliability of measure/estimate
England	<200	Estimate based on areas on SACs and expert opinion
Scotland	<200	Estimate based on areas on SACs and expert opinion
Wales	50	Estimate based on areas on SACs & Stevens & others. (2002) (areas of OV37 in Wales)
Northern Ireland	absent	–
Total UK extent	<450	Estimate calculated from different data sources, incomplete inventory data & expert opinion

Carbonate Mounds

This habitat description has been adapted from the OSPAR habitat description (2005) (www.ospar.org/ work areas/ biological diversity and ecosystems. Definition available through the linked text; 'case reports')

Correspondence with existing habitats

- OSPAR habitat: Carbonate mounds
- Habitats Directive Annex 1 –not covered

Description

Carbonate mounds are very steep-sided mounds of variety of shapes, which may be up to 350m high and 2 km wide at their base (Weering *et al*, 2003). They occur offshore in water depths of 500-1100m with examples present in the Porcupine Seabight and Rockall Trough (Kenyon *et al,* 2003). Carbonate mounds may have a sediment veneer, typically composed of carbonate sands, muds and silts. The cold-water reef-building corals *Lophelia pertusa* and *Madrepora oculata* which form colonies up to 30cm high, as well as echiuran worms are characteristic fauna of carbonate mounds. The solitary coral *Desmophyllum cristagalli* and the octocoral *Stylaster* sp. were also occasionally present and nearby areas of cobbles and small boulders provided a surface for settlement of individual coral colonies (Wilson & Vina Herbon, 1998). Where cold-water corals (such as *Lophelia*) can also be (occasionally) present on the mound summit, coral debris may form a significant component of the overlying substratum. The branching structure underlying dead coral cam provide a surface for settlement which was also elevated from the seabed and was extensively colonised by sponges, bryozoans, hydroids, soft corals, ascidians, calcareous tube worms, zoanthids, crinoids and bivalves. Other species that can be present include; large eunicid wormsnd sipunculids, *Ophiactis balli (*ophiuroid), *Astarte* sp (bivalve), cerianthid anemones and caridean shrimps (Wilson & Vina Herbon, 1998).

There is currently speculation on the origin of carbonate mounds, with possible associations with fault-controlled methane seepage from deep hydrocarbon reservoirs, or gas-hydrate dissociation (Henriet *et al*, 1998) through to the debris from 'cold-water' coral colonies such as *Lophelia*.

Relevant biotopes:

- EUNIS Classification: A6.75
- Marine Habitat Classification scheme v 4.05 – not covered

Current and potential threats

- *Demersal trawling operations*. Fishing activity is very intensive in some of the areas where mounds occur and repeated trawling does not allow time for the continual growth of coral colonies. Recovery may therefore only be possible over a long period of time, if at all.

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OSPAR Commission, 2008: Case Reports for the OSPAR List of Threatened and/or Declining Species and Habitats

Edited by Nikki Chapman, JNCC

Coastal and Floodplain Grazing Marsh

The definition of this habitat remains unchanged from the pre-existing Habitat Action Plan (http://www.ukbap.org.uk/UKPlans.aspx?ID=9) a summary of which appears below.

Grazing marsh is defined as periodically inundated pasture, or meadow with ditches which maintain the water levels, containing standing brackish or fresh water. The ditches are especially rich in plants and invertebrates. Almost all areas are grazed and some are cut for hay or silage. Sites may contain seasonal water-filled hollows and permanent ponds with emergent swamp communities, but not extensive areas of tall fen species like reeds; although they may abut with fen and reed swamp communities.

The exact extent of grazing marsh in the UK is not known but it is possible that there may be a total of 300,000 ha. England holds the largest proportion with an estimate in 1994 of 200,000 ha. However, only a small proportion of this grassland is semi-natural supporting a high diversity of native plant species (5,000 ha in England, an estimated 10,000 ha in the UK).

Grazing marshes are particularly important for the number of breeding waders such as snipe *Gallinago gallinago*, lapwing *Vanellus vanellus* and curlew *Numenius arquata* they support. Internationally important populations of wintering wildfowl also occur including Bewick swans *Cygnus bewickii* and whooper swans *Cygnus cygnus.*

Coastal Saltmarsh

This habitat description has been adapted from the 1994 UK BAP Action Plan for Coastal saltmarsh beds and would benefit from an update.

Correspondence with existing habitats

Habitats Directive – Annex 1 : Estuaries, Salicornia and other annuals colonising mud and sand, Spartina salt meadows and Meditterranean and thermo-Atlantic halophilous scrubs

Description

Coastal saltmarshes in the UK (also known as 'merse' in Scotland) comprise the upper, vegetated portions of intertidal mudflats, lying approximately between mean high water neap tides and mean high water spring tides. For the purposes of this action plan, however, the lower limit of saltmarsh is defined as the lower limit of pioneer saltmarsh vegetation (but excluding seagrass *Zostera* beds) and the upper limit as one metre above the level of highest astronomical tides to take in transitional zones. Saltmarshes are usually restricted to comparatively sheltered locations in five main physiographic situations: in estuaries, in saline lagoons, behind barrier islands, at the heads of sea lochs, and on beach plains. The development of saltmarsh vegetation is dependent on the presence of intertidal mudflats.

Saltmarsh vegetation consists of a limited number of halophytic (salt tolerant) species adapted to regular immersion by the tides. A natural saltmarsh system shows a clear zonation according to the frequency of inundation. At the lowest level the pioneer glassworts *Salicornia* spp can withstand immersion by as many as 600 tides per year, while transitional species of the upper marsh can only withstand occasional inundation.

The communities of stabilised saltmarsh can be divided into species-poor low-mid marsh, and the more diverse communities of the mid-upper marsh. On traditionally grazed sites, saltmarsh vegetation is shorter and dominated by grasses. At the upper tidal limits, true saltmarsh communities are replaced by driftline, swamp or transitional communities which can only withstand occasional inundation. Saltmarsh communities are additionally affected by differences in climate, the particle size of the sediment and, within estuaries, by decreasing salinity in the upper reaches. Saltmarshes on fine sediments, which are predominant on the east coasts of Britain, tend to differ in species and community composition from those on the more sandy sediments typical of the west. The northern limits of some saltmarsh species also influence plant community variation between the north and south of Britain.

Saltmarshes are an important resource for wading birds and wildfowl. They act as high tide refuges for birds feeding on adjacent mudflats, as breeding sites for waders, gulls and terns and as a source of food for passerine birds particularly in autumn and winter. In winter, grazed saltmarshes are used as feeding grounds by large flocks of wild ducks and geese. Areas with high structural and plant diversity, particularly where freshwater seepages provide a transition from fresh to brackish conditions, are particularly important for invertebrates. Saltmarshes also provide sheltered nursery sites for several species of fish.

Since medieval times, many saltmarshes have been reduced in extent by land claim. This practice continued until very recently; for instance, in the Wash 858 ha of saltmarsh were converted to agricultural use between 1970 and 1980. The land enclosed by sea walls was originally converted to grazing marsh with brackish ditches, but since the 1940s large areas of grazing marsh have been agriculturally improved to grow arable crops. As a consequence, many saltmarshes now adjoin arable land, and the upper and transitional zones of saltmarshes have become comparatively scarce in England. Sites still displaying a full range of zonation are particularly valuable for nature conservation. In Scotland and Wales, transitions (e.g. to freshwater, grassland and dune communities) are still comparatively common. In Northern Ireland most saltmarsh is composed of mid- and upper saltmarsh vegetation with transitions to freshwater or grassland.

The most recent saltmarsh surveys of the UK estimate the total extent of saltmarsh (including transitional communities) to be approximately 45,500 ha (England 32,500 ha, Scotland 6747 ha, Wales 6089 ha, and Northern Ireland 215 ha).This resource is concentrated in the major estuaries of low-lying land in eastern and north-west England and in Wales, with smaller areas in the estuaries of southern England, the firths of eastern and south-west Scotland and the sea loughs of Northern Ireland; north-west Scotland is characterised by a large number of very small saltmarsh sites at the heads of sea lochs, embayments and beaches. It is estimated that, at the mean high water line, 24% of the English coastline, 11% of the Welsh coastline and 3% of the Scottish coastline consists of saltmarsh vegetation.

Relevant biotope
LS.LMp.Sm Coastal saltmarsh

Current and potential threats

- *Land claim*. Large-scale saltmarsh land claim schemes for agriculture are now rare. Piecemeal smaller scale land claim for industry, port facilities, transport infrastructure and waste disposal is still comparatively common, and marina development on saltmarsh sites occurs occasionally.
- *Erosion and 'coastal squeeze'*. Erosion of the seaward edge of saltmarshes occurs widely in the high energy locations of the larger estuaries as a result of coastal processes. Many saltmarshes are being 'squeezed' between an eroding seaward edge and fixed flood defence walls. The erosional process is exacerbated in some locations by a reduced supply of sediment. 'Coastal squeeze' is most pronounced in south-east England. The best available information suggests that saltmarshes in the UK are being lost to erosion at a rate of 100 ha a year.
- *Sediment dynamics* Local sediment budgets may be affected by coast protection works, or by changes in estuary morphology caused by land claim, dredging of shipping channels and the impacts of flood defence works over the years.
- *Cord grass*. The small cordgrass, *Spartina maritima*, is the only species of cordgrass native to Great Britain. The smooth cordgrass, *S. alterniflora*, is a naturalised alien that was introduced to the UK in the 1820s. This introduction led to its subsequent crossing with *S. maritima* resulting in both a sterile hybrid, Townsend's cordgrass *S. townsendii*, and a fertile hybrid, commoncordgrass *S. anglica*. The latter readily colonises mudflats and has spread around the coast.
- *Grazing*. Grazing has a marked effect on the structure and composition of saltmarsh vegetation by reducing the height of the vegetation and the diversity of plant and invertebrate species. Intensive grazing creates a sward attractive to wintering and passage wildfowl and waders, whilst less intense grazing produces a tussocky structure which favours breeding waders.

- *Other human influences*. Saltmarshes are affected by a range of other human influences including waste tipping, pollution, drowning by barrage construction, and military activity. Turf cutting, oil pollution, recreational pressure, agricultural improvement (re-seeding and draining) and eutrophication.

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Edited by Nikki Chapman, JNCC

Coastal Sand Dunes

The definition of this habitat remains unchanged from the pre-existing Habitat Action Plan (http://www.ukbap.org.uk/UKPlans.aspx?ID=28) a summary of which appears below.

Coastal sand dunes develop where there is an adequate supply of sand (sediment within the size range 0.2 to 2.0 mm) in the intertidal zone and where onshore winds are prevalent. The critical factor is the presence of a sufficiently large beach plain whose surface dries out between high tides. The dry sand is then blown landwards and deposited above high water mark, where it is trapped by specialised dune-building grasses which grow up through successive layers of deposited sand.

Sand dunes form in relatively exposed locations, and in a number of physiographic situations. The most common are bay dunes, where a limited sand supply is trapped between two headlands; spit dunes, which form as sandy promontories at the mouths of estuaries; and hindshore dunes, which occur in the most exposed locations where large quantities of sand are driven some distance inland, over a low-lying hinterland. This last type forms the largest dune systems in the UK. Less common types are: ness dunes, which build out from the coast; dunes on offshore islands, which are often superimposed on a base of other material such as shingle; climbing dunes where sand is blown up on to high ground adjacent to the beach; and tombolos, where a neck of sand is deposited between two islands or between a promontory and an island.

Sand dune vegetation forms a number of zones, which are related to the time elapsed since the sand was deposited, the degree of stability which it has attained, and the local hydrological conditions. Embryonic and mobile dunes occur mainly on the seaward side of a dune system where sand deposition is occurring and occasionally further inland in blow-outs. They support very few plant species, the most characteristic being marram grass *Ammophila arenaria*. Semi-fixed dunes occur where the rate of sand accretion has slowed but the surface is still predominantly bare sand; marram is still common but there is an increasing number of other species. Fixed dune grassland forms largely closed swards where accretion is no longer significant, the surface is stabilised and some soil development has taken place. Calcareous fixed dunes support a particularly wide range of plant species. On dunes which have become acidified by leaching, acid dune grassland or dune heaths develop. Dune heaths are usually dominated by heather *Calluna vulgaris*. Acidic dunes which are heavily grazed by rabbits may support lichen communities. Dune slack vegetation occurs in wet depressions between dune ridges; it is often characterised by creeping willow *Salix repens* sap. *argentea* and a number of mosses. Fixed dunes and dune heath are particularly threatened habitats and are regarded as priorities under the EC Habitats Directive.

The fixed dune communities mentioned above are, or have been, maintained by grazing, whether by domestic stock or by rabbits. In their absence, the succession proceeds to rough grass and scrub. Dune scrub can include several species but only one of them, sea buckthorn *Hippophaë rhamnoides*, is largely confined to dunes; it is native to eastern England and south-east Scotland and has been widely introduced elsewhere, where it’s very invasive nature can cause problems. Wetter parts of dune systems may become colonised by sallows *Salix* spp., birches *Betula* spp. or alder *Alnus glutinosa*.

Sand dune communities vary geographically: lyme grass *Leymus arenarius* is increasingly common in northern Britain, growing alongside marram grass in mobile dunes; wild thyme *Thymus polytrichus* is characteristic of south-west England; and common juniper *Juniperus communis* occurs on dunes only in two locations, both in Scotland.

Dune grassland and dune slacks, especially on the more calcareous systems, support a wide variety of colourful flowering plants, including a number of species of orchid. Sand dune systems are also very rich in invertebrates, including butterflies, moths and burrowing bees and wasps.

The Sand Dune Survey of Great Britain (1993-1995) gives the total area of sand dunes as 11,897 ha in England and 8101 ha in Wales. The ongoing Sand Dune Vegetation Survey of Scotland indicates that there may be as much as 48,000 ha of dune and machair in Scotland, of which 33,000 ha is dune. There are approximately 3000 ha of dunes in Northern Ireland. Major dune systems are widely distributed within the UK, being found on all English coasts except the English Channel (other than Sandwich Bay) and the Thames Estuary. They occur on the north and south coasts of Wales and in the northern part of Cardigan Bay. In Scotland dunes are found on all coasts but are less frequent in the north-west and in Shetland; they are particularly extensive in the Western Isles and Inner Hebrides where they are associated with machair. In Northern Ireland the largest dune systems are located along the north and south-east coasts.

Coastal Vegetated Shingle

The definition of this habitat remains unchanged from the pre-existing Habitat Action Plan (http://www.ukbap.org.uk/UKPlans.aspx?ID=29) as summary of which appears below.

Shingle is defined as sediment with particle sizes in the range 2-200 mm. It is a globally restricted coastal sediment type with few occurrences outside north-west Europe, Japan and New Zealand. Shingle beaches are widely distributed round the coast of the UK, where they develop in high energy environments. In England and Wales it is estimated that 30% of the coastline is fringed by shingle. However most of this length consists of simple fringing beaches within the reach of storm waves, where the shingle remains mobile and vegetation is restricted to temporary and mobile strandline communities.

Shingle structures take the form either of spits, barriers or barrier islands formed by longshore drift, or of cuspate forelands where a series of parallel ridges piles up against the coastline. Some shingle bars formed in early post-glacial times are now partly covered by sand dunes as a result of rising sea levels leading to increased deposition of sand.

The origin of coastal shingle varies according to location. In southern England, much of it is composed of flint eroded out of chalk cliffs. Shingle deposits of Ice Age origin lying on the sea bed may be reworked by wave action and redeposited or moved by longshore drift along the coast. In northern and western Britain, shingle may derive from deposits transported to the coast by rivers or glacial outwash. Shingle structures are of geomorphological interest.

The vegetation communities of shingle features depend on the amount of finer materials mixed in with the shingle, and on the hydrological regime. Classic pioneer species on the seaward edge include sea kale *Crambe maritima*, sea pea, *Lathyrus japonicus,* Babington's orache*, Atriplex glabriuscula,* sea beet, *Beta vulgaris,* and sea campion *Silene uniflora*; which can withstand exposure to salt spray and some degree of burial or erosion. Further from the shore, where conditions are more stable, mixed communities develop, leading to mature grassland, lowland heath, moss and lichen communities, or even scrub. Some of these communities appear to be specific to shingle, and some are only known from Dungeness. On the parallel ridges of cuspate forelands, patterned vegetation develops, due to the differing particle size and hydrology. Some shingle sites contain natural hollows which develop wetland communities, and similar vegetation may develop as a result of gravel extraction.

Shingle structures may support breeding birds including gulls, waders and terns. Diverse invertebrate communities are found on coastal shingle, with some species restricted to shingle habitats.

Shingle structures sufficiently stable to support perennial vegetation are a comparatively rare feature even in the UK. The major vegetated shingle structures surveyed in 1987-1991 by Sneddon and Randall totalled some 5000 ha in England, 700 ha in Scotland and 100 ha in Wales. Dungeness, in southern England, is by far the largest site, with over 2000 ha of shingle, and there are only five other structures over 100 ha in extent in the UK. The main concentrations of vegetated shingle occur in East Anglia and on the English Channel coast, in north-east Scotland, and in north-west England and south-west Scotland. The Welsh coast has a number of small sites. This habitat is poorly represented in Northern Ireland, where the key site is Ballyquintin in County Down.

Cold-water Coral Reefs

This habitat description has been adapted from the OSPAR habitat descriptions (2005) (www.ospar.org work areas/biological diversity and ecosystems. Definition available through the linked text 'case reports)' and information extracted from the *Lophelia pertusa* JAMP OSPAR assessment, 2008.

Correspondence with existing habitats

- 1994 UK BAP habitat : *Lophelia pertusa* Reefs http://www.ukbap.org.uk/UKPlans.aspx?ID=45).
- OSPAR habitat: *Lophelia pertusa* Reefs
- Habitats Directive-Annex 1:Reefs

Description

Lophelia pertusa, a cold water, reef-forming coral, has a wide geographic distribution ranging from 55°S to 70°N, where water temperatures typically remain between 4-8°C. These reefs are generally subject to moderate current velocities (0.5 knots). The majority of records occur in the north-east Atlantic. The extent of *L. pertusa* reefs vary and occur within a depth range of 200->2000 m. The species that associate with *L. pertusa* reefs change from one biogeographic province to another with an overall reduction in diversity from south to north coupled with a shift towards a more northern fauna (Hall-Spencer *et al.* 2002, 2007; Roberts *et al*. 2008).

The biological diversity of the reef community can be three times as high as the surrounding soft sediment (ICES, 2003), suggesting that these cold-water coral reefs may be biodiversity hotspots. Characteristic species include other hard corals, such as *Madrepora oculata* and *Solenosmilia variabilis*, the redfish *Sebastes viviparous* and the squat lobster *Munida sarsi*.

The reef-forming coral *Madrepora oculata* often occurs amongst *L. pertusa* reefs which trap sediment and create carbonate-rich deposits to form isolated habitats of high benthic biomass. The reefs commonly harbour abundant sessile suspension feeders and a multitude of grazing, scavenging and predatory invertebrates such as echiurans (e.g. *Bonellia* sp.), molluscs (e.g. *Acesta oxcavate*), crustaceans (*Pandalus* spp. *Munida* spp.) and echinoderms (e.g. *Cidaris* spp. *Gorgonocephalus* sp.) (Freiwald *et al*. 2004; Hovland, 2008; Roberts *et al*. 2006, 2008). *L. pertusa* reefs occur on hard substrata; this may be *Lophelia* rubble from an old colony or on glacial deposits. For this reason, *L. pertusa* reefs can be associated with iceberg plough-mark zones.

The conservation importance of *L. pertusa* reefs is increasingly recognised, not only because of their longevity and high biodiversity, but also due to potential benefits for commercial fisheries. Although functional relationships have not been demonstrated so far, the reefs are presumed to act as breeding grounds for commercial species such as redfish (*Sebastes* spp.), which hide amongst the complex 3-dimensional structure, and provide hunting territory for demersal predators such as monkfish, cod, ling, saithe and tusk (Husebo *et al*. 2002; Costello *et al*. 2005).

Lophelia pertusa larvae require hard substrata to settle and its reefs mainly occur at depths where temperature varies less than in surface waters, in areas with strong currents and sloping bathymetry which enhance the supply of organic material for reef growth (Frederiksen *et al*. 1992; Duineveld *et al*. 2004; Thiem *et al*. 2006). *Lophelia pertusa* requires temperatures between 4-13°C and salinities of around 35-38 psu, with oxygen concentrations >3 ml l^{-1} in waters saturated with aragonite (Freiwald *et al*. 2004; Taviani *et al*. 2005; Dodds et al. 2007; Davies *et al*. 2008).

Relevant biotopes

SS.SBR.Crl.Lop Coral reefs
SS.SBR.Crl.Lop *Lophelia* reefs

Current and potential threats

- *Fisheries:* Trawling
- *Offshore Industry:* Physical damage from construction and smothering resulting from the associated discharges of drilling mud and drill cuttings.
- *Eutrophication:* Resulting from discharges of land-based activities (Hall-Spencer, University of Plymouth, pers. comm. 2008)
- *Scientific sampling* Given the slow growth rate of the reefs, they may take centuries to recover from damage, if at all (Hall- Spencer, University of Plymouth, pers. comm. 2008)..

References

OSPAR Commission, 2008: Case Reports for the OSPAR List of Threatened and/or Declining Species and Habitats
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Image

Figure above:*Lophelia pertusa* reef (showing the white and orange colour morphs) at 400 m depth off Rost, Norway, the largest cold-water coral reef on Earth. Photograph taken on Polarstern Cruise ARK-XXII © Jago/IFM Geomar 2007.

Edited by Nikki Chapman, JNCC

Deep-sea Sponge Communities

This habitat description has been adapted from the OSPAR habitat description (2005) (www.ospar.org/ work areas/ biological diversity and ecosystems. Definition available through the linked text 'case reports')

Correspondence with existing habitats

- OSPAR habitat: Deep–sea sponge aggregations
- Habitats Directive - Annex 1: Reefs

Description

Deep sea sponge aggregations are principally composed of sponges from two classes: Hexactinellida and Demospongia. Glass sponges (Hexactinellidae) tend to be the dominant group of sponges in the deep sea although demospongids such as *Cladorhiza* and *Asbestopluma* are also present. The massive sponges that dominate some areas include *Geodia barretti, G. macandrewi,* and *Isops phlegraei*. They can occur at very high densities, particularly on the slope in areas where substrate and hydrographic conditions are favourable. Survey material from a sponge field in the northern North Sea and other locations had a comparable diversity and density of sponges with tropical reefs (Konnecker, 2002). The sponges also influence the density and occurrence of other species by providing shelter to small epifauna, within the oscula and canal system, and an elevated perch, e.g. for brittlestars (Konnecker, 2002). Deep-sea sponges have similar habitat preferences to cold-water corals, and hence are often found at the same location. Research has shown that the dense mats of spicules present around sponge fields may inhibit colonisation by infaunal animals, resulting in a dominance of epifaunal elements (Gubbay, 2002). Information indicates that dominant species are slow growing taking several decades to reach large size (Klitgaard & Tendal, 2001). The habitat and the rich diverse associated fauna is therefore likely to take many years to recover if adversely affected (Konnecker, 2002).

They occur between water depths of 250-1300m (Bett & Rice, 1992), where the water temperature ranges from 4-10°C and there is moderate current velocity (0.5 knots). Deep-sea sponge aggregations may be found on soft substrata or hard substrata, such as boulders and cobbles which may lie on sediment. Iceberg plough-mark zones provide an ideal habitat for sponges because stable boulders and cobbles, exposed on the seabed, provide numerous attachment/settlement points (B. Bett, *pers comm.*). However, with 3.5kg of pure siliceous spicule material per m^2 reported from some sites (Gubbay, 2002), the occurrence of sponge fields can alter the characteristics of surrounding muddy sediments. Densities of occurrence are hard to quantify, but sponges in the class Hexactinellida have been reported at densities of 4-5 per m^2, whilst 'massive' growth forms of sponges from class Demospongia have been reported at densities of 0.5-1 per m^2 (B. Bett, pers. comm.).

Relevant biotopes

- EUNIS Classification: A6.62 – Deep-sea sponge aggregations (no associated biotopes)
- Marine Habitat Classification scheme v 4.06 - not covered

Current and potential threats

- *Fishing-bottom trawling* : There are anecdotal reports of sponges being brought up less and less frequently as the same area is fished. Little is known about damaged sponges that are left behind e.g. dislodging or smothering
- *Increased turbidity*: Which can lead to smothering.
- *Toxic pollution*: Little is known about the tolerance of sponges to toxic pollution of the water column although this may result in a higher than normal rate of abnormal and deformed spicules in a couple of species (Konnecker, 2002). This may be an issue if there are sponge fields in the vicinity of offshore oil and gas facilities.
- *Bioprospecting operations*.: they many different chemical compounds are found in sponge tissues, and may have important pharmaceutical properties, especially as antibiotic and anti-cancer agents (Konnecker, 2002).

Image

Geodia sponge ©Tomas Lundälf , Tjaernoe Centre for Underwater Documentation

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OSPAR Commission, 2008: Case Reports for the OSPAR List of Threatened and/or Declining Species and Habitats

Edited by Nikki Chapman, JNCC

Estuarine Rocky Habitats

Correspondence with existing habitats

- UK BAP broad habitat: Littoral rock
- May be a component part of Annex 1 habitats
- Numerous illustrative biotopes

Description

This habitat encompasses rocky habitats in estuaries, extending from supralittoral lichens down to the subtidal circalittoral. Estuarine rocky habitats incorporate substrata types such as bedrock and stable boulders. Generally rias, fjords and fjards are the most relevant types of inlet for rocky estuarine habitats.

Rocky habitat is a comparatively uncommon feature in estuaries in the UK. Although generally forming small areas in comparison with the extent of sediment substrates in estuaries, estuarine rocky habitats contribute much to the overall biodiversity within estuaries. Estuarine rocky habitats, along with a complex of other estuarine habitats, are part of the 'connectivity' of land, estuary and open sea. For example, the rich and sheltered waters of estuaries provide nursery grounds for fish, and estuarine rocky habitats are an important component of these nursery grounds.

Conditions in estuaries are distinctly different to those on the open coast, where rocky habitats are generally more abundant. Rocky habitats in estuaries are typically located in low wave energy environments with reduced salinity, and experience accelerated tidal streams with increased turbidity and siltation. The communities present on rocky habitats are adapted to these conditions and consequently their composition and character is different to that found on similar substrata on the open coast e.g. the cape form of the sugar kelp *Laminaria saccharina* and the tasselled morphology of sponges such as *Halichondria panicea*.

Depending on the extent and heterogeneity of the substrate, there can be a wide variety of community types associated with estuarine rocky habitats. The extent of rocky habitat in estuaries can range from a narrow strip restricted to the top of the shore to littoral reef structures extending to the subtidal, particularly in rias. Similarly, the topography of estuarine rocky shores varies from flat and gently sloping to rugged reefs and large boulders with many microhabitats.

In general terms, the supralittoral of rocky habitat supports yellow and grey lichens, with a band of the black lichen *Verrucaria maura* below. These bands may be unusually narrow in areas of low wave exposure. The remainder of the shore can be dominated by fucoids and kelp with an understorey of barnacles, algae, grazing molluscs and gammarids, and occasionally sponges and seasquirts. Where the topography is varied, there is added community interest - for example entangled turfs of the red algae *Gelidium pusillum* and *Catenella caespitosa* on shaded surfaces, dense covers of the seasquirt *Dendrodoa grossularia* on overhangs, variable salinity hydroids on shaded verticals, and green algae dominated rockpools in depressions.

The communities on subtidal estuarine rocky habitats are equally variable, and at the most diverse end of the scale, may support a rich and exceptionally abundant sessile epibiota of anemones (e.g. *Metridium senile* and *Diadumene sincta*), filter feeding sponges (e.g. *Halichondria panacea*, *Hymeniacidon perleve*, *Haliclona oculata*, *Raspalia* spp., *Suberties* spp. and *Stelligera* spp.), bryozoa (e,g, *Alcyonidium digitata*), hydroids (e.g. *Sertularella gaudichaudi*, *Bugula* spp. and *Tubularia* spp.) and seasquirts (e.g. *Ascidiella aspersa* and *Dendrodoa grossularia*).

Estuarine rocky habitats often display a transition of community types down the length of an estuary, reflecting the different environmental conditions i.e. those at the upper ends of estuaries being specific to ultra sheltered and low salinity to communities similar to open coast rock communities towards the mouth of estuaries.

This habitat excludes rocky habitats in areas of permanent full salinity. Some occurrences of estuarine rocky habitats may also fall within the BAP habitat of 'Tideswept Channels' and may contain examples of the BAP 'Intertidal Underboulder Community' habitat. The fucoid alga *Ascophyllum nodosum mackaii* and the native oyster *Ostrea edulis*, both UK BAP priority species, can be associated with estuarine rocky habitats.

Summary of environmental preferences:

Salinity	Variable - reduced
Wave exposure	Moderately exposed to ultra sheltered
Tidal streams	Weak - strong
Substratum	Bedrock, stable boulders
Zone/depth	Supralittoral to circalittoral

Most estuarine rocky habitats are found in the north and western UK; few examples are found on the predominantly soft shores of eastern England.

Illustrative biotopes

Some of the identified biotopes are associated with estuarine conditions only. However, not all biotopes identified are exclusive to an estuarine environment, and additional biotopes are included which may be found in estuarine conditions, but not exclusively.

- LR.LLR.FVS - Fucoids in variable salinity
- LR.LLR.FVS.PelVS - *Pelvetia canaliculata* on sheltered variable salinity littoral fringe rock
- LR.LLR.FVS.FspiVS - *Fucus spiralis* on sheltered variable salinity upper eulittoral rock
- LR.LLR.FVS.FvesVS - *Fucus vesiculosus* on variable salinity mid eulittoral boulders and stable mixed substrata
- LR.LLR.FVS.AscVS - *Ascophyllum nodosum* and *Fucus vesiculosus* on variable salinity mid eulittoral rock
- LR.LLR.FVS.Ascmac - *Ascophyllum nodosum* ecad *mackai* beds on extremely sheltered mid eulittoral mixed substrata
- LR.LLR.FVS.FserVS - *Fucus serratus* and large *Mytilus edulis* on variable salinity lower eulittoral rock
- LR.LLR.FVS.FCer - *Fucus ceranoides* on reduced salinity eulittoral rock
- IR.LIR.KVS.Cod - *Codium* spp. with red seaweeds and sparse *Laminaria saccharina* on shallow, heavily-silted, very sheltered infralittoral rock
- IR.LIR.KVS.LsacPsaVS - *Laminaria saccharina* and *Psammechinus miliaris* on variable salinity grazed infralittoral rock
- IR.LIR.KVS.LsacPhyVS - *Laminaria saccharina* with *Phyllophora* spp. and filamentous green seaweeds on variable or reduced salinity infralittoral rock

Further biotopes which are not exclusive to an estuarine environment:
LR.FLR.Eph.EntPor - *Porphyra purpurea* and *Enteromorpha* spp. on sand-scoured mid or lower eulittoral rock
LR.FLR.Eph.Ent - *Enteromorpha* spp. on freshwater-influenced and/or unstable upper eulittoral rock
LR.FLR.CvOv.SpR.Den - Sponges, shade-tolerant red seaweeds and *Dendrodoa grossularia* on wave-surged overhanging lower eulittoral bedrock and caves
LR.FLR.Rkp.G - Green seaweeds (*Enteromorpha* spp. and *Cladophora* spp.) in shallow upper shore rockpools
LR.FLR.Lic.Ver.Ver - *Verrucaria maura* on very exposed to very sheltered upper littoral fringe rock
LR.FLR.Lic.YG - Yellow and grey lichens on supralittoral rock

Current and potential threats

- *Commercial fisheries:* Communities in naturally sheltered conditions, such as those of estuarine rocky habitats, are not resilient to physical disturbance type impacts caused by mobile fishing gear.
- *Water Quality:* Estuaries are often major areas of urban and industrial development. As a result, estuaries and estuarine rocky habitats have experienced substantial losses through land claim, reduction in water quality (through industrial contaminants and also agricultural practices resulting in enhanced nutrient input and silt loading). Estuaries also receive disperse and point contaminant inputs from inland areas.
- *Dredging:* Estuaries form natural harbours and are used as safe havens for vessel traffic. With this use of estuaries is the associated need for navigational channels and dredging, with both direct and indirect impacts on estuarine rocky habitats.
- *Coastal Protection:* Coastal defence is widespread in estuarine environments to protect private dwellings and also industrial infrastructure. This can have immediate direct impacts on estuarine rocky habitats or indirect impacts away from the point of coastal defence.
- *Climate Change:* In Wales, sea level rise and increased storminess are likely to exacerbate the existing infilling of south and west facing estuaries, where eroded sediment is deposited within the estuary, gradually covering rocky outcrops.
- Non-natives:

Image

Figure 1. Estuarine rock habitat with *Ascophyllum nodosum* (Photo: CCW)

Figure 2. *Fucus serratus* and *Ascophyllum nodosum on boulders.* (Photo: JNCC image collection, Rodger Mitchell)

Author Aethne Cooke, CCW

Eutrophic Standing Waters

The definition of this habitat remains unchanged from the pre-existing Habitat Action Plan (http://www.ukbap.org.uk/UKPlans.aspx?ID=23) a summary of which appears below.

Physical and chemical status

Eutrophic standing waters are highly productive because plant nutrients are plentiful, either naturally or as a result of artificial enrichment. These water bodies are characterised by having dense, long-term populations of algae in mid-summer, often making the water green. Their beds are covered by dark anaerobic mud, rich in organic matter. The water column typically contains at least 0.035 mg L -1 total phosphorus (which includes phosphorus bound up in plankton and 0.5 mg L -1 or more total inorganic nitrogen (mainly in the form of dissolved nitrates). Many lowland water bodies in the UK are now heavily polluted, with nutrient concentrations far in excess of these levels although there is some geographical variation in the extent of the enrichment. This action plan covers natural and man made still waters such as lakes, reservoirs and gravel pits but it excludes small pools, field ponds and brackish waters. It includes some waters, such as Lough Neagh, Northern Ireland, which have been enriched as a result of human activity and so have been forced along the trophic continuum from a mesotrophic to a eutrophic state. The biodiversity action plans for mesotrophic and eutrophic waters are therefore complementary and their implementation should be co-ordinated. Eutrophic waters are most typical of hard water areas of the lowlands of southern and eastern Britain, but they also occur in the north and west, especially near the coast.

There are no accurate estimates of the amount of eutrophic standing water in Great Britain. The total area of still inland water is estimated as 675 km^2 in England, 125 km^2 in Wales and 1604 km^2 in Scotland. Current work suggests that over 80% of this resource in England, some 40% in Wales and approximately 15% in Scotland is eutrophic. On this assumption, the area of eutrophic standing water in Great Britain would be about 845 km^2. Measurements made by the Environment and Heritage Service put the area of eutrophic standing water in Northern Ireland at approximately 940 km^2. The total UK area for eutrophic standing waters is therefore likely to be around 1785 km^2.

Biological status

In their natural state eutrophic waters have high biodiversity. Planktonic algae and zooplankton are abundant in the water column, submerged vegetation is diverse and numerous species of invertebrate and fish are present. Plant assemblages differ according to geographical area and nutrient concentration but fennel-leaved pondweed *Potamogeton pectinatus* and spiked water-milfoil *Myriophyllum spicatum* are characteristic throughout the UK. Common floating-leaved plants include yellow water lily *Nuphar lutea* and there is often a marginal fringe of reedswamp, which is an important component of the aquatic ecosystems. A rare plant found in a few eutrophic waters is ribbon-leaved water-plantain *Alisma gramineum.*

Bottom-dwelling invertebrates such as snails, dragonflies and water beetles are abundant and calcareous sites may support large populations of the native freshwater crayfish *Austropotamobius pallipes*. Coarse fish such as roach *Rutilus rutilus*, tench *Tinca tinca* and pike *Esox lucius* are typical of eutrophic standing waters, but salmonids also occur naturally in some. Amphibians, including the protected great crested newt *Triturus cristatus*, are often present and the abundance of food can support internationally important bird populations. Loch Leven and Lough Neagh, for example, each support over 20,000 waterfowl, including large numbers of wintering whooper swan *Cygnus cygnus*. Loch Leven is nationally important for breeding ducks such as wigeon *Anas penelope*, gadwall *Anas strepera* and shoveler *Anas clypeata*, and Lough Neagh is of national importance for breeding great crested grebe *Podiceps cristatus*.

For centuries, periodic `blooms` of blue green algae, which may be natural phenomena, have been documented in Llyn Syfaddan (Llangorse Lake), south Wales, and in the meres of the west Midlands. Lakes change naturally over time, slowly filling in with silt and vegetation and usually, in the absence of human impact, gradually becoming less fertile. In water bodies which are heavily enriched as a result of human activity, biodiversity is depressed because planktonic and filamentous algae (blanket-weed) increase rapidly at the expense of other aquatic organisms. Sensitive organisms, such as many of the pondweed *Potamogeton* and stonewort *Chara* species, then disappear and water bodies may reach a relatively stable but biologically impoverished state.

File Shell Beds

Correspondence with existing habitats

Not covered by either OSPAR or habitats Direceitve Annex A

Definition

Limaria hians, commonly known as the ‘gaping file shell’, has been described as the most beautiful British bivalve (Yonge and Thompson, 1976). Individuals have a solid, but thin and delicately ribbed, shell up to 4 cm in length with a prominent gape running along the dorsal side. Even when the valves are closed, long vibrant orange tentacles (fringing the red mantle tissue) protrude (hence ‘gaping’). The *Limaria* form characteristic woven 'nests' or galleries constructed from byssal threads and the animals themselves are rarely seen above the seabed (Hall-Spencer and Moore, 2000).

Limaria hians beds in tide-swept sublittoral muddy mixed sediment (SS.SMX.IMX.Lim) have been recorded from 4-98 m on mixed muddy gravel or sand, coarse sands and muddy maerl in areas with weak to strong tidal streams and across the spectrum of wave exposure (although it is unlikely that dense beds can survive in shallow wave exposed locations) (Connor *et al.* 1997; JNCC, 1999; Hall-Spencer & Moore, 2000b; Tyler-Walters, H. 2003).

File shell beds are characterized by dense populations of *Limaria hians* where nests coalesce into a carpet over the sedimentary substratum. These nests can be built of shell, stones debris and maerl (when present) interlaced by several hundred byssus threads, and lined by mucus, mud and their faeces (Gilchrist, 1896; Hall-Spencer & Moore, 2000b). Nests may be constructed by expansion of smaller burrows, in gravel, shell sand or laminarian holdfasts, or may be simply composed of byssus threads (see Merrill & Turner (1963) and Gilmour (1967) for details). Nests are about the maximum gape of shell in diameter by about twice the length of the animal, with holes for the entrance and exit of water. Nests vary in size and complexity with individual *Limaria hians* being recorded from nests of 2-5 cm diameter, while larger nests of up to 25 cm diameter and 10 cm in length consisted of numerous ventilated holes and galleries (Gilmour, 1967; Tebble, 1976; Hall-Spencer & Moore, 2000). Hall-Spencer and Moore (2000) reported that six of these large nests contained 24-52 small and 25-40 large individuals of *Limaria hians*, with adult individuals occupying single galleries with two ventilation holes, while juveniles occupied complex galleries with multiple ventilation holes. *Limaria hians* can also occur individually or in small numbers, for example in kelp holdfasts, or under stones intertidally (Jason Hall-Spencer, pers comm.).

The biotope occurs at high densities in the Creag Gobhainn area of Loch Fyne (Hall-Spencer & Moore, 2000), is widespread in areas of accelerated tidal streams within Loch Sunart (Howson, 1996; Bates *et al*. 2004; Mercer *et al*. 2007) and a number of other sealochs on the west coast of Scotland (Loch Carron, Loch Creran, Loch Alsh, Lochs Broom and lower Loch Linnhe) and within Moross Channel, Mulroy Bay, Ireland (Minchin, 1995).

Biotopes associated with this habitat:

Limaria hians beds in tide-swept sublittoral muddy mixed sediment (SS.SMX.IMX.Lim).

Further information & references on this biotope is available from the Marlin website - www.marlin.ac.uk/biotopes/Bio_Eco_IMX.Lim.htm.

Current and potential threats

- *Fisheries:* Trawling

Image

		
Limaria hians on nest surface (openings visibles) at ~14m - Loch Carron - Photo Laura Baxter © SNH	*Limaria hians* nest surface openings ~14m - - Loch Carron - Photo Laura Baxter © SNH	Empty *Limaria hians* shell on dense carpet of nest material (numerous nest openings visible) ~14m - Loch Carron - Laura Baxter © SNH
		
Limaria hians with brittlestars - Loch Sunart - Photo Jon Moore © SNH	*Limaria hians* with brittlestars - Loch Sunart - Photo Jon Moore © SNH	*Limaria hians* with brittlestars in mixed sediments - Loch Sunart - Photo Christine Howson © SNH

File shell beds images, SNH

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Fragile Sponge and Anthozoan Communities on Subtidal Rocky Habitats

The Welsh BAP Habitat Atlas (20008) contains a description of this habitat which has been modified for use at a UK level.

This habitat refers to both shallow subtidal communities and deepwater communities e.g. CR.HCR.DpSp.PhaAxi- found at 3-50m deep. This habitat is still out to consultation.

Correspondence with existing habitats

Habitats Directive – Annex 1: Reefs

Habitat description

These communities are found on bedrock which is locally sheltered but close to tide-swept or wave exposed areas. They are dominated by large, slow growing species such as branching sponges and sea fans. The branching sponges include species such as *Axinella dissimilis*, *Axinella damicornis*, *Axinella infundibuliformis*, *Homaxinella subdola* and to a lesser extent *Raspailia* and *Stelligera* species. Other sponge species which may be present include *Dysidea fragilis*, *Pachymatisma johnstonia*, *Esperiopsis fucorum*, *Hemimycale columella*, *Cliona celata*, *Stelligera rigida*, *Polymastia boletiformis*, *Polymastia mamillaris*, *Stelligera stuposa*, *Raspailia ramosa* and *Tethya aurantium*. A silty hydroid/bryozoan turf may develop in the understorey of this rich sponge assemblage, with species such as *Aglaophenia pluma*, *Cellaria sinuosa, Bugula flabellata*, *Bugula plumosa* and *Bugula turbinata*, and crisiids. Larger species of hydroids such as *Nemertesia antennina* and *Nemertesia ramosa* may be present prominent surfaces together with the bryozoans *Pentapora foliacea* and *Alcyonidium diaphanum*. Other fauna includes aggregations of the colonial ascidians *Clavelina lepadiformis* and *Stolonica socialis*, together with the yellow cluster anemone *Parazoanthus axinellae*..

UK & Wales distribution

In Wales, this community is primarily found where there is steeply sloping bedrock with local shelter. Sites include north and west Anglesey, the Lleyn peninsula, and in Pembrokeshire from Strumble Head in the north to Stackpole in the south, excluding St Brides Bay. Elsewhere, this community is present around England's south-west peninsula from west Dorset to Lundy, and also off the south-east coast of Ireland.

Environmental preferences

Salinity Fully marine
Wave exposure Exposed to moderately exposed (though with local shelter)
Tidal streams Moderately strong (though with local shelter) to weak
Substratum Steeply sloping and inclined bedrock or large boulders
Zone/depth Upper circalittoral and lower circalittoral

Photograph by Dr Rohan Holt, showing a large specimen of the sponge *Axinella dissimilis*.

Illustrative biotopes

CR.HCR.XFa.ByErSp.Eun *Eunicella verrucosa* and *Pentapora foliacea* on wave-exposed circalittoral rock
CR.HCR.XFa.ByErSp.DysAct Mixed turf of bryozoans and erect sponges with *Dysidea fragilis* and *Actinothoe sphyrodeta* on tide-swept wave exposed circalittoral rock
CR MCR.EcCR. Car Swi *Caryophyllia smithii* and *Swiftia pallida* on circalittoral rock
CR.MCR.EcCr.CarSwi.LgAs *Caryophyllia smithii*, *Swiftia pallida* and large solitary ascidians on exposed or moderately exposed circalittoral rock
CR.HCR.XFa.SwiLgAs Mixed turf of hydroids and large ascidians with *Swiftia pallida* and *Caryophyllia smithii* on weakly tide-swept circalittoral rock
CR.HCR.DpSp.PhaAxi *Phakellia ventilabrum* and Axinellid sponges on deep, wave- exposed circalittoral rock

Current and potential threats

- *Fisheries:* Physical damage from fisheries that deploy bottom gear on rocky seabed areas, such as potting, some fixed nets, trawling and dredging.
- *Suspended sediments:* Increased levels from fishing activity, dredge disposal or nearby dredging/construction.
- *Divers:* Physical damage resulting from careless fining and inadequate buoyancy control.
- *Angling:* Physical damage from entanglement of branching sponges and corals in fishing line.
- *Climate change:* Potential for a wide range of possible effects, but significance is not known

Reference

Northen, K.O. and Irving, R.A. 2008. An Atlas of selected marine habitats and species listed on Section 42 of the NERC Act 2006. CCW Contract Science Report No: 833, 72pp. + appendices

Editor Nikki Chapman, JNCC

Hedgerows

The definition of this priority habitat has been amended from the pre-existing Habitat Action Plan for ancient and/or species rich hedgerows (http://www.ukbap.org.uk/UKPlans.aspx?ID=7).

A hedgerow is defined as any boundary line of trees or shrubs over 20m long and less than 5m wide, and where any gaps between the trees or shrub species are less that 20m wide (Bickmore, 2002). Any bank, wall, ditch or tree within 2m of the centre of the hedgerow is considered to be part of the hedgerow habitat, as is the herbaceous vegetation within 2m of the centre of the hedgerow. All hedgerows consisting predominantly (i.e. 80% or more cover) of at least one woody UK native species are covered by this priority habitat, where each UK country can define the list of woody species native to their respective country. Climbers such as honeysuckle and bramble are recognised as integral to many hedgerows, however they require other woody plants to be present to form a distinct woody boundary feature, as such they are not included in the definition of woody species. The definition is limited to boundary lines of trees or shrubs, and excludes banks or walls without woody shrubs on top of them.

Based on an analysis of Countryside Survey data, using the threshold of at least 80% cover of any UK native woody species, it is estimated that 84% of countryside hedgerows in GB would be included.

Horse Mussel Beds

This habitat description has been adapted from the 1994 UK BAP Action Plan for *Modiolus modiolus* beds and would benefit from an update

Correspondence with existing habitats

OSPAR habitat : *Modiolus modiolus* reefs
Habitats Directive –Annex 1: Large shallow inlets and bays and Reefs

Description

The horse mussel *Modiolus modiolus* forms dense beds at depths of 5-70 m in fully saline, often moderately tide-swept areas off northern and western parts of the British Isles. Although it is a widespread and common species, true beds forming a distinctive biotope are much more limited and are not known south of the Humber and Severn estuaries. Beds are known from Shetland, Orkney, the Hebrides and other parts of western Scotland, the Ards Peninsula, Strangford Lough, off both ends of the Isle of Man, off north-west Anglesey and north of the Lleyn Peninsula. Dense beds of young *Modiolus modiolus* also occur in the Bristol Channel but often seem not to survive to adulthood. Off North Sea coasts occasional beds occur between Berwickshire and the Humber, and probably elsewhere.
M. modiolus can occur as relatively small, dense beds of epifaunal mussels carpeting steep rocky surfaces, as in some Scottish sealochs, but is more frequently recessed at least partly into mixed or muddy sediments in a variety of tidal regimes. In some sea lochs and open sea areas, extensive expanses of seabed are covered in scattered clumps of semi-recessed *M. modiolus* on muddy gravels. In a few places in the UK, beds are more or less continuous and may be raised up to several

metres above the surrounding seabed by an accumulation of shell, faeces, pseudofaeces and sand. In some areas of very strong currents extensive areas of stony and gravelly sediment are bound together by more or less completely recessed *M. modiolus*, creating waves or mounds with steep faces up to one metre high and many metres long. These areas of semi-recessed and recessed beds may in some cases extend over hundreds of hectares, and in many cases may be considered as `biogenic reefs`, though they are all referred to here as beds. The JNCC Marine Nature Conservation Review (MNCR) has identified four major biotopes dominated by dense *M. modiolus*.
M. modiolus is a long-lived species and individuals within beds are frequently 25 years old or more. Juvenile *M. modiolus* are heavily preyed upon, especially by crabs and starfish, until they are about 3-6 years old, but predation is low thereafter. Recruitment is slow and may be very sporadic; there may be poor recruitment over a number of years in some populations.
There have been no studies of the recovery of damaged beds but full recovery after severe damage would undoubtedly take many years at best and may not occur at all. Some beds may be self maintaining relict features.
The byssus threads secreted by *M. modiolus* have an important stabilising effect on the seabed, binding together living *M. modiolus*, dead shell, and sediments. As *M. modiolus* is a filter feeder, the accumulation of faeces and pseudofaeces probably represents an important flux of organic material from the plankton to the benthos. This rich food source, together with the varied habitat, means that extremely rich associated faunas, sometimes with hundreds of species, may occur on dense beds. The composition of the biotopes is variable, and is influenced by the depth, degree of water movement, substrate, and density of *M. modiolus*. Sponges, ascidians, soft corals, anemones, hydroids, bryozoans, tubeworms, brittlestars, urchins, starfish, barnacles, crabs, spider crabs and other decapods, whelks and other gastropods, scallops and fish all tend to be abundant as epifauna, while there may also be coralline algae and other red seaweeds in shallower areas. Infauna often includes the purple heart urchin *Spatangus purpureus* and numerous bivalves. The possible role of *M. modiolus* beds as nursery areas for other species has not been investigated.

Relevant biotope
EUNIS Code: A5.621, A5.622, A5.623 and A5.624
National Marine Habitat Classification for UK & Ireland code:
SS.SBR.SMus.ModT, *Modiolus modiolus* beds with hydroids and red seaweeds on tide-swept circalittoral mixed substrata
SS.SBR.SMus.ModMx, *Modiolus modiolus* beds on open coast circalittoral mixed sediment
SS.SBR.SMus.ModHAs *Modiolus modiolus* beds with fine hydroids and large solitary ascidians on very sheltered circalittoral mixed substrata and
SS.SBR.SMus.ModCvar *Modiolus modiolus* beds with fine hydroids and large solitary ascidians on very sheltered circalittoral mixed substrata

Current and potential threats

- *Fishing*: Particularly using trawls and dredges for scallops and queen scallops, is known to have caused widespread and long-lasting damage to beds in Strangford Lough and off the south-east of the Isle of Man. Effects include flattening clumps of *M. modiolus* causing fatalities, and loss of much of the associated epifauna, especially emergent types such as *Alcyonium digitatum*. Fishing impacts are likely to be occurring on *M. modiolus* beds elsewhere.
- *Physical impacts: Modiolus* beds are likely to be badly damaged by any other physical impacts, such as aggregate extraction, trenching and pipe/cable-laying, dumping of spoil/cuttings, or use of jack-up drilling rigs.
- *Contaminants : M. modiolus* is known to accumulate contaminants such as heavy metals in spoil disposal areas but the effects on condition, reproduction and mortality rates are unknown.
- *Commercial consumption: M. modiolus* has until now been taken for consumption only on a very small scale in a few localities.
- *Natural fluctuations*: In spawning, settlement and recruitment into adult sizes occur in some beds, with predation of young mussels probably being very influential. These must affect the population structure of *M. modiolus* beds over periods of a few years, but in the long term they seem to be stable features.

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http://www.ukbap.org.uk/habitats.aspx

Edited by Nikki Chapman, JNCC

Inland Rock Outcrop and Scree Habitats

Correspondence with existing habitat/s

- UK BAP broad habitat: Inland rock
- Phase 1: Upland species-rich ledges; inland cliff; scree
- NVC: U16-U18, U21, OV38-OV40
- Annex I: H8110 Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani*); H8120 Calcareous and calcshist screes of the montane to alpine levels (*Thalaspietea rotundifolii*); H8210 Calcareous rocky slopes with chasmophytic vegetation; H8220 Siliceous rocky slopes with chasmophytic vegetation; H6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels; Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels

Description

This habitat covers a wide range of rock types, varying from acidic to highly calcareous and includes five Habitats Directive Annex 1 habitat types. The habitat occurs throughout the uplands, and is particularly characteristic of high altitudes, but is also found at low altitudes notably in northern Scotland. Representation of the two Habitats Directive Annex I chasmophytic vegetation types in the lowlands is also included. Coastal cliff and ledge habitats are excluded as they form part of the maritime cliffs and slopes priority habitat.

Natural rock exposures support a wide range of communities. Screes are typically dominated by *Cryptogramma crispa* and other ferns, lichens and bryophytes. On cliff ledges, tall herbs such as *Sedum rosea* and *Angelica sylvestris* are generally abundant. Chasmophytic vegetation (in rock crevices) is usually dominated by ferns such as *Asplenium viride* and small herbs such as *Thymus polytrichus* and *Saxifraga* spp. Bryophytes and lichens also occur in crevices but are able to flourish on the open rock surfaces where there is a lack of competition from vascular plants.

Many rock habitats, especially cliff faces, rock ledges, gorges and boulder fields are inaccessible to grazing animals and are unmanaged. Others are more accessible, such as fine screes and gently sloping rock outcrops, where accessible grazing may keep the vegetation in check. Burning can affect the more heather-rich rock faces with fires spreading up on to rocky slopes from muirburn below.

The inaccessibility of rock habitats to grazing animals, especially of rock ledges, provides a refuge for many vascular plants that are sensitive to grazing, including numerous local and rare species. Notable species of upland rock and scree habitats include *Athyrium distentifolium, Woodsia ilvensis, Carex rupestris, Cicerbita alpina, Artemisia norvegica, Hieracium sect. Alpestria, Salix lanata, Saxifraga cespitosa* and *S. cernua*.

The botanically rich rock habitats support a number of notable invertebrate species. Key groups include beetles such as *Leistus montanus* and *Nebria nivalis*, Diptera such as species of *Tipula* spp, *Thricops* spp and *Helina vicina*, and spiders such as *Pardosa trailli.* Several key species of birds use inland cliffs for nesting, notably the raptors peregrine and golden eagle, and raven.

Inland rock outcrop and scree habitats are widespread in upland areas of the UK, with more limited occurrence in the lowlands. Acidic rock and scree are especially widespread, whereas calcareous communities are restricted by the underlying geology, and good stands of tall-herb vegetation also tend to be restricted by heavy grazing. Reliable extent data are not available but the UK Second Report on the Implementation of the Habitats Directive (http://www.jncc.gov.uk/page-4060) gives the following broad estimates for the Habitats Directive Annex I habitats: tall-herb ledge vegetation, H6430: 100-300ha; siliceous rock and scree types, H8110 and H8220: 87,000-123,000ha; calcareous rock and scree types, H8120 and H8210: 800-1,700ha.

Intertidal Underboulder Communities

Correspondence with existing habitat/s

- UK BAP broad habitat: Littoral rock
- May be component part of Annex 1 habitats
- LR.MLR.BF.Fser.Bo; IR.MIR.KR.Ldig.Bo at least – see note below

Description

This habitat is found from the mid-shore down to the extreme lower shore, and encompasses areas of boulders (greater than 256 mm diameter) that support a diverse underboulder community. The underboulder habitat, along with fissures, crevices and any interstitial spaces between adjacent boulders, form a series of microhabitats that add greatly to the biodiversity of a shore. The presence of boulders on a shore may also lead to local modification to wave exposure, current strength and levels of trapped organic matter in the area surrounding the boulders themselves. Altering the physical environment in this way results in an enhancement to the immediate biodiversity beyond the boulders themselves. This habitat can occur on a variety of substrata (including bedrock, mixed rock and sediment or mud), but there needs to be a sufficient gap on the underside of the boulder to support an under-boulder community. The richest underboulder communities are often found where there is running seawater (for instance, from pools or lagoons emptying after the tide has fallen). Boulders with a limited underboulder community are not included in this UK BAP habitat, as may occur for example where boulders are embedded in sediment, in low salinity conditions, and where boulders experience high levels of mobility and scour.

Underboulder habitat provides an environment of shade, moisture and shelter. The undersides of boulders can therefore sustain a diverse collection of animals needing these conditions to survive on an otherwise hostile shore. Underboulder communities are generally dominated by an encrusting fauna of sea mats (bryozoans), sponges (Porifera), sea squirts (ascidians), barnacles, coat-of-mail shells (chitons) and calcareous tube worms (polychaetes). Crustaceans such as the hairy porcelain crab *Porcellana platycheles*, the long-clawed porcelain crab *Pisidia longicornis,* other small crabs and squat lobsters shelter on the undersides of boulders together with scale worms and brittle stars. Herbivores include the top shells *Gibbula* spp*.* the winkle *Littorina littorea*, the cushion star *Asterina gibbosa* and the green sea urchin *Psammechinus miliaris*. Encrusting sponges can be predated upon by sea slugs such as the sea-lemon *Archidoris pseudoargus,* as are colonial seasquirts by the cowrie, *Trivia monacha.* Encrusting coralline algae are also found on the undersides of the boulders. The bulbous encrusting bryozoan *Turbicellepora magnicostata* is only recorded in the British Isles in the Isles of Scilly where it is largely restricted to underboulder habitat. Like other examples of hard substrata, the species composition of the upward face of boulders varies with a number of factors – geology, wave exposure, tidal strength and position on the shore *etc*.

Underboulder habitat plays an important role in the life cycle of marine animals, for example the undersurfaces are an important refuge for the eggs of fish, dog whelks and sea slugs. The sheltered gaps between and under the boulders provide security for mobile species such as larger crabs and fish, and also the juveniles of many more species.

Whilst boulders are widespread around the UK coast, only a component of these support a diverse underboulder community.

Summary of environmental preferences:

Salinity	Fully marine – variable salinity
Wave exposure	Exposed, moderately exposed and sheltered shores
Tidal streams	From moderate to strong
Substratum	Boulders overlying bedrock, mixed substrata and muddy sediment
Zone/depth	From the mid-eulittoral to the sublittoral fringe.

Illustrative biotopes

- LR.MLR.BF.Fser.Bo - *Fucus serratus* and under-boulder fauna on exposed to moderately exposed lower eulittoral boulders
- IR.MIR.KR.Ldig.Bo - *Laminaria digitata* and under-boulder fauna on sublittoral fringe boulders

Both these biotopes correlate directly with this habitat. However this underboulder habitat can also be associated with other biotopes which occur on boulders on the mid to lower shore.

Current and potential threats

The level of threat this habitat experiences is influenced by ease of access and proximity to dense populations. Consequently, in certain parts of the UK such as Scotland, it is not considered to be under threat.

- *Boulder turning for peelers*: This activity is undertaken as part of bait collection – the seeking of small, 'soft' crabs or 'peelers'. Where boulders are not replaced in their original position, the underboulder community is exposed to desiccation, predation and wave action, whilst the surface cover of seaweed becomes smothered by the displaced boulder.
- *Boulder turning for winkles*: This is where winkles are collected for human consumption, from around and underneath the boulders. Again, boulders may not be replaced in their original position.
- *Public shore visits:* One of the recreational activities to be had on a shore is to turn boulders to see what lives beneath. Chronically elevated levels of recreational disturbance is generally only associated with popular tourist destinations with easy shore access.
- *Water Quality:* De-oxygenation of underboulders and consequent death of underboulder fauna may be caused by anthropogenic organic input e.g. sewage and agricultural inputs, and also as a consequence of eutrophication. Note that de-oxygenation may also occur naturally from rotting seaweed drift.

Diverse underboulder community including encrusting sponges and the bulbous bryozoan *Turbicellepora magnicostata*. (Image: Keith Hiscock)

Underboulder community of barnacles and bryozoans with the hairy porcelain crab *Porcellana platycheles*, (Image: CCW)

Author Aethne Cooke, CCW

Intertidal Chalk

This habitat description has been adapted from the OSPAR habitat descriptions (2005) (www.ospar.org work areas/ biological diversity and ecosystems. Definition available through the linked text; 'case reports)'

Correspondence with existing habitats

- Part of 1994 UK BAP habitat Littoral and sublittoral chalk
- OSPAR Habitat: Littoral Chalk Communities
- Habitats Directive : Annex 1 Submerged or partially submerged caves & Reefs

Description

The erosion of chalk exposures on the coast has resulted in the formation of vertical cliffs and gently-sloping intertidal platforms with a range of micro-habitats of biological importance. Supralittoral and littoral fringe chalk cliffs and sea caves support various algal communities unique to this soft rock type. Orange, brownish or blackish gelatinous bands of algae, composed of an assemblage of Haptophyceae species such as *Apistonema* spp. *Pleurochrysis carterae* and the orange *Chrysotila lamellosa*, but other genera and species of Chrysophyceae, Haptophyceae and Prasinophyceae are likely to be present as well. The lower littoral fringe may be characterised by a dense mat of green algae *Enteromorpha* spp. and *Ulva lactuca*. Lower down the shore in the eulittoral the generally soft nature of the chalk results in the presence of a characteristic flora and fauna, notably 'rock-boring' invertebrates such as piddocks, overlain by mostly algal-dominated communities (fucoids and red algal turfs) (Gubbay, 2002). Such coastal exposures of chalk are rare in Europe, with those occurring on the southern and eastern coasts of England accounting for the greatest proportion (57%) (ICES, 2003).

A recent survey of chalk cliffs throughout England revealed that 56% of coastal chalk in Kent, and 33% in Sussex has been modified by coastal defence and other works. On the Isle of Thanet (Kent) this increases to 74%. There has been less alteration of chalk at lower shore levels except at some large port and harbour developments (e.g. Dover & Folkestone) (Doody *et al.* 1991; Fowler & Tittley, 1993). Elsewhere in England, coastal chalk remains in a largely natural state.

Relevant biotopes – marine habitat classification scheme v4.05

LR.HLR.FR.Osm *Osmundea pinnatifida* on moderately exposed mid eulittoral rock
LR.MLR.BF.Fser.Pid *Fucus serratus* and piddocks on lower eulittoral soft rock
LR.FLR.CvOv.ChrHap Chrysophyceae and Haptophyceae on vertical upper littoral fringe soft rock
IR.MIR.KR.Ldig.Pid *Laminaria digitata* and piddocks on sublittoral fringe soft rock
LR.FLR.Lic.Bli *Blidingia* spp. on vertical littoral fringe soft rock
LR.FLR.Lic.UloUro *Ulothrix flacca* and *Urospora* spp. on freshwater-influenced vertical littoral fringe soft rock

Current and potential threats

- *Coastal protection works*: Is the main threat to littoral chalk communities. Coast protection work has led to the loss of micro-habitats on the upper shore and the removal of splash-zone communities, including the unique algal communities (Anon, 2000; Fletcher, 1974; Fowler & Tittley, 1993; Wood & Wood, 1986)
- *Toxic contaminants*: The deterioration of waters quality by pollutants and nutrients has caused respectively the replacement of fucoid dominated biotopes by mussel-dominated biotopes, and the occurrence of nuisance *Enteromorpha* spp. blooms (Anon, 2000; Fletcher, 1974; Fowler & Tittley, 1993; Wood & Wood, 1986).
- *Physical loss*: The human disturbance especially be trampling, stone-turning, small-scale fishery and damage to rocks though removal of piddocks blooms (Anon, 2000; Fletcher, 1974; Fowler & Tittley, 1993; Wood & Wood, 1986)
- *Oil spills*: Chalk exposures are vulnerable to oil spills due to the proximity of major shipping lands e.g. Straits of Dover
- *Non-natives*:Native species such as *Sargassum muticum* and *Undaria pinnatifida* have been displaced by non natives along the English Channel have also been displaced, for example by. These threats are significant primarily mainly because of the relatively restricted distribution and small total area of this habitat type.

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Edited by Nikki Chapman

Intertidal Mudflats

This habitat description has been adapted from the 1994 UK BAP Action Plan for Mudflats and would benefit from an update http://www.ukbap.org.uk/UKPlans.aspx?ID=34.

Correspondence with existing habitats

OSPAR habitat : Intertidal mudflats
Habitats Directive –Annex 1 Large shallow inlet and bays

Description

Mudflats are sedimentary intertidal habitats created by deposition in low energy coastal environments, particularly estuaries and other sheltered areas. Their sediment consists mostly of silts and clays with a high organic content. Towards the mouths of estuaries where salinity and wave energy are higher the proportion of sand increases. Mudflats are intimately linked by physical processes to, and may be dependent on, other coastal habitats such as soft cliffs and saltmarshes. They commonly appear in the natural sequence of habitats between subtidal channels and vegetated saltmarshes. In large estuaries they may be several kilometres wide and commonly form the largest part of the intertidal area of estuaries. However, in many places they have been much reduced by land claim.

Mudflats, like other intertidal areas, dissipate wave energy, thus reducing the risk of eroding saltmarshes, damaging coastal defences and flooding low-lying land. The mud surface also plays an important role in nutrient chemistry. In areas receiving pollution, organic sediments sequester contaminants and may contain high concentrations of heavy metals.

Mudflats are characterised by high biological productivity and abundance of organisms, but low diversity with few rare species. The mudflat biota reflects the prevailing physical conditions. The JNCC Marine Nature Conservation Review (MNCR) biotope codes for mudflats are LMU.SMu (Sandy mud shores), LMU.Mu (Soft mud shores) and LMS.MS (Muddy sand shores). In areas of lowered salinity, the macroinvertebrate fauna is predominantly of the Petersen *Macoma* community, characteristic species being: common cockle *Cerastoderma edule,* sand-hopper *Corophium volutator,* laver spire shell *Hydrobia ulvae*, ragworm *Hediste diversicolor* and, when salinity is low, large numbers of oligochaete annelids (principally *Tubificoides* spp). With a slight increase in the proportion of sand, the polychaetes catworm *Nephtys hombergi* and lugworm *Arenicola marina* occur. In slightly coarser areas, seagrass *(Zostera* spp) beds may develop. Where stones and shells provide an initial attachment for byssus threads, beds of the common mussel *Mytilus edulis* occur and accrete material through faecal deposition. Occasional stones or shells may also provide suitable attachment for stands of fucoid macroalgae such as *Fucus vesiculosus* or *F. spiralis*.

The surface of the sediment is often apparently devoid of vegetation, although mats of benthic microalgae (diatoms and euglenoids) are common. These produce mucilage (mucopolysaccharides) that binds the sediment. Under nutrient-rich conditions, there may be mats of the macroalgae *Enteromorpha* spp. or *Ulva* spp.

The total UK estuarine resource has been estimated as *c*588,000 ha of which 55% is intertidal area, mostly mud and sandflats with a lesser amount of saltmarsh. Intertidal flats cover about 270,000 ha. The UK has approximately 15% of the north-west European estuarine habitat.

Mudflats are highly productive areas which, together with other intertidal habitats, support large numbers of predatory birds and fish. They provide feeding and resting areas for internationally important populations of migrant and wintering waterfowl, and are also important nursery areas for flatfish. They are widespread in the UK with significant examples in the Wash, the Solway Firth, Mersey Estuary, Bridgwater Bay and Strangford Lough.

Illustrative biotopes

The 1994 UK BAP plan states the following biotopes are included in this habitat:
LMU.SMu (Sandy mud shores)
LMU.Mu (Soft mud shores) and
LMS.MS (Muddy sand shores).

However the Steering group associated with the marine UK BAP review have suggested that this habitat should focus on the following biotopes 2006 and any (important communities that these biotopes contain):

LS.LSa.MuSa : Polychaete / bivalve dominated muddy sand shores
LS.LMu : Littoral mud

The above grouping separates the habitat from shallow subtidal mud and coastal subtidal mud

Current and potential threats

- *Sea level rise*. Low water moves landward, but sea defences prevent a compensating landward migration of high water mark with the result that intertidal flats are squeezed out. Much of this loss is expected in southern and south-east England although research suggests that the major firths in Scotland will also be affected
- *Land claim*: Urban and transport infrastructure and for industry
- *Barrage schemes:* Water storage, amenity, tidal power and flood defence continue to pose a threat to the integrity and ecological value of mudflats in estuaries and enclosed bays.
- *Diffuse and point source discharges from agriculture, industry and urban areas*: Including polluted storm-water run-off, can create abiotic areas or produce algal mats which may affect invertebrate communities. They can also remove embedded fauna and destabilising sediments thus making them liable to erode.
- *Oil and gas extraction and related activities, and dredging for navigation*:Have an important effect on sediment biota and on sediment supply and transport
- Fishing and bait digging can have an adverse impact on community structure and substratum. For example, suction dredging for shellfish or juvenile flatfish bycatch from the shrimp fisheries may have a significant effect on important predator populations.
- *Human disturbance*: Affects bird populations` roosting and feeding areas.
- *Introduction of new or non-native species:* For example the spread of cord-grass *Spartina anglica* whichhas vegetated some upper-shore mudflat areas with important ecological consequences in some areas.
- *Estuarine dynamics* :Within estuaries, mudflats deposited in the past may erode due to changed estuarine dynamics and remobilised sediment may be redeposited elsewhere in the same littoral sediment cell.
- *Higher sea level and increased storm frequency:* Resulting from climate change, may further affect the sedimentation patterns of mudflats and estuaries.

References

http://www.ukbap.org.uk/habitats.aspx
Edited by Nikki Chapman, JNCC

Limestone Pavements

The definition of this habitat remains unchanged from the pre-existing Habitat Action Plan (http://www.ukbap.org.uk/UKPlans.aspx?ID=26) a summary of which appears below.

Limestone pavements are a scarce and non-renewable resource. They were exposed by the scouring action of ice sheets during the ice age which ended some 10,000 years ago. Since then water action has widened the cracks in the pavements to form a complex pattern of crevices known as *grikes* between which are massive blocks of worn limestone called *clints*.

The habitat is widely scattered in Britain, on Carboniferous limestone in Wales, Northern England and Northern Ireland, and Durness limestone in Scotland. The total area in the UK of this habitat is less than 3,000 ha with the largest areas occurring in North Yorkshire and Cumbria, and smaller areas in Lancashire, Wales and Scotland. The UK holds a significant proportion of the resource of this habitat within the European Union.

Limestone pavements are of both geological and biological importance. The vegetation is rich in vascular plants, bryophytes and lichens and varies according to geographical location, altitude, rock type and the presence or absence of grazing animals. Limestone pavement vegetation may also contain unusual combinations of plants, with woodland and wood-edge species well-represented in the sheltered grikes. The clints support plants of rocky habitats or are often unvegetated. In the absence of grazing scrub may develop. In oceanic areas scrub over limestone pavement is important for epiphytes.

Lowland Beech and Yew Woodland

The definition of this habitat remains unchanged from the pre-existing Habitat Action Plan (http://www.ukbap.org.uk/UKPlans.aspx?ID=2) a summary of which appears below.

Lowland beech and yew woodland spans a variety of distinctive vegetation types reflecting differences in soil and topographical conditions. Beech can grow on both acidic and calcareous soils, although its association with yew tends to be most abundant on the calcareous sites. These woods have been managed historically as coppice, coppice with standards, wood-pasture, high forest and minimum intervention. They are often found as intricate mosaics with other woodland communities. The wood-pasture and parkland element is dealt with in another Habitat Action Plan, although some of the issues apply to this plan also. Yew stands on the Carboniferous and Magnesian limestones of central and northern Britain are considered under the upland mixed ashwood plans.

In the United Kingdom beech is considered native only in southern England and southern Wales. Beech would certainly have spread naturally to other areas of the British Isles had forest fragmentation not impeded its progress. This Habitat Action Plan largely considers lowland beech and yew woodlands within their native range, but long-established planted beech woods outside the native range are included where they have acquired a high nature conservation value.

There are no precise data on the total extent of native lowland beech and yew in the UK. In the late 1980s the Nature Conservancy Council estimated the total extent of ancient semi-natural woodland of this type at between 15,000 and 25,000 ha which with recent beech woodland brings the total area to about 30,000 ha. It has declined in area by clearance and replanting with non-native species over the last 50 years.

Calcareous beech and yew woodland forms perhaps 40% of the total amount of lowland beech and yew habitat type defined above. The canopy can include mixtures of beech, ash, sycamore (non-native), yew and whitebeam. Oak is less common than in the other beechwoods, and pure stands of yew occur in places. Promotion of high quality beech for silviculture has often led to an artificial dominance of beech. Characteristic uncommon or rare plants can include box *Buxus sempervirens*, red helleborine *Cephalanthara rubra*, coralroot bitter-cress *Cardamine bulbifera*, and bird`s nest orchid *Neottia nidus-avis*. In some areas, this woodland type occurs as intricate mosaics with lowland mixed deciduous woods. The majority of stands have a high forest structure. This type occurs on the limestone and chalk outcrops in southern Britain *e.g.* chalk scarps of the North and South Downs, the Chilterns and the Cotswolds.

Beech woodland on neutral-slightly acidic soils comprises about 45% of the habitat. It is found on heavier soils (pH 7 to 4) and often where the drainage is poor or impeded. The boundary with the other beech types is often defined by pH, drainage and soil texture; thus it is common to find this type grading into one of the others. Again stands tend to be dominated by beech, but oak *Quercus robur* and sometimes *Q. petrea* is a common associate. Bramble *Rubus fruticosus* forms a characteristic ground layer. Often a shrub layer is lacking, although holly can form a second tier of trees, occasionally with yew. Violet helleborine *Epipactis purpurata* is a rare plant found in this community. Mosaics with oak/ bracken/ bramble woodland are common, and in some areas beech can be found colonising western oakwoods. This type tends to occur as high forest or relict wood-pasture (with pollards), less often abandoned coppice. It is common in (but not confined to) the High and Low Weald, the Chilterns plateau, the New Forest, the Cotswolds and the Wye Valley.

Acidic beech woodland forms the remaining 15% of the habitat type. It usually occurs as high forest but also makes up a large percentage of the lowland wood-pasture sites in England. Acidic beech stands are usually found on light sandy or sometimes gravelly soils that are well drained (pH 3.5 to 4.5). Holly is the main understorey species, less often yew, with oak being the common canopy associate. Mosaics with oak/ birch/ wavy-hair grass communities are not uncommon. The western edge of its range is ill-defined and beech clearance from and spread into western oakwoods occur in almost equal measure. Typical sites are found in the High Weald (on Greensand), Hampshire and London basins, the Chilterns plateau and at a few sites in East Anglia.

The main corresponding National Vegetation Classification (NVC) plant communities associated with this habitat type are W12 *Fagus sylvatica - Mercurialis perennis* woodland (base-rich soils), W14 *Fagus sylvatica - Rubus fruticosus* woodland (mesotrophic soils), W15 *Fagus sylvatica - Deschampsia flexuosa* woodland (acidic soils). Yew stands fall into W13 *Taxus baccata* woodland.

Lowland Calcareous Grassland

The definition of the habitat as given in the pre-existing Habitat Action Plan (http://www.ukbap.org.uk/UKPlans.aspx?ID=12) has been amended to:

- include examples of NVC CG10 *Festuca ovina - Agrostis capillaris - Thymus praecox* grassland where they clearly occur below the upper limits of agricultural enclosure; and
- exclude examples of CG1 *Festuca ovina - Carlina vulgaris* grassland and CG2 *Festuca ovina - Avenula pratensis* grassland where these clearly occur above the upper limits of enclosure.
- In Northern Ireland, enclosed calcareous grassland (mainly CG9 and CG10) is very limited and similar floristically to unenclosed grassland. For practical purposes all calcareous grassland in Northern Ireland is treated as Upland Calcareous Grassland.

Following the 2007 review, occurrences of this habitat on roadside verges are also covered by the definition.

Lowland Dry Acid Grassland

The definition of this habitat remains unchanged from the pre-existing Habitat Action Plan (http://www.ukbap.org.uk/UKPlans.aspx?ID=14) a summary of which appears below. Following the 2007 review, occurrences of this habitat on roadside verges are also covered by the definition.

Lowland acid grassland typically occurs on nutrient-poor, generally free-draining soils with pH ranging from 4 to 5.5 overlying acid rocks or superficial deposits such as sands and gravels. It includes the *Festuca ovina - Agrostis capillaris - Rumex acetosella* (U1), *Deschampsia flexuosa* (U2), *Agrostis curtisii* (U3) and *Festuca ovina - Agrostis capillaris - Galium saxatile* (U4) National Vegetation Classification grassland plant communities. Inland vegetation, but not coastal dunes, characterised by *Carex arenaria* (*Carex arenaria* dune *Festuca ovina* sub-community (SD10b) and *Carex arenaria - Cornicularia aculeata* dune, *Festuca ovina* sub-community (SD11b)) is also included but is highly localised.

Definition of lowland acid grassland is problematical but here it is defined as both enclosed and unenclosed acid grassland throughout the UK lowlands (normally below c. 300m). It covers all acid grassland managed in functional enclosures; swards in old and non-functional enclosures in the upland fringes, which are managed as free-range rough grazing in association with unenclosed tracts of upland, are excluded. It often occurs as an integral part of lowland heath landscapes, in parklands and locally on coastal cliffs and shingle. It is normally managed as pasture.

Acid grassland is characterised by a range of plant species such as heath bedstraw *Galium saxatile*, sheep`s-fescue *Festuca ovina*, common bent *Agrostis capillaris*, sheep`s sorrel *Rumex acetosella,* sand sedge *Carex arenaria*, wavy hair-grass *Deschampsia flexuosa,* bristle bent *Agrostis curtisii* and tormentil *Potentilla erecta,* with presence and abundance depending on community type and locality. Dwarf shrubs such as heather *Calluna vulgaris* and bilberry *Vaccinium myrtillus* can also occur but at low abundance. Lowland acid grassland often forms a mosaic with dwarf shrub heath, the latter being covered in the separate lowland heathland action plan. Acid grasslands can have a high cover of bryophytes and parched acid grassland can be rich in lichens. Acid grassland is very variable in terms of species richness and stands can range from relatively species-poor (less than 5 species per $4m^2$) to species-rich (in excess of 25 species per $4m^2$).

Parched acid grassland in particular contains a significant number of rare and scarce vascular plant species many of which are annuals. These include species such as mossy stonecrop *Crassula tillaea,* smooth rupturewort *Herniaria glabra,* slender bird`s-foot-trefoil *Lotus angustissimus,* bur medick *Medicago minima* and clustered clover *Trifolium glomeratum* and spring speedwell *Veronica verna*. Perennial taxa associated with these grasslands include, sticky catchfly *Lychnis viscaria* and shaggy mouse-ear-hawkweed *Pilosella peleteriana*.

The bird fauna of acid grassland is very similar to that of other lowland dry grasslands which collectively are considered to be a priority habitat for conservation action. Bird species of conservation concern which utilise acid grassland for breeding or wintering include woodlark *Lullula arborea*, stone-curlew *Burhinus oedicnemus*, nightjar *Caprimulgus europaeus*, lapwing *Vanellus vanellus*, skylark *Alauda arvensis*, chough *Pyrrhocorax pyrrhocorax*, green woodpecker *Picus viridis*, hen harrier *Circus cyaneus* and merlin *Falco columbarius*.

Many of the invertebrates that occur in acid grassland are specialist species which do not occur in other types of grassland. The open parched acid grasslands on sandy soils in particular, can support a considerable number of ground-dwelling and burrowing invertebrates such as solitary bees and wasps. A number of rare and scarce species are associated with the habitat, some of which are included on the UK Biodiversity Action Plan list of species of conservation concern, such as the field-cricket *Gryllus campestris*.

As with other lowland semi-natural grassland types, acid grassland has undergone substantial decline in the 20th century although there are no figures available on rates of loss. The decline is mostly due to agricultural intensification although locally, as in the Breckland, afforestation has been significant.

Cover data for lowland acid grassland across the UK for the full altitudinal range are not currently available. Stands remote from the upland fringe, which are the primary focus of conservation attention, are now of restricted occurrence and it is estimated that less than 30,000 ha now remain in UK. Important concentrations occur in the Breckland, the New Forest, Dorset, Suffolk Sandlings, the Weald, Dungeness, the coasts of SW England and the Welsh and English border hills of Powys and Shropshire. Scotland is estimated to have less than 5000 ha and much of this is likely to be on the upland fringe. Extensive areas of acid grassland are included within sites designated as common land, but separate figures for uplands and lowlands are not available.

It will be important to ensure that acid grasslands are taken into account during implementation of the action plan for lowland heathland; actions in the two plans need to be closely integrated.

Lowland Fens

Formerly named fens, details of this habitat can be found in the pre-existing Habitat Action Plan (http://www.ukbap.org.uk/UKPlans.aspx?ID=18); a summary appears below.

The UK is thought to host a large proportion of the fen surviving in the EU. As in other parts of Europe fen vegetation has declined dramatically in the past century.

Fens are peatlands which receive water and nutrients from the soil, rock and ground water as well as from rainfall: they are minerotrophic. Two types of fen can broadly be distinguished: topogenous and soligenous. Topogenous fens are those where water movements in the peat or soil are generally vertical. They include basin fens and floodplain fen. Soligenous fens, where water movements are predominantly lateral, include mires associated with springs, rills and flushes in the uplands, valley mires, springs and flushes in the lowlands, trackways and ladder fens in blanket bogs and laggs of raised bogs.

Fens can also be described as `poor-fens` or `rich-fens`. Poor-fens, where the water is derived from base-poor rock such as sandstones and granites occur mainly in the uplands, or are associated with lowland heaths. They are characterised by short vegetation with a high proportion of bog mosses *Sphagnum* spp. and acid water (pH of 5 or less). Rich-fens, are fed by mineral-enriched calcareous waters (pH 5 or more) and are mainly confined to the lowlands and where there are localised occurrences of base-rich rocks such as limestone in the uplands. Fen habitats support a diversity of plant and animal communities. Some can contain up to 550 species of higher plants, a third of our native plant species; up to and occasionally more than half the UK`s species of dragonflies, several thousand other insect species, as well as being an important habitat for a range of aquatic beetles.

In intensively farmed lowland areas fens occur less frequently, are smaller in size and more isolated than in other parts of the UK. There are, however, exceptions to this. The UK`s largest continuous area of base-poor fen, the Insh Marshes in the floodplain of the River Spey in Scotland, covers an area of 300 ha, the calcareous rich fen and swamp of Broadland covers an area of 3,000 ha and Lough Erne system in Fermanagh has extensive areas of fen and swamp. In some lowland areas such as the Scottish borders and southern Northern Ireland there are concentrations of small fens of particular importance.

Lowland Heathland

Amended from the pre-existing HAP (http://www.ukbap.org.uk/UKPlans.aspx?ID=15) lowland heathland is described as a broadly open landscape on impoverished, acidic mineral and shallow peat soil, which is characterised by the presence of plants such as heathers and dwarf gorses. It is generally found below 300 metres in altitude in the UK, but in more northerly latitudes the altitudinal limit is often lower. Areas of heathland in good condition should consist of an ericaceous layer of varying heights and structures, plus some or all of the following additional features, depending on environmental and/or management conditions; scattered and clumped trees and scrub; bracken; areas of bare ground; areas of acid grassland; lichens; gorse; wet heaths, bogs and open waters. Lowland heathland can develop on drift soils and weathered flint beds over calcareous soils (limestone or chalk heath). Lowland heathland is a dynamic habitat which undergoes significant changes in different successional stages, from bare ground (e.g. after burning or tree clearing) and grassy stages, to mature, dense heath. These different stages often co-occur on a site. The presence and numbers of characteristic birds, reptiles, invertebrates, vascular plants, bryophytes and lichens are important indicators of habitat quality.

In terms of distinguishing between lowland heathland and genuine acid grassland, less than 25% dwarf shrub cover should be assessed as grassland, over 25% as heathland.

Lowland Meadows

The definition of this habitat remains unchanged from the pre-existing Habitat Action Plan (http://www.ukbap.org.uk/UKPlans.aspx?ID=10) a summary of which appears below. Following the 2007 review, occurrences of this habitat on roadside verges are also covered by the definition.

A wide-ranging approach is adopted in this plan to lowland grasslands treated as lowland meadows. They are taken to include most forms of unimproved neutral grassland across the enclosed lowland landscapes of the UK. In terms of National Vegetation Classification plant communities, they primarily embrace each type of *Cynosurus cristatus - Centaurea nigra* grassland, *Alopecurus pratensis - Sanguisorba officinalis* floodplain meadow and *Cynosurus cristatus - Caltha palustris* flood-pasture. The plan is not restricted to grasslands cut for hay, but also takes into account unimproved neutral pastures where livestock grazing is the main land use. On many farms in different parts of the UK, use of particular fields for grazing pasture and hay cropping changes over time, but the characteristic plant community may persist with subtle changes in floristic composition.

In non-agricultural settings, such grasslands are less frequent but additional examples may be found in recreational sites, church-yards, roadside verges and a variety of other localities. Excluded from this plan are maritime grassland communities confined to coastal habitats (which will be covered in maritime cliff and machair action plans), *Anthoxanthum odoratum - Geranium sylvaticum* grasslands (which are treated in a companion action plan for upland hay meadows) and *Molinia - Juncus* pastures (which are covered in the purple moor grass and rush pasture (*Molinia-Juncus*) plan).

As indicated in the Habitat Statement included in *Biodiversity: the UK Steering Group Report, Vol 2* (1995), unimproved neutral grassland habitat has undergone a remarkable decline in the 20th century, almost entirely due to changing agricultural practice. It is estimated that by 1984 in lowland England and Wales, semi-natural grassland had declined by 97% over the previous 50 years to approximately 0.2 million ha. Losses have continued during the 1980s and 1990s, and have been recorded at 2 -10% per annum in some parts of England. Extensive agricultural modification of unimproved grasslands has also been recorded in Scotland between the 1940s and 1970s. Recent conservation survey findings in Britain and Northern Ireland reveal that the impact has been pervasive, and an estimated extent of less than 15,000 ha of species-rich neutral grassland surviving today in the UK is given in the Habitat Statement.

The plan concentrates on meadows and pastures associated with low-input nutrient regimes, and covers the major forms of neutral grassland which have a specialist group of scarce and declining plant species. Among flowering plants, these include fritillary *Fritillaria meleagris,* Dyer`s greenweed *Genista tinctoria,* green-winged orchid *Orchis morio,* greater butterfly orchid *Platanthera chlorantha,* pepper saxifrage *Silaum silaus* and wood bitter vetch *Vicia orobus*. Lowland meadows and pastures are important habitats for skylark and a number of other farmland birds, notably corncrake which has experienced a major range contraction across the UK.

The overall outcome of habitat change in the lowland agricultural zone is that *Cynosurus - Centaurea* grassland, the mainstream community of unimproved hay meadows and pastures over much of Britain, is now highly localised, fragmented and in small stands. Recent estimates for cover in England and Wales indicate that there is between 5000-10,000 ha of this community in total. There is an especially important concentration in Worcestershire and other particularly important areas include south-west England (Somerset, Dorset and Wiltshire), the East Midlands & East Anglia (Leicestershire, Northamptonshire, Cambridgeshire and Suffolk), in various parts of Wales and in West Fermanagh and Erne Lakeland in Northern Ireland. In certain areas, such as in the old district of Brecknock in Powys, remnant examples are locally aggregated. Scotland is estimated to have between 2000-3000 ha of this community, with particular concentrations in the crofting areas of Lochaber, Skye and the Western Isles. Local data for Northern Ireland are less complete, but the West Fermanagh and Erne Lakeland ESA in NI contains an important concentration of the resource.

Unimproved seasonally-flooded grasslands are less widely distributed. They have lower overall cover, but there are still a few quite large stands. *Alopecurus - Sanguisorba* flood-meadow has a total cover of <1500 ha and is found in scattered sites from the Thames valley through the Midlands and Welsh borders to the Ouse catchment in Yorkshire. These include well-known but now very rare Lammas meadows, such as North Meadow, Cricklade, and Pixey and Yarnton Meads near Oxford, which are shut up for hay in early spring, cropped in July, with aftermath grazing from early August; nutrients are supplied by flooding episodes in winter. *Cynosurus - Caltha* flood-pasture is also now scarce and localised, with probably <1000 ha cover in England and Wales. Scotland is estimated to have 600-800 ha of this community.

It will be important to ensure that such periodically flooded grasslands are taken into account during implementation of the action plan for coastal and floodplain grazing marshes; actions in the two plans need to be closely integrated.

Agricultural intensification has led to the extensive development of nutrient-demanding, productive *Lolium perenne* grasslands. These are managed for grazing and also silage production which has widely replaced traditional hay-making. Where fertiliser input is relaxed or in swards which have only been partially improved, *Lolium - Cynosurus* grassland is common; in many respects this is intermediate between improved and unimproved lowland neutral grasslands but has few uncommon species and is generally of low botanical value.

Lowland Mixed Deciduous Woodland

Lowland mixed deciduous woodland includes woodland growing on the full range of soil conditions, from very acidic to base-rich, and takes in most semi-natural woodland in southern and eastern England, and in parts of lowland Wales and Scotland. It thus complements the ranges of upland oak and upland ash types. It occurs largely within enclosed landscapes, usually on sites with well-defined boundaries, at relatively low altitudes, although altitude is not a defining feature. Many are ancient woods and they include the classic examples of ancient woodland studied by Rackham (1980) and Peterken (1981) in East Anglia and the East Midlands. The woods tend to be small, less than 20 ha. Often there is evidence of past coppicing, particularly on moderately acid to base-rich soils; on very acid sands the type may be represented by former wood-pastures of oak and birch.

There is great variety in the species composition of the canopy layer and the ground flora, and this is reflected in the range of associated NVC and Stand Types. *Quercus robur* is generally the commoner oak (although *Quercus petraea* may be abundant locally) and may occur with virtually all combinations of other locally native tree species.

In terms of the National Vegetation Classification the bulk of this type falls into W8 (mainly sub-communities a - c in ancient or recent woods; in the lowlands W8d mostly occurs in secondary woodland) and W10 (sub-communities a to d) with lesser amounts of W16 (mainly W16a). Locally, it may form a mosaic with other types, including patches of beech woodland, small wet areas, and types more commonly found in western Britain. Rides and edges may grade into grassland and scrub types.

The canopy variations as represented by the Stand Type system include most of the field maple (2), lime (4, 5), suckering elm (10) and hornbeam (9) Stand Groups, and substantial proportions of the wych elm (1), ash (3) and oak (6) Stand Groups. More rarely, birch (12) and some alder stands (7C) may also occur. These may require separate management treatments.

There are no precise data on the total extent of lowland mixed deciduous woodland in the UK, but in the late 1980s the Nature Conservancy Council estimated the total extent of this type to be about 250,000ha. There is however no doubt that the area of this priority type on ancient woodland sites has declined in area by clearance, overgrazing and replanting with non-native species, by about 30-40% over the last 50 years.

Lowland Raised Bog

The definition of this habitat remains unchanged from the pre-existing Habitat Action Plan (http://www.ukbap.org.uk/UKPlans.aspx?ID=20) a summary of which appears below.

Lowland raised bogs are peatland ecosystems which develop primarily, but not exclusively, in lowland areas such as the head of estuaries, along river flood-plains and in topographic depressions. In such locations drainage may be impeded by a high groundwater table, or by low permeability substrata such as estuarine, glacial or lacustrine clays. The resultant waterlogging provides anaerobic conditions which slow down the decomposition of plant material which in turn leads to an accumulation of peat. Continued accrual of peat elevates the bog surface above regional groundwater levels to form a gently-curving dome from which the term 'raised' bog is derived. The thickness of the peat mantle varies considerably but can exceed 12 metres.

In the UK lowland raised bogs are a particular feature of cool, rather humid regions such as the north-west lowlands of England, the central and north-east lowlands of Scotland, Wales and Northern Ireland, but remnants also occur in some southern and eastern localities, for example Somerset, South Yorkshire and Fenland.

Lowland raised bogs may develop from a preceding phase of fen via successional processes or, if the climate is sufficiently wet, by peat formation directly onto a bare substrate, a process known as 'paludification'. Accumulation of peat separates the bog surface from the influence of groundwater, so that it becomes irrigated exclusively by precipitation. This type of ecosystem is known as an 'ombrotrophic' (or 'rain-fed') bog. Consequently, the surface of a 'natural' lowland raised bog is typically waterlogged, acidic and deficient in plant nutrients. This gives rise to a distinctive suite of vegetation types, which although low in overall diversity, support specialised plant assemblages dominated by a colourful range of mosses of the genus *Sphagnum*, (Baltic bog-moss *Sphagnum balticum*, Skye bog-moss *Sphagnum skyense*) as well as vascular plants adapted to waterlogged conditions such as the cotton grasses *Eriophorum* spp. Lowland raised bogs also support rarer plants such as the bog mosses *Sphagnum pulchrum* and *Sphagnum imbricatum* as well as a number of higher plants which have become increasingly scarce in the lowlands including bog rosemary *Andromeda polifolia*, great sundew *Drosera anglica* and cranberry *Vaccinium oxycoccos*.

The raised bog surface may support a patterned mosaic of pools, hummocks and lawns, a microtopography created in part by the growth of the plants themselves. This provides a range of water regimes which support different species assemblages. *Sphagnum* mosses are the principal peat forming species on natural UK lowland raised peat bogs, and their dominance in the living vegetation layer gives a bog its characteristically 'spongy' surface. The ability of this layer to store water is thought to be important in keeping the bog surface wet during the summer.

A number of plant communities defined by the National Vegetation Classification can be found on raised bogs. Plant communities that are typical of natural raised bogs include the bog pool communities M1 to M3 and M18 *Erica tetralix* - *Sphagnum papillosum* raised and blanket mire. In addition a number of communities, including M15 *Scirpus cespitosus* - *Erica tetralix* wet heath, M19 *Calluna vulgaris* - *Eriophorum vaginatum* blanket mire, M20 *Eriophorum vaginatum* blanket and raised mire, M25 *Molinia caerulea* - *Potentilla erecta* mire and W4 *Betula pubescens* - *Molinia caerulea* woodland, can be found on raised bogs which have been subject to some disturbance such as drainage or peat-cutting.

Lowland raised bogs also support a distinctive range of animals including a variety of breeding waders and wildfowl and invertebrates. Rare and localised invertebrates such as the large heath butterfly *Coenonympha tullia,* the bog bush cricket *Metrioptera brachyptera*, and mire pill beetle *Curimopsis nigrita* are found on some lowland raised bog sites.

Peat accumulation preserves a unique and irreplaceable record of plant and animal remains and some atmospheric deposits from which it is possible to assess historical patterns of vegetation and climate change and human land-use.

As elsewhere across north-west Europe there has been a dramatic decline in the area of lowland raised bog habitat since around the start of the nineteenth century. The area of lowland raised bog in the UK retaining a largely undisturbed surface is estimated to have diminished by around 94% from an original c95,000 ha to c6,000 ha at the present day (England 37,500 ha reduced to 500 ha, Scotland 28,000 ha to 2,500 ha, Wales 4,000 ha to 800 ha, Northern Ireland 25,000 ha to 2,000 ha). Historically, the greatest decline has occurred through agricultural intensification, afforestation, and commercial peat extraction. Future decline is most likely to be the result of the gradual desiccation of bogs damaged by a range of drainage activities and/or a general lowering of groundwater tables.

Machair

The definition of this habitat remains unchanged from the pre-existing Habitat Action Plan (http://www.ukbap.org.uk/UKPlans.aspx?ID=30) a summary of which appears below.

Machair is a distinctive type of coastal grassland found in the north and west of Scotland, and in western Ireland. It is associated with calcareous sand, blown inland by very strong prevailing winds from beaches and mobile dunes. The Gaelic word *Machair* is the only name for this major habitat type in Britain.

In its strict sense, 'machair' refers to a relatively flat and low lying sand plain formed by dry and wet (seasonally waterlogged) short-turf grasslands above impermeable bedrock, a habitat termed 'machair grassland'. However, *machair* can also cover the beach zone, mobile and semi-fixed foredunes, dune slacks, fens, swamps, lochs (some of them brackish), saltmarsh, and sand blanketing adjacent hillslopes, together forming the 'machair system'. It is also often associated with an inland transition to heath and mire termed 'blackland' which can include sand-affected peatland. Though this action plan principally addresses the machair grassland, this is an integral part of the wider machair system so the plan must consider the former in the context of the latter.

It is estimated that 'machair grassland is restricted to about 25,000 ha in world-wide extent, with 17,500 ha in Scotland and the remainder in western Ireland, so that world distribution is very restricted. The largest extents in Scotland are in the Western Isles (10,000 ha, mainly in the Uists), Tiree and Coll (4000 ha), Orkney (2300 ha) western Scottish mainland (1000 ha) and Shetland (180 ha). The full (global) geographical extent of the wider 'machair systems' is believed to be in the region of 40,000 ha, with some 30,000 ha in Scotland and 10,000 ha in Ireland.

Machair grassland plains are complex features in terms of origin, development, processes, local habitat types and management. They are formed from sand blown inland following the periodic breakdown of foredunes above the beach and contain a mosaic of wet and dry grassland communities. These are related to grazing and tillage history superimposed upon gradients of surface stabilisation, soil acidity, and salinity which are controlled by local sand blow, water-table fluctuation and micro-topography, giving rise to highly complex habitat mosaics. Some plant communities are largely restricted to western and northern Scotland.

Machair has a very long history of management by local communities over several millennia. In recent times this has involved a mix of seasonal extensive grazing (mainly by cattle, with pastures rested in the summer) and low-input low-output rotational cropping based on potatoes, oats and rye. A very small area of beer barley is also cultivated. This traditional mixed management sustains varied dune, fallow and arable weed communities which offer in some areas superb displays of flowering colour across wide expanses of unfenced land in summer. The periodic ground disturbance and seasonal absence of stock supports very important breeding wader populations. The wider machair system has a rich invertebrate fauna. This traditional agriculture is associated mainly with the Uists and Tiree; outside these areas there has been a marked decline in such land management with a corresponding decline in wildlife.

No plant sub-communities of the National Vegetation Classification are confined to machair, but the two most indicative are the *Festuca rubra-Galium verum* fixed dune grassland, *Ranunculus acris-*

Bellis perennis sub-community of dry machair (SD8d) and the *Festuca rubra-Galium verum* grassland*,* *Prunella vulgaris* sub-community of wet machair (SD8e).

Few rare plant species are largely restricted to machair systems. Exceptions are the slender naiad *Najas flexilis* which is strongly associated with machair lochs, some pondweeds, *Potamogeton* spp (grass-wrack pondweed *Potamogeton compressus*, Shetland pondweed *Potamogeton rutilus*) and their hybrids, and the endemic orchid *Dactylorhiza majalis scotica*. This environment is more important as one of the last areas in Britain supporting old field successions, some of which are a century or more old. The great complexity and diversity of habitats and plant communities within machair systems is also a special feature. Two nationally scarce birds, corncrake *Crex crex* (which is globally threatened)and corn bunting *Miliaria calandra*, are noted birds of machair systems. The machair breeding wader populations of the Uists, Tiree and Coll are claimed as the most important in the north-west Palaearctic. Notable invertebrates include the belted beauty moth *Lycia zonaria,* and the northern colletes *Colletes floralis*.

There is a very strong association between traditional land use and crofting communities. Machair is a living, cultural landscape and much of its conservation value is dependent on the maintenance of viable crofting agriculture based on low-input shifting cultivation. Machair is highly susceptible to agricultural modification and is particularly sensitive to changes in grazing, sand and shingle extraction, and recreational impact.

Maerl Beds

This habitat description has been adapted from the 1994 UK BAP Action Plan for Maerl and would benefit from an update http://www.ukbap.org.uk/UKPlans.aspx?ID=40.

Correspondence with existing habitats

OSPAR habitat : Maerl beds
Habitats Directive Annex 1: Large shallow inlets and bays & Sandbanks which are slightly covered by seawater all the time.

Description

Maerl is a collective term for several species of calcified red seaweed. It grows as unattached nodules on the seabed, and can form extensive beds in favourable conditions. Maerl is slow-growing, but over long periods its dead calcareous skeleton can accumulate into deep deposits (an important habitat in its own right), overlain by a thin layer of pink, living maerl.

Maerl beds typically develop where there is some tidal flow, such as in the narrows and rapids of sea lochs, or the straits and sounds between islands. Beds may also develop in more open areas where wave action is sufficient to remove fine sediments, but not strong enough to break the brittle maerl branches. Live maerl has been found at depths of 40 m, but beds are typically much shallower, above 20 m and extending up to the low tide level.

Maerl beds are found off the southern and western coasts of the British Isles, north to Shetland, but are particularly well developed around the Scottish islands and in sea loch narrows, around Orkney, and in the south in the Fal Estuary. Maerl beds also occur in other western European waters, from the Mediterranean to Scandinavia.

The distributions of the three main maerl bed-forming species in the UK are not entirely clear because of problems with identification in the field. *Phymatolithon calcareum* occurs throughout British waters, while *Lithothamnion glaciale* is a northern species with its southern limits at Lundy in the Bristol Channel and in the North Sea, off Yorkshire. *Lithothamnion corallioides* has caused the most problems with identification, but appears to be a south-western species with Scottish records as yet unconfirmed. Currently, it is known to occur in less than 15 of the ten km squares for the UK as defined by JNCC.

Maerl beds are an important habitat for a wide variety of marine animals and plants which live amongst or are attached to its branches, or burrow in the coarse gravel of dead maerl beneath the top living layer. Maerl beds, because of the wide geographical range over which they occur, have a wide range of associated animals and plants, with species diversity tending to be greater in the south and west. Due to the fragility of maerl, the beds are easily damaged and have probably declined substantially in some areas.

Relevant biotope
Only one biotope is associated with this habitat which is; SS.SMp.Mrl Maerl beds

Current and potential threats
- *Commercial extraction* for use as a soil conditioner on acidic ground, as an animal food additive, for the filtration of acid drinking water and in pharmaceutical and cosmetic products.
- *Scallop dredging* has been identified as the biggest impact on maerl beds of both maerl, by breaking and burying the thin layer of living maerl, and the associated species. Other types of mobile fishing gear are also likely to damage the living layer of maerl on top of the bed.
- *Heavy anchors and mooring chains* could cause considerable damage to maerl beds.
- *Eutrophication,* which has causes smothering of the maerl by excess growth of other seaweeds and increased sedimentation.
- *Finfish farms* nutrient and chemical discharges that can effect the fauna associated with maerl beds may be affected.
- *Obstruction to water flow* building of barrages, causeways and bridges are potential blockages to water flow, particularly in sea lochs and between islands causing fine sediment particles to accumulate between the maerl fragments and smother the bed.

References

http://www.ukbap.org.uk/habitats.aspx

Edited by Nikki Chapman, JNCC

Maritime Cliff and Slopes
The definition of this habitat remains unchanged from the pre-existing Habitat Action Plan (http://www.ukbap.org.uk/UKPlans.aspx?ID=27) a summary of which appears below.

Maritime cliffs and slopes comprise sloping to vertical faces on the coastline where a break in slope is formed by slippage and/or coastal erosion. There appears to be no generally accepted definition of the minimum height or angle of slope which constitutes a cliff, but the zone defined as cliff-top (also covered in this plan) should extend landward to at least the limit of maritime influence (i.e. limit of salt spray deposition), which in some exposed situations may continue for up to 500 m inland. This plan may therefore encompass entire islands or headlands, depending on their size. On the seaward side, the plan extends to the limit of the supralittoral zone and so includes the splash zone lichens and other species occupying this habitat. Approximately 4000 km of the UK coastline has been classified as cliff.

Cliff profiles vary with the nature of the rocks forming them and with the geomorphology of the adjoining land. While most maritime cliffs have been formed by coastal erosion, steep slopes falling to the sea in mountainous districts may have been formed long before the sea level reached its present position; in such cases only the lower part of the slope will have been steepened by the sea.

Maritime cliffs can broadly be classified as 'hard cliffs' or 'soft cliffs', though in practice there are a number of intermediate types. Hard cliffs are vertical or steeply sloping; they are inclined to support few higher plants other than on ledges and in crevices or where a break in slope allows soil to accumulate. They tend to be formed of rocks resistant to weathering, such as granite, sandstone and limestone, but can be formed of softer rocks, such as chalk, which erode to a vertical profile. Soft cliffs are formed in less resistant rocks such as shales or in unconsolidated materials such as boulder clay; being unstable they often form less steep slopes and are therefore more easily colonised by vegetation. Soft cliffs are subject to frequent slumping and landslips, particularly where water percolates into the rock and reduces its effective shear strength.

The vegetation of maritime cliff and slopes varies according to several factors: the extent of exposure to wind and salt spray, the chemistry of the underlying rock, the water content and stability of the substrate and, on soft cliffs, the time elapsed since the last movement event. Cliff-top habitats can also be transformed by soil erosion processes.

Vegetation of a strictly maritime nature occurs where exposure to the waves and winds is at its greatest. In the UK, such conditions are found principally on the northern and south-western coasts. In extreme conditions, such as on the Isle of Lewis, saltmarsh vegetation can occur on cliff-tops. In other areas, where cliffs occur adjacent to sand dunes, sufficient wind blown sand can accumulate on the cliff-tops to allow cliff-top dune vegetation to develop (perched dunes). On exposed hard cliffs giving little foothold to higher plants, lichens are often the predominant vegetation. Ledges on such cliffs support a specialised flora with species such as rock samphire *Crithmum maritimum* and rock sea spurrey *Spergularia rupicola* in the south and Scots lovage *Ligusticum scoticum* and in the north. Seabird nesting ledges enriched by guano support a particular community characterised by oraches *Atriplex* spp and sea beet *Beta vulgaris* sap *maritima*. Maritime grasslands occur on cliffs and slopes in less severely exposed locations; a maritime form of red fescue *Festuca rubra* is a constant component, together with maritime species such as thrift *Armeria maritima*, sea plantain *Plantago maritima*, buck's-horn plantain *P. coronopus* and sea carrot *Daucus carota* sap *gummifer*. Species of inland grasslands which also commonly occur in maritime grasslands include ribwort plantain *Plantago lanceolata*, bird's-foot trefoil *Lotus corniculatus*, common restharrow *Ononis repens* and several species of grass.

On cliffs and slopes which are more sheltered from the prevailing winds and salt spray, the vegetation communities are more similar to those found inland, and are increasingly influenced by the chemistry of the substrate. Calcareous grassland communities with a few maritime specialist species occur on sheltered chalk or limestone cliffs. The upper sections and cliff-tops of hard cliffs on acidic rocks may support maritime heaths characterised by heather *Calluna vulgaris*. Mobile soft cliffs support a wide range of vegetation from pioneer communities on freshly exposed faces through ruderal and grassland communities to scrub and woodland. Wet flush vegetation commonly occurs on soft cliffs where groundwater issues as seepage.

Maritime cliffs are often significant for their populations of breeding seabirds, many of which are of international importance. Some 70% of the international population of gannet *Morus bassanus* and important proportions of the European populations of shag *Phalacrocorax aristotelis*, razorbill *Alca torda* and guillemot *Uria aalge* nest colonially on cliff ledges whilst significant populations of Manx shearwater *Puffinus puffinus* and puffins *Fratercula arctica* nest in burrows in turf on cliff-tops or slopes. Coastal cliffs are also important for crag nesting species, such as raven *Corvus corax* and peregine *Falco peregrinus,* and cliff-top vegetation may provide important feeding grounds for chough *Pyrrhocorax pyrrhocorax*.

Hard cliffs are widely distributed around the more exposed coasts of the UK, occurring principally in south-west and south-east England (the latter area having the bulk of the 'hard' chalk cliffs), in north-west and south-west Wales, in western and northern Scotland and on the north coast of Northern Ireland. Soft cliffs are more restricted, occurring mainly on the east and central south coasts of England and in Cardigan Bay and north-west Wales. There are also examples on the coasts of Fife and Skye in Scotland and Antrim in Northern Ireland.

Soft cliffs provide important breeding sites for sand martins *Riparia riparia*, which burrow into soft faces exposed by recent slippages, but they are particularly important for invertebrates as they provide a suite of conditions which are rarely found together in other habitats. The combination of friable soils, hot substrates and open conditions maintained by cliff slippages offer a continuity of otherwise very restricted microhabitats and these support many rare invertebrates which are confined to such sites. These include the ground beetle *Cicindela germanica*, the weevil *Baris analis*, the shore bug *Saldula arenicola,* and the Glanville fritillary *Melitaea cinxia*.

Seepages, springs and pools are a feature of many soft cliff sites and these provide the wet muds required by many species of solitary bees and wasps for nest building. They also support rich assemblages of other invertebrates including many rare species which are confined to this habitat.

These include the craneflies *Gonomyia bradleyi* and *Helius hispanicus*, and the water beetle *Sphaerius acaroides*.

The hard coastal cliffs of west Britain support a western oceanic invertebrate assemblage of European significance. Important species include the snail *Ponentina subvirescens*, weevils such as the highly restricted *Cathormiocerus attaphilus* and moths such as Barrett's marbled coronet *Hadena luteago*. Other species are confined to certain rock types. For example, the fiery clearwing *Bembecia chrysidiformis* is restricted to the chalk cliffs of Kent and Sussex and the water beetle *Ochthebius poweri* occurs predominantly in small seepages on red sandstone cliff faces in south-west England and south Wales.

The supralittoral zone represents the lowest belt of terrestrial vegetation on maritime cliffs and is usually exemplified by a zone of orange and grey maritime lichens. The zone tends to be dominated by species such as *Caloplaca marina, Ramalina siliquosa* and *Verrucaria maura*, but may also include uncommon species such as *Roccella filiformis* and *R. phycopsis*.

Mesotrophic Lakes

The definition of this habitat remains unchanged from the pre-existing Habitat Action Plan (http://www.ukbap.org.uk/UKPlans.aspx?ID=22) a summary of which appears below.

Physical and chemical status

Mesotrophic lakes (i.e. those in the middle of the trophic range) are relatively infrequent in the UK and largely confined to the margins of upland areas in the north and west. They are characterised by having a narrow range of nutrients, the main indicative ones being inorganic nitrogen (N) and total phosphorus (P). Typically, mesotrophic lakes have nutrient levels of 0.3-0.65 mgNl-1 and 0.01-0.03 mgPl-1. Whilst such levels simplify the complex interaction between plant nutrients and the hydrological and physical characteristics of individual lakes (for instance, virtually all available nutrients are `locked up` in algae during the growing season), they serve to show the sensitivity of the trophic state to artificially increased levels of nitrogen and phosphorus. Thus, this is an increasingly rare type of lake.

Several of the largest and most important lakes in the UK, including Lough Neagh and Lower Lough Erne were once mesotrophic but are now classified as eutrophic and not included in this action plan. Two existing large mesotrophic lakes, Lough Melvin and Upper Lough MacNean straddle the international border with the Republic of Ireland.

Biological status

Mesotrophic lakes potentially have the highest macrophyte diversity of any lake type. Furthermore, relative to other lake types, they contain a higher proportion of nationally scarce and rare aquatic plants. Macroinvertebrates are well represented, with particularly important groups being dragonflies, water beetles, stoneflies and mayflies.

Rare fish, of which only three species are found in UK lakes, are well represented in mesotrophic lakes. The vendace, *Coregonus albula* is only found in two sites in Britain, one of which is Bassenthwaite Water in Cumbria. Another whitefish, *Coregonus lavaretus*, known as the schelly (or gwyniad, or powan), is found in a mesotrophic tarn in Cumbria. The schelly is also found in oligotrophic lakes in Cumbria, Wales and Scotland and there is uncertainty as to whether it is abnormally stressed in a mesotrophic environment. In general, fish communities in mesotrophic lakes are a mix of coarse and salmonid species, but today there are few truly natural assemblages due to introduced species.

Mountain Heaths and Willow Scrub

Correspondence with existing habitat/s

- UK BAP broad habitat: Montane habitats
- Phase 1: D3 lichen/bryophyte heath; D4 montane heath/dwarf herb; D1 dry dwarf-shrub heath (part); A2 scrub (part)
- NVC: H13-H15, H17-H20, H22; U7-U15, U18, W20.
- Annex I: Alpine and boreal heaths; Sub-Arctic *Salix* scrub; Siliceous alpine and boreal grassland

Description

This habitat encompasses a range of natural or near-natural vegetation occurring in the montane zone, lying above or beyond the natural tree-line. It includes dwarf-shrub heaths, grass-heaths, dwarf-herb communities, willow scrub, and snowbed communities. The most abundant vegetation types are heaths dominated by *Calluna vulgaris* and *Vaccinium myrtillus* typically with abundant bryophytes (e.g. *Racomitrium lanuginosum*) and/or lichens (e.g. *Cladonia* species) and siliceous alpine and boreal grasslands with *Carex bigelowii* moss and sedge heaths. Rarer vegetation types include snow-bed communities with *Salix herbacea* and various bryophytes and lichens, and sub-arctic willow scrub (as described in McLeod and others, 2005).

As in the Annex I habitat H4080 Sub-Arctic *Salix* sp. Scrub, montane willow scrub, corresponding largely to NVC type W20 (though not all types fit W20), is included. Heaths with prostrate juniper of NVC type H15 are included, but upland stands of upright juniper (W19) fall within the upland heathland or native pinewood priority habitats, apart from more isolated stands that would usually be included in the upland heathland priority habitat. Stands of *Betula nana* would mostly be included within blanket bog or upland heathland priority habitats. Scrub forms of W17 and W18 should be included within the appropriate woodland priority habitat.

The lower altitudinal limit of montane communities varies in different parts of the UK, occurring at lower altitudes in the north and west of Britain. Most communities occur on thin soils, which may be acidic or calcareous. Some communities are characteristic of very exposed ridges and summits, whereas others are restricted to sheltered situations where there is late snow-lie. A range of important rock outcrop and scree types, including tall herb ledge vegetation, often occur in close association with this habitat, along with high-altitude springs, flushes and other mire types, and Alpine calcareous grasslands.

The invertebrate fauna is diverse, with species such as the mountain burnet, the beetles *Stenus glacialis* and *Phyllodecta polaris,* the flies *Alliopsis atronitens* and *Rhamphomyia hirtula*, and the spider *Micaria alpina.* UK BAP priority species include three vascular plant spp, *Salix lanata, Artemisia norvegica* and *Juniperus communis*; six bryophyte species including *Herbertus borealis and Andraea frigida;* eight lichen species; and two moths, the northern dart and the netted mountain moth. Many other rare and local arctic-alpine plants and invertebrates occur. Notable birds include dotterel and ptarmigan. See also Thompson and others (2003).

Mountain heaths and willow scrubs are extensive in the Scottish Highlands, but highly localised in southern Scotland, England, Wales and Northern Ireland. Some montane communities (e.g. sub-arctic willow scrub and snowbeds) are extremely rare in the UK, and are only found in very small amounts south of the higher Scottish mountains, where they represent the southernmost extent of this vegetation type. Although most of this habitat occurs above 600m, in the exposed areas of the northwest Highlands and Islands of Scotland the characteristic montane plant communities can occur almost at sea level. The full extent of mountain heaths and willow scrub has not been fully surveyed. There is an estimated in Wales, between 400-600 ha in England, 60,000 ha in Scotland and 150 ha in Northern Ireland.

Mud Habitats in Deep Water

This habitat description has been adapted from the 1994 UK BAP Action Plan for Mud habitats in deep water and would benefit from an update http://www.ukbap.org.uk/UKPlans.aspx?ID=41. The Steering group associated with the marine BAP review, agreed in 2007 that this habitat would benefit from being split into two subcategories i.e. coastal subtidal mud and shelf subtidal mud

Correspondence with existing habitats

OSPAR habitat : Sea-pen and burrowing megafauna communities
Habitats Directive –Annex 1 Large shallow inlets and bays

Description

Mud habitats in deep water (circalittoral muds) occur below 20-30 m in many areas of the UK's marine environment, including marine inlets such as sea lochs. The relatively stable conditions associated with deep mud habitats often lead to the establishment of communities of burrowing megafaunal species where bathyal species may occur with coastal species. The burrowing megafaunal species include burrowing crustaceans such as *Nephrops norvegicus* and *Callianassa subterranea*. The mud habitats in deep water can also support seapen populations and communities with *Amphiura* spp.

Burrows and mounds produced by megafauna are prominent features on the surface of plains of fine mud, amongst conspicuous populations of seapens, typically *Virgularia mirabilis* and *Pennatula phosphorea*. These soft mud communities occur extensively throughout the more sheltered basins of sea lochs and voes. As these sites are typically sheltered from wave action, these communities may occur in quite shallow depths (15 m). These communities also occur in deep offshore waters of the North Sea, where densities of *N. norvegicus* can reach 68 per 100 m2, and in the Irish Sea. Other burrowing crustaceans include *Calocaris macandreae*, *C. subterranea* and *Goneplax rhomboides*. The echiuran *Maxmuelleria lankesteri* forms large mounds in some sea loch sites. Epibenthic scavengers include *Asterias rubens*, *Pagurus bernhardus* and *Liocarcinus depurator*. Brittlestars may be present and the infauna can contain populations of polychaetes and bivalves

Within deep fjordic sea lochs, 'forests' of the nationally scarce tall seapen *Funiculina quadrangularis* can occur, together with the other two species of seapens. However, as *F. quadrangularis* is considered to be a bathyal species which 'intrudes' into sea lochs and fjords, it may only be nationally scarce in inshore waters. The mud is also extensively burrowed by crustaceans, mainly *N. norvegicus,* and the goby *Lesueurigobius friesii* may be present in burrow entrances.

Areas of soft anoxic mud can have extensive bacterial mats of *Beggiatoa* spp. The anoxia may be the result of natural conditions of poor water exchange in some Scottish sea lochs or of nutrient enrichment under fish farm cages. The associated fauna is usually impoverished but scavenging species such as *Asterias rubens* and *Carcinus maenas* are typically present. In extreme conditions of anoxia, little survives except the *Beggiatoa*.

Offshore mud habitats can be characterised by the burrowing urchin *Brissopsis lyrifera* and the brittlestar *Amphiura chiajei* and in certain areas around the UK, such as the northern Irish Sea, this community may also include *N. norvegicus*.

In boreal and Arctic areas of water deeper than 100 m, the soft muds are dominated by a community of foraminiferans and hatchett shells *Thyasira* spp. with polychaete worms. There can be thousands of dead foraminiferan tests per square metre.

The most rare deep mud biotope is notable for the very high density of the rare sea squirt *Styela gelatinosa* and is known from only one site in the UK: Loch Goil, a Clyde sea loch. Within Loch Goil, the fine mud at 65 m has large numbers of solitary ascidicans, including *S. gelatinosa, Ascidia conchilega, Corella parallelogramma* and *Ascidiella* spp along with terebellid worms and the bivalve *Pseudamussium septemradiatum*. This biotope is considered to be an ice age relic.

Relevant biotopes

The biotopes associated with this habitat (agreed by the UK Marine BAP Review Steering Group (MPLUG, 2007) are:

SS.SMu.CSaMu Circalittoral sandy mud
SS.SMu.CFiMu Circalittoral fine mud
SS.SMu.OMu Offshore circalittoral mud

Particular attention focusses on the sub-biotopes that contain important biological communities e.g.
SS.SMu.CFiMu.SpnMeg Seapens, including *Funiculina quadrangularis*, and burrowing megafauna in undisturbed circalittoral fine mud
SS.SMu.CFiMu.SpnMeg Seapens and burrowing megafauna in circalittoral fine mud
SS.SMu.CFiMu.BlyrAchi *Brissopsis lyrifera* and *Amphiura chiajei* in circalittoral mud
SS.SMu.OMu.ForThy Foraminiferans and *Thyasira* sp. in deep circalittoral fine mud
SS.SMu.OMu.StyPse *Capitella capitata* and *Thyasira* spp. in organically-enriched offshore circalittoral mud and sandy mud

Current and potential threats

- *Demersal fishing*. principally for *Nephrops norvegicus*. *Nephrops* is one of the most important fisheries in Scotland and benthic trawls or pots/creels are the two methods of fishing employed. The use of benthic trawls can result in the removal of non-target species and disturbance to the seabed. Potting for prawns and other crustacea selectively removes some of the burrowing megafauna from deep mud.
- *Marine fish farms*. may have direct effects on mud communities, including smothering and increasing the Biological Oxygen Demand of the mud. Additional effects may result from the discharges of chemicals, some of which are especially toxic to crustaceans.
- *Pollution*. Nutrient enrichment leading to eutrophication can have significant detrimental effects. This can lead to changes in the structure and composition of deep mud communities.
- *Development.* The construction of roads, bridges and barrages may affect the local hydrodynamic and sediment transport regimes of inshore enclosed areas and consequently affect the deep mud substratum.
- *Anchoring*. This can cause physical damage to static megafaunal species such as seapens and *S. gelatinosa*.
- *Offshore oil rigs and other oil installati*ons. These can cause a variety of disturbance effects such as smothering due to disposal of drill cuttings, localised disturbance of sediments due to anchors and rig feet implacement and trench digging for pipelines.

References

http://www.ukbap.org.uk/habitats.aspx
Edited by Nikki Chapman, JNCC

Native Pine Woodlands

The definition of this habitat remains unchanged from the pre-existing Habitat Action Plan (http://www.ukbap.org.uk/UKPlans.aspx?ID=6) a summary of which appears below.

Native pine woodlands are relict indigenous forests dominated by self-sown *Scots Pinus sylvestris* which occur throughout the central and north-eastern Grampians and in the northern and western Highlands of Scotland. They are an important western representative of the European boreal forests in which structure and succession was probably determined naturally by storms and natural fires caused by lightning.

Native pinewoods occur on infertile, strongly leached, podsolic soils. They do not support a large diversity of plants and animals compared with some more fertile habitats. However, there is a characteristic plant and animal community which includes many rare and uncommon species. The main tree species is Scots pine although birches *Betula spp*., rowan *Sorbus aucuparia,* alder *Alnus glutinosa*, willows *Salix spp*., bird cherry *Prunus padus* are also found. Sessile oak *Quercus petracea* also occurs infrequently, mainly in the north-east of Scotland. A shrub understorey, where browsing levels are low, includes common juniper *Juniperus communis,* aspen *Populus tremula*, holly *Ilex aquifolium* and hazel *Corylus avellana*. Old or dead trees and rotting wood supports significant beetle and bryophyte communities. The field layer is characterised by acid tolerant plants like bell heather *Erica cinerea*, billberry *Vaccinium myrtillus* and crowberry *Empetrum nigrum*. Many uncommon and rare species are found in this habitat including the specialist *hoverfly Callicera rufa* and the distinctive bird species capercaillie *Tetrao urogallus*. Britain`s only endemic bird species the Scottish crossbill *Loxia scotica*, and rare species such as twinflower *Linnaea borealis* and one-flowered wintergreen *Moneses uniflora* are also found mainly in the native pinewoods.

In pre-historic times native mixed forests dominated by pine may have covered over 1.5 million ha in the Scottish Highlands about 4,000 years ago. Now they occupy around 1% of this former range, some 16,000 hectares, which is spread over 77 separate areas across the Highlands. Much of the areas are sparsely wooded, and regeneration is being prevented in many areas by heavy browsing by deer and sheep. However, recent regeneration schemes have started to increase the area again. Genetically distinct populations have been identified in different regions, particularly in the north-western and south-western Highlands.

Oligotrophic and Dystrophic Lakes

Correspondence with existing habitat/s

- Broad Habitat: Standing open water and canals
- Phase 1: G1 Standing water
- JNCC revised lakes classification: Types A, B, C1 and C2
- NVC: Various, including A7, A9, A13, A14, A22- A24; S4, S8-S11, S19b
- Annex I: H3110 Oligotrophic waters containing very few minerals of sandy plains (part): *Littorelletalia uniflora*; H3130 Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoeto-Nanojuncetea* (part); H3140 Hard oligo-mesotrophic waters with benthic vegetation of *Chara* species (part); H3160 Natural dystrophic lakes and ponds (part)
- Other: Palmer lake macrophyte classification types 2 and 3

Description

Oligotrophic and dystrophic lakes are water bodies mainly more than 2 ha in size which are characterised by their low nutrient levels and low productivity. Their catchments usually occur on hard, acid rocks, most often in the uplands. This habitat type encompasses a wide range of size and depth, and includes the largest and deepest water bodies in the UK. Good examples may support some of the least disturbed aquatic assemblages in the UK.

Oligotrophic lakes usually have very clear water, whilst some examples with dystrophic characteristics have peat-stained waters. Characteristic plankton, zoobenthos, macrophyte and fish communities occur, including several UK BAP species and species of economic importance. Fish communities, generally dominated by salmonids, may include charr *Salvelinus alpinus* and *Coregonus* spp. A number of benthic and planktonic invertebrates, found only in oligotrophic lakes, are possibly glacial relicts. Macrophytes are typically sparse, with species such as shoreweed *Littorella uniflora* and quillwort *Isoetes* spp. Shores are typically stony, and emergent vegetation is generally restricted to sheltered bays, where species such as bottle sedge *Carex rostrata* and bulrush S*cirpus lacustris* may be found. Oligotrophic and dystrophic lakes support a range of UK BAP priority species and other species listed on Annexes of the Habitats and Birds Directives, e.g. slender naiad *Najas flexilis*, salmon *Salmo salar*, common scoter *Melanitta nigra*, black-throated diver *Gavia arctica*, and otter *Lutra lutra.*

Oligotrophic and dystrophic lakes occur throughout the UK, but mostly in upland areas of the north and west.

The BAP priority habitat will comprise Tier 1 and Tier 2 Lakes from the UK Lakes database (i.e. Lakes of known conservation importance; of this set, Tier 2 are the damaged but remediable lakes), plus any

Tier 3 Lakes which are assigned to that Tier due to lack of data, rather than because they are of known low importance.

New data are due to be incorporated in 2008-09 by the UK Lakes HAP Group (www.lakeshap.org.uk), which will then re-allocate all their lakes within the same Tier structure.

A small minority of dystrophic lakes are not also oligotrophic. The work described above will identify these, which can then be incorporated into this or into the priority habitats Eutrophic Standing Waters or Mesotrophic Lakes, on a case-by-case basis.

Open Mosaic Habitats on Previously Developed Land

(updated July 2010)

Correspondence with existing habitat/s

- UK BAP broad habitat: Built up areas and gardens.
- Phase 1: Quarry, Spoil, Mine, Ephemeral/short perennial, Bare Ground.
- NVC: Overall there is a poor fit to described communities and this weakness is identified in the review of coverage of the NVC communities (Rodwell *et al*., 2000). Although some components of the habitat are characterised by annual/open vegetation plant communities described in the NVC (Rodwell *et al*., 2000) others are allied to sclerotic associations better described in continental Europe. Grassland communities associated with this habitat complex include MG1-2, MG9, MG10, MG11, MG13; CG10 (Rodwell *et al*., 1992); and U1-2, whilst the scrub communities W6 and W23 are also commonly encountered (Rodwell *et al*., 1991). Complexes and mosaics can also include a range of aquatic plant communities (see Rodwell *et al*., 1995) and swamp communities (Rodwell *et al*., 1995).
- Annex I: None (Calaminarian grasslands are covered by another priority habitat proposal).
- Other: Poor fit to Shimwell (1983), but includes 3B and artificial-substrate equivalents of 7A
- The priority habitat is delimited by edaphic and other site conditions, and specific sites are likely to include elements of other priority habitats as minor components of the overall mosaic. With the specific exception of post-industrial substrates that are rich in heavy metal which would qualify as the proposed Calaminarian grassland priority habitat, sites with such mosaics will be considered as qualifying as 'open mosaic habitats on previously developed land' priority habitat.

Definition and criteria for field recognition of the habitat

The main source of evidence for this definition came from a Defra research project, Riding *et al.* (2009). Their proposed definition was very slightly amended by the inter-agency working group, in consultation with Defra and some members of their project steering group.

Each of these criteria must be met.

	Criterion
1.	The area of open mosaic habitat is at least 0.25 ha in size.
2.	Known history of disturbance at the site or evidence that soil has been removed or severely modified by previous use(s) of the site. Extraneous materials/substrates such as industrial spoil may have been added.
3.	The site contains some vegetation. This will comprise early successional communities consisting mainly of stress-tolerant species (e.g. indicative of low nutrient status or drought). Early successional communities are composed of (a) annuals, or (b) mosses/liverworts, or (c) lichens, or (d) ruderals, or (e) inundation species, or (f) open grassland, or (g) flower-rich grassland, or (h) heathland.
4.	The site contains unvegetated, loose bare substrate and pools may be present.

5.	The site shows spatial variation, forming a mosaic of one or more of the early successional communities (a)–(h) above (criterion 3) plus bare substrate, within 0.25 ha.

Definition: explanatory notes

The criteria are for guidance but cannot cover all potential scenarios and an element of expert judgement is therefore needed. It is assumed that the user will be a ble to recognise plant communities and the key component species.

1. The minimum size refers to the potential open mosaic habitat (OMH), which might be a part of a larger site containing other habitats such as woodland or developed land.

2. Disturbance refers to that resulting from major historical industrial use or development.
   - 2.1 Extraneous materials refer to extensive additions of spoil rather than incidental dumping of litter, broken glass, etc.
   - 2.2 There might be evidence of heavy metal contamination but extensive stands of Calaminarian grasslands are specifically excluded as that is a distinct Priority Habitat.

3. Brief descriptions of the early successional communities:
   - (a) Annual communities are those comprised mainly of stress tolerant ruderals, which are short in stature and suited to low nutrient availability. Typical examples would be *Arenaria serpyllifolia*, *Centaurium erythrea*, *Linum catharticum* or *Trifolium arvense*.
   - (b) Moss/liverwort communities can contain both acrocarpous (i.e. usually unbranched, tufted) and pleurocarpous (usually branched, carpeted) mosses and ar e usually relatively open and less luxuriant than in more mature habitats, often with bare ground present in a fine-grained mosaic. They can occur in discrete patches or interspersed in other communities such as open grassland or heathland. Common species are usually present such as the mosses *Brachythecium rutabulum*, *Dicranum scoparium* or *Hypnum cupressiforme* and the liverworts *Lophocolea heterophylla* or *Ptilidium ciliare*.
   - (c) Lichen communities are likely to occur in extensive patches or interspersed with other communities such as open grassland or heathland. Species with a r ange of growth forms might be present, for example foliose (leaf-like), crustose (crust) or fruticose (shrubby and branched).
   - (d) Ruderal communities are those composed mainly of taller annuals, biennials or short-lived perennials and t ypical of slightly more nutrient-rich, or less disturbed conditions than the annual communities. Typical examples would be *Daucus carota*, *Linaria vulgaris*, *Medicago lupulina* or *Reseda luteola*.
   - (e) Inundation communities are comprised of species suited to periodic, often seasonal flooding. Vegetation is usually interspersed with bare areas of mud which can have a caked surface during dry periods and can result in annuals establishing. Typical species would be *Alopecurus geniculatus*, *Juncus bufonius*, *Persicaria maculosa* or *Ranunculus flammula*.
   - (f) Open grassland is comprised mainly of perennial, stress-tolerant species of short stature with patches of bare ground at very fine-grained scale and often with a significant number of annual species or lichens in the sward. Typical species would be *Festuca ovina*, *Hypochaeris radicata*, *Pilosella officinarum* or *Rumex acetosella*.
   - (g) Flower-rich grassland is a more typical, mature community with fewer gaps and characterised by more robust mesotrophic forbs such as *Centaurea nigra*, *Lotus corniculatus*, *Ranunculus acris* or *Trifolium pratense*.
   - (h) Heathland communities are composed mainly of dwarf shrubs, often interspersed or in mosaics with graminoids, bryophytes or lichens. On OMH they tend to have a more open structure with less plant litter and other organic matter build up on the substrate than in more typical heathlands. Typical species include *Calluna vulgaris*, *Deschampsia flexuosa*, *Festuca ovina* or *Nardus stricta*.
   - 3.1 Annex 1 shows species of vascular plant known to be associated with, but not confined to, the habitat in certain areas and/or substrates.
   - 3.2 Other plant species associated with the particular edaphic conditions might also be present, for example ericaceous species on acidic sites. Species composition will also vary with geographic location and site age.

3.3 One of the principal reasons for the habitat being a priority is its importance for invertebrates. Many have very precise requirements for habitat 'niches' within their landscape. As well as areas of bare ground and food plants, these may be for sheltered places at various times of the year, or for rough vegetation or cover at others. At any particular site, features such as scrub may be essential to maintain the invertebrate value of the main habitat. Therefore, scattered scrub (up to 10–15% cover) may be present and adds to the conservation value of the site. Other communities or habitats might also be present (e.g. reed swamp, open water), but early successional communities should comprise the majority of the area.

4. 'Loose bare' substrate is intended to separate substrate potentially colonisable by plants from large expanses of sealed surface (concrete, tarmac, etc) where vegetation could only establish if it is broken up or heavily weathered.
   4.1 Bare substrate can occur at a range of spatial scales, from unvegetated patches easily seen from a distance, to small, open spaces between individual plants within a community. On some substrates, for example coal spoil, the patches of bare ground may be 10 cm across or less. A site with a wide variety of patch sizes could also qualify.
   4.2 Bare substrate also implies absence of organic matter accumulation.

5. A mosaic is defined as an area where a range of contiguous plant community types occur in transition with one another, usually with ecotone habitat gradients and repeated occurrences of each community, and often at a small scale.
   5.1 The mosaic could comprise either:
      - a mixture of one of the habitats (a)–(c) or (e)–(h) plus bare ground together forming a mosaic;
      - a mixture of two or more of the habitats (a)–(h) in a mosaic, with adjacent bare ground;
      - a mixture of two or more of the habitats (a)–(h) plus bare ground together forming a mosaic.
   5.2 Continuous blocks of a closed plant community greater than 0.25 ha would be classified as a habitat other than OMH, although those containing very fine-grained mosaics might qualify.

Background Information

The information in this section comes from the submission to the BAP species and Habitats review in 2006–07 (http://www.ukbap.org.uk/library/BRIG/SHRW/SpeciesandHabitatReviewReport2007.pdf). It has been edited.

These are generally primary successions, and as such unusual in the British landscape, especially the lowlands. The vegetation can have similarities to early/pioneer communities (particularly grasslands) on more 'natural' substrates but, due to the edaphic conditions, the habitat can often persist (remaining relatively stable) for decades without active management (intervention). Stands of vegetation commonly comprise small patches and may vary over relatively small areas, reflecting small-scale variation in substrate and topography.

Plant assemblages are unusual, selected by propagule supply as well as site conditions (Ash *et al*. (1991) for several waste types, Shaw (1994) on Pulverized Fuel Ash (PFA)). The habitat supports a range of notable vascular plant, moss and lichen species. These often include species declining in the wider countryside such as *Ophrys apifera*, *Gymnadenia conopsea* (alkaline wastes), *Epipactis youngiana* (acid waste), *Osmunda regalis* (acid sandstone quarries), *Peltigera rufescens* (lime waste, PFA), *Cladonia pocillum* (calcareous wastes), *Diploschistes muscorum* (PFA) and a UK BAP priority liverwort, *Petalophyllum ralfsii* (PFA). Exotic plant species, which are well adapted to the prevailing environmental conditions, are a characteristic component of associated plant assemblages.

Invertebrate faunas can be species-rich and include many uncommon species (Eyre *et al*., 2002, 2004). Between 12% and 15% of all nationally-rare and nationally-scarce insects are recorded from brownfield sites, which will include many post-industrial examples (Gibson, 1998; Jones, 2002) (see below). Exotic plants provide for an extended flowering season and, with the floristic and structural diversity of the habitat mosaic, contribute to the value of the habitat for invertebrates (see Bodsworth *et al*., 2005).

Some areas are important for birds that are primarily associated with previously developed or brownfield land such as little ringed plover (in 1984 97% of LRP nests in England were in 'man-made' habitats), as well as more widespread, but UK BAP priority species, including skylark and grey partridge. The habitat provides secure breeding and feeding areas commonly absent from land under agricultural management.

The heterogeneity within the habitat mosaic reflects chemical and physical modification by former development or previous industrial processes, including the exposure of underlying substrates and the tipping of wastes and spoils. Features such as ditches, other exposures, spoil mounds and even the relicts of built structures provide topographical heterogeneity at the macro- and micro-scale. Sealed surfaces and compaction add further variation and contribute to the modified hydrology of such habitats resulting in areas of impeded and accelerated drainage. Stochastic factors also have a significant influence in shaping the habitat.

Edaphic conditions for this habitat are severely limiting on plant growth. Examples are substrates with extreme pH, whether alkaline (e.g. chemical wastes) or acid (e.g. colliery spoils); deficiency of nitrogen (PFA), or available phosphate (highly calcareous Leblanc waste, blast furnace slag and calcareous quarry spoil); or water-deficient (dry gravel and sand pits). Other typical situations where such conditions arise include disused quarries, former railway sidings, extraction pits and landfill sites.

The habitat is concentrated in urban, urban fringe and large-scale former industrial landscapes, especially in the lowlands, though more isolated examples can be found on previously developed land in more remote rural areas.

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ANNEX 1: CHARACTERISTIC SPECIES

NOTE: these are provisional working lists, from February 2010. As more sites are surveyed and mapped, more up-to-date lists are likely to become available. Please check the UKBAP website http://www.ukbap.org.uk for up-dates.

Species	Common Name	Southern	N. England	Scotland	S. Wales colliery sites	Thames area (species important for invertebrates)
Achillea millefolium	Yarrow					x
Agrimonia eupatoria	Agrimony					x
Agrostis vineale	Brown Bent				x	
Aira caryophyllea	Silver Hair-grass				x	
Aira praecox	Early Hair-grass				x	
Anthemis arvensis*	Corn Chamomile				x	
Anthemis cotula*	Stinking Chamomile				x	
Anthyllis vulneraria	Kidney Vetch					x
Arctium lappa*	Greater Burdock				x	
Arctium minus	Lesser Burdock				x	
Armeria maritima	Thrift					x
Artemisia absinthium*	Wormwood	x			x	
Artemisia verlotiorum*	Chinese Mugwort	x				
Artemisia vulgaris*	Mugwort	x	x	x		
Aster novi-belgii*	Confused Michaelmas-daisy	x	x	x		
Atriplex patula	Common Orache				x	
Atriplex prostrata*	Spear-leaved Orache				x	
Ballota nigra*	Black Horehound				x	
Barbilophozia floerkei	Common Pawwort				x	
Beta vulgaris	Beet				x	
Blackstonia perfoliata	Yellow-wort	x	x			
Calluna vulgaris	Heather				x	
Campanula glomerata	Clustered Bellflower					x
Campanula rotundifolia	Harebell					x
Carduus crispus	Welted Thistle				x	
Carduus nutans	Musk Thistle				x	
Carduus tenuiflorus	Slender Thistle				x	
Carex arenaria	Sand Sedge				x	
Carex otrubae	False Fox-sedge				x	
Carex pilulifera	Pill Sedge				x	
Catapodium rigidum	Fern-grass				x	
Centaurea cyanus	Cornflower				x	
Centaurea nigra	Common Knapweed	x	x	x		x
Centaurium erythraea	Common Centaury	x	x			
Centranthus ruber*	Red Valerian					x
Cerastium fontanum	Common Mouse-ear	x	x	x		
Chaenorhinum minus*	Small Toadflax				x	
Chenopodium album	Fat-hen				x	
Chenopodium bonus-henricus*	Good-King-Henry				x	
Chenopodium ficifolium*	Fig-leaved Goosefoot				x	

Chenopodium hybridum*	Maple-leaved Goosefoot				x	
Chenopodium polyspermum*	Many-seeded Goosefoot				x	
Chenopodium rubrum	Red Goosefoot				x	
Chrysanthemum segetum*	Corn Marigold				x	
Cichorium intybus*	Chicory	x	x	x	x	
Clinopodium acinos	Basil Thyme					x
Clinopodium vulgare	Wild Basil					x
Conium maculatum*	Hemlock	x	x	x		
Conyza canadensis*	Canadian Fleabane	x				
Conyza sumatrensis*	Guernsey Fleabane	x				
Crepis biennis	Rough Hawk's-beard	x	x		x	
Crepis capillaris	Smooth Hawk's-beard	x	x	x	x	
Dactylorhiza praetermissa	Southern Marsh-orchid	x	x			
Daucus carota ssp. sativus*	Carrot	x	x			
Deschampsia flexuosa	Wavy Hair-grass	x	x		x	
Dianthus armeria	Deptford Pink					x
Dianthus deltoides	Maiden Pink					x
Diplotaxis tenuifolia*	Perennial Wall-rocket	x				
Dipsacus fullonum	Wild Teasel				x	
Echium vulgare	Viper's-bugloss	x	x	x		x
Equisetum arvense	Field Horsetail	x	x	x		
Erica cinerea	Bell Heather				x	
Erigeron acer	Blue Fleabane	x	x			x
Erodium cicutarium	Common Stork's-bill					x
Euphrasia spp.	Eyebright	x	x			
Festuca ovina	Sheep's-fescue				x	
Filago minima	Small Cudweed				x	
Filago vulgaris	Common Cudweed				x	
Galega officinalis*	Goat's-rue	x				
Galeopsis bifida	Bifid Hemp-nettle				x	
Galeopsis speciosa*	Large-flowered Hemp-nettle				x	
Galeopsis tetrahit	Common Hemp-nettle				x	
Galium verum	Lady's Bedstraw					x
Geranium molle	Dove's-foot Crane's-bill					x
Glaucium flavum	Yellow Horned-poppy					x
Gnaphalium uliginosum	Marsh Cudweed				x	
Helianthemum nummularium	Common Rock-rose					x
Hieraceum aurantiacum*	Fox-and-cubs					x
Hieracium sabaudum	Autumn Hawkweed	x	x			
Hypericum perforatum	Perforate St John's-wort	x	x	x		x
Hypochaeris radicata	Cat's-ear	x	x	x		
Juncus inflexus	Hard Rush	x	x	x		
Kickxia elatine*	Sharp-leaved Fluellen				x	
Kickxia spuria*	Round-leaved Fluellen				x	
Knautia arvensis	Field Scabious					x

Lactuca serriola*	Prickly Lettuce				x	
Lactuca virosa	Great Lettuce				x	
Lamium amplexicaule*	Henbit Dead-nettle				x	
Lamium hybridum*	Cut-leaved Dead-nettle				x	
Lathyrus latifolius*	Broad-leaved Everlasting-pea					x
Leontodon autumnalis	Autumn Hawkbit					x
Leontodon hispidus	Rough Hawkbit					x
Lepidium ruderale*	Narrow-leaved Pepperwort	x				
Leucanthemum vulgare	Oxeye Daisy					x
Linaria purpurea*	Purple Toadflax	x	x			x
Linaria repens*	Pale Toadflax	x	x		x	
Linaria vulgaris	Common Toadflax	x	x	x	x	x
Linum catharticum	Fairy Flax	x	x	x		
Lophozia ventricosa	A liverwort				x	
Lotus corniculatus	Common Bird's-foot-trefoil				x	x
Lotus glaber	Narrow-leaved Bird's-foot-trefoil	x				
Malva moschata	Musk-mallow					x
Marrubium vulgare*	White Horehound				x	
Matricaria matricarioides	Pineapple Weed	x	x	x		
Matricaria recutita*	Scented Mayweed				x	
Medicago lupulina	Black Medick	x	x	x		x
Medicago sativa	Lucerne	x				
Melilotus altissimus*	Tall Melilot	x	x			
Melilotus officinalis*	Ribbed Melilot	x	x			
Mentha arvensis	Corn Mint				x	
Misopates orontium*	Weasel's-snout				x	
Nardus stricta	Mat-grass	x	x			
Odontites vernus	Red Bartsia	x	x	x		
Oenothera spp.*	Evening Primrose	x	x			
Ononis spinosa	Spiny Restharrow					x
Onopordum acanthium*	Cotton Thistle				x	
Ophrys apifera	Bee Orchid	x	x			
Origanum vulgare	Wild Marjoram					x
Orobanche minor	Common Broomrape				x	
Parentucellia viscosa	Yellow Bartsia				x	
Picris echioides*	Bristly Oxtongue	x	x		x	
Picris hieracioides	Hawkweed Oxtongue	x	x			
Pilosella officinarum agg	Mouse-ear-hawkweed				x	x
Pilosella praealta*	Tall Mouse-ear-hawkweed	x				
Plantago coronopus	Buck's-horn Plantain				x	
Plantago lanceolata	Ribwort Plantain	x	x	x		
Plantago media	Hoary Plantain					x
Poa compressa	Flattened Meadow-grass				x	
Primula veris	Cowslip					x
Prunella vulgaris	Selfheal					x
Ptilidium ciliare	Ciliated Fringewort				x	
Pulsatilla vulgaris	Pasqueflower					x
Ranunculus acris	Meadow Buttercup					x
Ranunculus bulbosus	Bulbous Buttercup					x

Reseda lutea	Wild Mignonette	x	x	x		x
Reseda luteola*	Weld	x	x	x		
Rumex acetosa	Common Sorel				x	
Salvia pratensis	Meadow Clary					x
Sanguisorba minor	Salad Burnet					x
Saponaria officinalis*	Soapwort	x	x	x		
Scabiosa columbaria	Small Scabious					x
Scrophularia nodosa	Common Figwort				x	
Senecio squalidus*	Oxford Ragwort	x	x	x		
Silene vulgaris	Bladder Campion	x	x	x		x
Spergularia rubra	Sand Spurrey				x	
Tanacetum vulgare	Tansy				x	
Teucrium scorodonia	Wood Sage				x	
Thymus polytrichus	Wild Thyme				x	x
Thymus serpyllum	Breckland Garden					x
Tragopogon pratensis	Goat's-beard	x	x	x	x	
Trifolium arvense	Hare's-foot Clover	x	x	x		x
Trifolium campestre	Hop Trefoil	x	x	x	x	x
Trifolium dubium	Lesser Trefoil	x	x	x		
Trifolium hybridum*	Alsike Clover	x	x	x		
Trifolium medium	Zigzag Clover	x	x	x		
Trifolium micranthum	Slender Trefoil				x	
Trifolium pratense	Red Clover	x	x	x		
Trifolium scabrum	Rough Clover				x	
Trifolium striatum	Knotted Clover				x	
Trisetum flavescens	Yellow Oat-grass	x	x	x		
Tussilago farfara	Colt's-foot	x	x	x	x	
Vaccinium myrtillus	Bilberry				x	
Valerianella carinata*	Keeled-fruited Cornsalad				x	
Valerianella locusta	Common Cornsalad				x	
Verbascum nigrum	Dark Mullein	x			x	x
Verbascum thapsus	Great Mullein				x	
Veronica agrestis*	Green Field-speedwell				x	
Vicia cracca	Tufted Vetch	x	x	x		
Vicia hirsuta	Hairy Tare	x	x	x		
Vicia tetrasperma	Smooth Tare	x				
Vulpia bromoides	Squirreltail Fescue				x	
Vulpia myuros*	Rat's-tail Fescue				x	

*introduced species of lower biodiversity value but still characteristic of OMH sites. Species lists from Riding et al. (2009) (*Open Mosaic Habitats on Previously Developed Land, site identification guide* December 2009 ADAS UK Ltd. Sources of information about status: species represented in columns 2–4 – ADAS 2009 as above; other vascular species – status from BSBIs New Atlas CD-ROM, species always introduced in Wales (col 5) or in England (col 6).

Peat and Clay Exposures with Piddocks

Correspondence with existing habitats

- UK BAP broad habitat: Littoral sediment, Sublittoral sediment
- May be component part of Annex 1 habitats
- LR.HLR.FR.RPid and LR.MLR.MusF.MytPid; CR.MCR.SfR.Pid; CR.MCR.SfR (possibly)

Description

This habitat includes littoral and sublittoral examples of peat and clay exposures, both of which are soft enough to allow them to be bored by a variety of piddocks, particularly *Pholas dactylus*, *Barnea candida* and *Barnea parva*. Peat and clay exposures with either existing or historical evidence of piddock activity are unusual communities of limited extent, adding to the biodiversity interest where they occur. These unique and fragile habitats are irreplaceable, arising from former lake bed sediments and ancient forested peatland (or 'submerged forests'). Depending on erosion at the site, both clay and peat can occur together or independently of each other.

Where peat is present on the shore or in shallow waters, the surface may be characterised by algal mats consisting of the red seaweed *Ceramium* spp. and the green seaweeds *Ulva lactuca* and *Ulva intestinalis.* However, sand scour can limit the cover provided by these seaweeds. The crabs *Carcinus maenas* and *Cancer pagurus* often occur in crevices in the peat, with hydroids in any small pools. On clay, seaweed cover is generally sparse with species such as *Mastocarpus stellatus* and *Ceramium spp.* attached to loose-lying pebbles or shells. On the surface of the clay, there may be small clumps of the mussel *Mytilus edulis*, together with barnacles and the winkle *Littorina littorea*. The polychaete worms *Polydora* spp. and *Hediste diversicolor* can sometimes be present within the clay. When the piddocks have died, their holes provide a micro-habitat for species such as small crabs and anemones such as *Cereus pedunculatus* and *Aulactinia verrucosa*.

It is known that peat and clay beds exist sublittorally, but the extent and maximum depth of this habitat is not known. There is little information on the communities associated with subtidal examples of peat and clay exposures, but the flora and fauna is likely to be different to those found associated with intertidal examples. It is possible that subtidal exposures of this BAP habitat support communities, which may or may not include piddocks. Surveys of a subtidal peat and clay exposure in the Menai Strait recorded the piddock *Zirfaea crispata*, a sparse cover of hydroids, e.g. *Sertularia cupressina, Hydrallmania falcata, Tubularia indivisa* and *Nemertesia antennina* and crabs - *Cancer pagurus*, *Necora puber* and *Carcinus meanas.*

Depending on its location, this habitat can experience periodic inundation and emergence from sediments. This habitat encompasses examples of peat and clay exposures with either existing or historical piddock activity (i.e. dead shells in piddock holes). This BAP habitat also encompasses occurrences of peat and clay exposures with no evidence of either past or present piddock activity, but which have the potential for this community to develop on the basis of environmental conditions and presence of similar beds locally. This BAP habitat does not include examples of harder sedimentary rock (e.g. limestone) with the piddock *Hiatella arctica*. It also does not include piddocks in sandstone, chalk and soft mudstone.

Summary of environmental preferences:

Salinity	Fully marine - variable
Wave exposure	Exposed to extremely sheltered
Tidal streams	Moderate to strong
Substratum	Exposures occur within a variety of shore types.
Zone/depth	Littoral to circalittoral

This habitat is distributed along the north and south coasts of Wales, and the south and east coasts of England. Clay exposures with piddocks are also found in Cumbria. Little is known about UK distribution of subtidal peat and clay exposures, but they are likely to occur in the vicinity of intertidal occurrences.

Illustrative biotopes

- LR.HLR.FR.RPid - *Ceramium* sp. and piddocks on eulittoral fossilised peat
- LR.MLR.MusF.MytPid - *Mytilus edulis* and piddocks on eulittoral firm clay
- CR.MCR.SfR – Soft rock communities
- CR.MCR.SfR.Pid - Piddocks with a sparse associated fauna in sublittoral very soft chalk or clay

Both the above biotopes correlate with this BAP habitat. There are currently no biotopes that describe subtidal peat exposures.

Current and potential threats

- *Coastal development:* physical damage arising from development of infrastructure, trenching and cable/pipe-laying.
- *Coastal protection:* Coastal defence works can affect peat and clay habitats, both directly and indirectly, through habitat loss and also alteration of sediment regimes.
- *Dredging activity:* Maintenance and capital dredging operations may result in direct habitat removal or indirectly through changes in sediment and hydrological regimes.
- *Mussel fisheries:* Both peat and clay habitats are vulnerable to physical disturbance and smothering arising from dredge, mussel lay and mussel collection operations associated with commercial mussel fisheries.
- *Non-natives:* There is no evidence to suggest that native piddocks have been displaced in the UK, but in Belgium and The Netherlands, the non-native American piddock *Petricola pholadiformis*, has almost completely displaced the native piddock, *Barnea candida*. *Petricola pholadiformis* has been recorded in low abundances in exposures of this habitat in the UK.
- *Bait collection:* In some areas piddocks are harvested as fishing bait, which results in physical damage to the habitat.
- *Climate change:* Both clay and peat habitats are sensitive to increases in wave exposure, which can increase the rate of erosion. Elevated wave exposure may result from changes to tidal heights and increased storm events which may be linked to the effects of climate change.

Image

Figure 9. Clay exposure with dead piddock image collection, Anon.)

Figure.10 Piddocks in peat. (Image: JNCC shells. (Image: CCW).

Author Aethne Cooke, JNCC

Ponds

Correspondence with existing habitat/s

- UK BAP broad habitat: Standing open waters and canals
- Phase 1: G1 Standing water
- NVC: Various aquatic, swamp and fen communities; OV28-OV35; and others
- Annex I: Includes H3170 Mediterranean temporary ponds; H3110 Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflora*) (part); H3130 Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoeto-Nanojuncetea* (part); H3140 Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. (part); H3150 Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation (part); and H3160 Natural dystrophic lakes and ponds (part)

Description

Ponds, for the purpose of UK BAP priority habitat classification, are defined as permanent and seasonal standing water bodies up to 2 ha in extent which meet one or more of the following criteria:

- Habitats of international importance: Ponds that meet criteria under Annex I of the Habitats Directive.
- Species of high conservation importance: Ponds supporting Red Data Book species, UK BAP species, species fully protected under the Wildlife and Countryside Act Schedule 5 and 8, Habitats Directive Annex II species, a Nationally Scarce wetland plant species, or three Nationally Scarce aquatic invertebrate species.
- Exceptional assemblages of key biotic groups: Ponds supporting exceptional populations or numbers of key species. Based on (i) criteria specified in guidelines for the selection of biological SSSIs (currently amphibians and dragonflies only), and (ii) exceptionally rich sites for plants or invertebrates (i.e. supporting ≥30 wetland plant species or ≥50 aquatic macroinvertebrate species).
- Ponds of high ecological quality: Ponds classified in the top PSYM category ("high") for ecological quality (i.e. having a PSYM score ≥75%). [PSYM (the Predictive SYstem for Multimetrics) is a method for assessing the biological quality of still waters in England and Wales; plant species and / or invertebrate families are surveyed using a standard method; the PSYM model makes predictions for the site based on environmental data and using a minimally impaired pond dataset; comparison of the prediction and observed data gives a % score for ponds quality].
- Other important ponds: Individual ponds or groups of ponds with a limited geographic distribution recognised as important because of their age, rarity of type or landscape context e.g. pingos, duneslack ponds, machair ponds.

Priority habitat ponds can be readily identified by standard survey techniques such as those developed for NVC, Common Standards Monitoring, the National Pond Survey or for specific species groups. Ponds will need to be distinguished from other existing priority habitat types. The general principle to be applied is that where the standing water element is functionally a component of another priority habitat and that priority habitat definition takes account of the standing water element then it should be treated as part of that habitat. For example small waterbodies within blanket bog should be considered as part of the blanket bog priority habitat, but ponds in heathland (which are not dealt with through the heathland HAP) should be considered under the pond priority habitat. Agreement has been reached with the lake HAP group that the pond priority habitat will cover most water bodies up to 2 ha while the lake priority habitat will cover most water bodies greater than 2ha. As with other potentially overlapping priority habitat types a small proportion of cases will need to be individually assessed to decide how they are best dealt with.

Ponds are widespread throughout the UK, but high-quality examples are now highly localised, especially in the lowlands. In certain areas high quality ponds form particularly significant elements of the landscape, e.g. Cheshire Plan marl pits, the New Forest ponds, pingos of East Anglia, mid-Wales mawn pools, the North East Wales pond landscape, the forest and moorland pools of Speyside, dune slack pools, the machair pools in the Western Isles of Scotland, and examples of Habitats Directive Annex I pond habitats across Northern Ireland.

Estimates, based on the relatively small pond data sets currently available, suggest that around 20% of the c.400,000 ponds outside curtilage in the UK might meet one or more of the above criteria.

An inventory of ponds, including many high quality sites, has been established as part of the National Pond Monitoring Network and work is in progress to add further known sites to this database. This is publicly accessible (for non-sensitive sites/species) at www.pondnetwork.org.uk. Currently about 500 high quality sites are listed on this database. The National Pond Monitoring Network (NPMN) will provide the main mechanism for monitoring priority habitat ponds. The NPMN was established in 2002 as a partnership of organisations involved in pond monitoring led by the Environment Agency and Pond Conservation.

Purple Moor Grass and Rush Pastures

The definition of this habitat remains unchanged from the pre-existing Habitat Action Plan (http://www.ukbap.org.uk/UKPlans.aspx?ID=17) a summary of which appears below. Following the 2007 review, occurrences of this habitat on roadside verges are also covered by the definition.

Purple moor grass and rush pastures occur on poorly drained, usually acidic soils in lowland areas of high rainfall in western Europe. In the UK, they are found in south-west England, particularly in Devon, southern Wales, south-west Scotland, perhaps extending as far north as northern Argyll, and in Northern Ireland, especially Fermanagh. Elsewhere in Europe they are particularly characteristic of the oceanic and sub-oceanic regions of the western seaboard, from Portugal to the Low Countries, extending eastward into central Europe.

Their vegetation, which has a distinct character, consists of various species-rich types of fen meadow and rush pasture. Purple moor grass *Molinia caerulea,* and rushes, especially sharp-flowered rush *Juncus acutiflorus*, are usually abundant. Just as the best examples of lowland heath contain a wide range of plant communities, so the same is true for this habitat: the characteristic plant communities often occur in a mosaic with one another, together with patches of wet heath, dry grassland, swamp and scrub.

Key species associated with purple moor grass and rush pastures include: wavy St. Johns-wort *Hypericum undulatum,* whorled caraway *Carum verticillatum*, meadow thistle *Cirsium dissectum*, marsh hawk`s beard *Crepis paludosa*, greater butterfly orchid *Platanthera chlorantha,* lesser butterfly orchid *Platanthera bifolia*, marsh fritillary butterfly *Eurodryas aurinia*, brown hairstreak *Thecla betulae*, narrow-bordered bee hawkmoth *Hermaris tityus*, curlew *Numenius arquata*, snipe *Gallinago gallinago,* and barn owl *Tyto alba*.

Purple moor grass and rush pastures are a priority for nature conservation because they are highly susceptible to agricultural modification and reclamation throughout their range. In Devon and Cornwall, where the habitat is known as Culm Grassland, only 8% of that present in 1900 remains, with a staggering 62% of sites and 48% of the total area being lost between 1984 and 1991. In Northern Ireland, between 1990 and 1993, the rate of loss of fen meadow was reckoned to be 3.3% per annum. Fragmentation and isolation of stands have been common.

In Wales it is estimated that there is now about 24,000 ha of lowland purple moor grass and rush pasture. In south west England 530 purple moor grass and rush pastures sites are known to survive on the Culm Measures, covering 3,981 ha, 400 sites on Dartmoor covering 1,000 ha with a further 90 sites covering about 300 ha on the Blackdowns. In Northern Ireland it was estimated that there was about 24,600 ha in 1993. No area estimates are available for Scotland, but the total extent is thought likely to be in the region of 2,000 ha. Thus it is probable that the total extent of the habitat in the UK is now about 56,000 ha. This is thought to be considerably more than survives in the rest of Europe, with the possible exception of the Republic of Ireland.

Reedbeds

The definition of this habitat remains unchanged from the pre-existing Habitat Action Plan (http://www.ukbap.org.uk/UKPlans.aspx?ID=19) a summary of which appears below. Reedbeds are wetlands dominated by stands of the common reed *Phragmites australis*, wherein the water table is at or above ground level for most of the year. They tend to incorporate areas of open water and ditches, and small areas of wet grassland and carr woodland may be associated with them. There are about 5000 ha of reedbeds in the UK, but of the 900 or so sites contributing to this total, only about 50 are greater than 20 ha, and these make a large contribution to the total area. Reedbeds are amongst the most important habitats for birds in the UK. They support a distinctive breeding bird assemblage including 6 nationally rare Red Data Birds the bittern *Botaurus stellaris*, marsh harrier, *Circus aeruginosus*, crane *Grus grus*, Cetti`s warbler *Cettia cetti*, Savi`s warbler *Locustella luscinioides* and bearded tit *Panurus biarmicus,* provide roosting and feeding sites for migratory species (including the globally threatened aquatic warbler *Acrocephalus paludicola*) and are used as roost sites for several raptor species in winter. Five GB Red Data Book invertebrates are also closely associated with reedbeds including red leopard moth *Phragmataecia castanaea* and a rove beetle *Lathrobium rufipenne*.

Rivers (updated December 2011)

Contents

Correspondence with existing habitat/s

- UK BAP broad habitat: Rivers and streams
- Phase 1: G2 Running water
- NVC: Various, including A2, A8-9, A11-20, S4-9, S11-14, S16-19, S22 and others
- Annex I: H3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
- JNCC river types: I-X

Description

This habitat type includes a very wide range of types, encompassing all natural and near-natural running waters in the UK (i.e. with features and processes that resemble those in 'natural' systems). These range from torrential mountain streams to meandering lowland rivers.

Numerous factors influence the ecological characteristics of a watercourse, for example geology, topography, substrate, gradient, flow rate, altitude, channel profile, climate, catchment features (soil, land use, vegetation, etc.). Human activities add to this complexity. In addition most river systems change greatly in character as they flow from source to sea or lake. Although various classifications and typologies for rivers exist, none is considered adequate for identifying a discrete but comprehensive series of specific priority types against the criteria. Consequently a broad 'rivers' priority habitat has been adopted by the UK BAP, which includes the existing priority habitat, chalk rivers. Work to refine the criteria to identify the priority habitat was carried out by a partnership group, including representatives from the conservation and environment agencies, and Buglife, which proposed the following criteria. These were agreed by the UK BAP Biodiversity Reporting and Information Group (BRIG) on 19 July 2010.

Criteria for identification of BAP priority rivers

Units of assessment

The nature of rivers is typically one of continuous downstream change, with no clear boundaries and with localised physical and biological variability. Because of the physical, chemical and biological changes that occur from source to mouth, a single assessment of river 'quality' cannot be made for the entire watercourse (unless it is very short and uniform), but rather in shorter assessment sections. In SERCON (System for Evaluating Rivers for Conservation), rivers are divided into ECSs (Evaluated Corridor Sections) which are considered to constitute ecologically relevant units for evaluation (www.jncc.gov.uk/pdf/CSM_rivers_Mar05.pdf Appendix 1). An ECS is usually 10–30 km and comprises part of a single river (i.e. the main stem or a tributary) which shows predominantly uniform characteristics such as underlying geology, slope or size.

Although a national dataset of river ECS divisions has been developed, this covers only about 30% of the UK river network and is still subject to validation and amendment. In time it is desirable that BAP priority habitat should be defined with reference to ECSs as these have greater ecological relevance than divisions based on administrative or other boundaries drawn for practical rather than scientific reasons. However, until a comprehensive set of ECSs is available for the UK, the unit for assessment of BAP priority river habitat will be the individual river 'water bodies' defined for use in the EC Water Framework Directive (WFD). The environment agencies in the UK identified WFD water bodies soon after the directive came into force. Boundaries between water bodies often lie at the confluence of two watercourses; they do not necessarily comprise single rivers but may also include several streams within the catchment or sub-catchment. For BAP purposes, lower parts of the river within the freshwater tidal zone can also be included. Headwaters, because of the small size of their catchments, are often not classified as water bodies under the WFD; these should be included separately when identifying BAP priority habitat.

Features qualifying BAP priority river habitat

River water bodies will qualify as BAP priority habitat either because they are considered to be near-natural, or because they fulfil one or more specific criteria relating to BAP priority species or to particular habitat types. BAP actions and targets will be part of local biodiversity strategies. Where a stretch of river is near-natural, the aim will be to maintain this quality and, where possible, to increase the naturalness of other parts of the river system. There are various ways of defining what is meant by 'near-natural' but, to increase consistency, only the relatively few river water bodies defined as being at 'high status' under the WFD are included in this category. Where a river qualifies on grounds other than naturalness, improvements in habitat quality may also form part of the objectives for maintaining the interest of its BAP features. As a significant proportion of the running water resource in the UK is likely to qualify, achievable priorities will need to be set for action, to improve the extent, habitat connectivity or quality of BAP priority rivers.

The list of qualifying criteria is as follows. There is more detail in the background section.

1. **Riverine water bodies of high hydromorphological/ecological status**. The Environment Agency, the Northern Ireland Environment Agency and the Scottish Environmental Protection Agency have developed criteria and rules to identify such water bodies (http://www.wfduk.org/tag_guidance/article_4/high_status).
2. **Headwaters**. To qualify as a priority habitat for 'Rivers' under the criterion of 'headwaters' a stream must be:
   a watercourse within 2.5 km of its furthest source as marked with a blue line on Ordnance Survey (OS) maps at a scale of 1:50,000. Note that each tributary of a river will have its own headwater, so there will be more than one (sometimes many more) per catchment. Headwaters which have been significantly altered from their natural state are however not included.
3. **Occurrence of the EC Habitat Directive Annex I habitat (H3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation)**. The definition will include (but not be confined to) all river SACs designated for the feature.
4. **Chalk Rivers** as given in the existing BAP definition.
5. **Active shingle rivers**. Data for this can come from River Habitat Surveys (Environment Agency 2003) or indicator species of invertebrate (see criterion 7).
6. **A/SSSIs (Areas/Sites of Special Scientific Interest)** designated for river species, riverine features or fluvial geomorphology.
7. **Species** including:

i. Annex II Habitats Directive species
ii. BAP priority species
iii. Invertebrate species which are strongly indicative of river shingle

See the list of qualifying species, Annex 1. To qualify, an ECS or WFD water body needs to have either:

- records of any one species from criterion levels A (BAP priority species strongly dependent on river habitat quality) or C (non-BAP priority species, indicative of shingle rivers), or
- from criterion level B (widespread BAP priority species which are less dependent on river habitat quality alone), records of 6 or more species. This threshold has been selected by looking at available records for all criteria and identifying a level which returns a manageable proportion of the rivers network.

Where the English, Northern Irish, Scottish or Welsh country biodiversity groups have signed off their own lists of BAP priority species, including species which are not in the UK list, then rivers can qualify for these species using criteria agreed at country level.

A UK working group has collated data available at UK level about criteria 1 to 7 and used it to make an initial list of proposed BAP rivers, to support local BAP decisions. Local BAP practitioners may have access to better local data which can be used to refine the proposed list. The list will be posted on the UK BAP website (www.ukbap.org.uk), along with background papers explaining the data and methods used.

The following are excluded from this priority habitat:

- Canals;
- Ditches;

As a minimum the rivers priority habitat would be defined as extending to the top of the adjacent banks, recognising that (a) it may be desirable to restore a river to a previous course, and (b) a river's floodplain (present or historical) may be essential to its ecological functioning. Significant areas of adjoining priority habitats (such as fen, woodland, grassland and heathland types) may form an integral component of river systems for the purposes of conservation and management, but would be excluded from the formal definition of the Rivers priority habitat. This would also apply to areas of metalliferous river shingle supporting Calaminarian grassland (part of a separate proposed priority habitat). Adjacent ponds would be included within the River habitat if they have been formed as a result of river dynamics (e.g. oxbows), but not if they are artificial or formed by an unrelated process (e.g. pingos).

The plant and animal assemblages of rivers and streams vary according to their geographical area, underlying geology and water quality. Swiftly-flowing upland, nutrient-poor rivers support a wide range of mosses and liverworts and relatively few species of higher plants. The invertebrate fauna of upland rivers is dominated by stoneflies, mayflies and caddisflies, while fish such as salmon *Salmo salar* and brown trout *Salmo trutta* will almost certainly be present. In contrast, lowland nutrient-rich systems are dominated by higher plants, and coarse fish such as chub *Leuciscus cephalus*, dace *Leuciscus leuciscus* and roach *Rutilus rutilus*. Exposed sediments such as shingle beds and sand bars are important for a range of invertebrates, notably ground beetles, spiders and craneflies. Marginal and bankside vegetation is an integral part of a river, supporting a range of river processes, as well as acting as habitat in its own right for a diverse flora and fauna, and as a migration corridor.

Background Information

The information in this section comes from the submission to the BAP species and Habitats review in 2006–07 (http://www.ukbap.org.uk/library/BRIG/SHRW/SpeciesandHabitatReviewReport2007.pdf), unless stated otherwise.

Headwaters
Based on submission to priority habitats review dated 2/11/05.

The definition of 'headwater' as given by Furse (1995) is 'a watercourse within 2.5 km of its furthest source as marked with a blue line on Ordnance Survey (OS) Landranger maps with a scale of 1:50,000.' In Britain, headwaters probably represent >70% of the total length of flowing waters. This implies a total length >146,000 km.

Physical and chemical characteristics of headwaters vary greatly according to their location, altitude, geology, and surrounding land-use. By definition, headwaters form the uppermost segments of rivers, and as such play an important role in the overall functioning of river ecosystems downstream. Although some headwaters, either deliberately or incidentally, are included within protected areas such as SACs and SSSIs/ASSIs most are not, and the total length of headwaters receiving some form of special protection is a very small percentage of all headwaters in the UK.

Rivers with *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
Extracted from *McLeod* and others *(2005) Selection of SACs in the UK: habitat accounts;* see: http://www.jncc.gov.uk/ProtectedSites/SACselection/habitat.asp?FeatureIntCode=H3260. A fuller description and classification of this habitat type in the UK, together with details of threats and impacts, are given in Life in UK Rivers (2003).

This habitat type is characterised by the abundance of water-crowfoots *Ranunculus* spp., subgenus *Batrachium* (*Ranunculus fluitans*, *R*. *penicillatus* sap. *penicillatus*, *R*. *penicillatus* sap. *pseudofluitans*, and *R*. *peltatus* and its hybrids). Floating mats of these white-flowered species are characteristic of river channels in early to mid-summer. They may modify water flow, promote fine sediment deposition, and provide shelter and food for fish and invertebrate animals.

There are several variants of this habitat in the UK, depending on geology and river type. In each, *Ranunculus* species are associated with a different assemblage of other aquatic plants [but see sub-type 3], such as water-cress *Rorippa nasturtium-aquaticum*, water-starworts *Callitriche* spp., water-parsnips *Sium latifolium* and *Berula erecta*, water-milfoils *Myriophyllum* spp. and water forget-me-not *Myosotis scorpioides*. In some rivers, the cover of these species may exceed that of *Ranunculus* species. Three main sub-types are defined by substrate and the dominant species within the *Ranunculus* community.

Sub-type 1: This variant is found on rivers on chalk substrates. The community is characterised by pond water-crowfoot *Ranunculus peltatus* in spring-fed headwater streams (winterbournes), stream water-crowfoot *R*. *penicillatus* sap. *pseudofluitans* in the middle reaches, and river water-crowfoot *R*. *fluitans* in the downstream sections. *Ranunculus* is typically associated in the upper and middle reaches with *Callitriche obtusangula* and *C*. *platycarpa*.

Sub-type 2: This variant is found on other substrates, ranging from lime-rich substrates such as oolite, through soft sandstone and clay to more mesotrophic and oligotrophic rocks. There is considerable geographic and ecological variation in this sub-type. Faster-flowing western rivers on harder rocks, for example in Wales and south-west England, support stream water-crowfoot *Ranunculus penicillatus* sap. *penicillatus*, while western and northern rivers on sandstone or alluvial substrates often support both *R*. *penicillatus* sap. *penicillatus* and river water-crowfoot *R*. *fluitans*. Sub-type 2 rivers elsewhere in the UK contain a mixture of species, and often hybrids, but rarely support *R*. *penicillatus* sap. *penicillatus* or *R*. *fluitans*. Associated species which may be present include lesser water-parsnip *Berula erecta*, blunt-fruited water-starwort *Callitriche obtusangula*, and, in more polluted rivers, curled pondweed *Potamogeton crispus*, fennel pondweed *P*. *pectinatus* and horned pondweed *Zannichellia palustris*. Flowering-rush *Butomus umbellatus* is an occasional bank-side associate.

Sub-type 3: This variant is a mesotrophic to oligotrophic community found on hard rocks in the north and west. Rivers in Wales, Northern Ireland and south-west England are significant for the occurrence of stream water-crowfoot *Ranunculus penicillatus* sap. *penicillatus*. Other typical species include the aquatic moss *Fontinalis squamosa*, alternate water-milfoil *Myriophyllum alterniflorum* and intermediate water-starwort *Callitriche hamulata*. More oligotrophic examples of this community lack *Ranunculus* spp. and are dominated by *M*. *alterniflorum*, *C*. *hamulata* and bog pondweed *Potamogeton polygonifolius*.

Chalk Rivers
Extracted from the *UK HAP for chalk rivers* (http://www.ukbap.org.uk/UKPlans.aspx?ID=25). Further, updated information is given in *The state of England's chalk rivers* (2004).

There are approximately 35 chalk rivers and major tributaries ranging from 20 km to 90 km in length. They are located in south and east England – from the Frome in Dorset to the Hull in Humberside.

Chalk rivers have a characteristic plant community, often dominated in mid-channel by river water crowfoot *Ranunculus penicillatus* var. *pseudofluitans* and starworts *Callitriche obtusangula* and *C*. *platycarpa*, and along the edges by watercress *Rorippa nasturtium-aquaticum* and lesser water-parsnip *Berula erecta*. They have low banks which support a range of water-loving plants. This plan considers action required for the river channel and banks but not for the whole catchment or floodplain.

All chalk rivers are fed from groundwater aquifers, producing clear waters and a generally stable flow and temperature regime . These are conditions which support a rich diversity of invertebrate life and important game fisheries, notably for brown trout *Salmo trutta*, brook lamprey *Lampetra planeri*, salmon *Salmo salar*, crayfish *Austropotamobius pallipes* and otter *Lutra lutra* are among the species listed on Annex II of the EC Habitats Directive which chalk rivers support.

Most chalk rivers have 'winterbourne' stretches in their headwaters. These often run dry, or partially dry, in late summer because of lack of rainfall recharging the aquifer. A characteristic range of invertebrates has adapted to these conditions, as is the brook water crowfoot *Ranunculus peltatus*.

Where the river corridor (approximately 50 m either side of the river) is not affected by intensive agriculture, fisheries or urban development, rich fen vegetation has developed. This is maintained by extensive cattle grazing or naturally progresses to carr woodland. These areas are particularly rich in insect life and breeding birds.

Active Shingle Rivers
Based on submission to priority habitats review dated 2/11/05.

This habitat comprises those rivers which have significant reaches composed of a gravel or pebble bed material (with grain sizes in the range 2–256 mm), sometimes with discrete sandy reaches or deposits (0.064–2 mm diameter) in areas of lower slope, and having characteristic suites of features generated by the processes of erosion, sediment transport, deposition, and storage. Their headwaters are usually in upland areas which generate high-energy discharges, resulting in intermittent sediment movement. Average bed sediment size usually declines downstream (with the downstream reduction in underlying gradient and stream power) generating a commensurate change in habitat.

Typically, these rivers have extensive reaches of gravel, pebble and sand bed material in their middle reaches and in the piedmont zone, these shingle deposits being associated with a wandering, dynamic, meandering or divided channel and active erosion and sediment deposition features. The gravel-bed reaches exhibit characteristic macro-scale bed form morphology with features including point bars and eroding cliffs, side- and mid-channel bars, and pool–riffle sequences. These features are typically unvegetated, reflecting their dynamic nature. Sediment transport and the formation of the characteristic habitat features typically occur only at high flows, when bedload may comprise up to 50% of the total sediment load in transit. Many of the macro-scale features are exposed in the channel as shingle during low-flow conditions. Sand bed reaches or deposits typically exhibit micro-scale bed form morphology with features such as ripples, dunes and plane beds. The transport and deposition of sand-sized material occurs across a wide range of discharges.

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Annex 1: qualifying species

Criterion level	NBN current scientific name	Common name	Classification level 2	Annex II	BAP priority species	Active river shingle species	limits to criterion/notes
A	*Acipenser sturio*	common sturgeon	bony fish		√		There are few sites
A	*Alosa alosa*	allis shad	bony fish	Ann II	√		There are few sites
A	*Alosa fallax*	twaite shad	bony fish	Ann II	√		There are few sites
A	*Cobitis taenia*	spined loach	bony fish	Ann II	√		There are few sites
A	*Osmerus eperlanus*	smelt (sparling)	bony fish		√		Only 6, ephemeral populations left
A	*Salvelinus alpinus*	Arctic charr	bony fish		√		Only records where breeding in rivers
A	*Collema dichotomum*	river jelly lichen	lichen		√		There are few sites
A	*Endocarpon adscendens*	a lichen	lichen		√		There are few sites
A	*Peltigera lepidophora*	ear-lobed dog-lichen	lichen		√		There are few sites
A	*Phaeophyscia endococcina*	a lichen	lichen		√		There are few sites
A	*Andreaea nivalis*	snow rock-moss	bryophyte		√		There are few sites
A	*Bryum gemmiparum*	Welsh thread-moss	bryophyte		√		There are few sites
A	*Bryum schleicheri*	Schleicher's thread-moss	bryophyte		√		There are few sites
A	*Bryum uliginosum*	cernuous bryum	bryophyte		√		There are few sites
A	*Cryphaea lamyana*	multi-fruited river moss	bryophyte		√		There are few sites
A	*Dumortiera hirsuta*	Dumortier's liverwort	bryophyte		√		There are few sites
A	*Fissidens serrulatus*	large Atlantic pocket-moss	bryophyte		√		There are few sites
A	*Pohlia scotica*	Scottish pohlia	bryophyte		√		There are few sites
A	*Rhytidiadelphus subpinnatus*	scarce turf-moss	bryophyte		√		River-bank records only
A	*Seligeria carniolica*	water rock-bristle	bryophyte		√		There are few sites
A	*Thamnobryum angustifolium*	Derbyshire feather-moss	bryophyte		√		There are few sites
A	*Thamnobryum cataractarum*	Yorkshire feather-moss	bryophyte		√		There are few sites

Criterion level	NBN current scientific name	Common name	Classification level 2	Annex II	BAP priority species	Active river shingle species	limits to criterion/notes
A	*Agabus brunneus*	Sharp's diving beetle	beetle		√		There are few sites
A	*Bembidion testaceum*	pale pin-palp	beetle		√	√	
A	*Bidessus minutissimus*	minutest diving beetle	beetle		√	√	
A	*Donacia bicolora*	two-tone reed beetle	beetle		√		There are few sites
A	*Hydrochus nitidicollis*	brass necked beetle	beetle		√	√	
A	*Meotica anglica*	shingle rove beetle	beetle		√	√	
A	*Thinobius newberyi*	Newbery's rove beetle	beetle		√	√	
A	*Lophopus crystallinus*	a bryozoan	bryozoan		√		There are few sites
A	*Glossosoma intermedium*	small grey sedge	caddisfly		√		There are few sites
A	*Hydropsyche bulgaromanorum*	scarce grey flag	caddisfly		√		There are few sites
A	*Ironoquia dubia*	scarce brown sedge	caddisfly		√		There are few sites
A	*Austropotamobius pallipes*	white-clawed crayfish	crustacean	Ann II	√		recent records only
A	*Coenagrion mercuriale*	southern damselfly	damselfly	Ann II	√		Restricted & threatened
A	*Cliorismia rustica*	southern silver stiletto-fly	fly		√		
A	Empis limata	the borders dance-fly	fly		√		There are few sites
A	*Lipsothrix ecucullata*	Scottish yellow splinter	fly		√		There are few sites
A	*Lipsothrix nigristigma* (*L. nobilis*)	scarce yellow splinter	fly		√		There are few sites
A	*Rhabdomastix japonica*	river-shore cranefly	fly		√	√	
A	*Nigrobaetis niger*	southern iron blue mayfly	mayfly		√		
A	*Potamanthus luteus*	yellow mayfly	mayfly		√		There are few sites
A	*Gyraulus acronicus*	Thames ram's-horn snail	mollusc		√		There are few sites
A	*Margaritifera margaritifera*	freshwater pearl mussel	mollusc	Ann II	√	√	

Criterion level	NBN current scientific name	Common name	Classification level 2	Annex II	BAP priority species	Active river shingle species	limits to criterion/notes
A	*Myxas glutinosa*	glutinous snail	mollusc		√		There are few sites
A	*Pisidium tenuilineatum*	fine-lined pea mussel	mollusc		√		Intermediate between 'few sites' and widespread
A	*Sphaerium solidum*	Witham orb mussel	mollusc		√		There are few sites
A	*Brachyptera putata*	northern february red	stonefly		√	√	
A	*Isogenus nubecula*	scarce yellow sally	stonefly		√		There are few sites
A	*Illecebrum verticillatum*	coral-necklace	vascular plant		√		River records only (ie probably only Cornish records)
A	*Luronium natans*	floating water plantain	vascular plant	Ann II	√		River records only (probably only two rivers, in Gwynedd and Ceredigion)
A	*Potamogeton compressus*	grass-wrack pondweed	vascular plant		√		River records only
A	*Schoenoplectus triqueter*	triangular club-rush	vascular plant		√		There are few sites
B	*Anguilla anguilla*	European eel	bony fish		√		
B	*Cottus gobio*	bullhead	bony fish	Ann II	√		English or Welsh records only
B	*Salmo salar*	Atlantic salmon	bony fish	Ann II	√		
B	*Salmo trutta*	brown/sea trout	bony fish		√		
B	*Lampetra fluviatilis*	river lamprey	jawless fish	Ann II	√		widespread
B	*Lampetra planeri*	brook lamprey	jawless fish	Ann II	√		widespread
B	*Petromyzon marinus*	sea lamprey	jawless fish	Ann II	√		
B	*Lipsothrix errans*	northern yellow splinter	fly		√		
B	*Pseudanodonta complanata*	depressed (or compressed) river mussel	mollusc		√		Fairly widespread, may be under-recorded
B	*Arvicola terrestris*	water vole	terrestrial mammal		√		

Criterion level	NBN current scientific name	Common name	Classification level 2	Annex II	BAP priority species	Active river shingle species	limits to criterion/notes
B	*Lutra lutra*	otter	terrestrial mammal	Ann II	√		
B	*Pipistrellus pygmaeus*	soprano pipistrelle	terrestrial mammal		√		River records only
B	*Oenanthe fistulosa*	tubular water-dropwort	vascular plant		√		River records only
B	*Sium latifolium*	Greater Water Parsnip	vascular plant		√		River records only
B	*Stellaria palustris*	marsh stitchwort	vascular plant		√		River-bank records only
B	*Emberiza schoeniclus**	reed bunting	bird		√		only records of breeding near rivers
C	*Dyschirius angustatus*		beetle			√	
C	*Lionychus quadrillum*		beetle			√	
C	*Perileptus areolatus*		beetle			√	

* Note that when the revised definition was first agreed and published (July 2010), reed bunting (*Emberiza schoeniclus*) was classified as a category 'A' species (a BAP priority species strongly dependent on river habitat quality). A review of evidence was subsequently commissioned from the British Trust for Ornithology, and can be found here (http://jncc.defra.gov.uk/pdf/UKBAP_ReedBunting-2010.pdf). The review supports the inclusion of records of breeding reed bunting as a category B species, and therefore the table above has been amended accordingly.

The previous rivers' definition, published in July 2010, can be found at: http://jncc.defra.gov.uk/Docs/UKBAP_BAPHabitats-45-Rivers2010.doc

Sabellaria alveolata Reefs

This habitat description has been adapted from the 1994 UK BAP Action Plan for *Sabellaria alveolata* reefs and therefore would benefit from an update http://www.ukbap.org.uk/UKPlans.aspx?ID=32.

Correspondence with existing habitats

Habitats Directive –Annex 1: Reefs

Description

Sabellaria alveolata reefs are formed by the honeycomb worm *Sabellaria alveolata*, a polychaete which constructs tubes in tightly packed masses with a distinctive honeycomb-like appearance. These reefs can be up to 30 or even 50 cm thick and take the form of hummocks, sheets or more massive formations. Reefs are mainly found on the bottom third of the shore, but may reach mean high water of neap tides and extend into the shallow subtidal in places. They do not seem to penetrate far into low salinity areas. Reefs form on a variety of hard substrata, from pebbles to bedrock, in areas with a good supply of suspended sand grains from which the animals form their tubes, and include areas of sediment when an attachment has been established. The larvae are strongly stimulated to settle by the presence of existing colonies or their dead remains. *S. alveolata* has a very variable recruitment and the cover in any one area may vary greatly over a number of years, although in the long term reefs tend mainly to be found on the same shores.

In Britain, *S. alveolata* reefs are found only on shores with strong to moderate wave action in the south and west, between Lyme Bay on the south coast of England and the Scottish coast of the Solway Firth. The reefs have also been found on parts of the Northern Ireland coast. The British Isles represent the northern extremity of the range in the north-east Atlantic, which extends south to Morocco. The reefs also occur in the Mediterranean.

Individual worms have a lifespan of typically three to five years, and possibly up to nine years, but reefs themselves may last longer as a result of further settlement of worms onto existing colonies. Typically in the first two years or so, after a heavy intertidal settlement, there are few associated species. Over time, seaweeds including fucoids, *Palmaria palmata*, *Polysiphonia* spp, *Ceramium* spp, *Enteromorpha* spp and *Ulva lactuca*, and animals including barnacles, dogwhelks, winkles, mussels and other bivalves such as *Nucula nucleus*, *Sphenia binghami* and *Musculus discors*, colonise the reef. Small polychaetes such as *Fabricia stellaris, Golfingia* spp and syllidae predators may occur within the colonies. Blennies, small crabs (*Carcinus maenas*) and other crustacea (such as *Unicola crenatipalma*) can be found within crevices. Older reefs may increase the biodiversity and stability of what would otherwise be sand abraded rocks and boulders. Sheet-like reefs may restrict drainage of the shore, creating rockpools where there would otherwise be none. Less is known about subtidal communities.

In Britain, *S. alveolata* forms well developed reefs over much of its range. The most numerous and extensive areas occur on the Cumbrian coast, particularly between the Morecambe Bay and the Solway Estuary and at Dubmill Point. Reefs are also found in Cardigan Bay and in the Bristol Channel, including the coasts of south Wales, north Devon, Somerset and Avon. Very extensive subtidal reefs occur in the Severn Estuary, and subtidal populations have also been reported in the Walney Channel (Morecambe Bay) and from Glassdrumman, Northern Ireland.

There is evidence of a significant contraction in range on the south coast of England over a period of at least 20 years until 1984. Declines have also been reported in the western part of the north Cornish coast, the upper parts of the Bristol Channel and in North Wales and the Dee Estuary. Causes have not been postulated and it is difficult to assess the true significance of these changes given the natural variability of the species. For example, *S. alveolata* reefs have recently developed off Heysham (in Morecambe Bay), dominating two hectares of boulder scar from where it had been absent for 30 years

Relevant biotopes

LS.LBR.Sab Littoral Sabellaria honeycomb worm reefs
SS.SBR.PoR.SalvMx *Sabellaria alveolata* on variable salinity sublittoral mixed sediment

Current and potential threats

- *Cold winters / climate change Sabellaria alveolata* reefs are at the northern end of their range in Britain and are affected by extremely cold winters, after which they may die back for many years, particularly at higher shore levels.
- *Prolonged burial* will cause mortality. But can tolerate burial for a period of days or even weeks
- *Accumulations or losses of sand* as a result of shoreline development, which is the major cause of loss in parts of Europe. These developments may have positive or negative effects depending on the nature of the changes.
- *Trampling damage* by beach users and extraction of the worms for angling bait both occur, but on a limited and local scale.
- *Competition for space with common mussels Mytilus edulis* occurs, especially on boulder scars, but factors influencing this are unknown. Heavy settlement of mussels on *S. alveolata* reefs has been suspected of causing short term destabilisation and loss of habitat.
- *Variable recruitment :S. alveolata* is naturally subject to very variable recruitment, but the factors influencing this are not fully understood. Lack of larval supply and wave exposure is thought to be an important factor in the general absence of reefs on Anglesey and near to major peninsulas such as south-west Cornwall, Pembrokeshire and the Lleyn Peninsula.

References

http://www.ukbap.org.uk/habitats.aspx

Edited by Nikki Chapman, JNCC

Sabellaria spinulosa Reefs

This habitat description has been adapted from the 1994 UK BAP Action Plan for *Sabellaria spinulosa* reefs and therefore would benefit from an update http://www.ukbap.org.uk/UKPlans.aspx?ID=38.

Correspondence with existing habitats

OSPAR habitat: *Sabellaria spinulosa* reefs
Habitats Directive –Annex 1: Reefs

Description

Sabellaria spinulosa reefs comprise of dense subtidal aggregations of this small, tube-building polychaete worm. *Sabellaria spinulosa* can act to stabilise cobble, pebble and gravel habitats, providing a consolidated habitat for epibenthic species. They are solid (albeit fragile), massive structures at least several centimetres thick, raised above the surrounding seabed, and persisting for many years. As such, they provide a biogenic habitat that allows many other associated species to become established. The *S. spinulosa* reef habitats of greatest nature conservation significance are those which occur on predominantly sediment or mixed sediment areas. These enable a range of epibenthic species with their associated fauna and a specialised 'crevice` infauna, which would not otherwise be found in the area, to become established. Studies have compared an area of *S. spinulosa* with other macrofaunal communities in the Bristol Channel and found that the former had a higher faunal diversity (more than 88 species) and higher annual production (dominated by suspension-feeders) than other benthic communities in the area.

S. spinulosa requires only a few key environmental factors for survival in UK waters. Most important seems to be a good supply of sand grains for tube building, put into suspension by strong water movement (either tidal currents or wave action). *S. spinulosa* also appears to be very tolerant of polluted conditions. The worms need some form of hard substratum to which their tubes will initially be attached, whether bedrock, boulders, artificial substrata, pebbles or shell fragments. However, the presence of extensive reefs in predominantly sediment areas indicates that, once an initial concretion of tubes has formed, additional worms may settle onto the colony enabling it to grow to considerable size without the need for additional 'anchorage` points. Published work has noted that the planktonic larvae are strongly stimulated to settle onto living or old colonies of *S. spinulosa*, although they will eventually (after two or three months in the plankton) settle onto any suitable substratum in the absence of other individuals.

Given its few key requirements, and its tolerance of poor water quality, *S. spinulosa* is naturally common around the British Isles. It is found in the subtidal and lower intertidal/sublittoral fringe with a wide distribution throughout the north-east Atlantic, especially in areas of turbid seawater with a high sediment load. Recent research in the Wash using remote video, identified very extensive areas of reef rising up to 60 cm above the seabed and almost continuously covering a linear extent of 300 m. However, in most parts of its geographical range *S. spinulosa* does not form reefs, but is solitary or in small groups encrusting pebbles, shell, kelp holdfasts and bedrock. It is often cryptic and easily overlooked in these habitats. Where conditions are favourable, much more extensive thin crusts can be formed, sometimes covering extensive areas of seabed. However, these crusts may be only seasonal features, being broken up during winter storms and quickly reforming through new settlement the following spring. There are extensive examples of this form of colony on the west Wales coast, particularly off the Lleyn Peninsula and Sarnau candidate Special Area of Conservation (cSAC) and the Berwickshire and North Northumberland Coast cSAC. These crusts are not considered to constitute true *S. spinulosa* reef habitats because of their ephemeral nature, which does not provide a stable biogenic habitat enabling associated species to become established in areas where they are otherwise absent.

The closely related *Sabellaria alveolata* has been recorded as living for up to nine years. It is possible that *S. spinulosa* is similarly long-lived. The examination of reefs in the Bristol Channel revealed that they possessed only a small number of young, derived from sources outside of the study area. The adults in the colony were not gravid during the study and grew very little. The age of a colony may greatly exceed the age of the oldest individuals present, as empty concretions of *S. spinulosa* sand tubes are frequently found and must be able to persist for some time in the marine environment. However, there have been no studies of the longevity of individual worms, or the longevity and stability of colonies or reefs.

Consideration of the present and historical status of this habitat in the Wadden Sea area is useful because it has been much better studied than in the UK. Large subtidal *S. spinulosa* reefs in the German Wadden Sea, which provided an important habitat for a wide range of associated species, have been completely lost since the 1920s. *S. spinulosa* now appears in the *Red List of Macrofaunal Benthic Invertebrates of the Wadden Sea.*

Relevant biotopes
SS.SBR.PoR.SspiMx - *Sabellaria spinulosa* on stable circalittoral mixed sediment

Current and potential threats
- Dredging for oysters and mussels, trawling for shrimp or fin fish, net fishing and potting can all cause physical damage to erect *S. spinulosa* reef communities. The impact of the mobile gear breaks the reefs down into small chunks which no longer provide a habitat for the rich infauna and epifauna associated with this biotope..
- Aggregate dredging often takes place in areas of mixed sediment where *S. spinulosa* reefs may occur. The impacts of this activity on their long-term survival is unknown, but suspension of fine material during adjacent dredging activity is not considered likely to have detrimental effects on the habitat.
- Pollution is listed as one of the major threats to *S. spinulosa* in the Wadden Sea. However, pollution was not identify as a significant problem (sludge dumping in Dublin Bay actually encouraged the establishment of *Sabellaria*) unless high sedimentation drastically changed the substratum. *S. spinulosa* reefs in the Wadden Sea, destroyed by fishing activities, have been replaced by beds of mussel *Mytilus edulis* and sand-dwelling amphipods *Bathyporeia* spp. This is partly attributed to an increase in coastal eutrophication, favouring *Mytilus*.

References
http://www.ukbap.org.uk/habitats.aspx

Edited by Nikki chapman, JNCC

Saline Lagoons

This habitat description has been adapted from the 1994 UK BAP Action Plan for Coastal saltmarsh beds and would benefit from an update (http://www.ukbap.org.uk/UKPlans.aspx?ID=42).

Correspondence with existing habitats

Habitats Directive –Annex 1: Coastal Lagoons

Description

Lagoons in the UK are essentially bodies, natural or artificial, of salinewater partially separated from the adjacent sea. They retain a proportion of their seawater at low tide and may develop as brackish, full saline or hyper-saline water bodies.The largest lagoon in the UK is in excess of 800 ha (Loch of Stenness) although the rest are much smaller and some may be less than 1 ha. Lagoons can contain a variety of substrata, often soft sediments which in turn may support tasselweeds and stoneworts aswell as filamentous green and brown algae. In addition lagoons contain invertebrates rarely found elsewhere. They also provide important habitat for waterfowl, marshland birdsand seabirds. The flora and invertebrate fauna present can be divided into three main components: those that are essentially freshwater in origin, those that are marine/brackish species and those that are more specialist lagoonal species. The presence of certain indigenous and specialist plants and animals make this habitat important to the UK's overall biodiversity.
There are several different types of lagoons, ranging from those separated from the adjacent sea by a barrier of sand or shingle ('typical lagoons'), to those arising as ponded waters in depressions on soft sedimentary shores, to those separated by a rocky sill or artificial construction such as a sea wall. Sea water exchange in lagoons occurs through a natural or man-modified channel or by percolation through, or overtoppingof, the barrier. The salinity of the systems is determined by various levels of freshwater input from ground or surface waters. The degree of separation and the nature of the material separating the lagoon from the sea are the basis for distinguishing several different physiographic types of lagoon.

Relevant biotope

IR.LIR.Lag Submerged fucoids, green or red seaweeds (low salinity infralittoral rock)
SS.SSa.SSaLS Sublittoral sand in low or reduced salinity (lagoons)
SS.SMu.SMuLS Sublittoral mud in low or reduced salinity (lagoons)
SS.SMx.SMxLS Sublittoral mixed sediment in low or reduced salinity (lagoons)
SS.SMp.Ang Angiosperm communities in reduced salinity

Current and potential threats

- *Transient lagoons* Many lagoons, particularly in England and Wales, are naturally transient, salinity regimes change as succession leads to freshwater conditions and eventually to vegetation such as fen carr. Some formerly saline sites are now freshwater.
- *Infilling of lagoons*:The bar-built sedimentary barriers of 'typical' coastal lagoons tend to naturally move landwards with time. Lagoons behind them will eventually be in-filled as bar sediments approach the shore.
- *Pollution*, in particular nutrient enrichment leading to eutrophication, can have major detrimental effects. This may result from direct inputs to the lagoon or from water supply to the lagoon.
- *Artificial control of water* (sea and fresh) to lagoons can have profound influences on the habitat. Many lagoons are often seen as candidates for infilling or land claim aspart of coastal development.
- *Coastal defence works* can prevent the movement of sediments along the shore and lead to a gradual loss of the natural coastal structures within which manycoastal lagoons are located.
- *Sea level rise*: The impact of coastal defences will be compounded by the effects of sea level rise.

References

http://www.ukbap.org.uk/UKPlans.aspx?ID=42

Edited by Nikki chapman, JNCC

Seagrass Beds

This habitat description has been adapted from the 1994 UK BAP Action Plan for Seagrass beds reefs and therefore would benefit from an update http://www.ukbap.org.uk/UKPlans.aspx?ID=35. This habitat includes both intertidal and subtidal seagrass beds.

Correspondence with existing habitats

Intertidal seagrass beds:
OSPAR habitat : Zostera beds
Habitats Directive –Annex 1: Mudflats and sandflats covered by water at low tide

Subtidal seagrass beds:
Habitats Directive –Annex 1: Lagoons

Description

Seagrass beds develop in intertidal and shallow subtidal areas on sands and muds. They may be found in marine inlets and bays but also in other areas, such as lagoons and channels, which are sheltered from significant wave action.

Three species of *Zostera* occur in the UK, and all are considered to be scarce (present in 16-100 ten km squares). Dwarf eelgrass *Zostera noltii* is found highest on the shore, often adjacent to lower saltmarsh communities, narrow-leaved eelgrass *Zostera angustifolia* on the mid to lower shore and eelgrass *Zostera marina* predominantly in the sublittoral. The plants stabilise the substratum, are an important source of organic matter, and provide shelter and a surface for attachment by other species. Eelgrass is an important source of food for wildfowl, particularly brent goose and widgeon which feed on intertidal beds. Where this habitat is well developed the leaves of eelgrass plants may be colonised by diatoms and algae such as *Enteromorpha* spp, *Cladophora rectangularis, Rhodophysema georgii*, *Ceramium rubrum*, stalked jellyfish and anemones. The soft sediment infauna may include amphipods, polychaete worms, bivalves and echinoderms. The shelter provided by seagrass beds makes them important nursery areas for flatfish and, in some areas, for cephalopods. Adult fish frequently seen in *Zostera* beds include pollack, two-spotted goby and various wrasse. Two species of pipefish, *Entelurus aequoraeus* and *Syngnathus typhie* are almost totally restricted to seagrass beds while the red algae *Polysiphonia harveyi* which has only recently been recorded from the British Isles is often associated with eelgrass beds.

Five different community types have been identified for seagrass beds from the southern North Sea and the Channel and 16 microhabitats including the seagrass itself, sessile epifauna, infauna and free swimming animals not confined to a special part of the community. The diversity of species will depend on environmental factors such as salinity and tidal exposure and the density of microhabitats, but it is potentially highest in the perennial fully marine subtidal communities and may be lowest in intertidal, estuarine, annual beds.

The Cromarty Firth supports what is most probably the largest total area of dwarf eelgrass and narrow leaved eelgrass in Britain (approximately 1200 ha) while the Maplin Sands is estimated to be the largest surviving continuous population of dwarf eelgrass in Europe (covering around 325 ha). The Fleet has the most extensive population of all three *Zostera* species in Britain. Other important sites are the Exe Estuary, Maplin Sands, the Solents marshes and the Isles of Scilly, Morfa Nefyn, Milford Haven, the Moray Firth, Carlingford Lough, Dundrum Bay, Strangford Lough and Lough Foyle.

Relevant biotopes

Intertidal Seagrass beds
LS.LMp.LSgr Seagrass beds on littoral sediments
LS.LMp.LSgr.Znol *Zostera noltii* beds in littoral muddy sand

Subtidal Seagrass beds
SS.SMp.SSgr Sublittoral seagrass beds
SS.SMp.SSgr.Rup *Ruppia maritima* in reduced salinity infralittoral muddy sand

Current and potential threats

- *Disease*. A wasting disease was responsible for die-back of large areas of seagrass in the UK in the 1930s. The fungus and slime mould which colonised the weakened seagrass have recently reappeared in seagrass beds around the Isles of Scilly.
- *Natural cycles* . The extent of seagrass beds may change as a result of natural factors such as severe storms, exposure to air, and freshwater pulses. Grazing by wildfowl can have a dramatic seasonal effect with more than 60% reduction in leaf cover reported from some sites. Warm sea temperatures coupled with low level of sunlight may cause significant stress and die back of seagrass.
- *Physical disturbance*, for example by trampling, dredging, and use of mobile bottom fishing gear, land claim and adjacent coastal development through the construction of sea defences and potential for changes in the hydrological regime.
- *Introduction of, and competition from*, alien species such as *Spartina anglica* and *Sargassum muticum*
- *Increased turbidity reducing photosynthesis*.
- *Nutrient enrichment* , at low levels, may increase production in *Zostera* while high nitrate concentrations have been implicated in the decline of mature *Z. marina* Phytoplankton blooms, resulting from nutrient enrichment, have been shown to reduce biomass and depth penetration of eelgrass. Eutrophication can also result in a shift to phytoplankton epiphyte or macroalgal dominance.
- *Marine pollution*. Eelgrass is known to accumulate Tributyl, tin and possibly other metals and organic pollutants. Several heavy metals and organic substances have been shown to reduce nitrogen fixation which may affect the viability of the plant, particularly in nutrient poor conditions. Accumulated pollutants may become concentrated through food chains.

References

http://www.ukbap.org.uk/habitats.aspx

Edited by Nikki Chapman

Seamount Communities

This habitat description has been adapted from the OSPAR habitat description (2005) (www.ospar.org/ work areas/ biological diversity and ecosystems. Definition avialable through the linked text; 'case reports')

Correspondence with existing OSPAR habitat:

OSPAR habitat: Seamounts

Description

Seamounts are defined as undersea mountains, with a crest that rises more than 1,000 metres above the surrounding sea floor (Menard, 1964 in Rogers, 1994). Seamounts can be a variety of shapes, but are generally conical with a circular, elliptical or more elongate base. Seamounts are volcanic in origin, and are often associated with seafloor 'hot-spots' (thinner areas of the earth's crust where magma can escape). Seamounts, often with a slope inclination of up to 60°, provide a striking contrast to the surrounding 'flat' abyssal plain. Their relief has profound effects on the surrounding oceanic circulation, with the formation of trapped waves, jets, eddies and closed circulations known as Taylor columns (Taylor, 1917 in Rogers, 1994). Seamounts occur frequently within the OSPAR Maritime Area. Analysis of narrow beam bathymetric data by the US Naval Oceanographic office from 1967-1989 identified more than 810 seamounts within the North Atlantic. The majority occur along the Mid-Atlantic ridge between Iceland and the Hayes fracture zone (Gubbay, 2002).

The enhanced currents that occur around seamounts provide ideal conditions for suspension feeders. Gorgonian, scleratinian and antipatharian corals may be particularly abundant, and other suspension feeders such as sponges, hydroids and ascidians are also present. Concentrations of commercially important fish species, such as orange roughy, aggregate around seamounts and live in close association with the benthic communities (Gubbay, 2002).

Seamounts are a distinct and different environment from much of the deep sea. They act as 'islands' for epibenthic and pelagic faunas, have a high rate of endemic species, are used as 'stepping stones' for the transoceanic dispersion of shell species and as reproduction/feeding grounds for migratory species (eg. Richer de Forges, 2000)

Studies of the pelagic communities above seamounts reveal both qualitative and quantitative differences when compared to the surrounding water. The biomass of planktonic organisms over seamounts is often higher than surrounding areas, which, in turn, become an important component of the diet of fish and top predators such as sharks, rays, tuna and swordfish. The ecological importance of seamounts for top predators is emphasised by the fact that some far-ranging pelagic species concentrate their mating and spawning in such places. Two examples are the pelagic armorhead (*Pentaceros wheeleri*) and the scalloped hammerhead (*Sphyrna lewini*) (Boehlert & Sasaki, 1988). Some seamounts are belied to act as a feeding ground, fish spawning or possibly nursery areas for many species since groups of small cetaceans such as bottlenose dolphin, common dolphin, spotted dolphin and pilot whales as well as captures of loggerhead turtles have been recorded in the area.

The benthic fauna are dominated by suspension feeders some of which are typically restricted to the seamount environment. They are characterised by high levels of endemism, which suggests limited reproductive dispersal. Sampling of the benthic seamount fauna in the SW Pacific, for example, suggests that some of these species are notably localised. Somewhere between 29-34% of the species collected during 23 cruises to the region are believed to be new to science and potentially endemic to these seamounts (Richer de Forges *et al.* 2000). Less is known about the level of endemism on seamounts in the North East Atlantic.

The concentration of commercially valuable fish species around seamounts is well documented. Fishes such as the orange roughy and some deepwater oreos appear to be adapted to life in this environment, their substantial aggregations supported in the otherwise food-poor deep sea by the enhanced flow of prey organisms past the seamounts (Koslow & Gowlett-Holmes, 1998).

Apart from these general characteristics of seamounts that make them ecological significant there are also unique situations which make some even more significant. They may have an important role as a 'stepping stone' for species colonising islands.

Relevant biotopes

- Marine Habitats Classification scheme v4.05 – not covered
- EUNIS: A6.72, Seamounts, knolls and banks

Current and potential threats

- Fisheries Seamounts support commercially valuable fish, shellfish and corals. The result has been over-exploitation and major crashes in various stocks (eg. Koslow & Gowlett-Holmes, 1998; Koslow *et al*. 2001; Lutjeharms & Heydorn, 1981). The abundance and species richness of the benthic fauna on heavily fished seamounts was also markedly reduced.
- Deep sea mining some areas may be targeted by deep sea mining

References

OSPAR Commission, 2008: Case Reports for the OSPAR List of Threatened and/or Declining Species and Habitats

Edited by Nikki Chapman

Serpulid Reefs

This habitat description has been adapted from the 1994 UK BAP Action Plan for Serpulid reefs and therefore would benefit from an update http://www.ukbap.org.uk/UKPlans.aspx?ID=43.

Correspondence with existing habitats

Habitats Directive – Annex 1: Reefs & Large shallow inlets and bays

Description

Serpula vermicularis is a marine worm which makes a hard, calcareous tube 4-5 mm in diameter and up to 150 mm long. In most places the worms are solitary with the base of the tube attached to stones or shells, and the feeding end growing up into the water. The worms can also aggregate into clumps or 'reefs' up to 1 m across. The species has a worldwide distribution (except for polar seas) in sheltered sites, but the reef form has been reported from very few locations. In the UK, reefs have only been found in Loch Creran, and the Linne Mhuirich arm of Loch Sween, both sea lochs on the west mainland coast of Scotland. The reefs in Loch Sween are now reported to be dead. Small *Serpula vermicularis* reefs have also been found in two loughs on the west coast of Ireland, but the best developed reefs in the world are in Loch Creran.

The serpulid reefs in Loch Creran begin as single tubes on stones or shells on a sandy mud seabed. As more worms settle and grow on already established ones the reef grows upwards and outwards to form a rounded clump of white tubes, similar to a coral head. The worms extend their feeding fans, which are about 2 cm across and a range of colours from white through orange to bright red, from the ends of the tubes. The larger reefs, over 1 m in diameter, tend to collapse outwards from the centre but the collapsed sections continue growing. The reefs are best developed in a relatively narrow vertical zone in the loch, at a depth between 6-10 m.

The reefs are a haven for other marine wildlife on the muddy seabed where there is little other solid attachment, and become covered with orange sponges, colonial and solitary sea squirts, hydroids and seaweeds. Mobile animals live between the tubes in the centre of the reef; particularly common are brittlestars, terebellid worms, small spider crabs, squat lobsters, hermit crabs, starfish and a range of marine snails.

The reefs at Loch Creran, at least in the sublittoral fringe, have declined over the last 100 years (together with eelgrass *Zostera marina* beds), while those in Loch Sween apparently died between 1982 and the mid 1990s.

Relevant biotopes

SS.SBR.PoR.Ser *Serpula vermicularis* reefs on very sheltered circalittoral muddy sand

Current and potential threats

- Mobile fishing gear: serpulid reefs are fragile and vulnerable to mechanical disturbance, such as from mobile fishing gear, which would seriously damage the reefs.

- Anchors and mooring chains, movement of fish farm cages, creels can all cause mechanical damage.
- Blockages to water flow e.g. building of barrages, causeways and bridges. Serpulid worms rely on water movement to feed; in both Loch Creran and Loch Sween this is a relatively gentle flow. However, changes in the water flow may have adverse effects on the reefs and their associated fauna and flora.
- Smothering: serpulid tube apertures become blocked by sediments that settle out of the water column onto the seabed. Hence serpulids will be affected by any activities that result in the either heavy particle suspension or sedimentation.
- Pollution e.g. effluent discharge. There was a seaweed processing factory which discharged organic effluent straight into Loch Creran. It is thought that the effluent was responsible for the lack of serpulids in the area, as when the factory closed the serpulids began to colonise the area. The effluents from finfish farms might also be considered a potential threat although some of the best reefs in Loch Creran are adjacent to the moorings of a salmon farm. Finfish farms routinely use chemicals which are specifically toxic to fish lice and other crustaceans and molluscs. When such chemicals disperse in the marine environment, there is the possibility that the rich infauna of the reefs may be affected

References

http://www.ukbap.org.uk/habitats.aspx

Edited by Nikki Chapman

Sheltered Muddy Gravels

This habitat description has been adapted from the 1994 UK BAP Action Plan for Sheltered Muddy Gravels and therefore would benefit from an update http://www.ukbap.org.uk/UKPlans.aspx?ID=36. The Steering group associated with the UK Marine BAP review, agreed in 2007 that this habitat would benefit from being split into two subcategories i.e*.* *Intertidal mixed sediments* and *Subtidal mixed sediments*

Correspondence with existing habitats

Intertidal mixed sediments
Habitats Directive –Annex 1: Mudflats and sandflats not covered by seawater at low tide, estuaries and large shallow inlets and bays.
Subtidal mixed sediments – Not covered

Description

Sheltered muddy gravel habitats occur principally in estuaries, rias and sea lochs, in areas protected from wave action and strong tidal streams. In fully marine conditions on the lower shore this habitat can be extremely species-rich because the complex nature of the substratum supports a high diversity of both infauna and epifauna. However, good quality examples of this habitat are very scarce. Polychaetes and bivalve molluscs are normally dominant and the most varied, but representatives of most marine phyla can be present. The fauna is often characterised by a large range in body size. As one moves into an estuary, with a consequent reduction in salinity, there is a marked reduction in species richness. Low salinity (mid to upper estuarine) muddy gravels have a lower, but distinctive, species diversity. This plan concentrates on the intertidal and shallow subtidal high salinity muddy gravel habitats.

The carpet shell mollusc *Venerupis senegalensis* is often, though not necessarily, present and can sometimes occur in large numbers. The blunt gaper *Mya truncata* is another characteristic species. There are considerable variations in the composition of these communities depending upon the sediment composition and salinity regime present. Members of the fully saline community can include the tube-dwelling polychaetes *Sabella pavonina, Myxicola infundibulum* and *Amphitrite edwardsi*, the sipunculan worm *Golfingia* sp, the anemones *Sagartia troglodytes* and *Cereus pedunculatus* and the holothurian *Labidoplax digitata*. Burrowing deposit-feeding polychaetes such as *Notomastus latericeus*, *Aphelochaeta marioni* and *Melinna palmata* may be abundant throughout the salinity range. The presence of coarse gravel and stones at the sediment surface often provides a substratum for the attachment of a variety of fauna and epiflora, for example fucoids, ephemeral green algae with associated littorinids and filamentous red algae.

Although the most diverse communities occur in fully saline conditions a number of different species can occur under reduced salinity (upper estuarine) conditions. Here, *Mya arenaria* may be present, with the polychaetes *Neanthes virens* and *Cirriformia tentaculata*, the cockle *Cerastoderma edule* and the native oyster *Ostrea edulis*. Oligochaetes and the rag worm *Hediste diversicolor* usually dominate the upper estuarine low salinity muddy gravels.

The prority habitat may be considered as an intertidal extension of a habitat more common in the sublittoral. The communities of interest to this plan are restricted to the intertidal and shallow sublittoral. Shallow subtidal muddy gravel (more than 3 m below Chart Datum) can contain communities of burrowing anemones such as *Mesacmaea mitchelli*, *Aureliania heterocera*, *Cereus pedunculatus* and *Cerianthus lloydii*. Deeper water muddy gravel associations are not considered here. However, there are similarities in the infaunal component of the offshore muddy-gravel (*Venerupis*) associations.

Relevant biotopes

Intertidal mixed sediment,
LS.LMx Littoral mixed sediment
LS.LMx.GvMu Hediste diversicolor dominated gravelly sandy mud shores
LS.LMx.Mx Species-rich mixed sediment shores
LS.LMx.Mx.CirCer Cirratulids and *Cerastoderma edule* in littoral mixed sediment

Subtidal mixed sediment,
SS.SMx.IMx Infralittoral mixed sediment
SS.SMx.IMx.CreAsAn *Crepidula fornicata* with ascidians and anemones on infralittoral coarse mixed sediment
SS.SMx.IMx.SpavSpAn *Sabella pavonina* with sponges and anemones on infralittoral mixed sediment
SS.SMx.IMx.VsenAsquAps *Venerupis senegalensis, Amphipholis squamata* and *Apseudes latreilli* in infralittoral mixed sediment

Analysis of the survey records held on the MNCR database suggests that fully saline sheltered muddy gravel communities are scarce in their British distribution. However, the biotope is found extensively in the Solent and Helford River. Other notable locations include the rias of south-west Britain, for example the Fal Estuary, Salcombe Harbour and Milford Haven. Other known sites include the Sound of Arisaig, Lough Foyle, the Dyfi Estuary and Llanbedrog on the Lleyn Peninsula.

Available descriptions of intertidal muddy gravel beds are often sparse on detail due to a lack of comprehensive data. They are not easy to survey and monitor, due to the large quantities of coarse material that would need to be laboriously sampled and sieved.

Historical data on the distribution of muddy gravel beds are also very limited, presumably for similar reasons to those given above. Information from surveys carried out in the early 1900s in certain inlets (particularly the Kingsbridge Estuary and Helford River) highlights the extremely diverse communities found in muddy gravel habitats at that time. A review of sediment shores in Great Britain in the late 1970s described a similar distribution of muddy gravel communities to that shown by more recent surveys.

Current and potential threats

- *Physical disturbance*: Coastal developments including the construction of marinas and slipways, sediment extraction, the widening and dredging of channels and sea defences such as barrages. Such activity may alter tidal flow patterns, affecting the sedimentary conditions across the gravel beds.
- *Bait digging*: Threat is especially prevalent where king rag *Neanthes virens* is common.
- *Fisheries*: Intertidal mollusc beds, including *Venerupis senegalensis*, have been the subject of small fisheries in the past. The current fishery is small, but has the potential for resurgence, whereas *Mercenaria mercenaria* dredging in Southampton Water has severely disrupted this habitat.
- *Organic enrichment*, especially sewage pollution stress: Severe pollution can lead to anoxic conditions and a decrease in macrobenthic populations and species diversity.
- *Persistent bio-accumulating chemicals* (e.g. polychlorinated biphenyls and tri-butyl tin), waste discharges containing heavy metals and chemicals.
- *Introduction of non-native species*: *Crepidula fornicata* can dominate the fauna resulting in the smothering of the sediment surface leading to anoxia in the sediment. They are also considered a pest of oyster beds.

References

http://www.ukbap.org.uk/habitats.aspx

Edited by Nikki Chapman

Subtidal chalk

This habitat description has been adapted from the 1994 UK BAP Action Plan for Littoral and Sublittoral chalk and the 2005 NI Action plan for Littoral and Sublittoral chalk and would benefit from expert input.

Correspondence with existing habitats

Part of 1994 BAP habitat: Littoral and sublittoral chalk
No OSPAR equivalent
Habitats Directive - Annex 1: Reefs

Description

A characteristic of chalk coasts, in contrast to many harder rocky coasts of western and northern Britain is the geomorphological structure in which, because of subaerial and marine erosion , a vertical cliff face abuts an extensive Foreshore (a wave eroded platform) often extending several hundreds of metres seawards. This is of significance in the formation of subtidal chalk sea caves and reefs habitats and the occurrence of the associated communities / biotopes (Tittley *et al*. 1998).

The most extensive areas of sublittoral chalk in Britain occur in Kent and Sussex. In south-east England shallow subtidal (up to 5 m) communities are limited or absent due to the unusual friable and easily eroded nature of chalk and the prevailing harsh environment, characterised by extreme water temperatures, high levels of turbidity, siltation and scouring (UK BAP). In these conditions it is difficult to undertake subtidal surveys and hence the extent of this habitat and its associated communities are not well documented (Tittley *et al*, 1998). However less robust species e.g. large seaweeds which are more prone to scouring are replaced by more opportunistic species. As a result the shallow subtidal is dominated by animals and communities that are low in species richness reflecting the hostile environment.

At Flamborough, the Isle of Wight and Studland, shallow subtidal (up to 5M) communities are more diverse and extend into deeper waters where harder rock occurs but there are less unique algal species present.

In Northern Ireland, Upper Cretaceous chalk deposits belong to the Ulster White Limestone Formation with exposures on the County Antrim coast. The Northern Ireland chalk forms extremely hard, low porosity deposits with subsequent erosion forming cobble and boulder spreads with subtidal reefs. Faults on the seabed offshore have also exposed Cretaceous deposits. (UK BAP) and off Rathlin there are spectacular, deep subtidal cliffs affected by strong tidal currents (NI BAP).

Little is known of the extent or nature of chalk in the sublittoral zone in the Republic of Ireland. Rathlin has extensive underwater exposures of chalk, and sublittoral caves are known to be present in chalk down to at least 75m depth. These caves support rich populations of rare species. During the Northern Ireland Sublittoral Survey (NISS) (Erwin *et al*. 1986) up to three species of rare sponge were found from chalk habitats, one of which was known from only one other locality, on the west coast of Sweden. It is reported that chalk and limestone have a far higher biodiversity than any other rock types in the sublittoral zone on the island (B. Picton, pers. comm.) (NI BAP).

Relevant biotopes

IR.MIR.KR.HiaSw *Hiatella arctica with seaweeds on vertical limestone / chalk.*
CR.MCR.SfR Soft rock communities

Current and potential threats

- *Coastal defence and other works*. This causes a heavier impact to littoral chalk communities however alteration of chalk have occurred at lower shore and subtidal levels (e.g. Thanet), an although large ports have been developed at Dover and Ramsgate with harbour developments at Margate, Folkestone, Newhaven and Brighton Marina.
- *Pollution and eutrophication*. The deterioration of water quality by pollutants and nutrients has caused respectively the replacement of fucoid dominated biotopes by mussel-dominated biotopes, and the occurrence of nuisance *Enteromorpha* spp blooms.
- *Small-scale fisheries andharvesting of piddocks*. Damage to subtidal reefs
- *Non-natives*. Native species along the English Channel have been displaced by the incursion of non-native species. For example, *Sargassum muticum, Polysiphonia harveyi* and *Undaria pinnatifida*.

References

Tittley, C.J.H. Spurrier, P.J. Chimonides, J.D. George , J.A. Morre, N.J. Evans & A.I. Muir(1998) Survey of chalk cave, cliff, intertidal and subtidal reef biotopes in the Thanet coast cSAC Natural History Museum Report.
http://www.ukbap.org.uk/habitats.aspx

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Subtidal Sands and Gravels

This habitat description has been adapted from the 1994 UK BAP Action Plan for Sublittoral sands and gravels.

Subtidal sands and gravel sediments are the most common habitats found below the level of the lowest low tide around the coast of the United Kingdom. The sands and gravels found to the west of the UK (English Channel and Irish Sea) are largely shell derived, whereas those from the North Sea are largely formed from rock material.

The Steering Group associated with the Marine UK BAP Review, agreed in 2007 that this habitat would benefit from being split into six subcategories (but would require expert input to define each of the subcategories) i.e.:
Estuarine subtidal course sediment
Shallow coarse sediment
Coastal course sediment
Shelf/ offshore coarse sediment
Estuarine subtidal sand
Shallow subtidal sand
Coastal subtidal sand
Shelf subtidal sand

For the purposes of this habitat action plan, inshore is defined as extending to six nautical miles, and offshore as six nautical miles to the limit of UK waters. This plan encompasses both the inshore and offshore environments.

Correspondence with existing habitats

Habitats Directive – Annex 1 :Sandbanks that are slightly covered by seawater all the time & Estuaries

Description

Sublittoral sand and gravel habitats occur in a wide variety of environments, from sheltered (sea lochs, enclosed bays and estuaries) to highly exposed conditions (open coast). The particle structure of these habitats ranges from mainly sand, through various combinations of sand and gravel, to mainly gravel. While very large areas of seabed are covered by sand and gravel in various mixes, much of this area is covered by only very thin deposits over bedrock, glacial drift or mud. The strength of tidal currents and exposure to wave action are important determinants of the topography and stability of sand and gravel habitats.

The diversity of flora and fauna living within the biotopes varies according to the level of environmental stress to which they are exposed. Sand and gravel habitats that are exposed to variable salinity in the mid- and upper regions of estuaries, and those exposed to strong tidal currents or wave action, have low diversity and are inhabited by robust, errant fauna specific to the habitat such as small polychaetes, small or rapidly burrowing bivalves and amphipods. The epifauna in these habitats tends to be dominated by mobile predatory species. Upper estuarine mobile sands, subject to very low fluctuating salinity, are species poor. This habitat is characterised by mysids (*Neomysis integer*) and amphipods (*Gammarus* spp).

Coarse sand sediment can occur in sand-wave formations in shallow water, wave exposed and tide-swept coasts. The infauna in this type of habitat is highly impoverished and is typified by small opportunistic capitellid and spionid polychaetes and isopods (*Pontocrates arenarius, Haustorius arenarius* and *Eurydice pulchra*) that are adapted to living in a highly perturbed environment. The epifauna is characterised by mobile predators such as crabs (*Carcinus maenas* and *Liocarcinus* spp), hermit crabs (*Pagurus bernhardus*), whelks (*Buccinum undatum*), and occasionally sand eels (*Ammodytes* spp). Similar habitats also occur in estuaries where the marine fauna is replaced with a sparse low salinity tolerant fauna (Forth and Humber Estuaries, Solway Firth).
Well sorted medium and fine sands on exposed coasts subjected to frequent wave action and variable tidal currents are typified by errant polychaetes such as *Nephtys cirrosa* and isopods such as

Bathyporeia spp (common in full salinity areas of many estuaries). A low salinity variant of this habitat occurs in the Humber and Severn Estuaries.

Loose, coarse sand habitats fully exposed to wave action and swept by strong tidal streams are comparative with the 'Shallow *Venus* Community', the 'Boreal Off-shore Sand Association' and the '*Goniadella-Spisula* Association' defined in past studies. This habitat is dominated by small or highly mobile polychaetes, thick shelled and rapidly burrowing bivalves (*Spisula elliptica* and *S. subtruncata*) and mobile amphipods that are adapted to periodic disturbance. It is a common habitat with examples found from Shetland to the Scilly Isles.

A close variant of this community occurs in fine compacted sands with moderate exposure and weak tidal currents. This habitat is characterised by the thin-shelled bivalve *Fabulina fabula*, and is found in the Irish Sea, north-east coast of England and in numerous Scottish sea lochs.

Sand mixed with cobbles and pebbles that is exposed to strong tidal streams and sand scour is characterised by conspicuous hydroids (*Sertularia cupressina* and *Hydrallmania falcata*) and bryozoans (*Flustra foliacea* and *Alcyonidium diaphanum*). These fauna increase the structural complexity of this habitat and may provide an important microhabitat for smaller fauna such as amphipods and shrimps. Examples of the habitat are to be found in Shapinsay Sound, Cromarty Firth, Lowestoft, Thames, Thanet, Menai Strait, Lough Foyle and in numerous Scottish sea lochs.

In contrast, those biotopes found in full salinity in sheltered or deeper waters that are less perturbed by natural disturbance are among the most diverse marine habitats with a wide range of anemones, polychaetes, bivalves, amphipods and both mobile and sessile epifauna. Clean stone gravel habitats are characterised by the sea anemones *Halcampa chrysanthellum* and *Edwardsia timida*, associated with hydroid/bryozoan turfs and red seaweeds. This habitat type has limited recorded distribution: Loch Creran, Loch Eynort (Skye), Church Bay (Rathlin Island) and Strangford Narrows.

Shallow areas with coarse sand swept by tidal currents but sheltered from wave exposure may develop dense beds of the polychaete *Lanice conchilega.* Dense beds of polychaete tubes reduce near-bed currents and significantly increase sediment stability. Examples are to be found in Outer Hebrides lagoons, Skye and sea lochs.

Circalittoral gravels, sands and shell gravel are split into three different biotopes and have communities of high diversity. These habitats are dominated by thick-shelled bivalve and echinoderms species, (e.g. *Pecten maximus, Circomphalus casina, Ensis arcuatus* and *Clausinella fasciata*), sessile sea cucumbers (*Neopentadactyla mixta*), and sea urchins (*Psammechinus miliaris* and *Spatangus purpureus*). These biotopes have been described by previous workers as the 'Boreal Off-Shore Gravel Association' and the 'Deep Venus Community' and can be found in Shetland, the western coasts, Irish Sea and English Channel.

Many of the inshore habitats are important nursery grounds for juvenile commercial species such as flatfishes and bass. Offshore, sand and gravel habitats support internationally important fish and shellfish fisheries while SE have recently carried out a comprehensive survey of benthic communities in the Greater Minch. Broad scale habitat mapping has also been carried out on behalf of the nature conservation agencies to support their work on marine SACs and by other organisations responsible for carrying out environmental assessments, for example for dredging and cable laying

Illustrative biotopes
SS.SCS.SCSVS Sublittoral coarse sediment in variable salinity (estuaries)
SS.SCS.ICS Infralittoral coarse sediment
SS.SCS.CCS Circalittoral coarse sediment
SS.SCS.OCS Offshore circalittoral coarse sediment
SS.SSa.SSaVS Sublittoral sand in variable salinity (estuaries)
SS.SSa.IFiSa Infralittoral fine sand
SS.SSa.IMuSa Infralittoral muddy sand
SS.SSa.CFiSa Circalittoral fine sand
SS.SSa.CMuSa Circalittoral muddy sand
SS.SSa.OSa Offshore circalittoral sand

Please note that only the highest biotope level has been recorded in this section, all of the above contain subbiotopes and some of these biotopes contain important biological communities as described in the main body of the habitat description.

Current and potential threats

- *Pollutants in riverine discharge*
- *Trawling and aggregate dredging activities*. Most flatfish fisheries are found in areas of sandy seabed and are subjected to intensive perturbation by bottom fishing gears. Gravel substrata are also disturbed by scallop dredging. Large bodied, slow growing fauna such as bivalves are sensitive to fishing as are biogenic reefs
- *Aggregate extraction in licensed areas*
- *Other physical disturbances* include land claim, construction of marinas and slip ways, the widening and dredging of channels, pipe and cable laying and the construction of sea defences. These activities can alter tidal flow regimes and wave exposure, or result in deposition of sediments that influence the structure of sedimentary habitats.
- *Organic pollution from sewage* discharge and aquaculture activities leading to anoxic conditions and a decrease in benthic diversity (e.g. polychlorinated biphenyls and tri-butyl tin), heavy metals and other chemicals. These pollutants have led to decreases in the populations of common whelks in the North Sea and cause DNA breakdown in some marine organisms.
- *Oil exploration*, leakages and shipping accidents lead to localised pollution of sediment organisms.

References

http://www.ukbap.org.uk/habitats.aspx
Edited by Nikki Chapman, JNCC

Tide-swept Channels

This habitat description has been adapted from the 1994 UK BAP Action Plan for *Sabellaria spinulosa* reefs and therefore would benefit from an update. In addition the Steering group associated with the marine BAP review, agreed in 2007 that this' habitat would benefit from being expanded and will be eventually renamed 'Tide-swept communities. The resulting habitat will encompass broader and deeper channels with strong currents rather than a much more restricted definition of very shallow channels with very rapid water movement. It is likely that, sometime in the future, CCW will take the lead on drafting the habitat definition.

Correspondence with existing habitats

Habitats Directive – Annex 1: Reefs and large shallow inlets and bays

Description

In this habitat action plan, the term 'tidal rapids' is used to cover a broad range of high energy environments including deep tidal streams and tide-swept habitats. The JNCC`s Marine Nature Conservation Review (MNCR) defined rapids as 'strong tidal streams resulting from a constriction in the coastline at the entrance to, or within the length of, an enclosed body of water such as a sea loch. Depth is usually shallower than five metres.' In deeper situations, defined in this plan as being more than five metres, tidal streams may generate favourable conditions for diverse marine habitats (eg the entrances to fjordic sea lochs, between islands, or between islands and the mainland, particularly where tidal flow is funnelled by the shape of the coastline). Wherever they occur, strong tidal streams result in characteristic marine communities rich in diversity, nourished by a constantly renewed food source brought in on each tide.

The marine life associated with these habitats is abundant in animals fixed on or in the seabed, and typically include soft corals, hydroids (sea firs), bryozoans (sea mats), large sponges, anemones, mussels and brittlestars in dense beds. In shallow water, bedrock and boulders often support kelp and sea oak plants, which grow very long in the tidal currents, and have a variety of animals growing on them. Other smaller red and brown seaweeds grow on cobbles and pebbles, many of these being characteristic of tide-swept situations. Both the Menai Strait in North Wales and the Scilly Isles provide good examples of tide-swept communities considered to be of national importance. Also, the Dorn in Strangford Lough MNR is remarkable for its diversity of flora and fauna and for displaying a marked emergence phenomenon. Coarse gravel is a more difficult habitat for animals to colonise, as it is constantly moving, yet even here there are typical animals, such as sea cucumbers, worms and burrowing anemones. Maerl beds are also closely identified with the conditions found in tidal narrows and rapids in the south-west (the Fal estuary) and the north of the British Isles (Orkney).

In deeper water, such as between islands, strong tidal streams may be felt down to 30 m. For example, between the Pembrokeshire islands strong tidal currents in the centre of Ramsey Sound provide conditions for a distinctive community, unrecorded elsewhere in south-west Britain.

An important range of tidal rapid habitats are found in Scottish and Irish fjordic and fjardic sea lochs. Fjordic sea lochs occur in the more mountainous areas of the Scottish west coast and islands and were formed by the scouring action of glaciers and ice sheets. The result was an over-deepened basin (with some examples recording a charted depth of 200 m) or a series of basins connected to each other and the open sea by narrow and shallow 'sills' at depths of less than 30 m, with many less than 20 m. It is this high energy sill habitat, over which the tide flows, that produces the diverse communities that inhabit this environment. A considerable volume of water may move over the sill during the tidal cycle, with a tidal range in some Scottish sea lochs of up to 5 m on spring tides, generating a tidal flows of up to 10 knots. For example, Strangford Lough in Northern Ireland also has a long rapids system with very strong tidal streams up to 8 knots.

The variability of sea lochs in size, shape, number of basins and length and depth of sills, produces a wide range of marine communities. The seabed may be of bedrock and boulders, or a range of mixed material down to coarse shell gravel. The species composition of tidal rapids in some sea lochs may also be influenced by marked variations in salinity.

Fjardic sea lochs are much shallower often with a maze of islands and shallow basins connected by rapids, which are usually less than five metres deep and often intertidal. Fjardic sea lochs are found mainly in the Western Isles.

The morphology of fjords and fjards is therefore very different to lowland marine inlets and the estuaries of the south and east of the British Isles. However, in south-west England, eustatic change has created rias by drowning coastal river valleys such as the Dart, Tamar and Fal. At the narrow entrances of these rias, strong tidal currents have generated diverse habitats of biological significance.

Illustrative biotopes - marine habitat classification scheme v4.05

LR.HLR.FT Fucoids in tide-swept conditions
LR.HLR.FT.FserTX *Fucus serratus* with sponges, ascidians and red seaweeds on tide-swept lower eulittoral mixed substrata
IR.MIR.KR.LhypT *Laminaria hyperborea* on tide-swept, infralittoral rock
IR.MIR.KR.LhypTX *Laminaria hyperborea* on tide-swept, infralittoral mixed substrata.
IR.MIR.KT Kelp and seaweed communities in tide-swept sheltered conditions
CR.HCR.FaT Very tide-swept faunal communities
CR.MCR.CFaVS Circalittoral faunal communities in variable salinity
SS.SMp.KSwSS.LsacR.CbPb Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles

Please note the above biotopes may or mat not be present in the newly defined and expanded habitat ‘Tide-swept communities’.

Current and potential threats

- *Obstruction to the water flow* e.g. ferries running the entrance to sea lochs, bridges, causeways i.e. the causeway joining Vatersay with Barra (Churchill Barriers, Orkney
- *Tidal power generation* (in conjunction with bridge construction) change the ecology of the lochs considerably through restriction of seawater influence and consequent changes in salinity. The effects on the connecting rapids can also be expected to be drastic.
- *Fishing* - rapids often have dense beds of animals, for example mussels, which may become attractive for exploitation in the future. Rapids can be a sanctuary for crustaceans because strong tidal currents make creeling difficult.

- *Water pollution*. Although the currents in rapids may quickly disperse one-off sources of pollution, chronic continuing pollution could affect sensitive marine life.

References

http://www.ukbap.org.uk/habitats.aspx

Edited by Nikki Chapman, JNCC

Traditional Orchards

Correspondence with existing habitat/s

- UK BAP broad habitat*:* Broadleaved, mixed and yew woodland (the proposed habitat is a habitat complex like lowland wood-pasture and parkland, which is in this broad habitat)
- Phase 1: A. Woodland and scrub, A 1.1.2. Broadleaved plantation, orchard, to be identified by existing/added symbols (England Field Unit 1990).
- NVC: Incorporates several types as part of the orchard habitat complex e.g. MG5, MG6, W24.
- Annex I: Incorporates parts of several Annex I types, for example lowland calcareous grassland in some sites within the Annex I type H6210 semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*).

Description

Habitat structure rather than vegetation type, topography or soils, is the defining feature of the habitat. Traditional orchards are structurally and ecologically similar to wood-pasture and parkland, with open-grown trees set in herbaceous vegetation, but are generally distinguished from these priority habitat complexes by the following characteristics: the species composition of the trees, these being primarily in the family Rosaceae; the usually denser arrangement of the trees; the small scale of individual habitat patches; the wider dispersion and greater frequency of occurrence of habitat patches in the countryside. Traditional orchards include plantings for nuts, principally hazel nuts, but also walnuts.

Management of the trees is the other main feature distinguishing traditional orchards and wood-pasture and parkland. Trees in traditional orchards are, or were, grown for fruit and nut production, usually achieved through activities such as grafting and pruning, whereas timber has been the main product from trees in wood-pastures and parkland, mostly derived from pollarding or selective felling. Grazing or cutting of herbaceous vegetation are integral to orchard management, as they are in wood-pastures and parkland. The presence of scrub, mostly the form of hedgerows on the site boundaries, or sometimes, especially in unmanaged orchards, among the orchard trees, is analogous to the frequent occurrence of scrub in wood pastures and parkland and plays a similar ecological role (see under biodiversity characteristics described below). Ponds and other wetland features are often present, being used now, or in the past, for watering livestock.

Orchards are hotspots for biodiversity in the countryside, supporting a wide range of wildlife and containing UK BAP priority habitats and species, as well as an array of Nationally Rare and Nationally Scarce species. The wildlife of orchard sites depends on the mosaic of habitats they encompass, including fruit trees, scrub, hedgerows, hedgerow trees, non-fruit trees within the orchard, the orchard floor habitats, fallen dead wood and associated features such as ponds and streams. A feature of the biodiversity of traditional orchards is the great variety of fruit cultivars that they contain, for example Luckwill and Pollard (1963) list 101 varieties of perry pear distributed across the parishes of Gloucestershire. This agricultural biological diversity is not an explicit part of the current UK BAP, although the UK Government is a signatory to the Global Strategy for Plant Conservation 2001. The Government response (Cheffings and others 2004) includes a target for conserving crop diversity.

Traditional orchards are defined for priority habitat purposes as orchards managed in a low intensity way, in contrast with orchards managed intensively for fruit production by the input of chemicals such as pesticides and inorganic fertilisers, frequent mowing of the orchard floor rather than grazing or cutting for hay, and planting of short-lived, high-density, dwarf or bush fruit trees. Spacing of trees in traditional orchard can vary quite widely (from c.3 m in some plum orchards and traditional cobnut plats to over 20 m in some large perry pear and cherry orchards. There is some overlap of density of planting with intensive orchards, but these orchards often have densities at least twice the density of the most closely-spaced traditional orchard.

Like wood-pastures and parklands, traditional orchards can occur on a wide range of soil types from slightly acid, relatively infertile soils to fertile river floodplain soils and lime-rich soils. Orchards can be found on slopes ranging from steep to level, and with any aspect. Generally, sites do not have badly impeded drainage, although locally, within sites, there may be wetter areas. Orchards are found in the lowland landscape in the UK, defined as the land below the altitudinal limit of enclosure (i.e. below the 'moor wall').

Traditional orchards are found in all countries of the UK although England has the bulk of the resource. Areas digitally mapped by the Ordnance Survey have been found to provide a relatively accurate estimate of total orchard area, through testing by ground-truthing and aerial photograph interpretation (English Nature in prep). Together with country information on extent of commercial orchards in agricultural census returns, digital Master Map polygons can be used to make initial estimates of the extent of the resource (see table below).

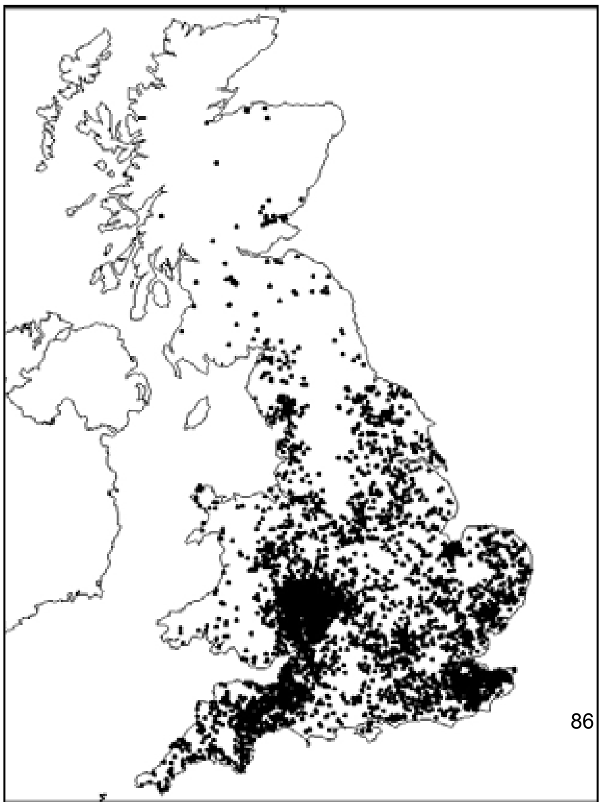
The estimated extent of traditional orchards in the UK (28,750ha), puts the habitat at the rarer end of the scale compared to existing priority habitats. These range from Upland hay meadows 1,100ha, Lowland wood-pasture and parkland 35,000ha, Lowland heathland over 60,000ha, Upland oakwood 85,000 ha to Upland heath 2,109,400ha).

Table: Estimated extent of traditional orchards in UK

Country	*Orchard area (ha)	**Traditional orchard area (ha)
England	47,000	28,000
Scotland	290	250
Wales	840	440
Northern Ireland	(1600)	60

*Ordnance Survey area except in Northern Ireland where area under fruit (top and soft) is given from the agricultural census 2004.

** England = Ordnance Survey area minus area of commercial orchards in census of 2000 defined as intensive (84%) by lack of fully grassed orchard floor (Central Science Laboratory data). Scotland and Wales = Ordnance Survey area minus area of commercial orchards in agricultural censuses of 2003 and 2002 respectively. Note that some of the commercial orchards in Scotland and Wales may be traditional orchards, thus the estimate of traditional orchard area may be an underestimate. Northern Ireland estimate from figure given in the Environmentally Sensitive Areas scheme booklet, traditional orchards option.



The Ordnance Survey data, which do not distinguish traditional and intensive orchards, show that orchards are dispersed throughout the lowlands of Britain (see Map 2), though there are concentrations in some areas particularly Kent, Cambridgeshire, Somerset and the Three Counties of Herefordshire, Worcestershire and Gloucestershire. The bulk (78%) of the commercial fruit production occurs in these concentrations in England, which implies that traditional orchards comprise the majority of the orchards elsewhere, as well as being known to occur in the orchard concentration areas.

Traditional orchards can easily be distinguished from other wooded habitats based on the preponderance of domestic fruit and nut species: apple, plum, pear, damson, cherry, walnut and cobnut. Only in a very few cases will there be a significant number of other tree species in a traditional orchard, unless the orchard is becoming woodland through neglect. An arbitrary distinction of, say, 50% of trees should be domestic fruit or nut species in an orchard, is rarely likely to be invoked for distinguishing orchards from wood-pasture/parkland.

Map 2: Orchard distribution in England, Scotland and Wales. Reproduced from Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationary Office © Crown copyright. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceeding. English Nature 100017954 [2005].

A simple mappable definition is under discussion in 2008 and may be based on the rules adopted for the Natural England orchard project which refer to the distance between crown edges and number of trees (for this project, crown edges of trees must be within 20m of each other to be included in the orchard patch, and there must be more than 5 trees within 20m of each other's crown edges).

Traditional orchards, as distinct from non-traditional orchards are defined for priority habitat purposes as orchards managed in a low intensity way. They contrast with orchards managed intensively for fruit production, where there are inputs of chemicals such as pesticides and inorganic fertilisers, frequent mowing of the orchard floor rather than grazing or cutting for hay, and planting of short-lived, high-density, dwarf or bush fruit trees (stems generally 75 cms or less). The simplest visual indicator of intensive management is the presence of herbicided strips along the tree rows, where the ground is generally bare or with some annual plant regrowth, contrasting with the permanent grassland of the between-row spaces. Such strips are readily observable on aerial photographs. According to orchard pesticide usage surveys by the Central Science Laboratory, use of herbicide is associated with other pesticide use and intensive mowing between tree-rows, while in contrast, orchards with fully grassed floors can be considered traditional (Dr Joe Crocker, CSL, pers comm.). There may potentially be cases where other pesticides or inorganic fertilisers or other intensive management practices are used without herbicide. As a consequence, there may be occasionally instances for limited ground-truthing, for instance, where herbicide strips are not evident but the trees appear small and closely-spaced, by checking density / spacing (see below) and stature of trees on the ground. Spacing of trees in traditional orchard can vary quite widely from around 3 m to over 20 m between trees (see above). There is some overlap of density of planting with intensive orchards, so a density distinction is not useful on its own. However, non-traditional orchards often have densities at least twice the density of the most closely-spaced traditional orchard, and density/planting distance (< 3m in many intensive orchards) can help in the distinction of intensive orchards as described above.

Upland Birchwoods

Upland Birchwoods in Scotland are dominated by a series of stands of downy and/or silver birch with constituents such as rowan, willow, juniper and aspen (Hall and Kirby, 1998). Boundaries are often diffuse and liable to change as woodlands expand and contract in response to fires and changes in grazing pressure (Kirby, 1984). Refuges, such as those occurring on cliffs or rocky patches, may develop permanent tree cover that can contain richer, less mobile species (Kirby, *pers. comm*.). On more acidic soils, rowan is a prominent component, and juniper can form the underwood in the eastern highlands. Aspen grows on a variety of site types where mineral soil is present (Worrell, 1996), occurring frequently within upland birchwoods as small groups and rarely as extensive stands. Only 12 stands greater than 5 hectares are known to exist within Scotland.

On all but the most acidic sites, birch influences the soil to allow development of a grass-herb flora on sites previously dominated by dwarf shrub heath. This successional development appears to be cyclical in nature with the ground flora of many senescent birchwoods eventually returning to heath as tree cover is lost (Miles, 1988). Heavily grazed woodlands tend to develop a grass and moss dominated flora (McVean and Ratcliffe, 1962; Patterson, 1993) and, where the sward has been changed due to heavy stocking of sheep or cattle, the return to heath may not happen so readily.

Upland birchwoods are composed of the following main communities from the National Vegetation Classification:

- W11 *Quercus petraea - Betula pubescens - Oxalis acetosella* woodland
  - (a) *Dryopteris dilatata* sub-community
  - (b) *Blechnum spicant* sub-community
  - (c) *Anemone nemorosa* sub-community
  - (d) *Stellaria holostea -Hypericum pulchrum* sub-community
- W17 *Quercus petraea - Betula pubescens - Dicranum majus* woodland
  - (a) *Isothecium mysuroides – Diplophyllum albicans* sub-community
  - (c) *Anthoxanthum odoratum - Agrostis capillaris* sub-community
  - (d) *Rhytidiadelphus triquetrus* sub-community
- W4 *Betula pubescens - Molinia caerulea*
  - (a) *Dryopteris dilitata - Rubus fruticosus* sub-community
  - (b) *Juncus effusus* sub-community

Small base-rich patches (W9 - *Fraxinus excelsior - Sorbus aucuparia - Mercurialis perennis* woodland) and wet areas (W7 - *Alnus glutinosa - Fraxinus excelsior - Lysimachia nemorum* woodland) are locally frequent but where these occur over extensive areas, they should be referred to the appropriate priority habitat (Hall and Kirby, 1998). W4a and b are included within Upland Birchwoods even when they occur extensively, as their transition to W11 and W17 becomes harder to define under the wetter conditions encountered (Kirby, *pers. comm*.). Soil-related differences tend to be masked by striking climatically-influenced similarities (Rodwell, 1991).

Birchwoods appear within Peterken's Stand types as 12A ((rowan) birchwoods) and 12B (hazel-birchwoods). The division of the two types is based on presence or absence of *Corylus*. This follows earlier classification by McVean and Ratcliffe. Small components of 1D (western valley ash-wych elm woods), and 3C (northern calcareous hazel-ash woods), may occur in base-rich patches and 7A (valley alder woods on mineral soil), and 7D (slope alder wood), may occur in wet stands with alder (Hall and Kirby, 1998). Some birchwoods may naturally move towards stand types 6A (upland sessile oakwoods), 11A (acid birch-pinewoods) or 3C (northern calcareous hazel-ash woods). Birch may naturally dominate higher elevation components of these respective stand types.

In the majority of high elevation woodlands, the upper boundary does not represent the natural tree line. This would be dominated, in most cases, by downy birch (thought by some to be a sub-species in this situation) and rowan. Natural tree lines form an important niche for dwarf birch (*Betula nana*) and other scarce species.

Upland Calcareous Grassland

The definition of this habitat remains substantially unchanged from the pre-existing Habitat Action Plan (http://www.ukbap.org.uk/UKPlans.aspx?ID=13) a summary of which appears below. Following the 2007 review, this habitat includes examples of CG1, CG2 and CG10 that clearly occur in an upland setting (i.e. above the level of agricultural enclosure).

Upland calcareous grasslands occur on lime-rich soils situated above the upper limit of agricultural enclosure, both in the sub-montane and montane zones. Most examples occur above 250-300 m altitude, but the habitat is also found within unenclosed moorland at lower elevations, and descends to sea level in north-west Scotland. Upland calcareous grasslands typically occur as components of habitat mosaics, which are generally managed as rough grazing land for domestic livestock. These are relatively rare upland vegetation types which support a wide range of uncommon species. Lowland calcareous grasslands are covered by a separate habitat action plan.

Upland calcareous grasslands are generally restricted to shallow soils derived from a variety of lime-rich bedrocks. The most widely distributed and locally extensive calcareous rock in the uplands is Carboniferous Limestone, which forms major exposures in north and south Wales, the North

Pennines and Northern Ireland. Other limestones support calcareous grassland in Scotland and northern England, while certain shales and sandstones are locally important. Basic igneous rocks provide another source of calcareous substrates, including the Borrowdale Volcanics in Cumbria, dolerites and pumice tuffs in north Wales, and Tertiary basalts in western Scotland and Northern Ireland. In Scotland especially, upland calcareous grasslands also occur on calcium-rich metamorphic rocks, such as the schists of the southern central and eastern Highlands.

This habitat comprises various forms of grassland characterised by the prominence of calcicolous ('calcium-loving') grasses and herbs. Six communities defined in the National Vegetation Classification are represented (CG9 to CG14). These include upland forms of *Sesleria albicans* grassland (CG9), *Festuca ovina - Agrostis capillaris* swards (CG10, CG11 and CG12), and *Dryas octopetala* communities (CG13 and CG14). Swards tend to be much more species-rich than upland grasslands on acidic substrates, and may contain over 60 species/4m². Montane forms of calcareous grassland are often enriched by a distinctive assemblage of Arctic-Alpine plants, such as *Alchemilla alpina*, *Polygonum viviparum* and *Silene acaulis*.

It is estimated that there are 10,000 ha of upland calcareous grassland in England, 10,000-13,000 ha in Scotland, 800 ha in Wales, and 1,100 ha in Northern Ireland. There is thus an estimated total of approximately 22,000-25,000 ha of upland calcareous grassland in the UK. Particularly important areas for the habitat include the North Pennines and Cumbria in England and Breadalbane in Scotland.

There are good data holdings on the extent and distribution of around two-thirds of the total area of upland calcareous grassland in the UK. However, few data are available regarding changes in either the extent or floristic composition of the habitat.

Upland Flushes, Fens and Swamps

Correspondence with existing habitat/s

- UK BAP broad habitat: Fen, marsh and swamp *pp*
- Phase 1: E2 Flush/spring *pp*; E3 Fen pp; F1 Swamp *pp*; B5 Marsh/marshy grassland *pp*
- NVC: (mostly *pp*) M4-M12, M21, M23a, M25c, M27-M29, M31-M35, M37, M38, S9-S11, S19, S27
- Annex I: Alpine pioneer formations of the *Caricion bicoloris-atrofuscae*; Transition mires and quaking bogs *pp*; Petrifying springs with tufa formation (*Cratoneurion*) *pp*; Alkaline fens *pp*.
- Birks and Ratcliffe types: C4 *pp*, H2, H3b-j, H4, I1, I2, I4
- JNCC upland CSM feature types: Alkaline fen (upland); Alpine flush; Short-sedge acidic fen (upland); Soakway and sump (upland); Spring-head, rill and flush (upland); Transition mire, ladder fen and quaking bog (upland); Mire grassland and rush pasture (upland)

Description

Upland flushes, fens and swamps are defined as peat or mineral-based terrestrial wetlands in upland situations, which receive water and nutrients from surface and/or groundwater sources as well as rainfall. The soil, which may be peaty or mineral, is waterlogged with the water table close to or above the surface for most of the year. Includes both soligenous mires (springs, flushes, valley fens) and topogenous mires (basin, open-water transition and flood-plain fens), as well as certain *Molinia* grasslands and rush pastures, but excludes ombrotrophic bogs and associated bog pools and seepages (blanket bog priority habitat). Also excluded are species-poor *Molinia* swards (M25 except M25c) and species-poor or 'weedy' *Juncus effusus* swards (M23b and MG10). Swamps are included except for those forming a fringe less than 5m wide adjacent to standing waters, which are included in the relevant standing water priority habitat type; and those reedbeds (S4) which qualify as the reedbed priority habitat.

This priority habitat is restricted to upland areas, i.e. above the limit of agricultural enclosure, so complementing but not overlapping the fens priority habitat. This 'upland/lowland' boundary definition is intended to match that for grassland and heathland priority habitats. For consistency with the Broad habitat definitions, upland flushes, fens and swamps includes montane/alpine springs and flushes, but not snowbeds (U11-14) which are part of the mountain heaths and willow scrub proposed priority habitat. Usually this habitat is grazed by deer and/or sheep, sometimes cattle, in conjunction with surrounding grassland/heath. Some types, e.g. springs, may be ungrazed. Generally this habitat is too wet to be burned.

This is a varied habitat category but is typically dominated by sedges and their allies, rushes, grasses (e.g. *Molinia*, *Phragmites*), and occasionally wetland herbs (e.g. *Filipendula ulmaria*), and/or a carpet of bryophytes e.g. *Sphagnum* spp., *Cratoneuron* spp. Vegetation generally short (<1m, often <30cm) but sometimes taller e.g. swamps.

The habitat overall supports a rich flora of vascular plants with many rare species e.g. scorched alpine-sedge (*Carex atrofusca*), bristle sedge (*C. microglochin*), sheathed sedge (*C. vaginata*), mountain scurvygrass (*Cochlearia micacea*), alpine rush (*Juncus alpinoarticulatus*), two-flowered rush (*J. biglumis*), chestnut rush *(J. castaneus*), three-flowered rush (*J. triglumis*), false sedge (*Kobresia simpliciuscula*), Iceland-purslane (*Koenigia islandica*), Yellow Marsh Saxifrage *Saxifraga hirculus* and Scottish asphodel (*Tofieldia pusilla*). Also exceptionally important for bryophytes with notable species including *Sphagnum lindbergii, S. riparium, Hamatocaulis vernicosus,,Bryoerythrophyllum caledonicum* and *Campylopus setifolius.*

The habitat may also be important as nesting habitat for waders, such as curlew, snipe and redshank. It also supports a varied invertebrate fauna, notably taxa such as Diptera (e.g. *Clinocera nivalis* and *Pseudomyopina moriens*), Coleoptera (e.g. *Gabrius scoticus* and *Elaphrus lapponicus*), spiders (e.g. *Maro lepidus*) and Mollusca (e.g. *Vertigo* spp), which in turn provide an important food source for upland breeding birds at critical times of year.

The habitat is widespread but local throughout the uplands of Scotland, Wales, England and Northern Ireland. Extent is difficult to assess because the habitat has not been comprehensively surveyed in many areas and tends to occur in small, sometimes numerous stands.

Upland Hay Meadows

The definition of this habitat remains unchanged from the pre-existing Habitat Action Plan (http://www.ukbap.org.uk/UKPlans.aspx?ID=11) a summary of which appears below. Following the 2007 review, occurrences of this habitat on roadside verges are also covered by the definition.

For the purposes of this plan upland hay meadows are treated as being equivalent to EC Habitats Directive Annex 1 habitat 38.3, Northern Hay Meadows (British types with *Geranium sylvaticum).* The habitat thus comprises the single National Vegetation Classification community MG3, *Anthoxanthum odoratum - Geranium sylvaticum* grassland and is characterised by a dense growth of grasses and herbaceous dicotyledons up to 60 - 80 cm high. No single grass species is consistently dominant and the most striking feature of the vegetation is generally the variety and abundance of dicotyledons, including wood crane`s-bill *Geranium sylvaticum,* pignut *Conopodium majus,* great burnet *Sanguisorba officinalis* and lady`s mantles *Alchemilla* spp*.*

Upland hay meadows considered in this plan are, for the most part, in upland valleys in the north of England, with outliers in Scotland. The main concentrations are in the northern Pennines of North Yorkshire, Durham and east Cumbria but there are scattered locations in west Cumbria, Lancashire, Northumberland, Perthshire and as far north as Aberdeenshire in Scotland. The most important centres are Teesdale, Lunedale, Weardale and Baldersdale in Durham, Swaledale and Wharfedale in North Yorkshire and around Tebay, Orton and Ravenstonedale in Cumbria. There are no known examples in Wales or southern England; certain stands of MG5 *Cynosurus cristatus - Centaurea nigra* grassland in Radnorshire and Herefordshire with frequent great burnet *Sanguisorba officinalis* are the nearest floristic equivalents but lack wood crane`s-bill *Geranium sylvaticum* and some other MG3 constants. These and other species-rich mesotrophic grassland communities are covered in the companion plan for lowland meadows.

Past cover data are not available, but it is highly likely that meadows of this kind have become much reduced in the 20th century through agricultural intensification. Recent estimates indicate that there are less than 1000 ha in northern England. Scotland, is believed to have less than 100 ha.

Upland hay meadows are confined to areas where non-intensive hay-meadow treatment has been applied in a sub-montane climate. They are most characteristic of brown earth soils on level to moderately sloping sites between 200m and 400m altitude. Stands of *Anthoxanthum - Geranium* meadow are typically found in isolated fields or groups of fields, where many are still managed as hay meadows, but they are also recorded from river banks, road verges, and in woodland clearings. Most stands of the habitat are less than 2 ha in extent.

Most of the variation within this habitat is attributable to management treatments. The fields are grazed in winter, mainly by sheep, except in the worst weather. In late April to early May the meadows are shut up for hay. Mowing takes place in late July to early August though, in unfavourable seasons, it may be delayed as late as September. The aftermath is then grazed once more until the weather deteriorates. Traditionally, the meadows have been given a light dressing of farmyard manure in the spring, and this, together with occasional liming, may have helped maintain the richness and diversity of the most species-rich stands.

Upland Heathland

The definition of this habitat remains unchanged from the pre-existing Habitat Action Plan (http://www.ukbap.org.uk/UKPlans.aspx?ID=16) a summary of which appears below.

Heathland vegetation occurs widely on mineral soils and thin peats (<0.5 m deep) throughout the uplands and moorlands of the UK. It is characterised by the presence of dwarf shrubs at a cover of at least 25%. Blanket bog vegetation may also contain substantial amounts of dwarf shrubs, but is distinguished from heathland by its occurrence on deep peat (>0.5 m).

For the purposes of this plan upland heathland is defined as lying below the alpine or montane zone (at about 600-750 m) and usually above the upper edge of enclosed agricultural land (generally at around 250-400 m, but descending to near sea-level in northern Scotland).

Lowland heathland occurs below the upper limit of agricultural enclosure and supports a range of birds, reptiles and invertebrates not found on upland heath; this habitat is covered by a separate habitat action plan. Montane heaths, restricted to high-altitude mountain summits and ridges, are also excluded from the upland heathland plan. Blanket bog and other mires, grassland, bracken, scrub, trees and woodland, freshwater and rock habitats frequently form intimate mosaics with heathland vegetation in upland situations. This plan recognises the importance of this habitat mosaic. Habitat action plans have been produced for some elements of this complex, for example, blanket bog and upland calcareous grassland.

Upland heath in 'favourable condition' is typically dominated by a range of dwarf shrubs such as heather *Calluna vulgaris*, bilberry *Vaccinium myrtillus*, crowberry *Empetrum nigrum*, bell heather *Erica cinerea* and, in the south and west, western gorse *Ulex gallii*. In northern areas juniper *Juniperus communis* is occasionally seen above a heath understorey. Wet heath is most commonly found in the wetter north and west and, in 'favourable condition', should be dominated by mixtures of cross-leaved heath *Erica tetralix*, deer grass *Scirpus cespitosus,* heather and purple moor-grass *Molinia caerulea,* over an understorey of mosses often including carpets of *Sphagnum* species. This habitat is distinct from blanket mire which occurs on deeper peat and which usually contains frequent occurrence of hare's-tail cotton-grass *Eriophorum vaginatum* and characteristic mosses. High quality heaths are generally structurally diverse, containing stands of vegetation with heather at different stages of growth. Upland heath in 'favourable condition' also usually includes areas of mature heather.

Upland heathland encompasses a range of National Vegetation Classification (NVC) plant communities. *Ulex gallii - Agrostis curtisii* (H4) and *Calluna vulgaris - U. gallii* (H8) are restricted to southern Britain. *Calluna - V. myrtillus* (H12) is particularly widespread in the east. *Calluna - E. cinerea* (H10), *Calluna - V. myrtillus - Sphagnum capillifolium* (H21), and *Scirpus cespitosus - E. tetralix* (M15) are especially characteristic of western margins. *Vaccinium myrtillus - Deschampsia flexuosa* (H18) is generally widespread in the uplands but other communities are more local in distribution, notably *Calluna - D. flexuosa* (H9), *Calluna - Arctostaphylos uva-uri* (H16)and *E. tetralix - Sphagnum compactum* (M16). The distribution of these communities is influenced by climate, altitude, aspect, slope, maritime influences and management practices including grazing and burning.

An important assemblage of birds is associated with upland heath, including red grouse *Lagopus lagopus*, black grouse *Tetrao tetrix*, merlin *Falco columbarius* and hen harrier *Circus cyaneus*. Some forms of heath also have a significant lower plant interest, including assemblages of rare and local mosses and liverworts that are particularly associated with the wetter western heaths. The invertebrate fauna is especially diverse.

This habitat type is present on an estimated 270,000 ha in England, 80,000 ha in Wales, up to 69,500 ha in Northern Ireland and between 1,700,000 and 2,500,000 ha in Scotland. The total upland heath resource in the UK thus amounts to between 2 and 3 million hectares. Dwarf shrub heaths are recognised as being of international importance because they are largely confined within Europe to the British Isles and the western seaboard of mainland Europe.

There have been considerable losses of heather moorland in recent times. For example, 27% of heather moorland is estimated to have been lost in England and Wales between 1947 and 1980. On the Berwyn mountains in north-east Wales there was a 44% decline in the extent of heather-dominated vegetation between 1946 and 1984, whereas other upland sites in Wales have shown much smaller losses over similar periods. An estimated 18% was lost in Scotland between the 1940s and 1970s and the trend continued throughout the 1980s with a further estimated loss of 5%. Much of this loss is attributed to agricultural land improvements, heavy grazing by sheep (and, in certain areas, red deer and cattle), and afforestation.

It has also been estimated that 440,000 ha of land in the uplands in England and Wales have less than 25% cover of heather (i.e. grassland containing suppressed dwarf shrubs). There is likely to be further significant loss of heather moorland to acid grassland if current grazing levels and pressures continue. However, the conversion of heathland to acid grassland is not a purely recent phenomenon. On some sites in Wales (and elsewhere in UK) the major decline in heathland cover probably took place in the 19th century or even earlier.

Upland Mixed Ashwoods

The definition of this habitat remains unchanged from the pre-existing Habitat Action Plan (http://www.ukbap.org.uk/UKPlans.aspx?ID=3) a summary of which appears below.

The term upland mixed ashwoods is used for woods on base-rich soils in the north and west, in most of which ash is a major species, although locally oak, birch, elm, small-leaved lime and even hazel may be the most abundant species. Yew may form small groves in intimate mosaics with the other major tree species and alder may occur where there are transitions to wet woodland. Despite variations in canopy composition the ground flora remains broadly similar. Upland in the name reflects the abundance of this type of woodland on base-rich soils in upland Britain rather than to the altitude at which individual sites occur - some, such as Rassal Ashwood, are only just above sea level.

In terms of National Vegetation Classification (NVC) plant communities this habitat is characterised by W8 *Fraxinus excelsior - Acer campestre - Mercurialis perennis* woodland, sub communities d. *Hedera helix, e. Geranium robertianum, f. Allium ursinum* and g. *Teucrium scorodonia,* and W9 *Fraxinus excelsior - Sorbus aucuparia - Mercurialis perennis* woodland, together with W13 *Taxus baccata* woodland for the yew groves on the Carboniferous and Magnesian limestones. Less frequent sub-communities that may occur in mosaic with the above are the relatively dry alder- ash stands W7c and the more southerly and eastern sub-communities of W8 (a-c).

The largest examples occur on limestone, i.e. well-drained, base-rich soils, but the type is also found on more acid poorly-drained soils where there is flushing of nutrients. Often these latter are just small fragments of woodland with irregular margins or narrow strips along flushes, riparian tracts, outcrops and steep banks. Most upland mixed ashwoods are probably ancient, but ash is a vigorous colonist of open ground, and some important areas such as Derbyshire Dales are mosaics of ancient and recent ash woodland. Many woods have been treated as coppice in the past, others have been wood-pastures, but most now have a high forest structure.

They are found throughout upland Britain and in Northern Ireland, though they are limited in the north-west Highlands. In the north-east they include the Angus glens and a high level ashwood near Glen Shee, while south-west examples include the Mendips. The boundaries between this type and lowland mixed deciduous woodland may be unclear in places, for example in Somerset and South Wales, because the two types form an ecological continuum determined by climate. In South Wales and the Wye Valley, upland ashwoods may also merge with beechwoods on base-rich soils (see the Lowland beech and yew woodland habitat action plan). In the north-west of Scotland ash is often scarce, but the type is represented by some of the most westerly European examples of hazel scrubs that are rich in lichens and higher plants.

There are no precise data on the total extent of upland ashwoods in the UK, but in the late 1980s the Nature Conservancy Council estimated the total extent of ancient semi-natural woodland of this type to be 40,000 - 50,000 ha. It has declined in area by clearance, overgrazing and replanting with non-native species, by about 30-40% over the last 50 years. A crude estimate places the total area of upland ashwood at 67,500 ha.

Mixed ashwoods are amongst the richest habitats for wildlife in the uplands, notable for bright displays of flowers such as bluebell *Hyacinthoides non-scripta*, primrose *Primula vulgaris*, wood cranesbill *Geranium sylvaticum* and wild garlic *Allium ursinum*. Many rare woodland flowers occur mainly in upland ashwoods, such as dark red helleborine *Epipactis atrorubens*, Jacob`s ladder *Polemonium caeruleum*, autumn crocus *Colchicum autumnale*, and whorled Solomon's seal *Polygonatum verticillatum*. Some rare native trees are found in these woods, notably large-leaved lime *Tilia platyphyllos* and various whitebeams (*Sorbus* spp.). Upland mixed ashwoods also harbour a rich invertebrate fauna, which may include uncommon or declining species. The dense and varied shrub layer found in many examples can in the southern part of the types range provide suitable habitat conditions for dormice *Muscardinus avellanarius.* The alkaline bark of old ash (and elm where it still survives) supports an important lichen flora, particularly the Lobarion community. The remains of dead trees such as old elm trees provide habitat for rare beetles, flies and other invertebrates.

Upland Oakwood

The definition of this habitat remains unchanged from the pre-existing Habitat Action Plan (http://www.ukbap.org.uk/UKPlans.aspx?ID=1) a summary of which appears below.

Upland oakwoods are characterised by a predominance of oak (most commonly sessile, but locally pedunculate) and birch in the canopy, with varying amounts of holly, rowan and hazel as the main understorey species. The amount of birch in the woods tends to increase in north-west Scotland. The range of plants found in the ground layer varies according to the underlying soil type and degree of grazing from bluebell-bramble-fern communities through grass and bracken dominated ones to healthy moss-dominated areas. Most oakwoods also contain areas of more alkaline soils, often along streams or towards the base of slopes where much richer communities occur, with ash and elm in the canopy, more hazel in the understorey and ground plants such as dog's mercury *Mercurialis perennis*, false brome *Brachypodium sylvaticum,* Ramsons *Allium ursinum,* Enchanter`s nightshade *Circaea lutetiana*, and tufted hair grass *Deschampsia cespitosa*. Elsewhere small alder stands may occur or peaty hollows covered by bog mosses *Sphagnum* spp. These elements are an important part of the upland oakwood system. The ferns, mosses and liverworts found in the most oceanic of these woods are particularly rich; many also hold very diverse lichen communities and the woods have a distinctive breeding bird assemblage, with redstarts *Phoenicurus phoenicurus*, wood warblers *Phylloscopus sibilatrix*, and pied flycatcher *Ficedula hypoleuca* being associated with them throughout much of their range. In Wales the woods are also the main breeding areas for red kites *Milvus milvus*. The invertebrate communities are not particularly well-studied compared to those in some other woodland types but support a range of notable species including for example the chequered skipper butterfly *Carterocephalus palaemon* in some Scottish sites.

There are no precise figures for the total extent of this woodland type, but it is believed to be between about 70,000 and 100,000 ha in the UK. It is found throughout the north and west of the UK with major concentrations in Argyll and Lochaber, Cumbria, Gwynedd, Devon and Cornwall. Related woodland does occur on the continent, particularly in the more oceanic areas but the British and Irish examples are recognised internationally as important because of their extent and distinctive plant and animal communities. For some of these species Britain and Ireland hold a substantial part of the world/European population.

Wet Woodland

The definition of this habitat remains unchanged from the pre-existing Habitat Action Plan (http://www.ukbap.org.uk/UKPlans.aspx?ID=4) a summary of which appears below.

Wet woodland occurs on poorly drained or seasonally wet soils, usually with alder, birch and willows as the predominant tree species, but sometimes including ash, oak, pine and beech on the drier riparian areas. It is found on floodplains, as successional habitat on fens, mires and bogs, along streams and hill-side flushes, and in peaty hollows. These woodlands occur on a range of soil types including nutrient-rich mineral and acid, nutrient-poor organic ones. The boundaries with dryland woodland may be sharp or gradual and may (but not always) change with time through succession, depending on the hydrological conditions and the treatment of the wood and its surrounding land. Therefore wet woods frequently occur in mosaic with other woodland key habitat types (e.g. with upland mixed ash or oakwoods) and with open key habitats such as fens. Management of individual sites needs to consider both sets of requirements.

In terms of National Vegetation Classification (NVC) plant communities this habitat is characterised by W1 *Salix cinerea - Galium palustre* woodland, W2 *Salix cinerea - Betula pubescens - Phragmites australis* woodland, W3 *Salix pentandra - Carex rostrata* woodland, W4c *Betula pubescens - Molinia caerulea* woodland: *Sphagnum* sub-community, W5 *Alnus glutinosa - Carex paniculata* woodland, W6 *Alnus glutinosa - Urtica dioica* woodland, and W7 *Alnus glutinosa - Fraxinus excelsior - Lysimachia nemorum* woodland. Some birch stands classified as W4 are relatively dry and in management terms better treated alongside other extensive birch stands. As a provisional division, sub-communities W4a and W4b are better associated with Upland/Northern Birchwoods. Just as small wet woodland patches may be treated as part of a dry land mosaic, so dry land fringes of predominantly wet woodland areas are linked with the accompanying wet woodland. Wet flood plain forests of ash, elm and oak, lacking alder, are most likely to fall into W8 *Fraxinus excelsior- Acer campestre - Mercurialis perennis* woodland.

Many alder woods are ancient and have a long history of coppice management which has determined their structure, and in some situations it appears that this practice has maintained alder as the dominant species and impeded succession to drier woodland communities. Other wet woodland may have developed through natural succession on open wetlands (sometimes following cessation of active management) and structurally are little influenced by direct forestry treatments.

Notable concentrations of wet woodland on fens occur in East Anglia, Shropshire and Cheshire, while hill-side and plateau alder woods are more restricted to Wales, Cumbria and western Scotland. Fragments of ancient floodplain forest are rare, and the best examples are probably in the New Forest and northern Scotland. Bog woodlands of pine on bog are confined to Scotland, but fragments of birch bog woodland occur more widely in scattered stands across the UK.

Some wet woods include habitats identified under Annex 1 of the EC Habitats Directive, for example Residual alluvial forests and Bog Woodland.

There are no precise data on the total extent of wet woodland in the UK, but in the late 1980s the Nature Conservancy Council estimated the total extent of this type in ancient semi-natural woodland to be about 25,000 - 30,000 ha. The area of recent wet woodland may be at least as large again. Thus a crude estimate of the total wet woodland area in the UK is 50,000 - 70,000 ha.

Wet woodland combines elements of many other ecosystems and as such is important for many taxa. The high humidity favours bryophyte growth. The number of invertebrates associated with alder, birch and willows, is very large, although some are now confined to just a few sites, for example the biodiversity priority species beetles *Melanopion minimun* and *Rhynchaenus testaceus*. Even quite small seepages may support craneflies such as *Lipsothrix errans* and the endemic *Lipsothrix nervosa*. Dead wood within the sites can be frequent, and its association with water provides specialised habitats not found in dry woodland types - the fly *Lipsothrix nigristigma* for example is associated with log jams in streams. Wet woodland provides cover and breeding sites for otters *Lutra lutra*. While few rare plant species depend on wet woodland *per se*, there may be relict species from the former open wetlands on the site such as the marsh fern *Thelypteris palustris*.

Wood-Pasture and Parkland (updated December 2011)
Habitat Definition and Description

Wood-pasture and parkland are mosaic habitats valued for their trees, especially veteran and ancient trees[1], and the plants and animals that they support. Grazing animals are fundamental to the existence of this habitat. Specialised and varied habitats within wood-pasture and parkland provide a home for a wide range of species, many of which occur only in these habitats, particularly insects, lichens and fungi which depend on dead and decaying wood. Individual trees, some of which may be of great size and age, are key elements of the habitat and many sites are also important historic landscapes.

Key features of these habitats are:

- Ancient/veteran trees which are special in their own right as some of the oldest living organisms in the UK.
- The presence of grazing animals – animal dung contributes to invertebrate and fungal diversity and grazing controls tree and shrub regeneration, maintaining a semi-open habitat.
- The presence of microhabitats including large diameter (relative to the species) hollowing trees, other decaying wood, rot holes, ageing bark and fallen but regenerating trees, which support a wide range of specialised invertebrates, lichen and fungi.
- Nectar sources for invertebrates.
- Open grassland or heathland ground vegetation.
- Continuity – in terms of very long-lived individual trees and continuity of management.

Description
Wood-pasture and parkland habitats display <u>at least some</u> of the following characteristics:

- Open grown trees, some of which are ancient or veteran and may be hollow and support significant amounts of dead and decaying timber. If managed, the ancient or veteran trees have generally been pollarded (cut high so re-growth is not in reach of browsing animals), although wood-pastures may incorporate other forms of tree management. The trees often exhibit a browse line at the maximum height that browsing animals can reach.

[1] The term 'veteran' tree encompasses a wide range of trees which display attributes associated with late maturity such as large trunk girth and truck hollowing. The term 'ancient' refers specifically to the age class of a tree, describing the stage of development in the ageing process beyond full maturity. Whilst all veteran trees are potentially of cultural and ecological value, ancient individuals are a key indication that there is likely to have been a continuity of veteran tree/deadwood habitat and management at a site. JNCC (2006)

- Origins in medieval hunting forests (which may not have been completely treed) and emparkments, wooded commons, or pastures with trees in them. Many of these sites were later developed as landscaped parks creating a rich legacy of layers of designed landscapes and archaeological features also of historic importance. A range of native species usually predominates amongst the oldest trees but there may be non-native trees which have been planted or regenerated naturally.
- Designed landscapes not originating from medieval parkland, but with veteran trees, including 19th century or later parklands with their origins in earlier agricultural landscapes.
- Scrub as individual plants or clumps, in some instances providing tree protection or opportunities for tree regeneration. A vital source of nectar for invertebrates.
- Evidence of past land use for extensive agriculture and transhumance systems (where livestock are moved between lowland in winter and upland or mountain grazing in the summer). Abandoned wood-pastures in the uplands, complete with associated archaeology, are remnants of a lost land-use system which is still extant in many parts of continental Europe. These wood-pastures contain open grown veteran trees (often pollards) which may in some instances now be within a matrix of secondary woodland or scrub that has developed by regeneration and/or planting in the absence of grazing animals.
- Wood-pasture or parkland that has been converted to other land uses such as arable fields, forestry and amenity land, but where surviving veteran trees are of nature conservation interest. Some of the characteristic wood-pasture and parkland species may be surviving this change in state in the short term while the veteran trees remain alive. Sites may contain ancient pollards (e.g. Hatfield Forest) and other less usual tree forms, which result from trees being managed for timber, fodder and other products in the presence of grazing animals.

The following types of habitat are generally outside the scope of the Habitat Action Plan:

- Upland sheep-grazed closed-canopy oak woodland derived from past coppice management;
- Parklands with 19th century or later origins with none of the above characteristics.

An extensive range of species is particularly associated with these habitats and many rare species are only known in the UK from this habitat:

- Fungi – on dead and decaying wood on trees (e.g. brackets), on living roots (mycorrhizal) and in unimproved grassland (e.g. waxcaps);
- Saproxylic invertebrates (e.g. spiders, beetles and flies) are highly specialised and dependent on deadwood habitats, often associated with particular forms of wood decay. Many are rare or uncommon species and are poor colonisers. They exist in isolated sites where conditions are suitable;
- Other invertebrates of large or long-lived trees use specialist habitat niches (e.g. sap runs, water-filled holes, sheltered hollows) including lichen and bryophyte mats on bark;
- Lichens;
- Bryophytes;
- Birds: especially hole nesters and woodpeckers;
- Bats: roosting and breeding in crevices and hollows and feeding across the habitat mosaic;
- Long established closed herds of deer, cattle and other livestock. Examples include White Park cattle at Dinefwr Park (Carmarthenshire) and the Bagot goats at Levens Hall (Cumbria).

In addition, these habitats may be good for a wide variety of other wildlife, including many other plants and animals that rely on edge conditions or habitat transitions or which require different conditions for different parts of their life cycles (e.g. butterflies and moths). Parklands and wood-pasture may also preserve indigenous tree genotypes. Upland and lowland wood-pastures display different characteristics.

Vegetation types: Most semi-natural woodland types can have wood-pasture variants, though the typical understorey is usually absent, fragmented or present as pockets of scrub. The lack of woodland understorey is a result of grazing and high light levels and it is usually replaced by grassland or heathland communities. The current range of tree species may be the result of manipulation by past management, for example to favour species which provided animal fodder or longer lived tree species (notably oak) for timber. Other typical tree species include beech, alder, birch, hazel and sweet chestnut with Scots pine typical in parts of Scotland. Woody scrub is a particularly important element with species such as hawthorn and blackthorn contributing nectar sources for invertebrates and protection for regenerating trees.

From the early 18th century newly introduced exotic trees such as Cedar of Lebanon began to be used in parkland design as well as native species and existing trees. However, for parklands to be included within the scope of the HAP they must contain some ancient or veteran trees. Where ancient or veteran trees exist in a changed vegetation type, such as arable, and it is impractical to revert to grazed grassland, steps should be taken to minimise risks to existing old trees and allow for the establishment of a new generation of trees.

Parklands contain some of the oldest specimens of introduced tree species. Some, such as the Cedar of Lebanon, are now very rare or under threat in their native habitat.

Tree spacing in wood-pastures is variable, so a range of tree morphologies (open growth, pollard, etc.) are a significant feature and some wood-pasture may be closed canopy in part or for the whole extent. Shrubs and tree regeneration, though not always present, are an important habitat element in wood-pasture and parkland providing structural diversity, nectar sources for invertebrates and also the next generation of trees.

Remnant Hunting Forest with medieval origins and parkland sites may now be tightly defined by physical boundaries, or by surrounding land use which has fossilised past boundaries. Wood-pasture, especially in the uplands, often has undefined boundaries which may in the past have been dynamic. In some places the distinction between closed canopy woodland, grazed woodland, wood-pasture and grassland is not easily discernable on the ground and may vary temporally, depending on management systems within and adjacent to the habitat.

Distribution and extent: These habitats occur throughout the UK, though more extensively in some areas than others. The extent of the habitat varies from landscape scale (the New Forest, Epping Forest) to small discrete sites comprising a few veteran trees. At present, there are no reliable statistics on the extent of the overall resource, nor on historic or current rates of loss or degradation of this habitat.

Wood-pasture and parkland landscapes are frequently of international historic, cultural and landscape importance, for example World Heritage Sites such as Studley Royal (Yorkshire) and Greenwich Park (London). Other notable sites are the New Forest (Hampshire), Bredon Hill (Worcestershire), Croft (Herefordshire); Borrowdale and Glenamara, (Cumbria), Epping Forest (Essex); Dinefwr Park (Carmarthenshire); Hamilton High Parks/Cadzow Oaks (South Lanarkshire), Dalkeith Park (Midlothian), Glen Finglas (Stirling), and Crom (Co Fermanagh). As wood-pasture and parkland have been shaped closely by human uses, archaeological sites and designated monuments may be integral features of these sites.

The high biodiversity value of some parklands, such as Windsor Great Park (Berkshire), has been evident for some time, but wood-pasture in general was not widely recognised as being of special ecological significance until relatively recently. A number of wood-pasture sites, particularly in the uplands, were considered to be examples of impoverished woodlands being destroyed by livestock grazing, but it is now appreciated that these sites are degraded wood-pastures being lost through abandonment of traditional management. The last twenty years has brought recognition of the value of these habitats because of their associated species, especially the saproxylic invertebrates which are confined to a very limited range of sites and closely associated with fungi. There is a growing understanding of the habitat, but more work is required on the distribution and characteristics of the resource.

The wider context

Veteran, especially ancient trees, with their associated distinctive decay and mycorrhizal fungi, saproxylic fauna and epiphytic fauna and flora are more abundant in Britain than elsewhere in Northern Europe. Similar systems with old trees are also found in the Fennoscandian / Baltic Regions (wooded pastures and meadows), Spain and Portugal (dehesas and montados in the hotter south and wood-pastures in the Cordillera Cantabrica and Pyrenees more similar to those found in the UK). Continental sites tend to be richer in associated species than those in the UK. There are a few Royal Hunting Forest remnants in some countries such as Fontainebleau (France), Jaegersborg Dyrehaven, Copenhagen (Denmark) and Bialowieza (Poland). Structurally, there may be similarities to savannah habitat where the tree canopy cover is low. The extent and richness of the UK wood-pasture and parkland habitats are outstanding in the northern European context and there is a need for further studies to assess UK habitats in relation to the continent, particularly eastern and southern Europe.

Note the previous description of this habitat is available at:
http://jncc.defra.gov.uk/Docs/UKBAP_BAPHabitats-65-WoodPastureParkland.doc

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