Common Standards Monitoring Guidance

for

Saltmarsh Habitats

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Contents

1 Introduction

Saltmarshes are found in sheltered embayments and estuaries and in the lee of barrier islands and spits, as mud can accumulate only in relatively low energy environments where wave action is limited. Saltmarsh is restricted to the area between mid neap tide level and high water spring tide level. It lies inland of littoral inshore sediment and/or rock. Landward, there may a transition to other habitats such as cliff, dune, shingle, machair, reedbed, fen, carr or saline wet grassland (grazing marsh) containing brackish ditches.

1.1 Dynamics of saltmarsh

The location, character, and dynamic behaviour of saltmarshes is governed by four physical factors: sediment supply, tidal regime, wind-wave climate and the movement of relative sea level. There are four elements necessary for the development and growth of a salt marsh:

- a relatively stable area of sediment that is covered by the tide for a shorter period than the time it is exposed
- a supply of suitable sediment available within the period of tidal cover
- water velocities that are sufficiently low for some of the sediment to settle out
- a supply of seeds or other propagules for the establishment of vegetation cover.

Saltmarshes are dynamic systems. They have been subject to historical land claim. Many estuaries are still adjusting to the reduction of tidal prism caused by large-scale agricultural reclamation. Estuaries can show at least two different responses, depending on the amount of offshore sediment available. On the west coast, the Ribble and Dee Estuaries have been enhanced by intertidal accretion resulting in channel cross sections that have been progressively reduced through sedimentation. In Essex, on the other hand, where little offshore sediment is available, velocity of the flood tidal wave has increased and erosion has speeded up.

In addition, there may be anthropogenic fixtures both within or outwith the coastal cell (a natural division of the coastline – ideally each cell is self-contained in sediment transport terms) which limit the volume of sediment entering the system. Anthropogenic factors include the interruption of natural cliff erosion through hard coastal defences or the interception of mobile sediment through groynes.

In many cases both accretion and erosion will occur within one cell e.g. Morecambe Bay, where over the last 25 years there has been erosion on one side of the bay, at Silverdale marsh, while on the other side, the saltmarsh on the Cartmel Peninsula is actively accreting. There is net accretion within the Bay system as a whole.

Many areas show cycles of erosion and accretion within a given period that may span decades or hundreds of years, as for example in the Severn Estuary, where episodes of erosion and accretion, governed by changes in wind-wave climate, are reflected by marsh terraces. Saltmarsh may be part of a successional sequence, and later develop to a different feature. For example, at Berrow Marsh in Somerset, the saltmarsh that formed after 1910 in the lee of a sand dune has subsequently become reed swamp, as a result of dune formation blocking tidal inundation and thereby reducing salinity. Topography and vegetation may alter quickly.

2 Definitions

There have been several different classifications of salt marsh biotopes in Britain. We have used a classification proposed by the Council of Europe (Dijkema (ed.), 1984).

2.1 Biotope classification on sedimentary shores

1. Open-coast back-barrier salt marshes

These marshes develop in the lee of spits or barrier islands, where the angle of slope of the inter-tidal and immediate sub-tidal area is shallow on the exposed side. This type of salt marsh is found in north Norfolk. The salt marsh develops adjacent to sand dune or shingle and these transition zones can be rich in plant species.

2. Foreland salt marsh

This type of salt marsh develops in front of sheltered alluvial coastal plains (e.g. areas protected by a bay or offshore banks). There tend to be deeper sediment deposits in this type of marsh. Typical examples of this marsh are found around the Wash or Dengie in Essex, Morecambe Bay, Kentra Bay (Ardnamurchan Peninsula), the North Lincolnshire Coast.

3. Estuarine salt marsh

Estuarine marshes are found where rivers gradually merge into the open sea. There is usually, at least in the upper part of the system, an appreciable influence of fresh water which often leads to interesting transitions to fresh-water such as brackish reed beds or fen communities. However, estuarine marshes have often been 'reclaimed' and converted to agricultural land.

Estuarine salt marsh is associated with the larger rivers of the east coast of Britain e.g. the Severn, Dee, or Thames and the river valleys and rias of the upland coasts of the western seaboard. Most of the estuaries where saltmarshes are extensive are in areas where there is a significant soft-sediment supply - i.e. the north west and eastern England (although sediment is mainly marine and not fluvial in England). In areas of low sediment supply, such as the south west rias, we would not expect large areas of saltmarsh.

4. Lagoonal

Lagoonal salt marshes occur where a narrow spit of land encloses a tidal water body with a narrow opening to the sea. Poole Harbour and Montrose basin are examples.

2.2 Biotope classification on rocky shores

1 Loch or fjord-head salt marshes

These are typically small and are characteristic of north-western Scotland and parts of Northern Ireland. Sediment supply is limited. Natural transitions to terrestrial habitats such as reedbeds or alder-sallow carr occur. Examples include Lochan Havurn at the head of Loch Eriboll on the north coast and Kinlochhourn on the west coast of Scotland.

2 Beach head salt marsh

These develop locally on rocky steeply-shelving shorelines where there is little sediment. The best examples are on the east coast of Scotland. They are usually species rich and show a natural foreshortened succession to brackish and freshwater fen.

3 Ria-bay salt marsh

Rias are drowned river valleys and appear as shallow tidal bays on rocky coasts. They are characterised by a thin clay layer over a rocky subsoil. The Fal-Ruan estuaries in Cornwall are a good example in Britain.

2.3 Descriptions of United Kingdom salt marshes

England has the largest area of salt marsh of the four countries that make up the UK, with an estimated total area of 32,500 hectares and 59 sites over 100ha. This compares to 6748 ha in Scotland (14 sites over 100 ha) 6089 ha in Wales and 239 ha in N. Ireland.

United Kingdom saltmarshes include the following NVC communities (Rodwell, 2000). Saltmarsh zonation follows SSSI/ASSI selection guidelines (NCC, 1989).
E = England, S = Scotland, NI = Northern Island and W = Wales.

Pioneer saltmarsh

NVC community	Community name	Distribution
SM4	*Spartina maritima*	E only
SM5	*S. alterniflora*	E only
SM6	*Spartina anglica* salt-marsh	S, E, NI, W
SM7	*Sarcocornia perennis*	E only
SM8	Annual *Salicornia* salt-marsh	S, E, NI, W
SM9	*Suaeda maritima* salt-marsh	S, E, NI, W
SM11	*Aster tripolium* var. *discoides* saltmarsh	E,
SM12	Rayed *Aster tripolium* on saltmarsh	S, E, W

Low-mid marsh communities

NVC community	Community name	Distribution
SM10	Transitional low marsh vegetation with *Puccinellia maritima*, annual *Salicornia* species and *Suaeda maritima*.	S, E, NI, W
SM13a	*Puccinellia maritima* saltmarsh, *Puccinellia maritima* dominant sub-community	S, E, NI, W
SM14	*Atriplex portulacoides* saltmarsh	E, NI, W

Mid-upper marsh communities

NVC community	Community name	Distribution
SM13b	*Puccinellia maritima* saltmarsh, *Glaux maritima* sub-community	S, E, NI, W
SM13c	*Puccinellia maritima* saltmarsh, *Limonium vulgare-Armeria maritima* sub-community	S, E, NI, W
SM13d	*Puccinellia maritima* saltmarsh, *Plantago maritima-Armeria maritima* sub-community	S, E, NI, W
SM13e	*Puccinellia maritima* saltmarsh, turf fucoid sub-community	S only
SM13f	*Puccinellia maritima – Spartina maritima* sub-community	E only
SM15	*Juncus maritimus – Triglochin maritima* saltmarsh	S, E, W
SM16a	*Festuca rubra* saltmarsh *Puccinellia maritima* sub-community	S, E, W
SM16b	*Festuca rubra* saltmarsh *Juncus gerardii* sub-comunity	S, E, NI, W
SM16c	*Festuca rubra* saltmarsh *Festuca rubra-Glaux maritima* sub-community	S, E, NI, W
SM16d	*Festuca rubra* saltmarsh tall *Festuca rubra* sub-community	S, E, NI, W
SM16e	*Festuca rubra* saltmarsh *Leontodon autumnalis* sub-community	S, E, NI, W
SM16f	*Festuca rubra* saltmarsh *Carex flacca* sub-community	S, E, W
SM17	*Artemisia maritima* saltmarsh	S, E, W

SM18	*Juncus maritimus* saltmarsh	S, E, NI, W
SM19	*Blysmus rufus* saltmarsh	S, E, NI, W
SM20	*Eleocharis uniglumis* saltmarsh	S, E, NI, W
SM21	*Suaeda vera - Limonium binervosum* saltmarsh	E only
SM22	*Atriplex portulacoides - Frankenia laevis* saltmarsh	E only
SM23	*Spergularia marina – Puccinellia distans* saltmarsh	S, E
SM26	*Inula crithmoides* stands	E only
SM27	Ephemeral saltmarsh vegetation with *Sagina maritima*	S, E, W

Drift-line

NVC community	Community name	Distribution
SM24	*Elytrigia atherica* saltmarsh	E, W,
SM25	*Suaeda vera* drift-line	E only
SM28	*Elytrigia repens* saltmarsh	S, E, NI, W

The salt marshes of Britain were described by Burd (1989). Burd saltmarsh categories are related to NVC categories in the report Appendix. In addition, there have been more recent surveys of some areas, including Morecambe Bay (Hawker, 1998), the Severn Estuary (Dargie, 1998) and the Wash and North Norfolk (Posford Haskoning, 2003).

In general, communities common to the four countries of the UK are annual *Salicornia* and *Suaeda maritima* salt marsh, transitional low marsh vegetation with *Puccinellia maritima*, typical *Puccinellia maritima* saltmarsh and the *Festuca rubra* community. There is, however, considerable variation in salt marsh communities in the four countries, which partly reflects the climatic requirements of one or more of the key species concerned.

2.3.1 Saltmarsh in England

In England the pattern of salt marshes is one of large marshes in the south and east. In the north-west saltmarsh is associated with the major estuaries. In contrast, in the south-west and the north-east there are many smaller scattered marshes.
Sarcocornia perennis and the community it characterises (SM7) is restricted to south-east England. *Spartina maritima* (and SM4) is restricted to south-east England and *S. alterniflora* (SM5) to Hampshire and Dorset. Two Mediterranean species reach their northern limit in East Anglia or Lincolnshire - *Suaeda vera* (and SM21) - restricted to Norfolk - and *Frankenia laevis* (SM22) restricted to the south-east. Both these species are associated with the transition zone at the upper edge of the marsh. *Suaeda maritima* (and SM9) is found in East Anglia and *Aster tripolium discoides* (SM11) to the south or south east of England.

Other species reach their northern limit in Britain at the Solway (e.g. *Elytrigia atherica* and *Atriplex portulacoides*). *Inula crithmoides* is restricted to southern England and Wales. There is also a western element where a wetter climate favours species such as *Juncus maritimus, J. gerardii* and *Eleocharis uniglumis.* SM28, with *Elytrigia repens* as the north-western equivalent of the SM24 *Elytrigia atherica*.

2.3.2 Saltmarsh in Scotland

Saltmarshes are often associated with estuaries or Firths, and the largest saltmarsh area in Scotland is on the Solway. The other Firths also have significant representation, but the smaller saltings of the islands and west coast loch-heads are varied and add to the overall coastal biodiversity, even where the area of an individual marsh is small. The

number of salt marsh communities is fewer than those found in England or in the much smaller area of Wales.

Scottish saltmarshes are under-represented by the NVC, which tends to concentrate on English types. Scottish saltmarshes tend to have little 'pioneer' vegetation in comparison with those of England and to be dominated by communities of higher tidal levels than those of England and Wales. An important feature of Scottish saltmarshes is the frequent occurrence of natural transitions to terrestrial habitats, which remain intact in many areas.

Many of the common plants of English systems are absent from Scotland (e.g. perennial glasswort *Sarcocornia perennis*, shrubby sea-blite *Suaeda vera*) or are very much restricted to the south-west (e.g. sea-purslane *Atriplex portulacoides*, rock sea-lavender *Limonium binervosum* and sea couch *Elytrigia atherica*) (e.g. Angus, 2001). The marshes of the south facing coasts of Dumfries and Galloway leading in to the Solway estuary appear to represent a natural geographical boundary which has been referred to by a number of authors as the 'Solway line' (Adam, 1990). *Limonium vulgare, L. humile, Seriphidium maritimum* (SM17) *Parapholis strigosa, Elytrigia atherica* and *Atriplex portulacoides* (SM14) are typical of the salt marsh species which reach their northern limit along the north coast of the Solway, while saltmarsh flat-sedge *Blysmus rufus* and slender spike-rush *Eleocharis uniglumis* are northern elements which become more frequent in Scotland. The rare *Eleocharis parvula* has recently been discovered in the Cromarty Firth. A short, closely grazed turf containing the turf fucoid *Fucus cottonii* is characteristic of saltmarshes in NW Scotland. As with England, there is also a western element with species such as *Juncus maritimus* (SM18) and *Blysmus rufus* (SM18).

2.3.3 Saltmarsh in Wales

There are an estimated 6,000 hectares of salt marsh in Wales and of this nearly half (2,876 ha) is found in Llanelli and West Glamorgan. Salt marshes are, however, found in all the major estuaries and inlets around the Welsh coast and in other sheltered locations such as in the lee of spits as at Abermenai Point, Anglesey, or in the shelter of islands such as Holy Island. There is a detailed survey of the Welsh salt marsh currently being conducted by the Countryside Council for Wales (pers. comm.).

Juncus maritimus (SM18) and *Juncus gerardii* (SM16) are found around the coast, while *Blysmus rufus* (SM19) and *Eleocharis uniglumis* (SM20) communities are restricted to the north west of the principality and *Seriphidium maritimum* (SM17) is limited to the south west.

2.3.4 Saltmarsh in Northern Ireland

Ireland as a whole contains some extensive saltmarshes, but the larger systems occur in the Republic. Saltmarshes are frequent around the coast of Northern Ireland, but they tend to be small in extent, and only account for around 250 ha. Estuarine marsh is the main type of saltmarsh, but there are many smaller bay head or loch head marshes similar to those found in the west of Scotland. One of the major floristic differences in the salt marshes of Ireland is the replacement of *Limonium vulgare*, the species common in most English, Scottish and Welsh marshes, with *L. humile*, continuing the trend set in the west of the Solway and in west Pembrokeshire (Boorman, 1966). *Atriplex portulacoides* is also significant phytogeographically as it reaches its northern limit at Ballymacormick Point in north Down. A number of other species are either absent or uncommon towards the north, showing a clear correlation with the "Solway Line" in Britain. As a result, some of the saltmarsh plant communities on the north coast tend to be rather impoverished.

In Northern Ireland, salt marshes are found all around the coast, mostly in units of 1 hectare or less, but they are more extensively developed at Strangford Lough, Mill Bay in Carlingford Lough, the Roe Estuary, Larne Lough and the Bann Estuary. These five sites account for 90% of the salt marsh area of Northern Ireland. The NVC classification did not include Northern Ireland. However, it is possible to compare many of the plant communities in Northern Ireland with equivalent communities in Great Britain. Many of the coastal plant communities in Northern Ireland have been described to NVC standard by the Northern Ireland Coastal Vegetation Survey (Cooper, *et al*. 1992). Eleven of the 25 NVC salt marsh categories have been found in Northern Ireland, including the rare SM19 (*Blysmus rufus* - community) and SM20 (*Eleocharis uniglumis* - community). Strangford Lough is the most diverse salt marsh site with 14 of the 17 NVC salt marsh communities and sub-communities found in Northern Ireland. In addition, there is an unassigned community found across Northern Ireland with extensive secondary colonisation of SM 16 by *Spergularia media* and, near the Giant's Causway in Antrim, a variant of SM16 (the sub-community dominated by *Juncus gerardii*) with *Schoenus nigricans*.

3 Attributes and targets

A series of broad habitat attributes have been defined that should normally be part of the conservation objectives or the management plan for all sites where saltmarsh is an interest feature.

There should normally be at least one target specified for each of the attributes. The targets set out here are for guidance only. They should be interpreted in terms of local knowledge of the site, its history and its surroundings. When a target is not applicable to a particular site it should be excluded, but a record of why the decision was taken should be made.

For saltmarsh the mandatory(*) attributes are

- Habitat extent
- Physical structure: creeks and pans
- Vegetation structure: zonation; sward structure
- Vegetation composition: characteristic species; indicator of negative trend (*Spartina anglica*)
- Other negative indicators

The presence of notable species (vascular plants) or other important features e.g. transitions to other habitats, is considered to be a discretionary attribute (indicators of local distinctiveness). It will not be appropriate to use these ‘quality indicators’ on every saltmarsh site, but where they are part of the reason for notification of the feature they should form an integral part (mandatory) of the condition assessment.

Guidance is given in the following sections as to what needs to be considered for the above attributes and, where appropriate, some examples are provided of the sorts of targets that should be set.

4 Habitat Extent

Extent of the saltmarsh is a fundamental attribute to be assessed in determining condition of the saltmarsh feature. The target is no decrease in extent from the established baseline with the caveat 'subject to natural change'. There is a need to focus on the long term geomorphological future of the feature. Coastal features are dynamic and will attempt to adjust and reach

equilibrium in response to climatic changes or local changes in wind and wave energy. The amount of offshore sediment available will also determine response of the system to such changes. Offshore sediment may be affected by anthropogenic activities or structures both within or outwith the coastal cell that limit the volume of sediment entering the system. Effects include the interruption of natural cliff erosion through hard coastal defences or the interception of mobile sediment through groynes. There are other activities which may affect sediment supply, such as dredging. Both accretion and erosion may occur within one coastal cell, estuary or throughout one designated site. There may also be cycles of erosion and accretion within a period which may span decades or hundreds of years. See Appendix I for examples of case studies.

Where there is erosion in one part of a site and, following the key for extent (see section 13**),** that component would be assessed as unfavourable, the overall feature could be judged favourable for extent **provided** we can be certain that there is at least equal accretion in other components of the feature on the same site, i.e. within the saltmarsh system as a whole.

4.1 The effects of sea level rise

Sea level rise may contribute to saltmarsh erosion. There may be various reasons for this. In south-east England, increase in tidal range and in particular increase in storminess (wind and wave energy) have caused much of the accelerated erosion of saltmarsh in the past 30 years.

Marshes may continue to accrete both vertically and laterally despite sea level rise if sufficient sediment is available. Their position in the tidal frame will determine lateral growth; if sea level rise occurs the estuary needs to be wider in order to maintain equilibrium. This is called landward transgression or migration of the saltmarsh. Where the system is constrained by hard sea defences, the migration of saltmarsh habitats is prevented. In addition, energy levels within the estuary will be high if a wide expanse of shallows is not available to dissipate energy within the system. These trends result in a reversal of vegetation succession where high and mid marsh communities revert to low marsh communities with the eventual drowning of the vegetation and the reversion of saltmarsh to mudflat or pools of standing water (‘coastal squeeze’).

Vertical accretion may keep pace with the loss of saltmarsh horizontal extent (e.g. on Furzey Island on Poole Harbour, where erosion is greater in the lower marsh and pioneer zones but where there is increased accretion at the higher elevations on the same marsh). However, this is not always the case, and on the Dengie Peninsula, although there is vertical accretion of up to 7.5mm/year, lateral retreat reaches 22m/year in places. Similarly, at Gravesend, Thames Estuary a 2m high marsh-edge cliff has accreted but continues to retreat at an average rate of 1-2m/year.

Where landward transgression of the saltmarsh is constrained by anthropogenic constructions such as fixed sea defences, natural habitat migration which would otherwise occur is prevented (coastal squeeze). The condition of the feature would be **unfavourable**, since it is prevented from reaching a natural geomorphological equilibrium. However, if the feature is prevented from migrating by a natural topographic feature, such as a cliff, we would consider this to be in **favourable** condition as regards extent (although it may not be favourable for other attributes such as zonation), as the feature is free to reach a natural dynamic equilibrium.

4.2 Patterns of saltmarsh erosion

Short to medium term trends of marsh edge progradation (shoreline accretion) can often be found by examination of the marsh-edge morphology. Accreting and stable seaward marsh

edges have an accretional ramp upon which pioneer and low-marsh vegetation can become established (see Sherwood *et.al*.2000, p365). Erosional margins are characterised either by the presence of mud-mound topography or by marsh-edge cliffs fronted by:

- toppled cliff blocks with live or dying vegetation
- rotational slide
- overhanging (cantilever) blocks.

Terraced marsh margins indicate episodic erosion and accretion on timescales over decades to centuries (see Sherwood *et.al*.2000, p365)

The main modes of saltmarsh erosion are

- lateral retreat of the seaward edge
- erosional lowering of parts of the marsh surface usually involving partial or complete destruction of the vegetation (e.g. in the Orwell Estuary)
- internal dissection and enlargement of the drainage network, ultimately leading to the creation of mud basins (e.g. in the Orwell Estuary)

A marsh cliff edge may be eroded by storm events, followed by a period of re-advancement. (Pethick, chapter 3 *in Saltmarsh geomorphology*, 1992). Many open coast marshes are characterised by a highly dissected edge on which vegetation growth is absent, or ephemeral 'mud-mounds'. Vegetation is eroded from the mounds during storm events (pushing back the marsh edge) but will later re-advance over the upper surface of the mud-mounds.

4.3 Managed realignment

Managed realignment or managed retreat involves relocating sea embankments further inland and recreating inter-tidal habitat in front of them. Alternatively, intertidal habitat can be recreated back to a natural, high ground contour. There have been several sites where sea wall have been breached and saltmarsh is re-establishing (for example Orplands and Abbotts Hall in Essex) although restoring a fully functioning saltmarsh ecosystem will be a lengthy process (see for example Boorman, 2002; DEFRA/Environment Agency, 2002; Hazelden and Boorman, 2001).

5 Physical structure: creeks and pans

Creeks and pans of varying size and density typical of the site are frequent features of the saltmarsh. Creeks absorb tidal energy and assist with the delivery of sediment into saltmarshes. The efficiency of this process depends on creek pattern. Creek density is influenced by vegetation cover, suspended sediment load and tidal influence. Creeks allow pioneer vegetation to be established along their banks higher into the saltmarsh system. Natural salt pans can occur at any level in a saltmarsh. Major erosion of saltmarsh is indicated by internal dissection and enlargement of the drainage network, ultimately leading to the creation of mud basins. The target is no further anthropogenic alteration of creek patterns or loss of pans compared to an established baseline. This is assessed by examination of aerial photographs or other output from remote sensing.

6 Vegetation structure

6.1 Zonation

When considering the range and distribution of zones, care should be taken to allow for variation in saltmarsh composition. The pattern of saltmarsh zonation will vary regionally

and also from site to site. Saltmarshes have been subject to large-scale historical claim for agriculture, which in many cases has limited or destroyed natural transitions to terrestrial communities. In other cases the pioneer zone may naturally be reduced or even missing, for example in Scotland or on many higher estuarine saltmarshes in south-west England. We are interested in monitoring a habitat to detect **change**, with consideration for natural processes. Pioneer saltmarsh may move around in an estuary, especially if river channels are shifting. At Berrow in North Somerset a succession was seen through pioneer to mixed saltmarsh and subsequently to reedbed, where development of a dune system blocked tidal inundation and reduced salinity.

Where coastal squeeze is occurring (e.g. in Essex) reversed vegetation succession may occur when pioneer saltmarsh (particularly *Salicornia* spp.) recolonises higher marsh as this is eroded.

6.1.1 Characteristics of saltmarsh zones

In most cases there should be several distinct saltmarsh zones, typically pioneer (low, patchy cover of *Salicornia* spp., *Suaeda maritima*, *Aster tripolium* with bare mud and sand surface), low-mid marsh (continuous cover with *Puccinellia maritima* or *Atriplex portulacoides* often dominant), mid-upper marsh (with *Festuca rubra*, *Limonium vulgare*, *Armeria maritima*, *Plantago maritima* often dominant) and transitions to terrestrial habitats (see 6.1.2) (see Appendix II for list of common names).

Pioneer vegetation may present some problems in deciding the boundary of pioneer saltmarsh and mudflat. We recommend taking the edge of the pioneer zone where the first *Salicornia* or *Suaeda* annuals appear.

6.1.2 Transitions to terrestrial habitats

A variety of communities may occur at the transition zone at the upper edge of the salt marsh, where these are still present. These include mesotrophic grassland communities (e.g. MG11 - MG13) tall fen community (with *Filipendula ulmaria, Althaea officinalis* and *Iris pseudacorus*) brackish swamp communities (with *Phragmites australis*, *Bolboschoenus maritimus*, *Scirpus tabernaemontani*) or sand dune. Natural transitions to terrestrial habitats are a particularly important feature of Scottish saltmarshes, where many persist. An endemic Red Data Book eyebright *Euphrasia heslop-harrisonii* is found in upper and transition zones in some Scottish saltmarshes, and the nationally rare *Euphrasia foulaensis* occurs in saltmarshes in northern Scotland.

Site-specific targets should be set according to conservation objectives or the management plan (see also 7.1Characteristic species).

6.2 Sward structure

Sward structure is closely related to community type and grazing. In many areas grazing continues to be a major determinant of the nature conservation importance of the saltmarsh habitat, particularly where there is ornithological interest. As a general principle, maintenance of the status quo should be a first option until investigations reveal any opportunities for improving existing management or the nature of any adverse changes. If there has been no history of grazing management this should not be considered. The target is to maintain site-specific structural variation. A varied vegetation structure is important for maintaining invertebrate diversity. Stocking levels will need to be appropriate to the interest of the site. Over-grazing can lead to loss of rare plant species and affect bird breeding and feeding habitats and under-grazing can lead to a loss of plant diversity by competitive exclusion.

Levels of grazing are defined by the standing crop (Dijkema and Wolff, 1983):

- light grazing - most of the standing crop is not removed
- moderate grazing - standing crop almost completely removed
- heavy grazing - height < 10 cm, all standing crop removed
- abandoned grazing - matted vegetation, no standing crop removed

Lightly grazed or ungrazed marshes may still retain good structural diversity, a complete sequence of vegetation from pioneer to transitions to terrestrial habitats and plants sensitive to grazing such as *Atriplex portulacoides, Limonium vulgare* and *Seriphidium maritimum*. Where grazing has traditionally been heavy (e.g. in northwest England and north-west Scotland, marshes tend to be heavily grazed. stocking densities up to 6.5 sheep (year round) or 2 cows (summer) per hectare occur (Gray, 1972)) grazing-sensitive species may be eliminated and tillering grasses favoured. However, there will usually be specific bird species associated with these close-cropped swards, such as breeding oystercatcher, or winter-grazing ducks and geese and management must consider all interest features of the saltmarsh site.

Where there is a trend towards a cessation of grazing, such as in eastern Scotland, this may lead to a reduction in species diversity and may also lead to increased sedimentation (as taller plants trap more sediment) and a fall in numbers of feeding and roosting birds.

7 Vegetation composition

7.1 Characteristic species

Communities may be dynamic in their distribution and are linked to the physical processes operating at the site, including topography, creek patterns etc. The species composition and type of saltmarsh will vary regionally and also from site to site (see also text on zonation, Section 6.1). The target is to maintain the frequency of characteristic species of saltmarsh zones (see Box 1, Section 14) as follows:

Pioneer zone: At least one listed species frequent and another occasional

Low-mid marsh: At least one of *Puccinellia maritima, Atriplex portulacoides* or *Salicornia* spp. dominant., and two other listed species at least frequent

Mid-upper marsh: At least one listed species abundant and three frequent.

Transitions to terrestrial habitats are often a very important feature of saltmarshes, and appropriate targets should also be set for these where present (see 6.1.2). Advice on target setting in the relevant guidance sections (e.g. lowland grassland, lowland wetland) should be referred to and adapted to take account of the maritime situation. Examples of targets might be:

- at least one of the following locally abundant: *Filipendula ulmaria*, *Phalaris arundinacea*, *Bolboschoenus maritimus*, *Phragmites australis*, *Iris pseudacorus*

7.2 Negative indicator species: *Spartina anglica*

Cord grass *Spartina anglica* is considered to be an invasive species and may impact on intertidal mud flats, pioneer and low-mid marsh communities. However, stands of *Spartina anglica* may play a role in sediment trapping, although under certain tidal conditions erosion around *Spartina* stands may be greater (e.g. on the Humber Estuary). At a number of sites in north west England, former *Spartina*-dominated areas are currently reverting

rapidly to more diverse mixed saltmarsh in which *Spartina* is no more than a component. Scottish saltmarshes have not been affected so much by the introduction of *Spartina anglica* (SM6) as those of England. *Spartina* is a problem only at Auchencairn Bay and the Water of Fleet (both in the Solway) and in the Eden estuary in Fife (Angus, pers.comm).

Natural die-back of *Spartina* has occurred on some saltmarsh along the east and south coasts of England, for example Chichester Harbour or the Solent. It is not yet clear whether this will happen in other areas. Conflict may occur where there is rapid expansion of *Spartina* which impacts negatively on pioneer saltmarsh or mudflat Annex I features. An indicative target has therefore been set of less than 10 % expansion to pioneer saltmarsh in the last 10 years, but this figure may have to be revised following consultation. A monitoring programme would be triggered and management decisions would need to take account of the other designated features of the site. Control of the species would be confined to the pioneer zone. In general, there is no point controlling *Spartina* to protect other types of saltmarsh vegetation. In England, some sites were notified with high *Spartina anglica* cover, so a pragmatic approach is needed. See Appendix I for an example of a case study.

8 Other negative indicators

In addition to recording *Spartina anglica*, observations should be made during the field visit for other negative indicators such as:

- signs of disturbance such as new artificial drains (creek realignment is covered in 5)
- obvious visual pollution
- turf cutting
- vehicle damage or trampling at vulnerable locations (tracks, access points).

Targets can be found in the generic table.

9 Indicators of local distinctiveness

Indicators of local distinctiveness are features of a saltmarsh that make it ‘special’ (forming part of the reason for notification) but which are not covered by the attributes already described or by separate guidance e.g. for notified species features. They should be apparent from the SSSI citations or past surveys. This is a discretionary attribute in that it may not be applicable to every site; but where local distinctiveness has contributed to the selection of a site for saltmarsh it should be mandatory. Targets are set to maintain the distinctive elements at current extent/levels and/or in current locations (e.g. to maintain existing populations of notable species or transitions between habitats). The target(s) should be tailored to each site. Such ‘quality indicators’ may include the following:

- notable plant or animal species that are not notified features in their own right
- associations between saltmarsh and other habitats, e.g. mosaics of vegetation types, transitions to brackish or freshwater swamp.

10 Recommended visiting period and frequency of visits

The characteristic plant species of saltmarshes are mostly perennial, which allows them to be assessed over a period of several months. The suggested visiting period is May to October. However, in areas of coastal squeeze, where low-marsh communities dominate, annuals are relatively more abundant and the assessment will need to take this into account (April to August is suggested). In addition to the basic six yearly monitoring cycle, we recommend the site be checked more frequently if possible.

11 Skills required

The person carrying out the assessment should be capable of identifying species most likely to be encountered on saltmarshes. He/she should also have some understanding of the management practices and other factors likely to affect saltmarshes. Knowledge of the site would also be helpful.
Equipment required includes: baseline maps, aerial photographs, hand lens, field forms, SSSI citations and the Conservation Objectives table, management plan or any type of document where the conservation aims for the site are stated. A **hand-held GPS** is extremely desirable for accurate location of sample points.

12 Methods of assessment

12.1 Data collation

The assessment should be applied to the reporting unit, which may be an SSSI site unit or SAC.

Prior to going out in the field, existing information on the site should be collated. Aerial photographs are particularly useful. Some NVC information should be available for most sites. Each local team should have a copy of the county report of the 1989 Saltmarsh Survey of Great Britain (Burd, 1989), which has original maps for all sites surveyed. In many cases, more recent survey information should be available.

The guidance should be read prior to the field visit and the assessment forms need to be tailored to suit the particular site. If contractors are used, consultation with local conservation agency staff is essential for selecting routes and stopping places.

12.2 Assessing habitat extent

Habitat extent should be assessed using any previous information available, preferably aerial photographs. If none is available this first reporting round must form the baseline. The source of the baseline must be clearly identified - aerial photography should include source, date (at least month and year) and scale. Field trials have shown that failure to provide some of this information may mean change will not be able to be assessed. A further problem that may need to be considered is the possible disparity between the extent of saltmarsh habitat notified for saltmarsh interest and that for overwintering birds, as this may not be clear for a site. Local knowledge may be important in this respect. We have a provided a key to help assess condition on saltmarsh if there is loss of habitat extent (see the **key for extent in section 13**)
.
Where there is erosion in one area and (following the **key for extent in section 13**) it was assessed as unfavourable, it could be judged favourable **provided** we can be certain that there is at least equal accretion in other areas on the same site, i.e. within the saltmarsh system as a whole.

12.3 Field survey

12.3.1 Structured walk

It is recommended that vegetation structure, vegetation composition and negative indicators for each saltmarsh zone should be assessed using a **structured walk** (e.g. a W shaped walk) with at least 10 stops within each assessment unit (block, management

unit etc.) to avoid excessively variable results. The number of stops should be enough to allow the assessor to have an overview of the site and to judge the condition of the feature. To avoid subjectivity in selecting stops and to ensure that as wide an area as possible is covered, general routes with stops should be pre-selected, based on a map or aerial photograph before the field visit. This also allows the number of stops per unit area to be determined more consistently. The **exact** stopping locations will be recorded in the field using GPS if possible. If contractors are using the guidance, consultation with local staff on route selection and stopping points is **mandatory**.

At each stop, the appropriate attributes (e.g. percentage cover and/or presence of relevant species) should be assessed within approximate 4 m^2 sampling units. There is no need to measure cover values precisely – simple visual estimates will suffice. It should not take very long (no more than 5 minutes) to record all the relevant attributes at each 'stop'.

The recommended methods of selecting the number and location of the stops are not intended to have statistical value, and the final condition of the interest feature is not simply the average of the condition of each stop. On the contrary, each stop should contribute to improve the assessor's overview of the state of the site. The following is a quantitative definition of frequency, intended to assist with the assessment of several of the saltmarsh attributes. This is a version of the well-known DAFOR scale which has been adapted to the particular characteristics of saltmarsh:

- **Dominant:** the species appears at most (>60%) stops and it covers more than 50% of each sampling unit.
- **Abundant:** species occurs regularly throughout a stand, at most (>60%) stops and its cover is less than 50% of each sampling unit.
- **Frequent:** species recorded from 41-60% of stops.
- **Occasional:** species recorded from 21-40% of stops.
- **Rare:** species recorded from up to 1-20% of stops.

Sward structure can be assessed by taking the average sward height recorded from the structured walk stops.

12.3.2 Transects

This technique can be used for assessing saltmarsh zonation. It is an assessment of where one zone ends and another begins; the aim of the assessment is to detect long-term negative trends that may be occurring. Transects will allow the width of the saltmarsh zones to be estimated at a minimum of five locations. Transects should ideally be pre-selected, based on a map or aerial photograph before the field visit and locations fixed by GPS. Transects will extend from strandline to lowest continuous marsh and the position should be recorded ideally with GPS to allow easy relocation for future assessments. Transect locations can be recorded using a recording form and ideally drawn over aerial photographs using a GIS system. the width of the zones to be estimated. Where possible the estimated width of zones at the five chosen locations should be compared to previous surveys, to assess any changes.

It is recommended that the transects to assess width of saltmarsh zones are done after the assessment for the vegetation composition.

12.3.3 Other aspects of recording

The routes followed for the structured walk and the start and finish points of the transects should be marked on a map for future comparative use. Ideally these should be traced over aerial photos of the site using GIS, to enable comparisons on future visits.

Photographs are essential to the condition assessment and should be taken as an accompanying record wherever possible. These should be archived with the assessment file. In some countries photography is a mandatory part of the condition assessment.

There are several new technologies being trialled to aid the condition assessment process, such as CASI (Compact Airborne Spectrographic Imager) and LIDAR (Light Detection and Ranging) which may provide a very useful tool for assessing zonation as well as extent.

12.4 Health and safety

Health and safety is particularly important on saltmarshes and will be another aspect to be considered when planning the route. Saltmarsh creeks can make some areas almost inaccessible and survey may be impossible. In some systems, such as the Solway, the tide may come in with great speed. In other areas you may need to be accompanied, which has significant workload implications.

13 Field recording forms

The agencies will supply separate field recording forms that fit within the objectives detailed in this guidance.

It is advisable to record as much information as resources and time allow in a consistent manner during different visits and to keep all the records in a file. This will provide a track of the history of the condition of the site in relation to management. Mark the route of your 'W' walk and transects on a map and take photographs, especially of the more dynamic parts of the habitat. Transects to assess zonation should also be marked on a map.

The tables provided in the field recording forms supplied by each agency are for guidance only. Lists of species should be produced on a site-specific basis, and the assessment should be carried out based on the particular conservation objectives tables or management plans.

An example of a recording form for zonation:

Target: Maintain the range of variation of zonations typical of the site

Zonation should ideally be assessed **after** sward composition, as you will then be more familiar with the vegetation composition at your site.

As a crude baseline, estimate the width of saltmarsh zones for one or more transects. The transect should extend from strand to lowest continuous marsh. Use the table below to record the GPS start and finish points for each zone. The GPS transect locations should be marked on a map.

Saltmarsh zones (if present)	Transect				
	1	2	3	4	5
GPS coordinates					
Brackish swamp or sand dune transition					

Other habitats above upper marsh					
Saltmarsh strand					
mid-upper saltmarsh					
low-mid saltmarsh					
pioneer saltmarsh					

Draft key for assessing zonation:

Where there is horizontal loss of extent and evidence of erosion at the marsh edge, the following key should help decide condition for saltmarsh zonation:

If there is..

- reversed vegetation succession where high and mid marsh communities revert to low marsh or pioneer communities with eventual drowning of the vegetation and reversion to mudflat or pools of standing water ***or*** vertical accretion of the saltmarsh accompanying horizontal loss of area

is the

-zonation altered with one or more saltmarsh zones (e.g. midmarsh) reduced
Favourable condition

-zonation altered with one or more saltmarsh zones (e.g. low-mid marsh or mid-upper saltmarsh) disappeared
Unfavourable condition

Draft key for assessing the extent attribute

1. extent of the feature based on the most recent aerial photography

- appears to be increasing *or*
- no apparent change *go to 2*

- increase in some places, decrease in others *or*
- appears to be net decrease over the entire area *go to 3*

2. evidence of accretion at the marsh edge (accretional ramp with pioneer species)
favourable condition for extent

3. - evidence of erosion in some areas (mud mounds, cliff edge toppling) but accretion in other areas (accretional ramp with pioneer species); indicating a net balance or gain within the system
favourable condition for extent

- evidence of erosion over most of the marsh edge surface areas (mud mounds, cliff edge toppling etc.) combined with loss of horizontal extent of the saltmarsh area
go to 4

4. – We need to consider the long-term future of the saltmarsh feature.

- is the saltmarsh constrained by natural topographical features (e.g. high ground, cliff)?
favourable condition for extent
continue with condition assessment

- do anthropogenic constraints prevent the feature from reaching morphological equilibrium?

unfavourable condition for extent

14 Generic guidance table

Table 1. UK GUIDANCE ON CONSERVATION OBJECTIVES FOR MONITORING DESIGNATED SITES

Interest feature: Saltmarsh

Includes the following:

Pioneer saltmarsh: Equivalent NVC communities: SM4, SM5, SM6, SM7, SM8, SM9, SM11, SM12.
Annex I types: *Salicornia* and other annuals colonising mud and sand (1310), *Spartina* swards (1320)
Low-mid marsh communities: Equivalent NVC communities: SM10, SM13a, SM14.
Annex I types: Atlantic saltmeadows (1330) *pp*.
Mid-upper marsh communities: Equivalent NVC communities: SM13b,c,d, SM15, SM16, SM17, SM18, SM19, SM20, SM21, SM22, SM23, SM26, SM27
Annex I types: Atlantic saltmeadows (1330) *pp*, Mediterranean and thermo-Atlantic halophilous scrubs (1420).
Driftline: Equivalent NVC communities: SM24 and SM25, SM28
Annex I types: Atlantic saltmeadows (1330) *pp*
Transitions: including mesotrophic grassland communities (e.g. MG 11, MG12, MG13) brackish mire (M28) and swamp communities (e.g. S4, S5, S18, S19, S20, S21, S26)

Phase I category: H2 Saltmarsh

Reporting category: Littoral sediment

NB All attributes listed are mandatory, unless indicated as discretionary. A single failure to achieve a target among the mandatory attributes leads to unfavourable condition for the whole monitoring unit

Attribute	Targets	Method of assessment	Comments
Extent of habitat	No decrease in extent from the established baseline, subject to natural change.	A baseline map should be prepared to show the distribution of saltmarsh vegetation, using aerial photography or existing NVC survey data. **See extent key in 5**	See guidance on habitat extent, patterns of saltmarsh erosion, effects of sea level rise (Section 4). Extent may be subject to periodic and seasonal variation, particularly pioneer saltmarsh. Extent should be measured at low tide.
Physical structure: creeks and pans	No further anthropogenic alteration of creek patterns or loss of pans compared to an established baseline. Realignment of creeks absent or rare.	Aerial photographs can be used, combined with information gathered from the site visit.	Creeks and pans vary in size and density. Creeks absorb tidal energy and assist with the delivery of sediment into saltmarshes. Major erosion of saltmarsh is indicated by internal dissection and enlargement of the drainage network, ultimately leading to the creation of mud basins.

Attribute	Targets	Method of assessment	Comments
Vegetation structure: zonation of vegetation	Maintain the range of variation of zonations typical of the site. See lists of indicators (Box 1) and notes on transitional vegetation below.	The width of zones can be estimated using one or more transects extending from strand to lowest continuous marsh. The GPS information can be collected and marked on a map.	The pattern of saltmarsh zonation will vary regionally and also from site to site (see Section 6.1). Saltmarsh has up to five main zones: pioneer, low-mid marsh, mid-upper marsh, saltmarsh strand plus transitions (see transitions below)
Vegetation structure: sward height	Maintain site-specific structural variation in the sward. (see section 6.2) Example: Strangford Lough: Maintain short sward (4 – 12 cm) in areas of species-rich vegetation	This can be assessed by taking average sward height from the quadrats forming part of the structured walk	Stocking levels need to be appropriate to the interest of the site (see Section 6.2). Over-grazing can lead to loss of rare plant species and affect bird breeding and feeding habitats and under-grazing can lead to a loss of plant diversity by competitive exclusion. A varied vegetation structure is important for maintaining invertebrate diversity.
Vegetation composition: characteristic species	Maintain frequency of characteristic species of saltmarsh zones (see Box 1 below) as follows: Pioneer zone: At least one listed species frequent and another occasional Low-mid marsh: At least one of *Puccinellia maritima, Atriplex portulacoides* or *Salicornia* spp. dominant., and two other listed species at least frequent Mid-upper marsh: At least one listed species abundant and three frequent Terrestrial transition: where present appropriate targets should be set, with reference to relevant guidance section e.g. Lowland grassland, lowland wetland (see 7.1)	Visual assessment of cover, using structured walk	Communities may be dynamic in their distribution and are linked to the physical processes operating at the site, including topography, creek patterns etc. The species composition and type of saltmarsh will vary regionally and also from site to site (see also text on zonation). A variety of communities may occur at the transition zone at the top of the salt marsh. These include mesotrophic grassland communities (e.g. MG11 - MG13) together with swamp communities (e.g. S4, S12, S20, S21 & S28). In addition stands of tall fen community with *Filipendula ulmaria* and *Iris pseudacorus* (M28) can locally be prominent.
Vegetation composition: negative indicator species *Spartina anglica*	No recent evidence of expansion into pioneer saltmarsh (indicative target of less than 10 % expansion in last 10 years)	Aerial photographs, together with visual assessment of cover, using structured walk	*Spartina anglica* is a species that is considered undesirable in intertidal habitats where it is expanding at the expense of mudflats (seeSection 7.2). However it can be a precursor to the development of saltmarsh where sediments are accreting. Natural die-back has occurred in some areas.

Attribute	Targets	Method of assessment	Comments
Other negative indicators	Artificial drainage channels adversely affecting hydrology are absent or rare No obvious signs of pollution. Turf cutting absent or rare No increase in bare substrate as a result of anthropogenic activities such as vehicle use or trampling at vulnerable locations (tracks, access points) Poaching damage from stock or horses rare, with bare mud extent <25%	Visual assessment during site visit	
Indicators of local distinctiveness* *If part of the reason for the notification of the site, this is a mandatory attribute	Maintain distinctive elements at current extent/levels and/or in current locations (e.g. maintain existing populations of notable species, important structural attributes or notable transitions between habitats).	Presence confirmed during visit at appropriate season (list species, add DAFOR score, mark locations on map(s) in file). List to be tailored to each site	This attribute is intended to cover any site-specific aspects of this habitat feature (forming part of the reason for notification) which are not adequately covered by the previous attributes , or by separate guidance e.g. for notified species features.

Box 1. Typical species for saltmarsh zones

pioneer zone	low-mid marsh	mid-upper marsh	
Salicornia spp.	*Puccinellia maritima*	*Festuca rubra*	*Artemisia maritima*
Suaeda maritima	*Triglochin maritima*	*Juncus gerardii*	*Leontodon autumnalis*
Puccinellia maritima	*Plantago maritima*	*Armeria maritima*	*Carex flacca*
Aster tripolium	*Atriplex portulacoides*	*Agrostis stolonifera*	*Carex extensa*
	Aster tripolium	*Limonium vulgare*	turf fucoids
	Spergularia maritima	*Glaux maritima*	
	Suaeda maritima	*Seriphidium maritimum*	
	Salicornia spp.	*Plantago maritima*	
	turf fucoids	*Aster tripolium*	
		Juncus maritimus	
		Triglochin maritima	
		Blysmus rufus	
		Eleocharis uniglumis	

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APPENDIX I CASE STUDIES

1. Extent

Essex Estuaries
Abbotts Hall on the Blackwater Estuary is backed by a seawall. There is a high level of erosion with mud mounds, algae and *Salicornia* spp. recolonising on the lower marsh as this is eroded. The low-mid marsh (with dominant Atriplex portulacoides) is degrading, indicated by increasing abundance of pioneer species (*Salicornia* spp, *Suaeda maritima*). Maritime grasses, e.g. *Puccinellia maritima* are now confined to the seaward face of the seawall and mid-upper species are now absent (Carole Reid *pers.comm*.).
The marsh is recorded as in unfavourable condition (for extent and zonation).

Norfolk
The North Norfolk Coast SSSI contains areas where continuous accretion is occurring (at Blakeney Point, western end of Scolt Head, Holkham and Thronham harbour) and others where there is some erosion (at Brancaster Staithe, Blakeney Ridge and Gore Point). Overall a balance is ocurring and the site can be considered to be in favourable condition for extent.

Morecambe Bay
Similarly, at Morecambe Bay SSSI there has been erosion over the last 25 years on one side of the bay, at Silverdale marsh, while on the other, at the Cartmel Peninsula, the saltmarsh is actively accreting. There is net accretion within the Bay system as a whole (Adam, P. *in* Sherwood *et al.* 2000, *British Saltmarshes*). Overall a balance is occurring and the site can be considered to be in favourable condition for extent.

2. Negative indicators: *Spartina anglica*

Exe Estuary
Cockwood corner is part of the Exe Estuary SSSI and is backed by sea defences. This corner of estuarine saltmarsh consists largely of SM6 *Spartina anglica* with some SM14 *Atriplex portulacoides* and some SM24 *Elymus pycnanthus* saltmarsh (from Hughes, M. 1992) but there has been very little change since 1992. The assessment for the area would be favourable condition. (Chris Davies *pers.comm*.).

APPENDIX II Common names and synonyms for saltmarsh plant species

Scientific name	**English/common name**
Agrostis stolonifera	Creeping bent
Armeria maritima	Thrift
Seriphidium maritimum (*Artemisia maritima*)	Sea wormwood
Aster tripolium	Sea aster
Atriplex (*Halimione*) *portulacoides*	Sea-purslane
Blysmus rufus	Saltmarsh flat-sedge
Carex extensa	Long-bracted sedge
Carex flacca	Glaucous sedge
Eleocharis uniglumis	Common spike-rush
Eleocharis parvula	Dwarf spike-rush
Elytrigia atherica	Sea Couch
Elytrigia (*Elymus*) *repens*	Couch
Elytrigia juncea (*Elytrigia pungens*, *Elymus farctus*)	Sand Couch
Festuca rubra	Red fescue
Filipendula ulmaria	Meadowsweet
Fucus cottonii	a turf fucoid
Frankenia laevis	Sea-heath
Glaux maritima	Sea-milkwort
Inula crithmoides	Golden Samphire
Iris pseudacorus	Yellow Iris
Juncus gerardii (*gerardi*)	Saltmarsh rush
Juncus maritimus	Sea rush
Limonium vulgare	Common sea lavender
Limonium humile	Lax-flowered sea lavender
Parapholis strigosa	Sea hard-grass
Plantago maritima	Sea plantain
Puccinellia distans	Northern saltmarsh-grass
Puccinellia maritima	Common saltmarsh-grass
Salicornia spp.	Glasswort, Samphire
Sarcocornia perennis (*Arthrocnemum perenne)*	Perennial glasswort
Spartina anglica	Common cord-grass
Spartina maritima	Cord-grass
Spartina alterniflora	Smooth cord-grass
Spergularia marina	Lesser sea-spurrey
Suaeda maritima	Annual sea-blite
Suaeda vera	Shrubby sea-blite
Triglochin maritima	Sea arrowgrass