# 10. Habitats and features

## Reedbeds

**Lower Humber South Bank** 0.92ha of reedbed with *Phragmites australis.*
**Lower Humber North Bank** 5.07ha of reedbed with *Phragmites australis.*
**The Grues** 3.9ha of reedbed with *Phragmites australis.*
**The Lagoons** 0.98ha of reedbed with *Phragmites australis.*
**Upper Humber North Bank** 96.24ha of reedbed with *Phragmites australis.*
**Upper Humber South Bank** 186.19ha of reedbed with *Phragmites australis.*
**North Lincolnshire Coast** 0.4ha of reedbed with *Phragmites australis.*
**Saltfleetby / Theddlethorpe** 1.01ha of reedbed with *Phragmites australis.*

**Key Sites:** Blacktoft, Faxfleet, Broomfleet Island, Whitton Sand, Barton & Barrow Clay Pits, Dawson City Clay Pits in Lincolnshire, Donna Nook, Northcoates Point.

**Summary Status:**

- There are 378 hectares of reed communities within the Humber Estuary and North Lincolnshire coast.
- Extensive reedbed habitats in the middle to upper Humber support breeding populations of priority conservation species of bird.

### Description

Reedbeds are wetlands dominated by the common reed *Phragmites australis*. They contain few plant species and the water level remains above or at ground level all year. The UK contains around 5000ha of reedbeds, of which 400ha can be accounted for in Yorkshire and the Humber Estuary (Selman *et al* 1999). Only about 50 UK sites cover more than 20 ha, but these make a large contribution to the total area.

### Distribution within the Humber

Reedbeds are an important feature of the Humber predominantly encountered throughout the inner estuary where large reedbeds are located at Blacktoft, Faxfleet-Broomfleet Island, Whitton Sand and the Barton and Barrow Clay Pits complex, as well as smaller stands lining the banks of the tidal rivers and the estuary.

Blacktoft Sands is the second largest tidal reedbed in Britain and it supports an almost continuous sward of *Phragmites australis* reedbed from the River Trent to opposite Blacktoft Clough (Bullen Consultants 2001). There is also a strip of vegetation between the flood embankment and the reserve path dominated by *Phragmites australis*, which equates to the *Phragmites australis-Urtica dioica* (S26) community in the National Vegetation Classification (Bullen Consultants 2001).

Elsewhere, Barton and Barrow Clay Pits located on the south bank of the Humber between New Holland and Chowder Ness, comprises an extensive mosaic of reedbeds. The marginal zones of the clay pits support a tall sward of *Phragmites australis* (S4 community). Around

the edges of some of the ponds the S4 community grades into the S26 community, which has a greater species diversity with *Urtica dioica* and *Epilobium hirsutum* often being co-dominant within the sward (Bullen Consultants 2001). The Dawson City Clay Pits Nature Reserve also supports tall swards of S4.

On the outer estuary, *Phragmites australis* reedbed (S4a *P. australis* sub-community) account for only 0.4ha of the North Lincolnshire Coast SSSI. This community is restricted to brackish-freshwater areas of open water in borrowdykes, ponds south of Donna Nook, and at the head of a single saltmarsh creek system at Northcoates Point (Dargie 2001).

On the north shore, the majority of the *Phragmites* beds are located between Faxfleet and North Ferriby although small, generally poor quality beds are present to the east and west (IECS 1993). As with the south bank of the upper Humber, much of the reedbed vegetation along the north shore is restricted to a narrow strip between the flood defence embankment and the mean high water level. Communities present include S4 (83.35ha) and S26 (13.89ha) (Bullen Consultants 2001).

The Faxfleet saltmarsh is dominated by a tall sward of *Phragmites australis* (S4). At Broomfleet, the S4 community in some areas stretches from the embankment to the foreshore and in other areas is found between the embankment and the perennial rye-grass *Lolium perenne leys* (MG7) community. Elloughton Ings is similar to the saltmarsh found at Faxfleet, being dominated by a tall sward of *Phragmites australis* interspersed by patches of SM28 (Bullen Consultants 2001).

Although the recent NVC survey carried out by Bullen Consultants (2001) covered the majority of reedbeds in the Humber Estuary, a few areas not designated as SSSIs also support reedbed habitat but were not surveyed. For instance, the open water adjacent to the embankment at Welton Waters supports a fringing reedbed dominated by *Phragmites australis*. On the outer shore *Phragmites australis* vegetation is also present in dykes around Kilnsea, although the habitat tends to be increasingly fragmented within this area.

### Historical changes and trends

In 1993, a habitat survey recorded 207ha of reedbed along the Humber Estuary (Selman *et al* 1999). The NVC survey carried out in 2001 provide a detailed distribution and extent of the reedbed in the Humber SSSIs recording a total of 267ha of *Phragmites australis* swamp (S4) (Bullen Consultants 2001), although is not clear how the boundaries of these surveys correspond. In addition to S4 swamp communities, the recent NVC surveys recorded a further 108ha of tall swamp communities, see Table 15.

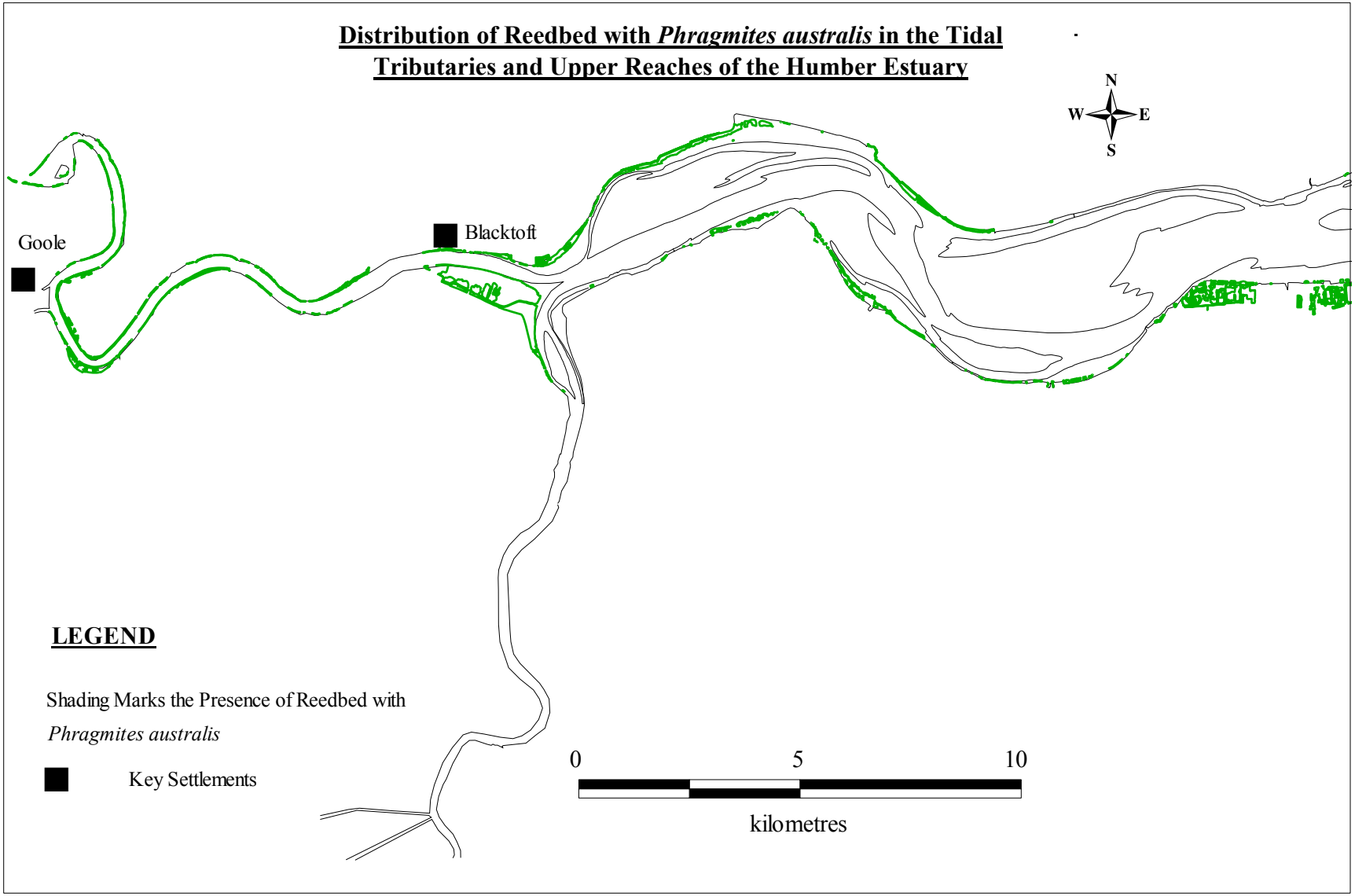
**Table 15** Reedbed and associated swamp and fen vegetation communities

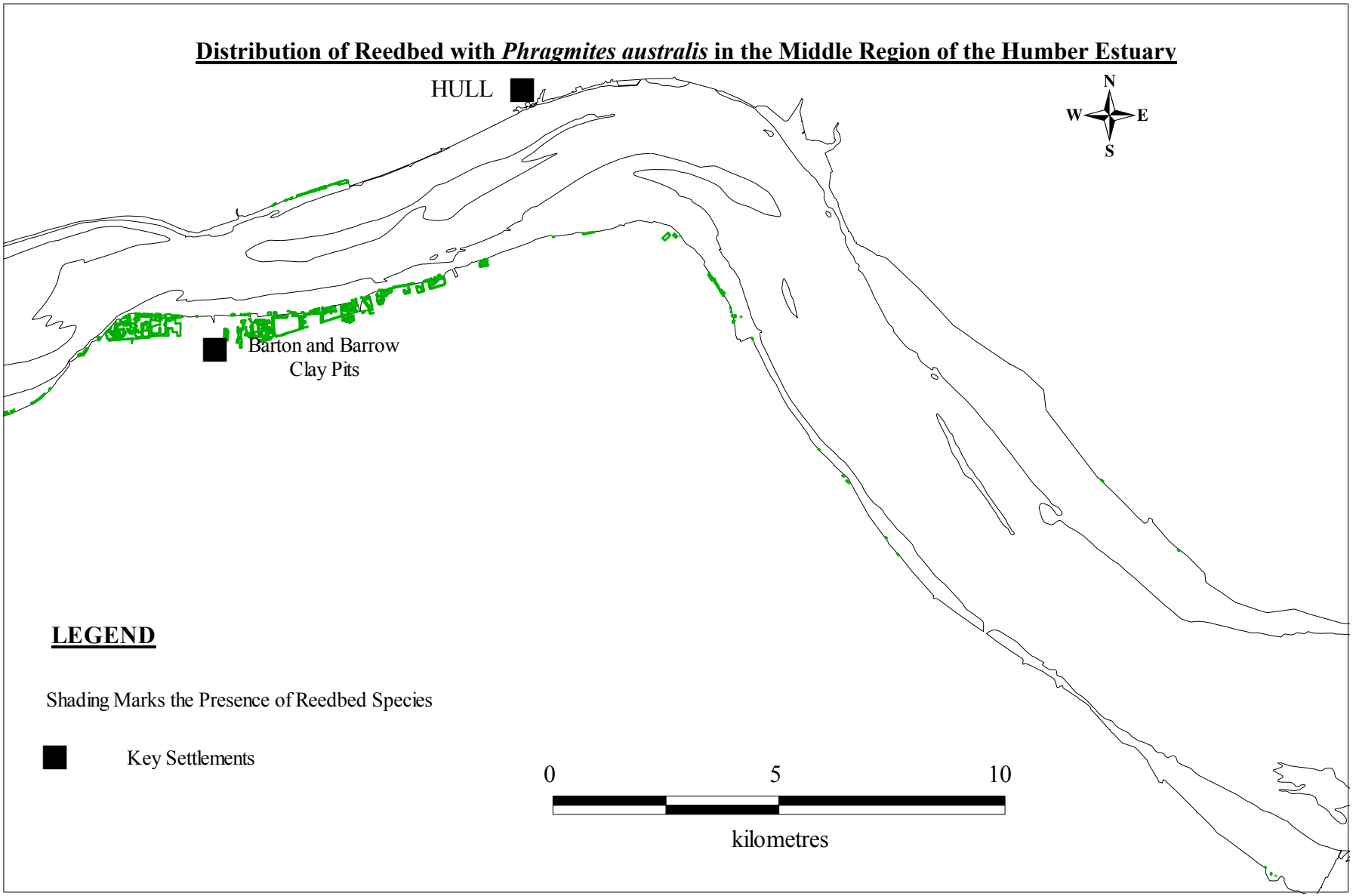
| NVC Code | Community Name | Upper South Bank | Upper North Bank | The Grues | Lower South Bank | Lower North Bank | The Lagoons | North Lincs coast | Saltfleetby/ Theddlethorpe Dunes | Total (ha) |
|---|---|---|---|---|---|---|---|---|---|---|
| S4 | *Phragmites australis* swamp | 173.33 | 83.35 | 3.9 | 0.92 | 4.38 | 0.83 | | | **266.71** |
| S4a | *Phragmites australis* swamp and reedbeds *Phragmites australis* sub-community | | | | | | 0.15 | 0.4 | 0.14 | **0.69** |
| S4d | | | | | | | | | 0.04 | **0.04** |
| S4/SM24 | Intermediate between S4 *Phragmites australis* swamp and SM24 *Elytrigia atherica* saltmarsh strand | | | | | | | 2.6 | | **2.6** |
| S6 | *Carex riparia* swamp | | | | | | | 0.1 | 2.25 | **2.35** |
| S12 | *Typha latifolia* swamp | | 0.07 | | | 0.01 | | | | **0.08** |
| S18 | *Carex otrubae* swamp | | | | | 0.16 | | | | **0.16** |
| S19 | *Eleocharis palustris* swamp | | | 0.15 | | | | | | **0.15** |
| S21 | *Bulboschoenus maritimus* swamp | 29.43 | 38.37 | 1.98 | 0.94 | 3.1 | 0.04 | 0.21 | | **74.07** |
| S21b | *Bulboschoenus maritimus* swamp *Atriplex prostrata* sub-community | 0.02 | | 0.01 | 0.03 | | | | | **0.06** |
| S21c | *Bulboschoenus maritimus* swamp *Agrostis stolonifera* sub-community | 0.08 | | 0.11 | 0.04 | | | | | **0.23** |
| S22 | *Glyceria fluitans* water-margin vegetation | | 0.12 | | | | | | | **0.12** |
| S22a | *Glyceria fluitans* water-margin vegetation – *Glyceria fluitans* sub-community | | 0.49 | | | | | | | **0.49** |
| S26 | *Phragmites australis-Urtica dioica tall herb fen* | 9.26 | 12.32 | | | 0.22 | | | 0.87 | **22.67** |
| S26b | *Phragmites australis-Urtica dioica tall-herb fen Arrhenatherum elatius sub-community* | 0.14 | 0.57 | | | 0.47 | | | | **1.18** |
| S26d | *Phragmites australis-Urtica dioica tall-herb fen Epilobium hirsutum sub-community* | 3.46 | | | | | | | | **3.46** |
| S28 | *Phalaris arundinacea tall-herb fen* | 3.13 | 3 | | | | | | | **6.13** |
| S28c | *Phalaris arundinacea tall-herb fen Elymus repens-Holcus lanatus sub-community* | 0.12 | | | | | | | | **0.12** |
| **Total hectares:** | | | | | | | | | | **381.31** |

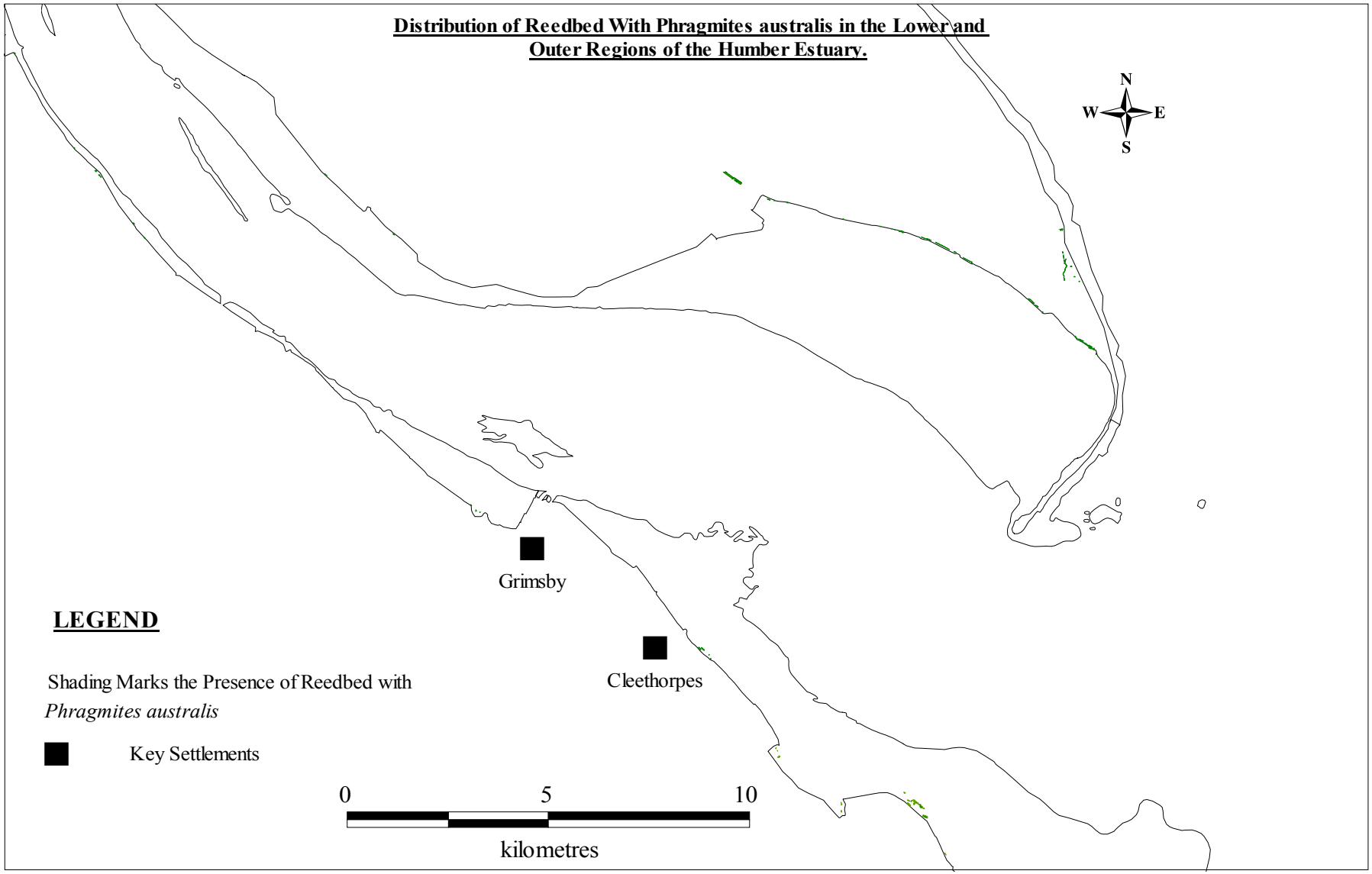
### Conservation status

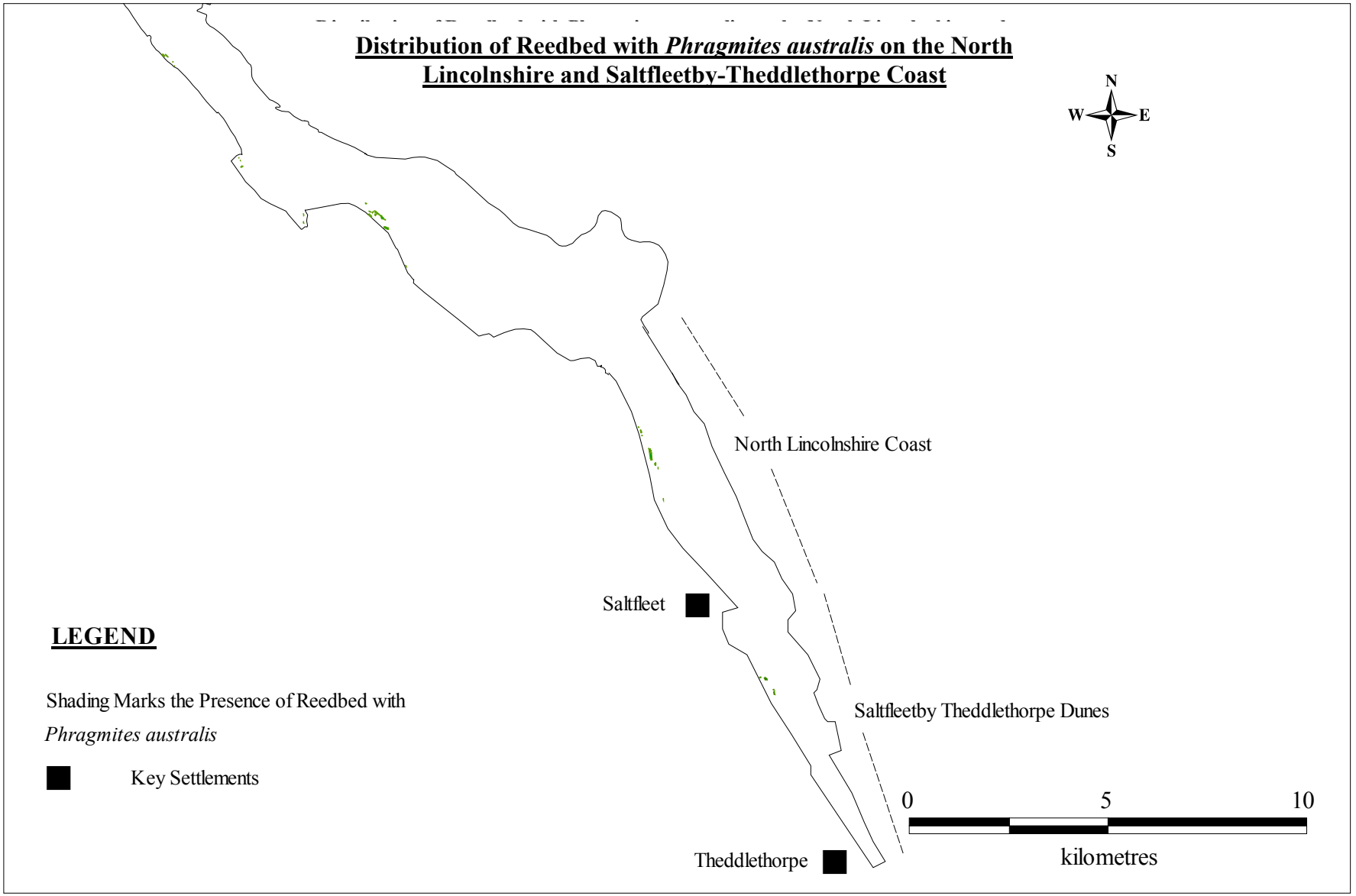
Reedbeds are very important for several Red Data Bird species including the bittern *Botaurus stellaris*, marsh harrier, *Circus aeruginosus*, Cetti's warbler *Cettia cetti* and bearded tit *Panurus biarmicus* (Batten *et al* 1991). Reedbeds also provide roosting and feeding sites for migratory species. In winter, birds of prey such as hen harrier and short-eared owl form communal roosts in reedbeds.

In the middle to upper Humber, the extensive reedbed communities support breeding populations of priority conservation species including bittern *Botaurus stellaris*, marsh harrier *Circus aeruginosus* and bearded tit *Panurus biarmicus*. In addition, they support breeding and wintering populations of other bird species of local and national importance, as well as fish, invertebrate and small mammal communities.


Distribution of Reedbed with *Phragmites australis* in the Tidal Tributaries and Upper Reaches of the Humber Estuary
N
W
E
S
Goole
Blacktoft
LEGEND
Shading Marks the Presence of Reedbed with *Phragmites australis*
Key Settlements
0
5
10
kilometres


Distribution of Reedbed with *Phragmites australis* in the Middle Region of the Humber Estuary
HULL
N
W
E
S
Barton and Barrow
Clay Pits
LEGEND
Shading Marks the Presence of Reedbed Species
Key Settlements
0
5
10
kilometres


Distribution of Reedbed With Phragmites australis in the Lower and Outer Regions of the Humber Estuary.
N
W
E
S
Grimsby
Cleethorpes
LEGEND
Shading Marks the Presence of Reedbed with
Phragmites australis
Key Settlements
0
5
10
kilometres


Distribution of Reedbed with *Phragmites australis* on the North Lincolnshire and Saltfleetby-Theddlethorpe Coast
N
W
E
S
North Lincolnshire Coast
Saltfleet
Saltfleetby Theddlethorpe Dunes
Theddlethorpe
LEGEND
Shading Marks the Presence of Reedbed with
*Phragmites australis*
Key Settlements
0
5
10
kilometres

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## Standing Open Water

**Key Sites:** Barton to Barrow Clay Pits Complex (40 ha), Faxfleet Ponds (1 ha), Welton Waters (exact area not known), Blacktoft Sands (15.3 ha).

**Summary Status:**

- Habitats Directive: not listed.
- UK Biodiversity Action Plan with Local Biodiversity Action Plan implementation.

### Description

This habitat includes natural systems such as lakes, meres and pools, as well as man-made waters such as reservoirs, canals, ponds and gravel pits. It includes the open water zone which may contain submerged, free floating or floating-leaved vegetation, and water fringe vegetation. It also includes adjacent wetland habitats with contiguous water levels that are less than 0.25ha. Ditches with open water for at least the majority of the year should also be included in this type. Small areas of open water in a predominately terrestrial habitat such as bog pools or temporary pools on heaths should be included in the appropriate terrestrial broad habitat (UK BAP Steering Group 1999).

Standing open waters may be classified according to their nutrient status. Nutrient-rich (eutrophic) waters predominate in lowland areas, where their nutrient status is often artificially increased by agricultural fertilisers, whilst nutrient-poor (oligotrophic) waters tend to occur in the uplands. Water bodies with intermediate nutrient levels are classed as mesotrophic. Peaty and acidic water bodies, which are occasionally found in bogs and heathland are termed dystrophic.

Rodwell *et al* (1995) classified the vegetation of open water into 24 communities but vegetation can be considered under six general headings: surface and sub-surface duckweed and frogbit vegetation of moderately-rich to eutrophic standing waters, free floating or rooted and submerged pondweed vegetation, rooted water-lily and pondweed vegetation with floating leaves, crowfoot and starwort vegetation of running waters, submerged vegetation of quillworts and hairgrass and free-floating vegetation of impoverished base-poor standing waters (Rodwell *et al* 1995).

There are few 'natural' open water bodies around the Humber, as nearly all areas of open water have been created by man. The extraction of clay for brick and tile making and for the manufacture of cement in the 19$^{th}$ and early 20$^{th}$ Century and of sand and gravel for the construction industry in more recent years has left a legacy of water-filled pits around the estuarine margins.

### Distribution within the Humber and associated species

Most pits are relatively small (<10ha), however at several sites around the Humber there are a series of such pits often forming a mosaic of differing open water habitat, depending on factors such as the length of time since last worked, water quality, bathymetry, adjacent vegetation and management. Such complexes generally range from between 20ha to 50ha in size and include sites such as Blacktoft Sands, Broomfleet Brick Pits, Welton Waters, Winteringham Ings and North Killingholme Pits. However the most extensive complex of

pits, with many fringed by extensive reedbeds, is located immediately inland from the Humber bank between Chowder Ness and New Holland, considerable parts of which are managed by the Lincolnshire Wildlife Trust and most of which are included in Barton and Barrow Clay Pits SSSI. The clay pits vary greatly in size and support varying amounts of vegetation. The marginal zones of the all the clay pits support a tall sward of *Phragmites australis*. A number of the pits have become choked by *Phragmites* and it was evident that reed cutting has been undertaken to open up some of the ponds (Bullen Consultants 2001). For the majority of clay pits the aquatic communities were not assessed, however where the open water could easily be viewed, aquatic species recorded included *Elodea canadensis*, *Nymphaea alba* and *Lemna gibba* (Bullen Consultants 2001).

This site is important for its bird assemblage, including breeding bittern *Botaurus stellaris* and marsh harrier *Circus aeruginosus*. Many duck, including mallard *Anas platyrhynchos*, pochard *Athya ferina* and tufted duck *Aythya fuligula* nest on the islands and margins. In winter many more wildfowl move into the area, including wigeon *Anas penelope*, teal *Anas crecca*, goldeneye *Bucephala clangula* and gadwall *Anas strepera*, goosander *Mergus merganser* and occasionally smew *Mergus albellus*. Great-crested grebe *Podiceps cristatus*, little grebe *Tachybaptus ruficolis* and water rail *Rallus aquaticus* also nest. The water in many of the pits is rich in microscopic organisms which provide food for many invertebrates, which in turn support fish such as eel *Anguila anguila*, roach *Rutilus rutilus*, rudd *Scardinius erythrophthalmus* and perch *Perca fluviatilis*.

Further east, at Goxhill Haven, two disused clay pits can also be classified as an open water habitat. Like Barton City Clay Pits, these areas are associated with reedbeds. The largest pond is dominated by a tall sward of *Phragmites*, the smaller pond supports a greater diversity of aquatic species including *Eleocharis palustris, Persicaria amphibia, Phragmites* and *Bolboschoenus maritimus* (Bullen Consultants 2001). These areas are particularly important for a wide range of birds, not only as a breeding site but also as a migration staging post. Over 20 species have been recorded breeding, including reed warbler *Acrocephalus scirpaceus*, sedge warbler *Acrocephalus schoenobaenus*, water rail, garganey *Anas querquedula* and, in the past, bittern. Snipe *Gallinago gallinago* are regular visitors and migrant waders include green sandpipers *Tringa ochropus* and wood sandpipers *Tringa glareola*, redshank *Tringa totanus*, greenshank *Tringa nebularia* and ruff *Philomachus pugnax*. Numbers of surface-feeding ducks, such as shoveler *Anas clypeata*, teal *Anas crecca* and mallard also utilise the site, with peak numbers occurring in late winter and early spring.

On the north shore important open standing water is found at Welton Waters, this complex provides an important habitat for many species of aquatic bird. Welton Waters support a breeding population of kingfisher in addition to breeding duck species including shoveler, garganey, tufted duck and pochard. The open water often holds large concentrations of wintering wildfowl with large numbers of teal (*c.*300), pochard (*c*. 200) and wigeon (*c.*200) recorded during the winter (Thomas unpubl.).

Another area of open water exists at Faxfleet. Although this is a smaller wetland area, with reedbed appearing to be gradually encroaching on the open water, the site is locally important for breeding wildfowl such as tufted duck, little grebe, great crested grebe, pochard and also supports wintering gadwall (N.D. Cutts pers. obs. 2002).

Other pit complexes occur further inland, for instance gravel/clay pits near Newport and Broomfleet, and although these sites support resident populations of many species, they can also be considered to be part of the Humber system, as they often support waterfowl communities which are directly associated with the Humber Estuary. For instance there is a known movement of wildfowl, including mallard and wigeon between the Broomfleet pits and the Humber wildfowl refuge, whilst wader flocks, including ruff have also been recorded using both areas (N.D. Cutts pers. obs. 2002).

Standing open waters which occur in the form of both flooded gravel and brick pits are of considerable national significance for nature conservation. They, together with ponds and ditches immediately around the Humber, contribute to the importance of the area for waterfowl and are important habitats for invertebrates (e.g. the assemblage of dragonflies), fish including eels and flatfish spp. and small mammals. For instance, water courses and ponds provide useful habitat for water voles (UK BAP Species), with the borrow pits and adjacent water courses at Thorngumbald having supported a population (N.D. Cutts pers. obs. 2002), whilst the saline lagoons at North Killingholme support a scarce invertebrate community which includes the polychaetes worm *Alkmaria romijni*.

### Historical changes and trends

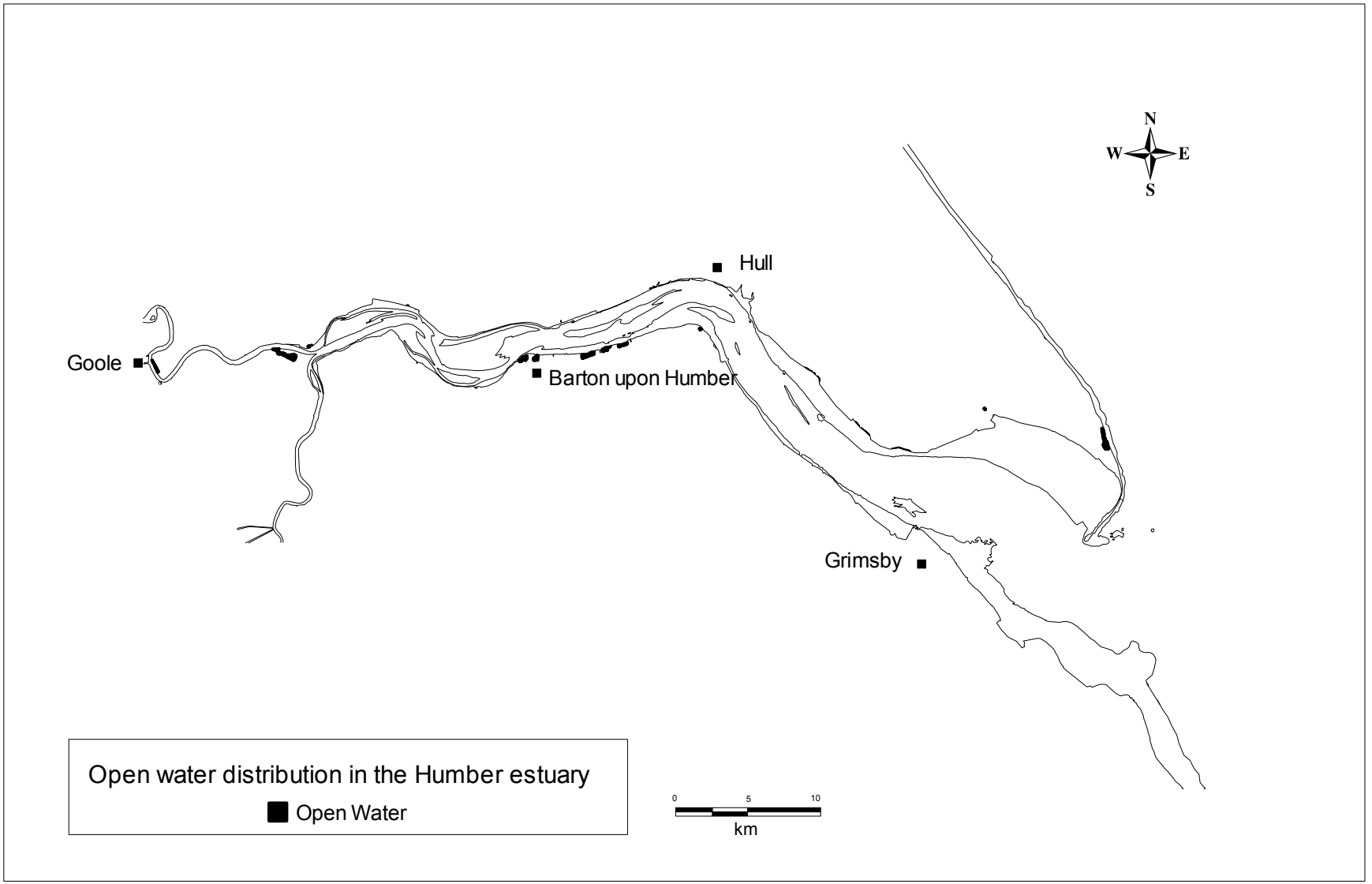
The standing open water resource around the Humber has largely been created through the excavation and flooding of brick pits. In recent years, with the cessation of active commercial working and appropriate habitat and water management, the number and quality of these pits has increased.

Paradoxically however, the number of standing water sites in their more natural 'pond' form have suffered a huge decline over the last 100 years, due to agricultural intensification, pollution or poor management (Farrow & Wright 2000).

Enclosed bodies of water such as pits are susceptible to elevated nutrient loadings, largely through agricultural run-off. In severe cases this can cause eutrophication which in turn can cause a significant loss of biodiversity. The introduction of exotic or inappropriate species can also affect the native populations of species supported in them and in particular, the invertebrate and plant communities (UK BAP Steering Group 1999).

### Conservation status

The status of other standing water in the Humber and their qualification as mesotrophic standing waters of national conservation value has been produced (Selman *et al* 1999). They identify a numbers of provisional sites under consideration by the UK BAP Steering Group for Mesotrophic Standing Waters; amongst them Barton & Barrow Clay Pits (SSSI). Mesotrophic standing waters are listed as key habitats in the UK Steering Group. There is little information about the status of standing eutrophic water. An inventory of eutrophic standing waters has not yet been produced in Yorkshire and Humberside (Selman *et al* 1999).


N
W
E
S
Hull
Goole
Barton upon Humber
Grimsby
Open water distribution in the Humber estuary
Open Water
0
5
10
km

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## Saltmarshes

### *Salicornia* and other annual colonising mud and sand

**Key Sites:** Horse Shoe Point, Cleethorpes.

**Summary Status:**

- Habitats Directive: Annex 1
- Constituent NVC Communities: SM8, SM9
- Estimated Total Area: 61.48ha

### Atlantic salt meadows

**Key Sites:** North Somercotes, Spurn Bight, Cleethorpes, Cherry Cob Sands.

**Summary Status:**

- Habitats Directive: Annex 1
- Constituent NVC Communities: SM10, SM11, SM11/SM12, SM12, SM13, SM13a, SM13b, SM13c, SM13c/d, SM13f, SM13/*y, SM14, SM14a, SM14c, SM15, SM16, SM16a, SM16b, SM16c, SM16e.
- Estimated Total Area: 899.42ha

### Mediterranean and thermo-Atlantic halophilous scrub and associated intertidal marsh

**Key Sites:** Long Bank/North Marsh Road.

**Summary Status:**

- Habitats Directive: Annex 1
- Constituent NVC Communities: SM7.
- Estimated Total Area: 0.04ha

### Other NVC communities not included as an Annex I habitat:

**Key Sites:** Tetney Marshes, The Fitties, North Coates, North Somercotes, The Grues, Paull Holme Sands, Spurn Bight, Spurn Peninsula.

**Summary Status:**

- Habitats Directive: N/A
- Constituent NVC Communities: MG11, SM2, SM6, SM17, SM18a, SM16a/SM24, SM24, SM24/SM18a, SM28.
- Estimated Total Area: 511.08ha

### Description

Coastal saltmarshes generally form on sheltered coasts between the levels of mean high water spring tides and mid neap tides. They are vegetated by halophytic grasses, herbs or low shrubs that tolerate flooding by saline waters. They may be dissected by creeks and include unvegetated pools or saltpans. The fraction of sand and mud may vary in the marsh substrate which can influence the composition of vegetation and marsh morphology. At their lower limits marshes may grade into seagrass beds, mudflats with hollow green weed *Enteromorpha* or open mud and/or sandflats. At its upper limits, saltmarsh vegetation may cease abruptly due to relief and the influence of freshwater terrestrial habitats. The distribution of characteristically low, mid and upper saltmarsh vegetation may be complicated by within-marsh morphological heterogeneity (Ranwell 1972; Adam 1990; Rodwell 2000). In the upper reaches of the Humber, saline influences decrease resulting in saltmarshes grading into tidal marsh stands of swamp communities dominated by sea club-rush *Bolboschoenus maritimus* and common reed *Phragmites australis* (Rodwell 1996). While the latter communities do not form part of the Habitats Directive Annex 1 saltmarshes as defined in the EU Interpretation Manual, they are mentioned here, as well as under the 'estuaries' (1130), because of their obvious affinity and association within the estuary (European Commission DG Environment 1999).

Saltmarshes are connected by dynamic physical coastal processes to intertidal flats, supra-tidal features such as dunes, shingle ridges and lagoons and sediment sources, such as eroding cliffs upon which they may depend for sediment inputs (Pethick 1992).

### Distribution within the Humber

Fringing saltmarsh habitat is found in the Humber Estuary between the mouth and the Wolds, most notably in sheltered areas such as at Cherry Cobb Sands and in artificial embayments like Welwick on the north bank. On the south bank there are notable areas of saltmarsh near Tetney where the coast is sheltered by offshore banks and south of Donna Nook where they front the North Lincolnshire coastal dune systems, again in the shelter of extensive intertidal flats and offshore banks. Saltmarshes also front the dune complex between Saltfleet and Theddlethorpe. Elsewhere within the Humber, saltmarshes are confined to a discontinuous narrow fringe in front of sea walls or tidal defence structures. For the purposes of this description, marshes are divided into Humber Estuary saltmarshes west of a line between Donna Nook and Spurn point and the North Lincolnshire coast saltmarshes, which have formed along the sunken barriers coast from Donna Nook south (Bullen Consultants 2001; Dargie 2001).

**Humber Estuary saltmarshes:** Saltmarshes occupy less than 2% of the total area of the estuary and <4% of the intertidal area (Davidson & Buck 1997; Bullen Consultants 2001). This is an uncharacteristically low ratio of marsh for estuaries, both for the east coast and nationally (Davidson & Buck 1997). This low absolute quantity of saltmarsh in the Humber may be explained by a combination of the estuary's geomorphology and its history of extensive land-claim.

The composition of the Humber's saltmarsh communities is quite distinct. The lower marsh is dominated by the species poor, common cord-grass *Spartina anglica* saltmarsh community (NVC community SM6), with smaller areas of the annual glasswort *Salicornia* community

(SM8). Together these lower marsh communities account for a little over a quarter of the saltmarsh in the Humber (Bullen Consultants 2001). Lower-middle saltmarsh communities are mostly represented by sea aster *Aster tripolium* (SM12), common saltmarsh grass *Puccinellia maritima* (SM13) and the species poor, sea purslane *Atriplex portulacoides* communities (SM14). While other middle marsh vegetation communities do occur (most notable the red fescue *Festuca rubra* community (SM16), they are not widespread (Bullen Consultants 2001). The middle to upper portion of the saltmarsh community is atypical in the Humber. Elsewhere in England, part of the marsh tends to be occupied by sub-communities of the common saltmarsh grass *Puccinellia maritima* (SM13) and red fescue *Festuca rubra* communities (SM16). In the Humber, these vegetation communities are relatively scarce, while the upper marsh in the outer estuary is dominated by a species poor sea couch *Elytrigia atherica (Elymus pycnanthus)* saltmarsh community (SM24). Other transition communities are scarce (Burd 1989; Bullen Consultants 2001).

In the upper reaches of the estuary from the Wolds to Trent Falls, the tidal marsh community is dominated by the common reed *Phragmites australis* fen (S4) and sea club-rush *Bulboschoenus maritimus* swamp (S21) with the couch grass *Elymus repens* saltmarsh community (SM28). These habitats are relatively well represented forming more than half of the total tidal vegetation in the estuary (Bullen Consultants 2001).

**North Lincolnshire coast saltmarshes:** Large extents (154.1ha) of pioneer saltmarsh vegetation (SM6, SM8, SM9, SM10, SM11/SM12) are present with pioneer communities distributed throughout most of the length of the site. More established saltmarsh surfaces are dominated by middle marsh vegetation (438.8ha of SM13, SM14 and SM15 vegetation), particularly SM13 and SM14 types. The largest extents of such middle marsh are at Somercotes Haven - Grainthorpe Haven and Tetney Haven. Sea-purslane *Atriplex (Halimione) portulacoides* SM14 community includes a very unusual form developed as intertidal embryo 'dunes' which could, alternatively, be considered as a pioneer form of saltmarsh. Good height zonations are present, with levee development along creeks creating extensive depressions holding waterlogged saltmarsh types. Upper saltmarsh (SM16) vegetation is uncommon (11.3ha), in contrast to SM24 saltmarsh strand (96.7ha) which is quite extensive (possibly masking some potential SM16 habitat). Strand vegetation is extensive on middle saltmarsh habitat, the result of increased soil nutrient status following decay of organic strand material. The balance between middle and upper saltmarsh is probably the result of coastal reclamation in the 18$^{th}$, 19$^{th}$ and 20$^{th}$ centuries and vertical accretion being mainly confined to the middle saltmarsh zone. Current accretion rates do not seem sufficient to produce significant quantities of upper saltmarsh habitat (Dargie 2001). South of Saltfleet Haven, another extensive area of saltmarsh has formed in the shelter of the Haven training wall and extensive intertidal flats, which narrow to the south. Here the nature and composition of the marsh vegetation is similar in character to the north Lincolnshire coastal saltmarshes described above (EMEC Ecology 1999). However, the absence of any artificial defence structures through most of the site gives rise to some exceptional saltmarsh, sand dune and wetland interfaces and transitions give the site a particular conservation value.

**Comparison of the Humber and Lincolnshire coast saltmarshes:** The North Lincolnshire coast saltmarshes are similar in extent to those on the Humber but are somewhat different in a number of characteristics. Notable differences include the greater element of well developed saltmarsh scrub sea-purslane *Atriplex (Halimione) portulacoides* saltmarsh, sub-community with *A. portulacoides* dominant (SM14a) and middle marsh common saltmarsh grass *Puccinellia maritima* communities, especially the sea lavender *Limonium vulgare* –

thrift *Armeria maritima* and SM13d sea plantain *Plantago maritima* – thrift *Armeria maritima* sub-communities (SM 13 c/d) in the coastal marshes. The Lincolnshire coast marshes are also recorded as having much less of the common cord-grass *Spartina anglica* saltmarsh community (SM6). However, common cord-grass *Spartina anglica* is a common feature of the vegetation in the coastal marshes with the surveyor assigning a substantial portion of the middle marsh vegetation to a provisional new NVC sub-community of common saltmarsh grass *Puccinellia maritima* saltmarsh, common cord-grass *Spartina anglica* sub-community (Dargie 2001). Therefore, potentially differing interpretations make comparison between surveys difficult. One common element of the saltmarsh vegetation in the two areas is the large representation of sea couch *Elytrigia atherica (Elymus pycnanthus)* saltmarsh (SM 24) although the community is notably more extensive in the estuary. Table 16 shows the extent of saltmarsh community types according to recent NVC surveys of the Humber and North Lincolnshire Coast by Bullen Consultants (2001) and Dargie (2001).

**Table 16** NVC Saltmarsh communities recorded on the Humber by Bullens 2001 and Dargie 2001 (hectares)

| NVC Code | Community Name | Upper Humber North Bank | Upper Humber South Bank | Barton and Barrow Claypits | The Grues | Spurn Head to Saltend Flats | Pyewipe and Cleethorpes Coast | North Lincs coast | The Lagoons | Saltfleetby-Theddlethorpe Dunes | Total (ha) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MG11 ++ | *Festuca rubra – Agrostis stolonifera – Potentilla anserina* inundation grassland and intermediates with MG11/SM18 *Juncus maritimus* saltmarsh | - | - | - | - | - | - | 3.4 | - | | **3.4** |
| SM2 | *Ruppia maritima* saltmarsh community | - | - | - | - | - | - | 2.4 | - | | **2.4** |
| SM6 | *Spartina anglica* saltmarsh community | 0.72 | 0.17 | 4.5 | 8.68 | 92.92 | 11.1 | 18.3 | - | 1.37 | **137.76** |
| SM7 | *Arthrocnemum perenne* stands | - | - | - | - | - | - | - | 0.04 | | **0.04** |
| SM8 | Annual *Salicornia* saltmarsh community | - | - | - | - | 2.05 | 13.28 | 26.1 | - | 13.73 | **55.16** |
| SM9 | *Suaeda maritima* saltmarsh community | - | - | - | - | 0.16 | - | 5.7 | 0.37 | 0.09 | **6.32** |
| SM10 | Transitional low-marsh vegetation with *Puccinellia maritima*, annual *Salicornia* species and *Suaeda maritima* | - | - | - | - | 10.3 | 0.05 | 101.1 | - | 7.28 | **118.73** |
| SM11 | *Aster tripolium var. discoideus* saltmarsh community | 0.17 | 0.01 | - | - | 4.46 | 1.26 | - | - | 4.39 | **10.29** |
| SM11 / SM12 | *Aster tripolium var. discoideus* and rayed *A. tripolium* saltmarsh | - | - | - | - | - | - | 0.7 | - | - | **0.7** |
| SM12 | Rayed *Aster tripolium* on saltmarshes | 0.09 | 6.43 | 0.11 | 6.47 | 25.13 | 1.93 | - | 0.37 | - | **40.53** |

| NVC Code | Community Name | Upper Humber North Bank | Upper Humber South Bank | Barton and Barrow Claypits | The Grues | Spurn Head to Saltend Flats | Pyewipe and Cleethorpes Coast | North Lincs coast | The Lagoons | Saltfleetby-Theddlethorpe Dunes | Total (ha) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SM13 | *Puccinellia maritima* saltmarsh community | - | - | - | 0.21 | 8.11 | 30.37 | - | - | - | **38.69** |
| SM13a | *Puccinellia maritima* saltmarsh community-sub-community with *Puccinellia maritima* dominant | - | - | - | - | 0.09 | - | 17.3 | - | - | **17.39** |
| SM13b | *Puccinellia maritima* saltmarsh community – *Glaux maritima* sub-community | - | - | - | 2.54 | 5.35 | 0.02 | 0.2 | - | - | **8.11** |
| SM13c | *Puccinellia maritima* saltmarsh community - *Limonium vulgare* sub community | - | - | - | - | 1.36 | - | - | - | 44.04 | **45.4** |
| SM13c/d | *Puccinellia maritima saltmarsh, intermediate between SM13c Limonium vulgare – Armeria maritima and SM13d Plantago maritima – Armeria maritima sub-communities* | - | - | - | - | - | - | 89.8 | - | - | **89.8** |
| SM13f | *Puccinellia maritima saltmarsh community - Puccinellia maritima – Spartina anglica sub-community* | - | - | - | - | 6.73 | - | - | - | - | **6.73** |
| SM13/*y | *Puccinellia maritima saltmarsh, provisional new Spartina anglica sub-community* | - | - | - | - | - | - | 83.5 | - | - | **83.5** |
| SM14 | *Atriplex portulacoides saltmarsh community* | - | - | - | - | 34.01 | 0.81 | - | - | - | **34.82** |
| SM14a | *Atriplex portulacoides saltmarsh community – sub-community with Atriplex portulacoides dominant* | - | - | - | - | 23.87 | - | 119.4 | - | 34.89 | **178.16** |
| SM14c | *Atriplex portulacoides saltmarsh community, Puccinellia maritima sub community* | - | - | - | - | 15.47 | 21.95 | 127.1 | - | 20.78 | **185.3** |
| SM15 | *Juncus maritimus - Triglochin maritima saltmarsh community* | - | - | - | - | 0.14 | - | 0.1 | - | 0.65 | **0.89** |
| SM16 | *Festuca rubra saltmarsh community* | 1.98 | 1.02 | 0.08 | 2.42 | 1.96 | 0.28 | - | 0.15 | - | **7.89** |
| SM16a | *Festuca rubra saltmarsh community Puccinellia* | - | - | - | 0.31 | 10.29 | 0.94 | 6.6 | - | 0.06 | **18.2** |

| NVC Code | Community Name | Upper Humber North Bank | Upper Humber South Bank | Barton and Barrow Claypits | The Grues | Spurn Head to Saltend Flats | Pyewipe and Cleethorpes Coast | North Lincs coast | The Lagoons | Saltfleetby-Theddlethorpe Dunes | Total (ha) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *maritima sub-community* | | | | | | | | | | |
| SM16b | *Festuca rubra saltmarsh community, Juncus gerardi dominant* | - | - | - | 0.65 | - | - | 0.2 | - | 0.11 | **0.96** |
| SM16c | *Festuca rubra saltmarsh community Festuca rubra-Glaux maritima sub-community* | - | 0.84 | 0.07 | 4.82 | - | 0.27 | 4.1 | - | 2.83 | **12.93** |
| SM16e | *Festuca rubra saltmarsh, Leontodon autumnalis sub-community* | - | - | - | - | - | - | 0.4 | - | - | **0.4** |
| SM17 | *Artemisia maritima* salt-marsh community | - | - | - | - | - | - | - | - | 1.65 | **1.65** |
| SM18a | | - | - | - | - | - | - | - | - | 0.74 | **0.74** |
| SM16a / SM24 | *Mosaic community* | - | - | - | 0.72 | - | - | - | - | - | **0.72** |
| SM24/ SM18a | | - | - | - | - | - | - | - | - | 1.95 | **1.95** |
| SM24 | *Elymus pycnanthus saltmarsh community* | 0.2 | - | 11.22 | 23.54 | 125.96 | 6.03 | 97.7 | - | 25.6 | **290.25** |
| SM28 | *Elymus repens saltmarsh community* | 9.82 | 59.57 | 0.17 | 0.03 | - | - | - | 2.62 | - | **72.21** |
| **Total hectares** | | | | | | | | | | | **1472.02** |

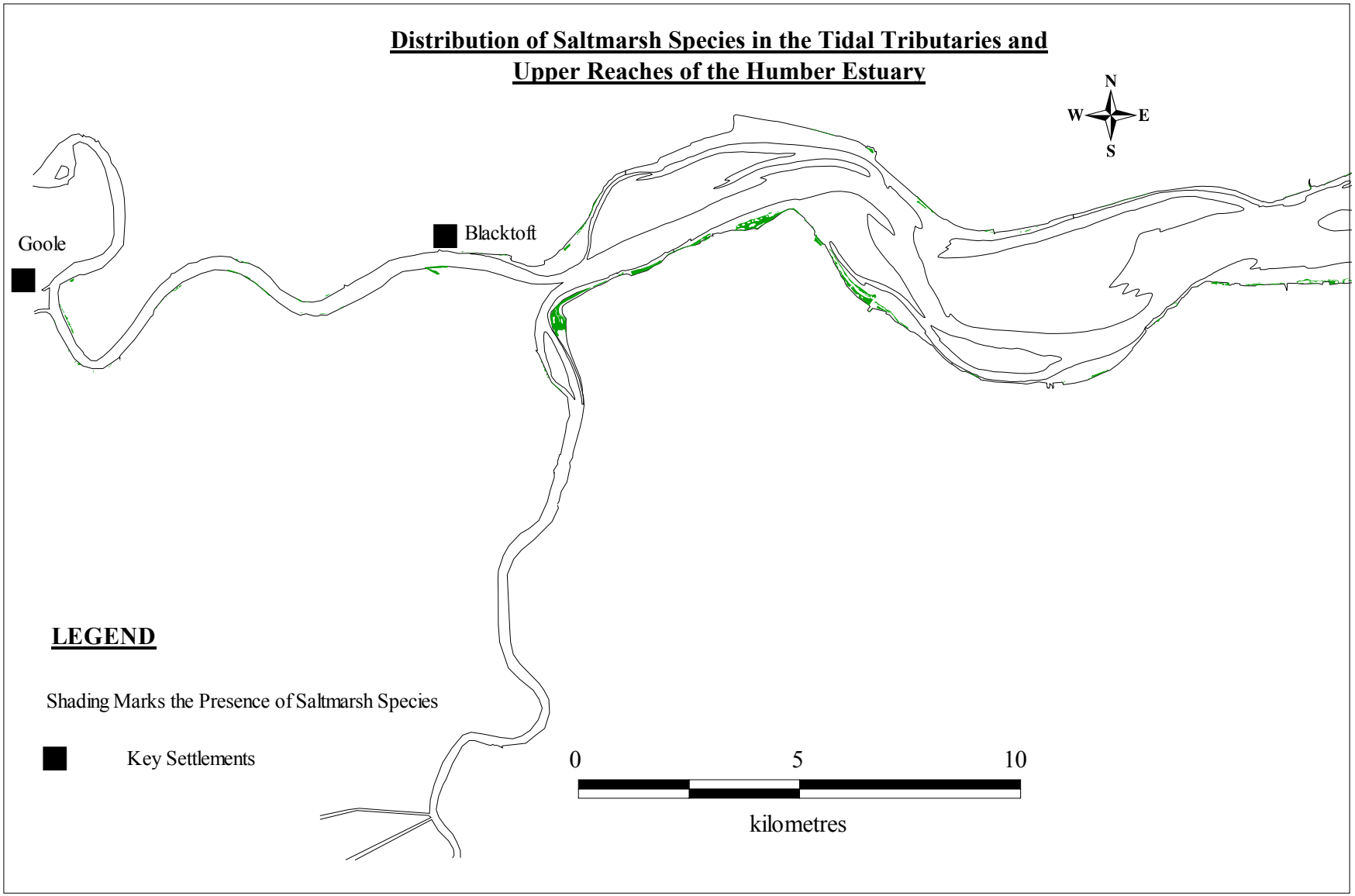
### Historical changes and trends

Land-claim and drainage, particularly in the 18th and 19th Centuries, undoubtedly had a profound impact on the total amount of saltmarsh in the Humber. Although the total amount of land claimed and the timing of the events are well documented (Sheppard 1958 & 1966; de Boer 1970; Robinson 1981; Berridge & Pattison 1994; Gaunt 1994; IECS 1994; Van de Noort & Ellis 1995), it is not possible to ascertain exactly what net effect this has had on the quantity and distribution of saltmarshes in the estuary (Murby 2001). Differing methodologies and reporting styles make comparison between the 1988 NCC saltmarsh vegetation survey (Burd 1989) and the most recent NVC survey difficult (Bullen Consultants 2001). However, other research indicates a small net increase of 37ha in the marsh area of the Humber as a whole with losses of saltmarsh in the outer estuary being offset by gains in the inner estuary (ABP Research 1996). Earlier work points to a net loss of 678ha between 1826 and 1977 (IECS 1994). A trend of erosion in the outer estuary and accretion in the inner area would conform to the broad role-over model of evolution advanced by the Environment Agency's Humber Estuary Geomorphological Studies interim report (Environment Agency 2000a). However, this overall trend remains unconfirmed and is likely to be complicated by considerable local variation. There is, for example, considerable anecdotal evidence of local accretion in areas such as Tetney, Welwick and Whitton Sands over recent decades. However, substantial land-claim over recent centuries has squeezed out much of the upper saltmarsh, especially in the outer and middle estuary.

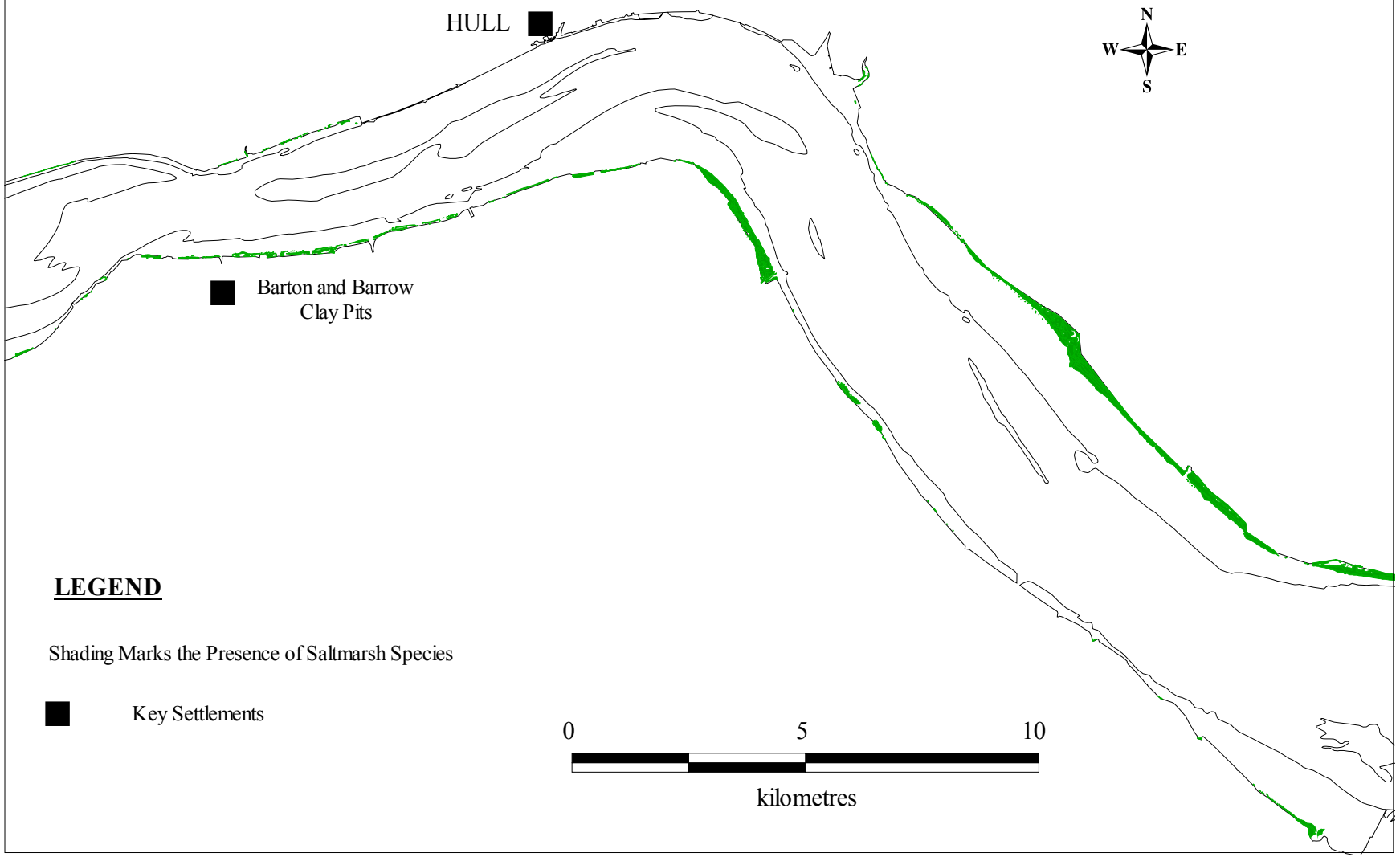
On the North Lincolnshire coast, comparison with earlier survey data suggests that there has been a loss of approximately 45ha of pioneer saltmarsh since *c*. 1984 (Dargie 2001). However, this result contrasts with other studies which suggest accretion has been the dominant trend in saltmarsh vegetation of the site (Dargie 2001). There has been little change in the area of middle or upper saltmarsh. Despite a large area of pioneer vegetation, the site might be slowly eroding, particularly in the south around Saltfleet Haven. Dargie (2001) suggests that accretion might be taking place at approximately the same rate as sea-level rise, maintaining most inner saltmarsh as middle marsh types.

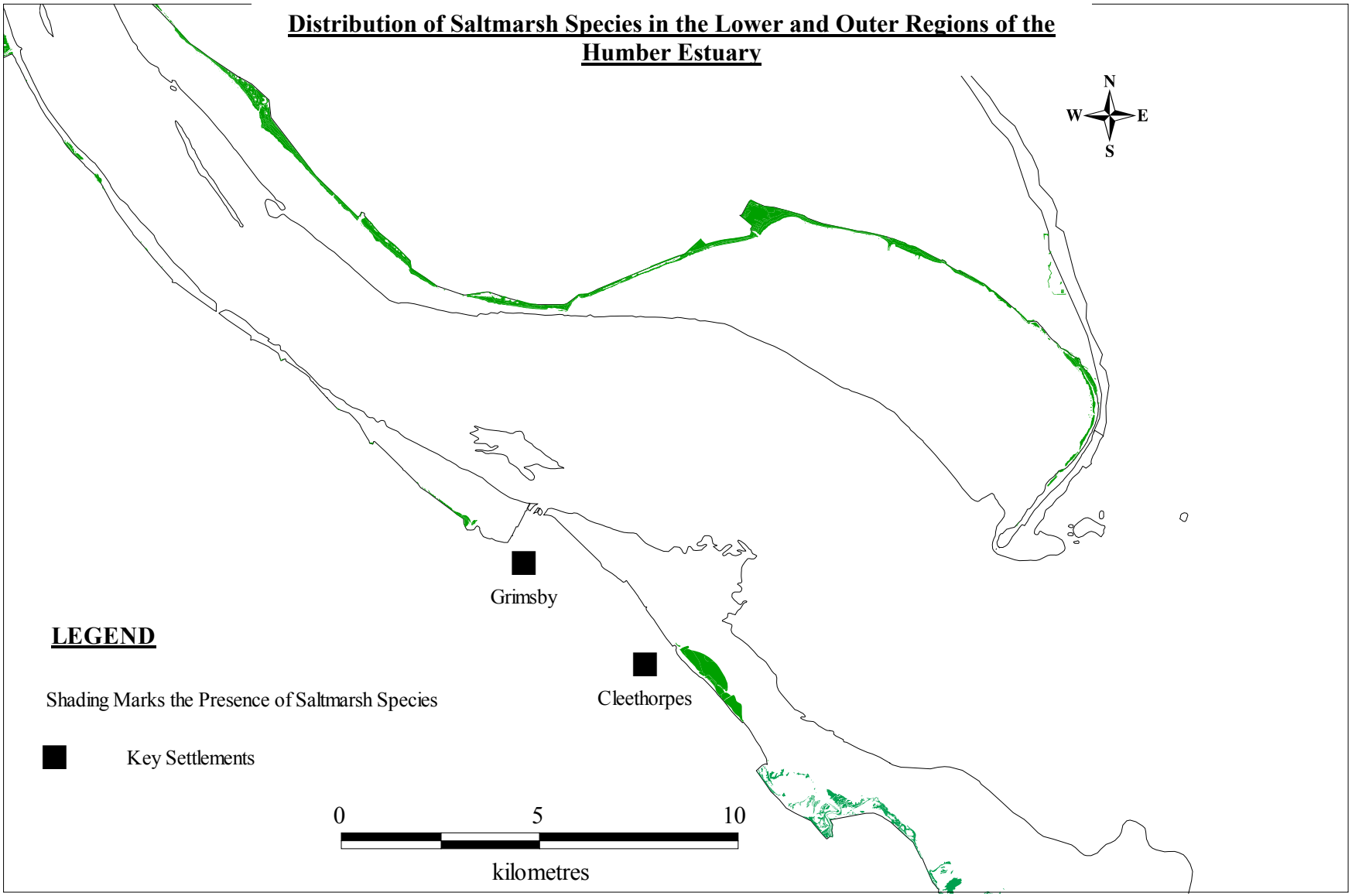
### Conservation status

Good evidence exists for substantial saltmarshes and foreshore erosion in south and eastern Britain in recent decades, making the conservation of this feature a high priority in order to maintain the favourable conservation status of the habitat within its range. While the structural and species diversity of many of the saltmarshes in the outer Humber is poor, opportunities may exist to improve this in combination with the long-term plans to maintain the estuary's tidal defences (Environment Agency 2000b). In the inner estuary, the Humber tidal marshes are a feature of considerable interest forming an important component of the estuary feature and provide important breeding sites for breeding species, such as marsh harrier and bearded tits. The North Lincolnshire marshes have considerable structural diversity and inherent conservation interest. Dargie (2001) reports large extent and good range of SM13 vegetation types, good zonations associated with SM13 and SM14 communities and ungrazed conditions allowing large area of marsh to development. However, there is poor representation of SM16 and other upper saltmarsh types, probably due to the relative youth of the system. The Lincolnshire coastal marshes have a particular conservation value associated with the habitat complexes within which they exist in the shelter of open coastal intertidal flats and front dune systems.

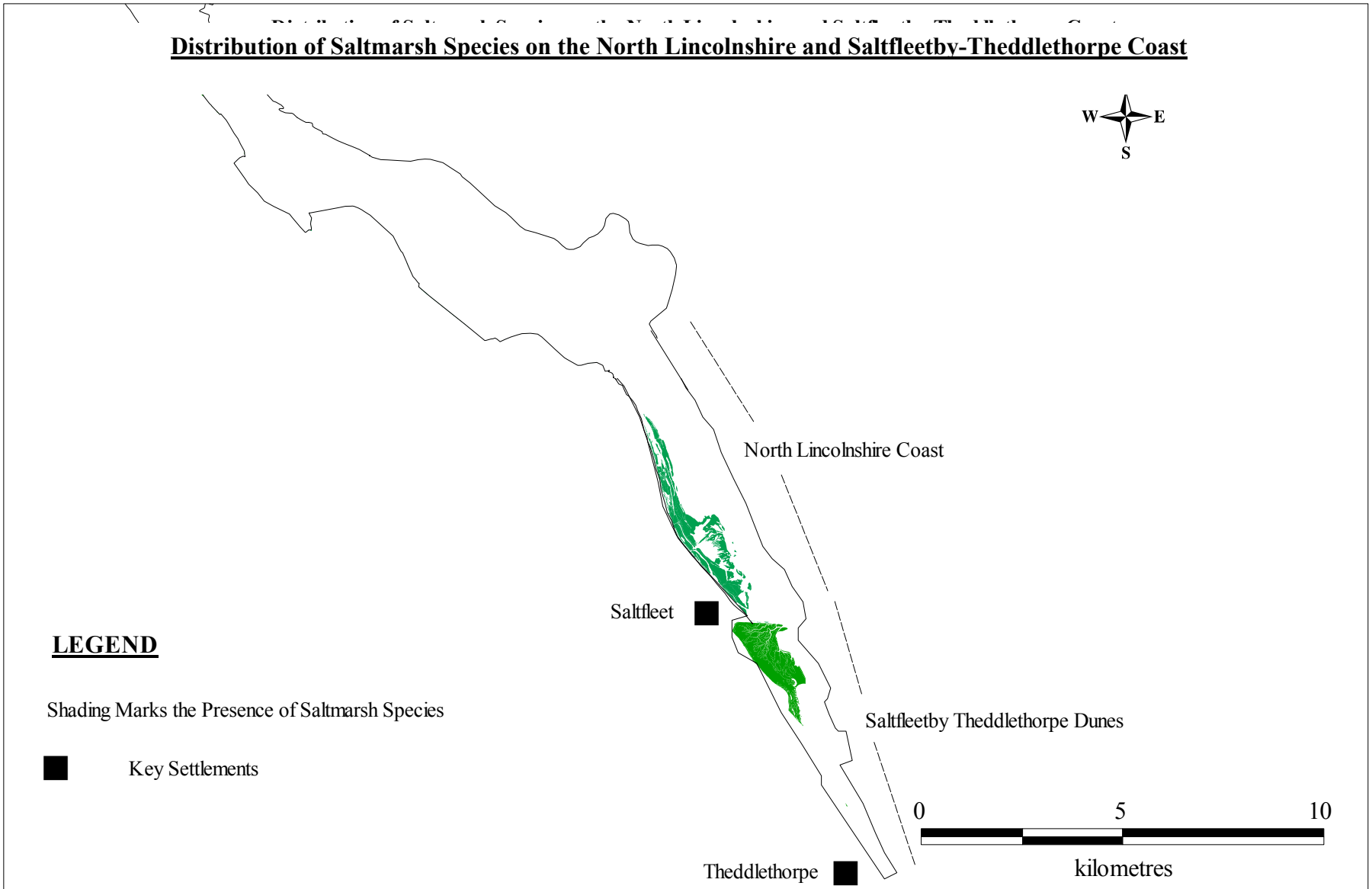

Distribution of Saltmarsh Species in the Tidal Tributaries and Upper Reaches of the Humber Estuary
N
W
E
S
Goole
Blacktoft
LEGEND
Shading Marks the Presence of Saltmarsh Species
Key Settlements
0
5
10
kilometres

## Distribution of Saltmarsh Species in the Middle Region of the Humber Estuary




Distribution of Saltmarsh Species in the Lower and Outer Regions of the Humber Estuary
N
W
E
S
Grimsby
Cleethorpes
LEGEND
Shading Marks the Presence of Saltmarsh Species
Key Settlements
0
5
10
kilometres

**Distribution of Saltmarsh Species on the North Lincolnshire and Saltfleetby-Theddlethorpe Coast**



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## Coastal Sand Dunes

### Embryonic shifting dunes

**Key Sites:** Spurn Peninsula, Easington Lagoons, North Somercotes.

**Summary Status:**

- Habitats Directive: Annex 1
- Constituent NVC Communities: SD4
- Estimated Total Area: 27.34ha

### Shifting dunes along the shore with *Ammophila arenaria* (white dunes)

**Key Sites:** Spurn Peninsula.

**Summary Status:**

- Habitats Directive: Annex 1
- Constituent NVC Communities: SD5, SD5a, SD5b, SD5c, SD6, SD6a, SD6b, SD6c, SD6d, SD6e.
- Estimated Total Area: 30.67ha

### Fixed dunes with herbaceous vegetation (grey dunes)

**Key Sites:** Spurn Peninsula.

**Summary Status:**

- Habitats Directive: Annex 1
- Constituent NVC Communities: SD7, SD7a, SD7c, SD7d, SD8, SD8a, SD8b, SD8c.
- Estimated Total Area: 45.08ha

### Dunes with *Hippophae rhamnoides*

**Key Sites:** Cleethorpes, Spurn Peninsula.

**Summary Status:**

- Habitats Directive: Annex 1
- Constituent NVC Communities: SD18, SD18a, SD18b.
- Estimated Total Area: 134.33ha

**Humid dune slacks**

**Key Sites:** Skidbrooke.

**Summary Status:**

- Habitats Directive: Annex 1
- Constituent NVC Communities: SD17, SD17b.
- Estimated Total Area: 4.44ha

**Other NVC communities not included as an Annex I habitat:**

**Key Sites:** Spurn Peninsula, Easington Lagoons, Lincolnshire coast from Cleethorpes to Mablethorpe with relic dunes found at Welwick and between North Somercotes and Saltfleet.

**Summary Status:**

- Habitats Directive: N/A.
- Constituent NVC Communities: SD2, SD4/SM24, SD7d/SD9a, SD9, SD9a, SD10, SD15a.
- Estimated Total Area: 55.34ha

### Description

Sand dunes form along coasts where there is an adequate supply of sand in intertidal drying areas together with winds to blow the sediment into supratidal mounds. Blown sand is then trapped by vegetation creating more stable structures in which vegetation, sediment, aeolian and marine processes play a dynamic role in the maintenance of the dunes. Dune habitats vary from highly dynamic embryonic dunes, which form the transition to intertidal beach habitats, through mobile 'white' dunes dominated by a few maritime grasses, to more stable 'grey' dunes that may develop a diverse sward of specialist maritime plants together with more terrestrial species. In the absence of limiting factors such as grazing, dune grassland develops into dune scrub typically dominated by sea-buckthorn *Hippophae rhamnoides*. The continual tension and ecological stress created between erosion and stabilization is a normal process in dunes that creates biological diversity and distinctiveness associated with the habitat (Ranwell 1972; Pethick 1984; Radley 1994; Rodwell 2000).

### Distribution within the Humber

Sand dunes are features of the outer Humber on both the north and the south bank of the estuary, most notably on Spurn Peninsula where dunes cap a beach and form a substantial landmass at the point. More extensive dune systems are present along the Lincolnshire coast from Cleethorpes southwards. A substantial relic dune ridge is separated from the active coastal ridges by land claim on the North Lincolnshire coast between North Somercotes and Saltfleet. There are smaller areas of dune vegetation at Easington Lagoons on the Holderness coast. At Welwick in Spurn Bight there is a relic dune system formed before the embankment and drainage of Sunk Island and at other points around the margins of the outer estuary there are elements of dune vegetation.

Sea-buckthorn *Hippophae rhamnoides* scrub (NVC community SD18) dominates both the north and south bank supratidal dunes habitats of the outer estuary. This habitat covers 73% (5.5ha) of the sand dunes on the south bank and 51% (27ha) of the north bank, mostly on Spurn Peninsula (Bullen Consultants 2001). Fixed grey dunes occupy 13% of both north and the south bank outer estuarine dune systems with 6.85 and 0.98ha respectively (Bullen Consultants 2001). More dynamic 'white' dunes occupy 16.66ha (32%) for the north bank, 0.74ha (10%) of the south bank system and 5.64ha of Easington Lagoons. Embryonic shifting dunes account for 4% of both north and south bank systems (Bullen Consultants 2001).

Spurn Peninsula has a range of sand dune vegetation communities. Foredunes support *Elymus farctus* SD4 and SD5 communities, the latter a community with a northerly distribution (Rodwell 2000), with smaller patches of SD2 - sea sandwort *Honkenya peploides* - sea rocket *Cakile maritima* strandline community. Within the foredune communities, plants such as sea holly *Eryngium maritimum,* restharrow *Ononis repens,* sea bindweed *Calystegia soldanella,* sea rocket *Cakile maritima,* prickly saltwort *Salsola kali,* colt's foot *Tussilago farfara* and wild celery *Apium graveolens* are also present. Behind the foredunes, strips of marram grass *Ammophila arenaria* mobile dune SD6 are backed by semi-fixed dunes dominated by marram grass *Ammophila arenaria,* lyme grass *Leymus arenarius,* red fescue *Festuca rubra,* sand couch *Elytrigia juncea* and sea couch *Elytrigia atherica* (SD7). Stable dune areas are mostly dominated by *Hippophae rhamnoides* dune-scrub, with both SD18a and SD18b sub-communities well represented, although some areas of fixed dune grassland, SD8, still remain. Areas of maritime cliff and grassland are also present along the peninsula and contain species such as wild carrot *Daucus carota,* restharrow *Ononis repens,* bird's foot trefoil *Lotus corniculatus,* scented mayweed *Matricaria recutita* and ribwort plantain *Plantago lanceolata* (Bullen Consultants 2001). At the Lagoons sand dune communities include variants of the SD4 and SD5 vegetation communities. The main community being SD5b with occasional areas of SD5a dominated by sand couch *Elytrigia juncea* and lyme grass *Leymus arenarius* found on the intact sand dunes to the north of the site and is also on found in localised patches on the small sand dunes located to the south of the site (Bullen Consultants 2001).

On the south bank of the estuary, fixed dunes are dominated by MG1 grassland and SD18 scrub. Mobile and semi-fixed dunes on the seaward side of the fixed dunes support a mosaic of lyme grass *Leymus arenarius* (SD5 & SD5c) and marram grass *Ammophila arenaria* mobile dune community red fescue *Festuca rubra* sub-community (SD6e). Areas of relic dunes support a species diverse sward of MG1 grassland, species present include false oat-grass *Arrhenatherum elatius,* lady's bedstraw *Galium verum,* yellow oat-grass *Trisetum flavescens,* adiantifolium *Thalictrum minus* and perennial rye-grass *Lolium perenne.* Also present within the sward is the nationally scarce plant, bulbous meadow-grass *Poa bulbosa* with small areas of red fescue *Festuca rubra* - lady's bedstraw *Galium verum* fixed dune (SD8) and sand sedge *Carex arenaria* dune community (SD10) (Bullen Consultants 2001).

More substantial dune complexes occupy the north Lincolnshire coast from Donna Nook south to Mablethorpe. Although the coast has been much altered by land claim north of Saltfleet, relics of the old coast and dune habitats remain inland and the interface between intertidal, supra-tidal and artificial habitats creates area of considerable interest. There is a typical range of vegetation types associated with dry calcareous sand, including quite extensive examples of sea-buckthorn *Hippophae rhamnoides* dune scrub (SD18), one type of

coarse grey dune grassland (SD7d/SD9a), and a large area of embryo dune (SD4), with other dune vegetation types are more restricted in area and distribution. On the North Lincolnshire coast, dunes occur as relatively narrow strips of vegetated sand as a result of habitat evolution on a prograding shoreline. While land-claim and development have destroyed much of the inner dune progradation sequences, significant interest features remain. The vegetated sand strips show an age sequence from embryo dune to slightly leached forms of grey dune, with dune scrub development forming another locally important form of succession. There are good examples of transitionary marsh to dune habitats with the upper saltmarsh community (SM24) grading into SD6 and SD7/SD9 vegetation. There are also good examples of the eastern England type of northern grey dunes (SD7, SD8 and SD9) and sea-buckthorn *Hippophae* scrub (SD18) (Dargie 2001). Although dune slacks are not well represented north of Saltfleet, there is one good area of inundation grassland south of Donna Nook (MG11 to possible SD17) (Dargie 2001). South of Saltfleet the complex of intertidal habitats, dune and wetlands adds further interest. The same dry dune habitats are found as described above but with the addition of more extensive areas of red fescue *Festuca rubra* fixed dune vegetation types (SD8) and large areas of dune slack (Ecological Services Ltd 1999; Dargie & Dargie 2000; Brown & Goodyear 1999). The main dune wetlands on the site are creeping willow *Salix reprens* - *Calliergon cuspidatun* dune-slack, common sedge *Carex nigra* sub-community (SD15a) and *Potential anserine* - common sedge *Carex nigra,* glaucous sedge *Carex flacca* dune-slack sub-community (SD17a) however in part these habitat grade into common reed *Phragmites australis* swamp (S4a), common reed *Phragmites australis* - common nettle *Urtica dioica* tall-herb fen (S26), greater pond-sedge *Carex riparia* swamp (S6) and grey willow *Salix cinerea* wet woodland communities (W1 and W2a). There are also areas of *Calamagrostis epigejos* dominated vegetation, not categorised by the NVC, and *Potentilla anserine* - common sedge *Carex nigra,* marsh pennywort *Hydrocotyle vulgaris*- lesser spearwort *Ranunculus flammula* dune-slack sub-community (SD17d) (Ecological Services Ltd 1999).

**Table 17** NVC Sand dune communities recorded on the Humber by Bullens 2001 and Dargie 2001 (hectares)

| **NVC Code** | **Community Name** | **North Bank** | **The Lagoons** | **South Bank** | **North Lincs coast** | **Saltfleetby/ Theddlethorpe Dunes** | **Total (ha)** |
|---|---|---|---|---|---|---|---|
| SD2 | *Honkenya peploides* - *Cakile maritima* strandline | 0.06 | - | - | 0.1 | | **0.16** |
| SD4 | *Elymus farctus ssp. boreali-atlanticus* foredune community | 2.31 | 1.12 | 0.27 | 15.7 | 7.91 | **27.31** |
| SD4 / SM24 | Intermediate between SD4 *Elytrigia juncea* embryo dune and SM24 *E. atherica* saltmarsh strand | - | - | - | 1.1 | 1.42 | **2.52** |
| SD5 | *Leymus arenarius* mobile dune community | 0.17 | - | 0.13 | 1.1 | | **1.4** |
| SD5a | *Leymus arenarius* mobile dune community – species-poor sub-community | 0.75 | 0.21 | - | - | | **0.96** |

| NVC Code | Community Name | North Bank | The Lagoons | South Bank | North Lincs coast | Saltfleetby/ Theddlethorpe Dunes | Total (ha) |
|---|---|---|---|---|---|---|---|
| SD5b | *Leymus arenarius* mobile dune community – *Elymus farctus* sub-community | 3.17 | 4.14 | - | - | 0.5 | **7.81** |
| SD5c | *Leymus arenarius* mobile dune community *Festuca rubra* sub-community | - | - | 0.19 | - | | **0.19** |
| SD6 | *Ammophila arenaria* mobile dune community | 1.41 | 0.03 | - | 1.1 | | **2.54** |
| SD6a | *Ammophila arenaria* mobile dune community – *Elymus farctus* sub-community | 2.18 | 0.89 | - | - | 1.68 | **4.75** |
| SD6b | *Ammophila arenaria* mobile dune community – *Elymus farctus* – Leymus arenarius sub-community | 2.77 | - | - | - | 0.01 | **2.78** |
| SD6c | *Ammophila arenaria* mobile dune community – *Leymus arenarius* sub-community | 2.66 | 0.37 | - | - | | **3.03** |
| SD6d | *Ammophila arenaria* mobile dune community - *Ammophila arenaria* sub community | 0.22 | - | - | - | | **0.22** |
| SD6e | *Ammophila arenaria* mobile dune community *Festuca rubra* sub-community | 3.33 | - | 0.42 | - | 3.24 | **6.99** |
| SD7 | *Ammophila arenaria* - *Festuca rubra* semi-fixed dune community | 0.45 | - | 0.39 | 2.6 | | **3.44** |
| SD7a | *Ammophila arenaria* - *Festuca rubra* semi-fixed dune community, Typical sub community. | - | - | 0.16 | - | 5.95 | **6.11** |
| SD7c | *Ammophila arenaria* – *Festuca rubra* semi-fixed dune community - *Ononis repens* sub-community | 0.31 | - | - | - | | **0.31** |
| SD7d | *Ammophila arenaria* – *Festuca rubra* semi-fixed dune community – *Elytrigia atherica* sub-community | 5.61 | - | - | - | 13.38 | **18.99** |

| NVC Code | Community Name | North Bank | The Lagoons | South Bank | North Lincs coast | Saltfleetby/ Theddlethorpe Dunes | Total (ha) |
|---|---|---|---|---|---|---|---|
| SD7d/SD9a | Intermediate between SD7d *Ammophila arenaria – Festuca rubra* semi-fixed dune, *Elytrigia atherica* sub-community and SD9a *Ammophila arenaria – Arrhenatherum elatius* dune grassland, Typical sub-community | - | - | - | 18.4 | 1.21 | **19.61** |
| SD8 | *Festuca rubra - Galium verum* fixed dune community | 0.07 | - | 0.01 | - | | **0.08** |
| SD8a | *Festuca rubra - Galium verum* fixed dune community Typical sub-community | 0.38 | - | 0.27 | 2.1 | | **2.75** |
| SD8b | *Festuca rubra – Galium verum* fixed dune, *Luzula campestris* sub-community | - | - | - | 0.6 | 9.21 | **9.81** |
| SD8c | *Festuca rubra – Galium verum* dune grassland, *Tortula ruralis* ssp. ruraliformis sub-community | - | - | - | 0.1 | 3.49 | **3.59** |
| SD9 | *Ammophila arenaria - Arrhenatherum elatius* dune grassland | 0.03 | - | - | - | | **0.03** |
| SD9a | *Ammophila arenaria – Arrhenatherum elatius* dune grassland, Typical sub-community | - | - | - | 2.4 | 23.42 | **25.82** |
| SD10 | *Carex arenaria* dune community | - | - | 0.15 | - | | **0.15** |
| SD15a | *Salix repens-Calliergon cuspidatum* dune-slack *Carex nigra* sub-community | | | | | 7.05 | **7.05** |
| SD17 | *Potentilla anserina – Carex nigra* dune slack | - | - | - | 0.06 | | **0.06** |
| SD17b | *Potentilla anserina – Carex nigra* dune slack *Carex flacca* sub-community | | | | | 4.38 | **4.38** |
| SD18 | *Hippophae rhamnoides* dune scrub | 0.41 | - | 5.56 | - | | **5.97** |
| SD18a | *Hippophae rhamnoides* dune scrub – *Festuca rubra* sub-community | 12.62 | 0.06 | - | 3.2 | 0.76 | **16.64** |

| NVC Code | Community Name | North Bank | The Lagoons | South Bank | North Lincs coast | Saltfleetby/ Theddlethorpe Dunes | Total (ha) |
|---|---|---|---|---|---|---|---|
| SD18b | *Hippophae rhamnoides* dune scrub – *Urtica dioica* – *Arrhenatherum elatius* sub-community | 13.68 | - | - | 30.6 | 67.44 | **111.72** |
| **Total hectares:** | | | | | | | **297.17** |

### Historical changes and trends

Dune development on the neck of Spurn was almost certainly induced by stabilisation in the 19th and 20th Centuries substantially increasing the quantity of fixed dune vegetation. Reduction of grazing pressure from the mid 20th Century, partly due to myxomatosis, has probably contributed to the development of dune scrub with some detriment to the herbaceous flora (Murby 1994). While rabbits and domestic stock grazing probably held *Hippophae* in check prior to the 1950's, the shrub has a long natural history in the area with evidence of it presence dating back to the last glaciation (Godwin 1975; Beckett 1981; Van de Noort & Davies 1993). *Hippophae* is thus certainly native to this part of the east coast of Britain (Groves 1959; Pearson & Rogers 1962; Ward 1972) an important element in the local vegetation. This opinion has also been supported by the findings of the Ecological Assessment of *Hippophae rhamnoides* conducted by Dargie (2002). Recent records of *Hippophae* at Spurn date back to 1878 (Pickwell 1878). In 1902, Robinson described it as *"abundant ..... being the principal shrub there"* with no suggestion that it was then a new arrival on the site. Earlier references to *"scrubby thorns"* in 1567 and, in the 17th Century when *"bushes, scroggs and berry trees"* were present on the Den (HRO DDCC/139/66) suggesting a longer recent history. Ainsworth (1951) describes the scrub as co-dominant with marram grass *Ammophila* in the main dune ridge in the late 1940's, and in the mid 1950's it was recorded as *"dominating large areas of the peninsula - from the southern part of the Warren southwards"* (Crackles 1954). However, comparison of maps drawn for the *Hippophae* Inquiry in the late 1960's/early 1970's with those of the National Sand Dune Vegetation Survey in 1988 (Radley & Woolven 1990) together with photographic and anecdotal evidence, clearly confirm the progressive expansion of *Hippophae* scrub in the post myxomatosis period. Early 20th Century photographs of Spurn Point show a landscape dominated by dune grasses with considerably less evidence of *Hippophae* scrub reinforcing the longer-term trend (Murby 1994). Comparison of the 1988 NVC survey (Radley & Woolven 1990) and the 2001 survey (Bullen Consultants 2001) indicates an ongoing increase in the coverage of *Hippophae* on the peninsula although exact comparison is difficult.

If the present management policy at Spurn, which aims to reintroduce a more dynamic regime thus allowing the peninsula to regain a sustainable morphology, is maintained, it may be anticipated that fixed dune scrub and grassland will decrease on the peninsula as the existing artificial defences fail. While the exact habitat outcome of this is difficult to predict, white dune vegetation types, strandline and shingle habitats are likely to increase. Sea-buckthorn should be carefully managed at the site to balance this habitat with other interest features. Management via rotational coppice blocks, areas where *Hippophae* cover is reduced, and other areas where scrub is left to allow succession, should all aim to maintain a

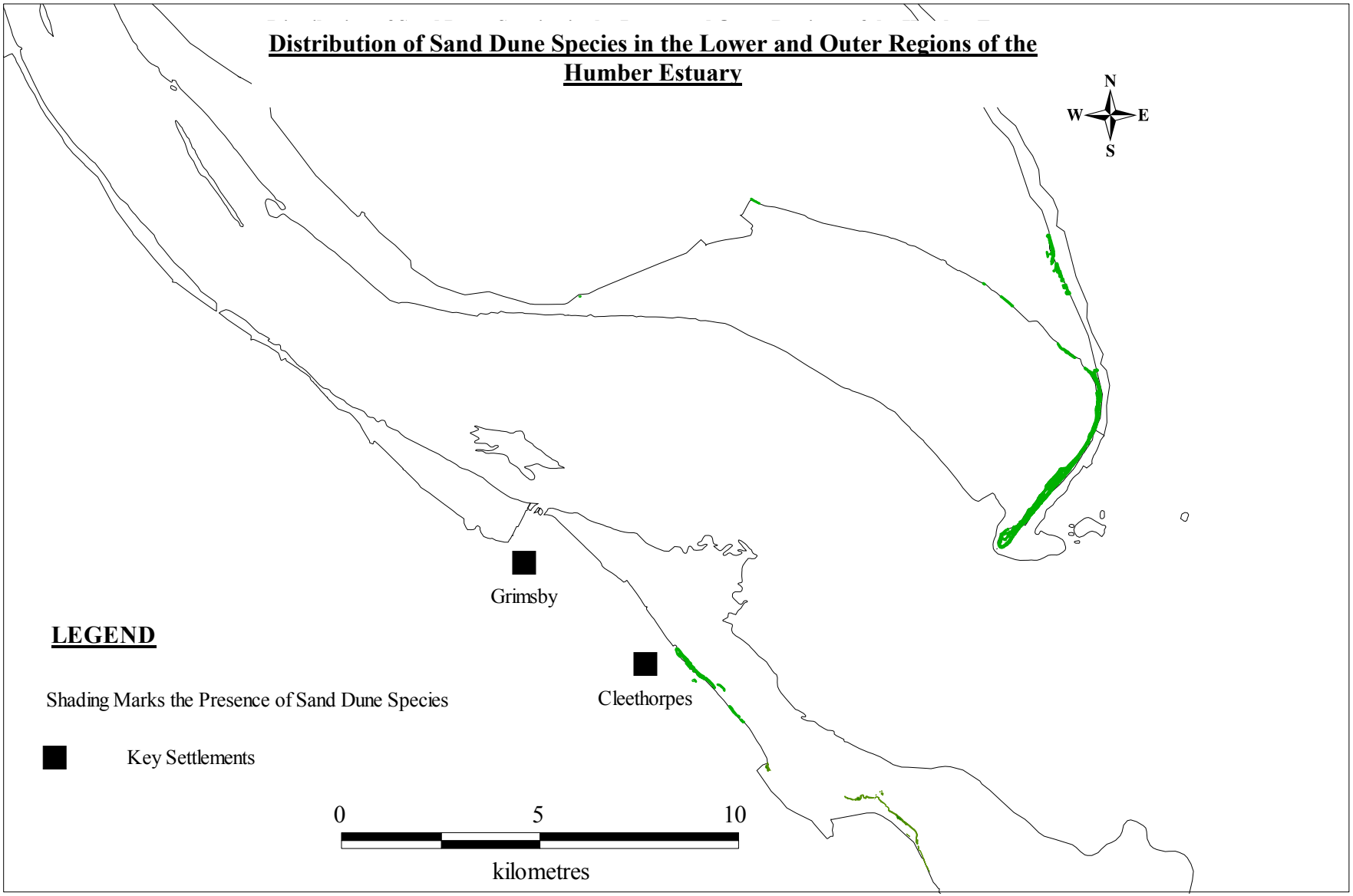
diverse age and class structure for *Hippophae* without adversely affecting the other interest features on the site (Smith, 2000; Dargie, 2002; Farrow and Wright, 2000). Elsewhere grazing pressure, conservation management and coastal processes will be the major influence on dune habitats.

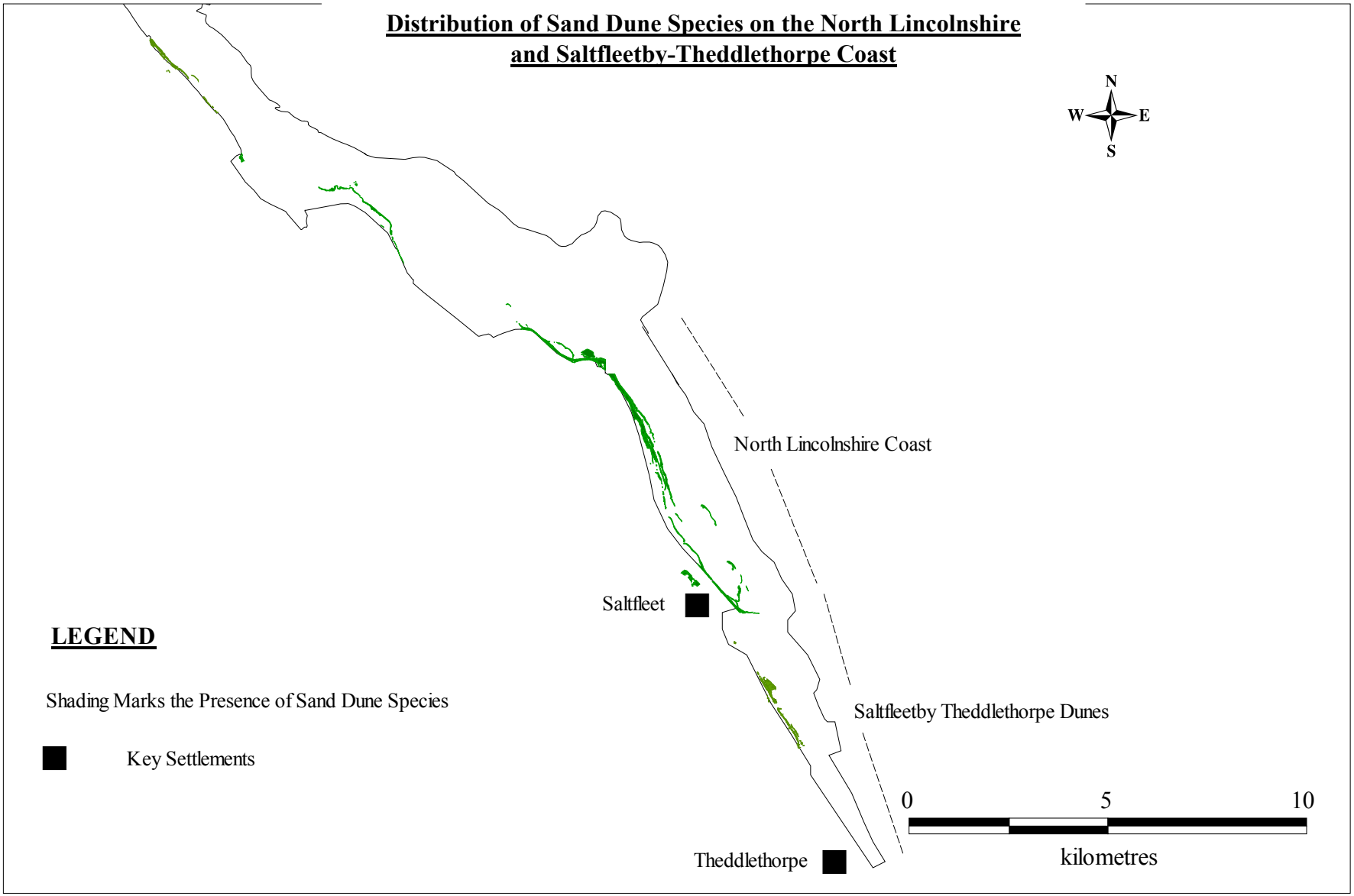
On the North Lincolnshire dunes, comparison between dune surveys carried out in 1988 (Radley & Woolven 1990) and 2001 indicate a major reduction in the extent of SD8b dune grassland and some SD8b and SD9a vegetation change to MG1a (Dargie 2001). There has also been an increase in scrub area around the edges of the site, particularly in the east and on damper ground (Dargie 2001).

### Conservation status

Dynamic coastal habitats featuring species such as sea holly *Eryngium maritimum,* sea bindweed *Calystegia soldanella* and yellow horned-poppy *Glaucium flavum* that are relatively common on Spurn, have decreased substantially elsewhere on the east coast due to coastal defence and stabilisation. This gives Spurn a particular significance (Preston *et al* 2002). At the more stable southern head of the peninsula, the *Hippophae* scrub is a noteworthy habitat feature both here and on the North Lincolnshire coastal dunes. Elsewhere on Spurn, the fixed dune grassland is relatively species poor, although there have been many rare and scarce species recorded on the peninsula (see for example Ainsworth 1951; Crackle 1986 & 1990). The conservation status of Spurn lies principally in its inherent geomorphology and the mixture of habitats that arise from the unusual combination of physical conditions in a very small area. The morphology of the peninsula together with the habitats and the species that occur there, are by nature dynamic in both space and time, with many features being transient or incidental. The dune and intertidal complexes of the North Lincolnshire coast are of notable conservation interest, especially where dune slack habitats feature at Saltfleetby-Theddlethorpe and in other places where the ecological transitions and dynamics remain well intact between intertidal, supratidal, terrestrial and freshwater features. Here again, it is principally the complex of habitats and the geomorphological configuration of features that underpins the conservation interest.

## No Maps for the Upper and Middle Estuary as Distribution is Restricted to the Lower Reaches of the Estuary


Distribution of Sand Dune Species in the Lower and Outer Regions of the Humber Estuary
N
W
E
S
Grimsby
Cleethorpes
LEGEND
Shading Marks the Presence of Sand Dune Species
Key Settlements
0
5
10
kilometres


Distribution of Sand Dune Species on the North Lincolnshire and Saltfleetby-Theddlethorpe Coast
N
W
E
S
North Lincolnshire Coast
Saltfleet
Saltfleetby Theddlethorpe Dunes
Theddlethorpe
LEGEND
Shading Marks the Presence of Sand Dune Species
Key Settlements
0
5
10
kilometres

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## Saline Lagoons

**Key sites (best examples of each lagoon type):** Easington North and South Lagoons (partly natural, isolated, high salinity); Humberston Fitties (semi-natural, isolated, moderate salinity); Killingholme Pools 1 & 3 (sluiced, moderate-high salinity); Killingholme 2 (isolated, low salinity); Northcotes A (silled, high salinity); Northcotes B (percolation, moderate salinity); Blacktoft Sands (sluiced, low salinity) (P. Gilliland, pers comm, 2002).

**Summary status:**

- Habitats Directive: Annex 1.
- Humber lagoons: proportion of total number UK lagoons: 7.9%.
- Humber lagoons: proportion of total area UK lagoons: 3.1%.

### Description

Saline lagoons may be formed in a variety of ways and can be entirely natural, modified by man or wholly artificial. Both man-made and natural categories are classified as lagoons in the UK. Both can support important distinctive animal and plant communities.

In essence lagoons are bodies of saline water separated from the sea by a physical barrier which restricts tidal movements or renders them tideless. Salinity may be very low or very high (hypersaline) depending on water exchange and evaporation regime. The following definition is from Bamber *et al* (2001):

> "Saline lagoons are areas of typically (but not exclusively) shallow, coastal saline water, wholly or partially separated from the sea by sandbanks, shingle or, less frequently, rocks or other hard substrata. They retain a proportion of their water at low tide and may develop as brackish, fully saline or hyper-saline water bodies."

Bamber *et al* (2001) have designated five categories of lagoons and this classification is extensively used in identifying sites of potential statutory significance (Table 18). All of these categories occur in the Humber region except lagoonal inlets.

**Table 18** Types of saline lagoon (Bamber *et al* 2001)

| Category | Features | Longevity |
|---|---|---|
| Isolated | Isolated by a rock or sediment barrier which allows saline water to enter by seepage or overtopping. Water loss is by evaporation and a relatively high salinity may be maintained. Usually tideless. | Brief (usually) |
| Percolation | Separated by a shingle bank. Seawater flows in by percolation or occasional overtopping. Low tidal range or tideless. | Extended (usually) |
| Silled | Open to the sea but water-exchange is restricted by a sill. Reduced tides. | Extended |
| Sluiced | Water exchange governed by a man-made sluice. Tidal range depends on efficiency of sluice. | Extended |
| Lagoonal inlets | Open to the sea but with a narrow constriction. Reduced tidal range. | Extended |

### Distribution within the Humber

Twenty-six lagoons (eight sluiced, eleven isolated, four percolation and three silled) have been identified in the Humber area ranging in size from 0.14ha (at North Somercotes) to 42.5ha (Welton Waters Central Lagoon). These are listed in Table 19. Most are distributed along the southern shoreline from North Somercotes in the east to Blacktoft Sands in the west. There are two north shore sites near Spurn Point (Easington and Kilnsea) and one at Welton Waters. Gilliland (pers. comm. 2002) identified 19 of the Humber lagoons as either high or medium conservation priority using the criteria from the Best Practice Guidance of Bamber *et al* 2001 (pp. 30). The SSSI guidelines state that only natural and near natural lagoons are selected for conservation value, whereas artificial sites (such as docks) are excluded from consideration (McLeod *et al* 2002).

**Table 19** Lagoons found on the Humber Estuary

| Site | Salinity | Extent | Designations | Notes: Lagoonal specialist spp or spp associated with saline lagoons present |
|---|---|---|---|---|
| Easington North Lagoons (isolated) | 37 - 38 | 4.5 - 6.5ha | The Lagoons SSSI; pSPA; BAP; pRamsar; ASI; Spurn Heritage Coast | Natural.<br>Species include:<br>*Conopeum seurati*<br>*Ventrosia ventrosa*<br>*Idotea chelipes*<br>*Ruppia cirrhosa*<br>*Chaetomorpha* spp. |
| Easington South Lagoons (isolated) | 39 - 50 | 5.6 - 7.7ha | The Lagoons SSSI; pSPA; BAP; Ramsar; ASI; Spurn Heritage Coast. | Species include:<br>*Conopeum seurati*<br>*Corophium insidiosum*<br>*Idotea chelipes*<br>*Cerastoderma glaucum*<br>*Ventrosia ventrosa*<br>*Chaetomorpha spp.* |
| Kilnsea (isolated) | 7 - 19 | 0.5ha | Humber Flats & Marshes SSSI; Spurn Head to Saltend Flats SSSI; SPA; Ramsar; Spurn Heritage Coast. | Man-made.<br>Species include:<br>*Ventrosia ventrosa*<br>*Idotea chelipes*<br>*Ruppia cirrhosa*<br>*Chaetomorpha* spp. |
| Welton Waters Eastern Lagoon (sluiced) | 10 | 7.0ha | None | |
| Welton Waters Central Lagoon (sluiced) | 5 | 42.5ha | None. | Species include:<br>*Ventrosia ventrosa* |
| Welton Waters Western Lagoon (sluiced) | 4 | 7.5ha | None | |
| Blacktoft Sands (sluiced) | 1.5 - 9.5 | 17.0ha | Upper Humber SSSI; SPA; Ramsar; pSAC. | Species include:<br>*Glyptotendipes barbipes*<br>*Recurvirostra avosetta* |
| Read's Island (sluiced) | 3 - 11 | 17.0ha | Upper Humber SSSI; SPA; Ramsar; pSAC. | Modified.<br>Species include:<br>*Recurvirostra avosetta* |
| Barton Pool 1 (isolated) | 4 | 22.4ha | Humber Flats & Marshes SSSI; Barton & Barrow Claypits SSSI; pRamsar; pSPA. | Man-made claypit<br>Species include:<br>Lekanesphaera hookeri |

| Site | Salinity | Extent | Designations | Notes: Lagoonal specialist spp or spp associated with saline lagoons present |
|---|---|---|---|---|
| Barton Pool 2 (isolated) | 4 - 7 | 10.5ha | Humber Flats & Marshes SSSI; Barton & Barrow Claypits SSSI; pRamsar; pSPA. | Man-made claypit |
| Barton Pool 3 (sluiced) | 5 | 10.0ha | Humber Flats & Marshes: Barton & Barrow Claypits SSSI; pRamsar; pSPA. | Man-made claypit:<br>Species include.<br>*Alkmaria romijni*<br>*Lekanesphaera hookeri* |
| Barton Pool 4 (isolated) | 0.2 | 6.0ha | Humber Flats and Marshes: Barton and Barow Claypits SSSI, pSPA, pRamsar | Man-made claypit. |
| Killingholme Pool 1 (sluiced) | 22 - 48 | 9.0ha | North Killingholme Haven Pits SSSI, pSPA; pRamsar. | Man-made claypit.<br>Species include.<br>*Alkmaria romijni*<br>*Ventrosia ventrosa*<br>*Conopeum seurati*<br>*Lekanesphaera hookeri* |
| Killingholme Pool 2 (isolated) | 4 | 2.0ha | North Killingholme Haven Pits SSSI, pSPA; pRamsar. | Man-made claypit.<br>Species include:<br>*Ventrosia ventrosa*<br>*Lekanesphaera hookeri* |
| Killingholme Pool 3 (sluiced) | 27 | 4.0ha | North Killingholme Haven Pits SSSI, pSPA; pRamsar. | Man-made claypit. |
| Humberston Fitties (isolated) | 11 - 24 | 1.7ha | N. Lincs Coast SSSI; pSAC; SPA; Ramsar. | Semi-natural.<br>Species include:<br>*Gammarus insensibilis*<br>*Ventrosia ventrosa*<br>*Conopeum seurati*<br>*Idotea chelipes*<br>*Corophium insidiosum*<br>*Ruppia maritima*<br>*Chaetomorpha linum* |
| Northcoates Point A (silled) | 33 - 40 | 1.8ha | N. Lincs. Coast SSSI; RSPB Reserve; pSAC; SPA; Ramsar. | Modified.<br>Species include:<br>*Gammarus chevreuxi*<br>*Idotea chelipes*<br>*Ventrosia ventrosa*<br>*Hydrobia acuta*<br>Ruppia cirrhosa |
| Northcoates Point B (percolation) | 29 | 2.2ha | N. Lincs. Coast SSSI; RSPB Reserve; pSAC; SPA; Ramsar. | Modified.<br>Species include:<br>*Idotea chelipes*<br>*Ventrosia ventrosa* |
| North Somercotes A (isolated) | 3-4 | 014ha | N.Lincs Coast SSSI; SPA; Ramsar; pSAC | Man-made borrow pit |
| North Somercotes B (percolation) | 9 - 15 | 0.03ha | N. Lincs. Coast SSSI; SPA; Ramsar; pSAC. | Man-made borrow pit.<br>Species include:<br>*Ruppia cirrhosa*<br>*Ventrosia ventrosa*<br>*Agabus conspersus*<br>*Conopeum seurati* |

| Site | Salinity | Extent | Designations | Notes: Lagoonal specialist spp or spp associated with saline lagoons present |
|---|---|---|---|---|
| North Somercotes C (percolation) | 21 - 23 | 0.2ha | N. Lincs. Coast SSSI; SPA; Ramsar; pSAC. | Man-made borrow pit.<br>Species include:<br>*Idotea chelipes*<br>*Conopeum seurati*<br>*Ruppia cirrhosa*<br>*Ventrosia ventrosa* |
| North Somercotes D (silled) | 30-31 | 1.65ha | N.Lincs Coast SSSI; SPA; Ramsar; pSAC | Man-made borrow pit. |
| North Somercotes E (silled) | 20 - 26 | 1.7ha | N. Lincs. Coast SSSI; SPA; Ramsar; pSAC. | Man-made borrow pit.<br>Species include:<br>*Idotea chelipes*<br>*Chaetomorpha linum*<br>*Ruppia cirrhosa*<br>*Ventrosia ventrosa*<br>*Conopeum seurati* |
| North Somercotes F (percolation) | 9 - 11 | 0.4ha | N. Lincs. Coast SSSI; SPA; Ramsar; pSAC. | Man-made borrow pit.<br>Species include:<br>*Ruppia cirrhosa*<br>*Agabus conspersus*<br>*Idotea chelipes*<br>*Ventrosia ventrosa* |
| North Somercotes G (isolated) | 6-7 | 1.73ha | N.Lincs Coast SSSI; SPA; Ramsar; pSAC | Man-made borrow pit<br>*Idotea chelipes*<br>*Ventrosia ventrosa* |
| North Somercotes H (isolated) | 05 | 0.64ha | N.Lincs Coast SSSI; SPA; Ramsar; pSAC | Man-made borrow pit. |

The Easington North site appears to be the only natural lagoon in the area, all the others are either man-made borrow/clay pits or have been modified by man in the recent past. However, artificial or semi-artificial sites still provide important habitats for invertebrates and birds and many have been colonised by lagoonal specialist species.

### Importance of saline lagoons

Saline lagoons are unusual habitats with limited distribution throughout Europe. They are designated as a priority habitat type under Annex 1 of the Habitats Directive (92/43/EEC). The large tidal range and types of sediment found around the UK coast have created lagoons which are rarely encountered on the continent. Because of their scarcity, they have long been recognised as habitats worthy of conservation and many are protected as SSSIs, SACs, SPAs, Ramsar sites or nature reserves. All the Humber sites have SSSI, SAC or SPA status except the sluiced lagoons at Welton Waters.

As well as being significant as geophysical features lagoons are also important because of the specialist species and biotopes they support. At least seven lagoonal biotopes have been defined in the UK and there are 62 species of plant and animal of "conservation significance" associated with lagoons (Bamber *et al* 2001). Twenty-six of these are strictly lagoon

specialists and 16 have been afforded protection under the various schedules of the Wildlife and Countryside Act 1981 (Bamber *et al* 2001).

Because these species are more or less limited to lagoons they also have restricted distribution and this means they are vulnerable to any changes in their habitat. Bamber *et al* (2001) list 11 species (not necessarily lagoon specialists) whose UK populations would be unsustainable if saline lagoons were to be lost.

### The Humber lagoons

The lagoons of the Humber region (excluding the North Somercotes and Skidbrooke lagoons) were surveyed by Sheader & Sheader (1985 & 1986) who concluded that Welton Waters Central Lagoon, Barton Pools and Killingholme Pools were of conservation interest. The 1992 directory (Smith & Laffoley 1992) recommended the Easington pools, Killingholme pools and Humberston Fitties for conservation and these now have designated status (Table 12).

Unicomarine (2001) conducted a north Lincolnshire coast survey of potential saline lagoons, including the lagoons at North Somercotes and Skidbrooke, and stated that "the saline systems were good examples of saline lagoons and similar habitats have been noted as worthy of conservation in other areas" (Worsfold 2001).

As already stated, lagoons provide rare and unusual habitats which support scarce and protected species. Spiral tasselweed (*Ruppia cirrhosa*), a nationally scarce seagrass has been found in the Easington and Kilnsea lagoons (Selman *et al* 1999; Crackles 1990). The tentacled lagoon worm (*Alkmaria romijni* - a terebellid polychaete) has been recorded from the Killingholme Pools (Bamber *et al* 2001) and Barton Pools (Sheader 1987 - unpublished data). Killingholme also supports the spire snail *Hydrobia neglecta* (Smith 1996). The amphipod "shrimp" *Gammarus insensibilis* appears to reach the northern limit of its distribution in the Humber Estuary and has been recorded at Humberston Fitties (Selman *et al* 1999). *A. romijni* and *G. insensibilis* are Red Data Book species listed on Schedule 5 of the Wildlife and Countryside Act 1981. The amphipod is listed as a priority species under the UK Biodiversity Action Plan.

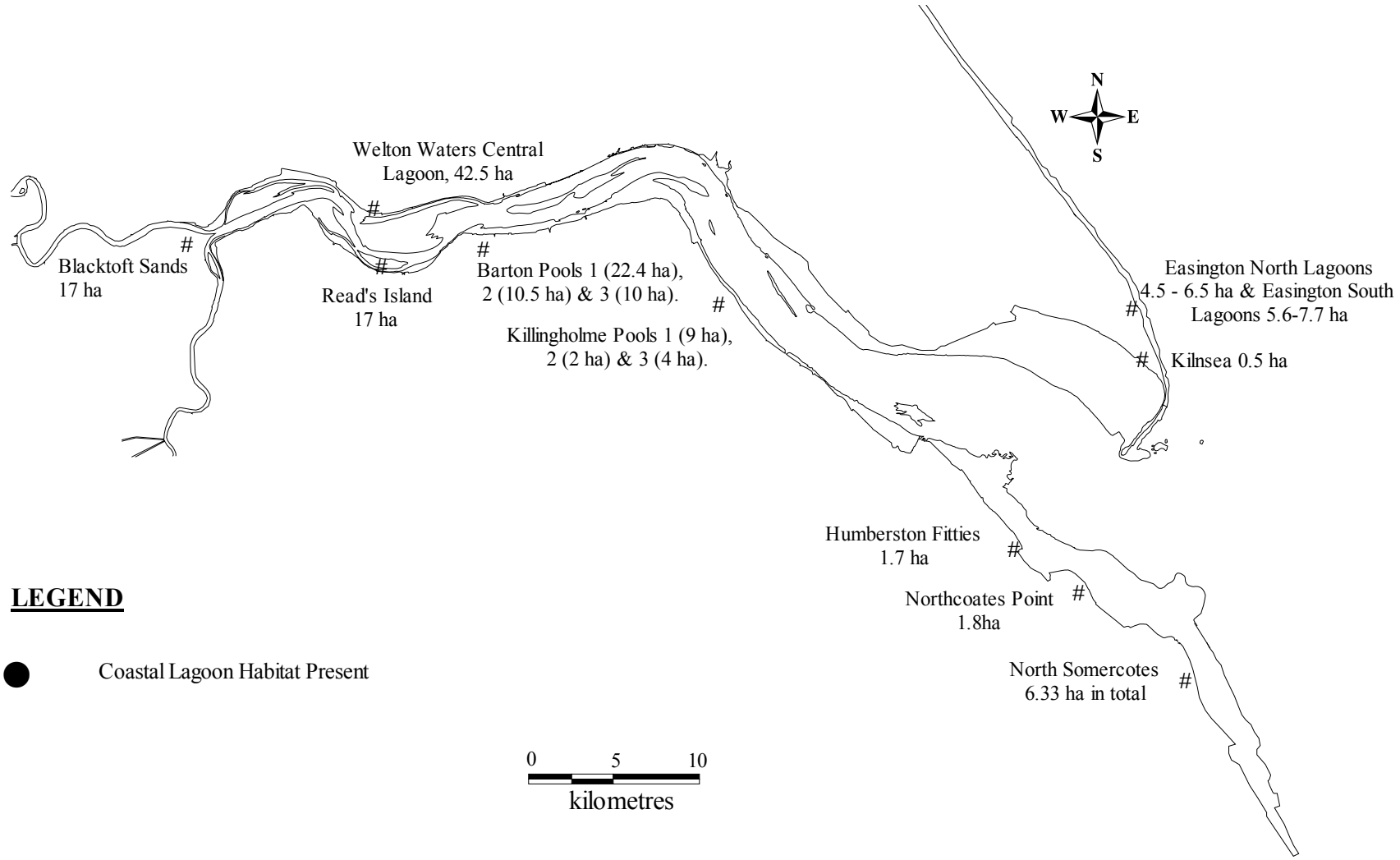
### Threats to conservation status

Lagoons are naturally ephemeral features and may be drastically altered by natural changes to sediment distribution through storms or the action of currents. In the UK coastal engineering projects may inhibit the evolution of lagoons by starving them of gravel or sand supply.

Sedimentary barriers tend to migrate landwards and natural succession often results in the conversion of saline lagoons to freshwater wetlands such as fen carr. The effects of isostatic rebound combined with the current rise in sea levels also endanger existing lagoons (but may also create new ones). This is especially so on the east coast and Humber Estuary where lagoons may be constricted between flood defences and the eroding shoreline in the so-called "coastal squeeze" (Selman *et al* 1999).

In common with other coastal habitats, lagoons are susceptible to pollution, nutrient enrichment, invasive species, recreation pressure, development and reclamation schemes all of which are, in most cases, modifications brought about by Man's activities.

## Distribution of Coastal Lagoon Habitat in the Humber Estuary



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## Humber Estuary

**Summary Status:**

- Approximately 10% of the UK resource and 2.5% of the north-west Europe resource.
- Includes a range of SNCIs & SSSIs; NNR; Humber Wildfowl Refuge, and the majority is designated as SPA, pSPA, pSAC, Ramsar & pRamsar.

### General description

The Humber is a complex coastal plain estuary with its catchment draining over one fifth of England (24,240km$^2$) including the former industrial areas of west and south Yorkshire and the Midlands.

The Humber is usually divided into three sub-units, the Inner Humber from Trent Falls to the Humber Bridge, the Middle Humber from the Humber Bridge to Grimsby and the Outer Humber from Grimsby to Spurn (Townend *et al* 2000). Water quality has been assessed as being largely good (Class A) to the east of the Humber Bridge, and fair class (Class B) to the west of the bridge. Although the estuary may be hyper-nutrified, it is not considered to be eutrophic (IECS 2002).

The erosion and accretion of sediments is a feature of much of the estuary, as is the changing position of the main channel upstream of the bridge, although channel oscillation was more frequent prior to the construction of the training walls at Trent Falls. General channel morphology is however subject to regular spring-neap and winter-summer erosion-deposition cycles and in the upper reaches of the estuary, the steeply sloping bed of the upper Humber also produces a tidal bore, particularly noticeable in the North Channel around Whitton Sand. The constant resuspension of sediment and the associated high suspended solids load gives the estuary its characteristic brown colouration (IECS 1994).

The dynamic nature of the estuary is constrained by flood defences along almost its entire length, with these structures restricting the development of intertidal mudflat and saltmarsh along many reaches. The most extensive intertidal areas are the mud flats of Spurn Bight on the north bank and the sandy areas of Cleethorpes to Donna Nook on the south bank, with further extensive mud flats at Cherry Cobb. The upper estuary is also characterised by large, often mobile, mud and sand flats which are exposed at high water, with one of these, Whitton Sand, having undergone extensive accretion and becoming extensively vegetated in recent years. There are smaller muddy embayments at Saltend/Paull on the north bank and at Pyewipe on the south, although the morphology of these areas is not entirely natural, being at least in part due to landclaim on adjacent areas creating low energy conditions, whilst the remaining intertidal areas are predominantly linear fringing mudflats for the most part constrained by coastal defences.

Fronting grazing marsh and common reed *Phragmites* beds characterise much of the upper Humber, although backing most of these areas are sea defences. Vertical or steeply shelving walls front the docks and residential areas at Hull, Grimsby and Immingham but elsewhere the defences generally comprise banks constructed from boulders or clay. Within the estuary there are therefore a range of physical and biological environments although the most extensive areas are mud and sand flats. As with all soft sediment areas, the physical

dynamics and bathymetry create and influence the conditions suitable for colonisation and modification by fauna and flora (Elliott *et al* 1998). Unlike other industrialised estuaries such as the Thames, Mersey and Clyde, there are no abiotic areas or large areas with opportunistic populations, and there have been few fish kills resulting from low oxygen or pollution incidents (Elliott *et al* 1998). The estuary is also one of the most important in terms of commerce as it has a rapidly expanding port complex (Hull, Immingham, Grimsby, Goole and is the feeder into smaller ports and wharves in the Rivers Trent and Ouse) as well as supporting considerable bank-side industries.

### Physical characteristics

The Humber is the largest macro-tidal estuary on the British North Sea coast, with a mean tidal range of 5.7m at Spurn increasing to 7.4m at Saltend (the maximum), and decreasing to 6.9m by Hessle. Tidal amplification occurs as far as Blacktoft on a spring tide and Brough on a neap tide, with a variation between neap and spring high water levels of 2.5m. The estuary features tidal asymmetry, with ebb dominant flows and an ebb residual (BTDB 1970). It has an area of approximately 30,000ha, and at its mouth, it is 6.6km wide and 13.2m deep (Spurn Head to Tetney), with an average width of 4.3km and depth of 6.5m. The intertidal area of the estuary has been calculated at $1x10^8m^2$, with the area of saltmarsh between Spurn and Trent Falls estimated at $6.3x10^6m^2$ (Environment Agency 1998).

The bed of the estuary is mostly sandy with some patches of gravel and glacial till grading into silty/clay in the intertidal areas of the main body of the estuary. An exception is the outer part of the south bank where the intertidal area is sandy. There are no natural rocky outcrops except where the Humber cuts through the chalk Wolds. This area, where the Humber Bridge is sited, is characterised by a chalk cobble and gravel substratum on the north bank but this is covered by surficial muds on the south bank at this point. However a small chalk cliff is present at South Ferriby on the south bank, and an area of cobble substratum (with interstitial mud) is located at Skitterness.

The tidal limits of the Humber are in its tributaries (the Rivers Trent, Ouse and Hull) to the weirs at Gainsborough on the Trent and Naburn Lock on the Ouse, and Hempholme Lock on the River Hull, with the tidal limit of the other main tributary, the River Ancholme, restricted at its mouth by a sluice. The tidal limit on the River Trent is some 147km from the mouth of the estuary and the Humber features both oligohaline conditions in the west to fully marine conditions in the east, with the limits of saline intrusion considered to be around Boothferry Bridge on the River Ouse, Keadby on the River Trent, Rawcliffe on the River Don and Wawne on the River Hull. Many of the tributaries, including the lower reaches of the Rivers Don, Ancholme and Hull have been partially canalised, with the low lying nature of the lower catchment entailing that tributaries are confined by flood defence embankments, whilst training walls have been constructed at the confluence of the River Ouse and River Trent.

The effects of freshwater flow can be observed as far downstream as Trent Falls around high water and Hull at low water, with tidal effects dominating 20km further up the estuary of Trent Falls. The estuary characteristically has a high suspended solids load (over $5g\ l^{-1}$), especially in the turbidity maximum zone (TMZ) upstream of the Humber Bridge, with the TMZ generally between Brough and Goole, but sometimes moving up the estuary as far as Selby or down as far as Hull, depending on the level of freshwater flow. Additional bed load transport of sediment results in even higher levels of suspended material (up to $14g\ l^{-1}$) (Environment Agency 2000).

Sediment transport is extremely important within the estuary, affecting both physical and biological characteristics. Sediment enters the estuarine system from three main pathways; the North Sea, the Holderness coastline and from fluvial sources. The majority of the suspended sediment is sourced from the sea, with over 1,500 tonnes carried per tide, compared to on average 320 tonnes from riverine sources (Environment Agency 1998). It has been estimated that up to 1.26 million tonnes of sediment may be in the water column, with around 170 tonnes deposited in the estuary on each tide, and 150 exported to the sea (IECS 1994; Environment Agency 1998).

The effect of wave energy on the estuarine system is largely restricted to the outer estuary, both in terms of offshore propagation, and those locally generated, with only the Spurn Bight area producing a significant fetch from the prevailing wind direction. Sediment movement due to wave action is therefore generally restricted to the outer estuary and the coastal reaches. The higher energy environment and greater marine sediment component of the outer estuary means that the intertidal flats of this area are predominantly sandy.

Studies have shown that over the last 150 years, the form of the estuary has been changing, with a loss of intertidal area as a result of sea-level change, with the estuary moving slowly towards its equilibrium state, with a loss of coarse bed material and an import of fine sediment, and an increase in accretion in the inner estuary, together with erosion in the outer estuary around Grimsby (Townend *et al* 2000). However, at a more local level there are interactions between banks, and the inner estuary is particularly dynamic. For instance, the reach between Crabley and Brough has undergone accretion over the last 20 years, with Whitton Sand accreting to such an extent that it is now well-vegetated, whilst Read's Island has undergone a period of erosion. The interactions in local sediment budgets between these areas are important, with erosion of one area leading to deposition elsewhere in the estuary, and *vice versa* (IECS 1994).

### Biological characteristics

The Humber is of ecological importance for a number of habitats and for species using the system. In particular, the intertidal mudflats provide an internationally important feeding and roosting resource for migratory and wintering waterfowl, with the mudflats and saltmarsh also providing nursery habitats for bass *Dicentrarchus labrax* and flatfish species including plaice *Pleuronectes platessa*, sole *Solea solea* and flounder *Platichthys flesus*. The estuary is also a migratory route for some fish species and supports a seal colony at its mouth. The areas of fringing saltmarsh support a number of rare invertebrate species, with adjacent habitats such as sand dunes and brackish lagoons also supporting important invertebrate species and assemblages. Further details on the assemblages and species are given elsewhere in this report.

The estuary contains at least 22 of the 34 biotopes identified in the MNCR Section 6 Inlets of Eastern England assessment, and is dominated by soft substrata. These are included in the following table where it is apparent that examples of sheltered eulittoral hard, littoral (intertidal) gravels and sands, littoral muddy sands, littoral muds, sublittoral gravels and sands and sublittoral muds are prevalent. The most extensive biotopes are the littoral (intertidal) muddy environments. The remainder are less extensive and are either restricted by natural factors or based on artificial substrata.

Within the following table (Table 20), additions to the MNCR biotope assignations have been made. Underlining indicates our addition of information to existing MNCR biotopes as derived by JNCC for the inlets of Eastern England (Hill 1998). Additional MNCR biotopes which we feel are applicable to the Humber Estuary are highlighted as being 'New' and do not have an MNCR Sector 6 code.

**Table 20** Biotopes found within the Humber Estuary (based upon Hill 1998)

| MNCR Sector 6 code | Biotope | Equivalent national classification code (Connor *et al* 1997a, b) | Extent within the estuary |
|---|---|---|---|
| | **LITTORAL ROCK/HARD SUBSTRATA** | | |
| | **Sheltered eulittoral (intertidal) hard substrata** | | |
| R6.5 | Upper shore estuarine firm substrata with *Enteromorpha* spp. | Ent | On flood defences fringing habitats from the outer estuary to the Humber Bridge |
| R6.6 | Upper eulittoral silted hard substrata with *Fucus spiralis* and *Enteromorpha* spp. | Fspi | As above |
| R6.9 | Mid eulittoral mixed substrata with *Fucus vesiculosus* and barnacles | FvesX | On hard substrata (rocks) at Saltend, Paull & Killingholme |
| | **LITTORAL SEDIMENT** | | |
| | **Littoral (intertidal) gravels and sands** | | |
| R6.14 | Strand-line pebbles and sand with *Talitrus saltator* | Tal | Spurn, Cleethorpes |
| R6.15 | Barren upper shore shingle | BarSh | Hessle & S. Ferriby – chalk shingle |
| R6.16 | Low salinity mid shore poorly sorted coarse sand with oligochaetes | Ol | ? [#3] |
| R6.17 | Upper shore medium and fine sand with polychaetes | ?PCer in part[#3] | Found in the outer estuary (South bank) & some at Spurn |
| R6.18 | Mid to lower shore clean mobile fine and medium sand with *Nephtys cirrosa*, *Scolelepis squamata* and amphipods | AEur, AP.P, AP.Pon | Extensive: Spurn Bight & Cleethorpes to Donna Nook |
| R6.19 | Tide-swept mid to lower shore poorly sorted sand with dense *Lanice conchilega* | Lan | Cleethorpes eastwards |
| | **Littoral (intertidal) muddy sands** | | |
| R6.20 | Upper to mid shore muddy fine sand with dense *Arenicola marina* and bivalves | MacAre, HedMac.Are | Cleethorpes to Donna Nook |
| | **Littoral (intertidal) muds** | | |
| R6.21 | Upper shore stable estuarine sandy mud with *Salicornia* spp. and *Pelvetia canaliculata* | NVC SM8 | South Bank – around Horseshoe Point |
| R6.22 [#1] amended | Mid shore sandy mud with *Macoma balthica* and *Cerastoderma edule* | HedMac (HedMac.Mare) <u>& HedMacAre?</u> | Extensive in outer estuary, Spurn Bight & Cleethorpes eastwards |
| R6.23 | Variable salinity upper to mid shore sandy mud with *Macoma balthica* and *Manayunkia aestuarina* | HedMac | Mid estuary variable width intertidal area. Hawkins Point to Paull & opposite bank (?). |

| MNCR Sector 6 code | Biotope | Equivalent national classification code (Connor *et al* 1997a, b) | Extent within the estuary |
|---|---|---|---|
| R6.24 | Upper to mid shore mud with *Scrobicularia plana* | HedScr | Part of Spurn Bight, South Bank (?). Extensive |
| MNCR Sector 6 code | Biotope | Equivalent national classification code (Connor et al 1997a, b) | Extent within the estuary |
| R6.25 | Upper shore sandy mud with dense bivalves and *Zostera* spp. | Znol | North-east corner of Spurn Bight |
| R6.26[#1] amended | Variable salinity lower shore mud with *Nephtys hombergii* and *Caulleriella* (*Tharyx*) *killariensis* | HedMac (HedStr) | Ubiquitous in middle & outer estuary |
| R6.27 | Low salinity mid to lower shore mud with *Hediste diversicolor*, *Heterochaeta costata, Tubificidae spp.* and *Corophium volutator* | HedOl | Mid to upper estuary, on the South Bank |
| | **SUBLITTORAL SEDIMENT** | | |
| | **Sublittoral gravels and sands** | | |
| R6.28 | Sublittoral very poorly sorted sandy shell gravel with polychaetes, crustaceans and bivalves | PolMtru? | Patchy distribution mainly outer-middle estuary |
| R6.29[#1] amended | Sublittoral medium and fine sand with *Nephtys cirrosa* and *Bathyporeia* spp. | NcirBat[#3] | Mid to lower estuary |
| New[#2] | Sublittoral impoverished mobile sands with mysids and *Gammarus* spp. | NeoGam | Upper estuary |
| New[#2] | Sublittoral muddy sands and sands with *Capitella capitata* | MobRS/Ncir/Cap | Middle estuary |
| | **Sublittoral muds** | | |
| R6.30 | Sublittoral sandy mud with *Scoloplos armiger* and *Phoronis muelleri* | AphTub (CreAph?) | Middle-outer estuary? |
| R6.31 | Sublittoral mud with dense *Nephtys hombergii* and *Phoronis muelleri* | AphTub (NhomTub) | Outer estuary |
| New[#2] | Nearshore mud with *Macoma balthica* | MacAbr? | Middle-outer estuary |
| New[#2] | Sublittoral mud/clay and sandy mud with *Polydora* sp., *Aphelochaeta* sp., *Pygospio elegans, Corophium* and *Tubificoides* spp. | PolVS(AphTub) | Outer estuary |
| | **Sublittoral mixed sediment** | | |
| R6.33 | Sublittoral mixed muddy substrata with polychaetes, crustaceans and ascidians | CreAph?, AphTub, PolMtru? | Middle & outer estuary |
| R6.34 | Variable salinity sublittoral poorly sorted mud with *Hediste diversicolor* and *Corophium volutator* | AphTub | Middle estuary |

[#1] Underlining indicates our addition of information to existing MNCR biotopes as derived by JNCC for the inlets of Eastern England (Hill 1998).

[#2] Additional MNCR biotopes which we feel are applicable to the Humber Estuary are highlighted as being 'New' and do not have an MNCR Sector 6 code. However, a further revision of the soft sediment biotopes is currently being prepared, and it is expected that a series of additional estuarine biotopes will be identified, which the above descriptions can be ascribed to.

[#3] A ? is used where either the location or presence of a biotope is considered uncertain based on current knowledge.

### Historical changes and trends

There have been improvements in the water quality of the estuary over the last few decades, with estuarine water quality issues often associated with the quality of the tributaries (National Rivers Authority 1993). This is perhaps most apparent in the reduction in the extent and depth of the oxygen sag recorded in the upper reaches of the estuary, which has been attributed predominantly to the improvement in the quality of the River Trent (National Rivers Authority 1993). The closure of some industries, especially along the outer south bank, inner north bank and in the tidal rivers, as well as the regulatory activities of the EA have also reduced the polluting loads. Many of the discharge effects have decreased in extent and/or severity in the last two decades. The apparent health of the biota, for example the fish populations, reflects the health of the estuary as well as the conditions outside the estuary. For example, anglers now fish up to Paull and East Halton Skitter, with angling activity along the Hull frontage being in sharp contrast to conditions even up to a couple of decades ago. The adoption of Environmental Quality Objectives (EQO's) in the early 1970's was a major step in improving environmental quality, but these need to be assessed against the results of new investment and/or regulation.

Substantial landclaim occurred in the outer estuary during the late 18$^{th}$ and early 19$^{th}$ Century when large-scale embankments at Sunk Island and Cherry Cobb Sands had an enormous impact on the intertidal morphology of the estuary (Murby 2001). Murby (2001) reported that nearly 2700ha of intertidal land had been lost in the middle and outer Humber between 1828 and 1996, with 2330ha attributed to landclaim. Other small areas (*c.* 40ha) have been reclaimed within the last ten years for dock developments on the Hull and Immingham fronts, adding to the loss of intertidal land. However, accretion has occurred in the outer estuary at Spurn Bight as a result of the land-claim and the closure of the once navigable North Channel, which traced a course north of Sunk Island from Spurn to Patrington Haven. The closure of the channel had the effect of reducing the volume and velocity of tidal water flooding Spurn Bight and thus facilitated accretion in the truncated channel. Landclaim has therefore not only squeezed the tidal channels within the estuary but also changed its character (Murby 2001).

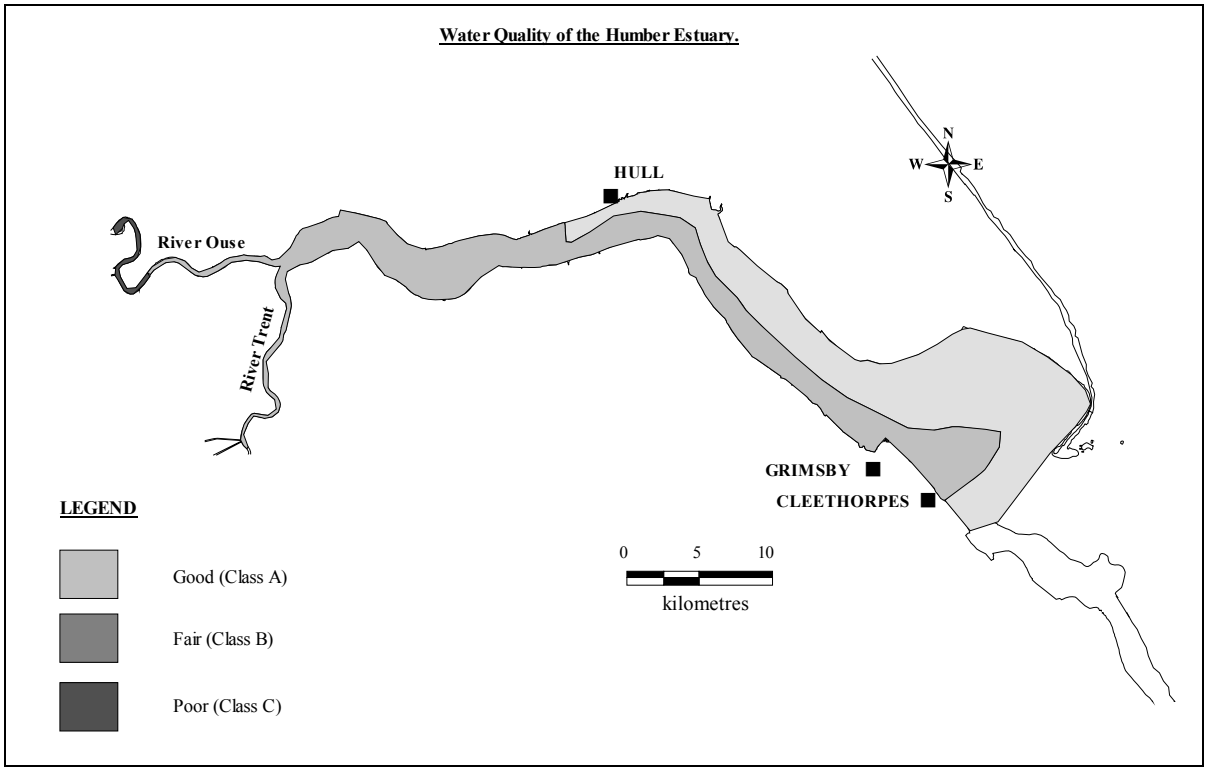
### Conservation status

Almost the whole of the rural shoreline of the Humber is included in international or national designated sites on the basis of their wildlife value. Designations range from site specific SNCIs, SSSIs, Humber Wildfowl Refuge and two NNRs to ecosystem based SPA, pSAC and Ramsar designations. In addition, there are a number of nature reserves managed by local wildlife trusts, the RSPB and other conservation groups. The high ecological value afforded the Humber should be assessed in the context of human usage and intervention, although it remains the perception of the general public that the estuary is badly polluted with poor water quality. Pollution levels are generally within the Environmental Quality Standards set by the Environment Agency, and water quality continues to improve, with the initiation of projects under IPPC and the implementation of revised sewage treatment standards including the newly completed sewage treatment works in Hull.

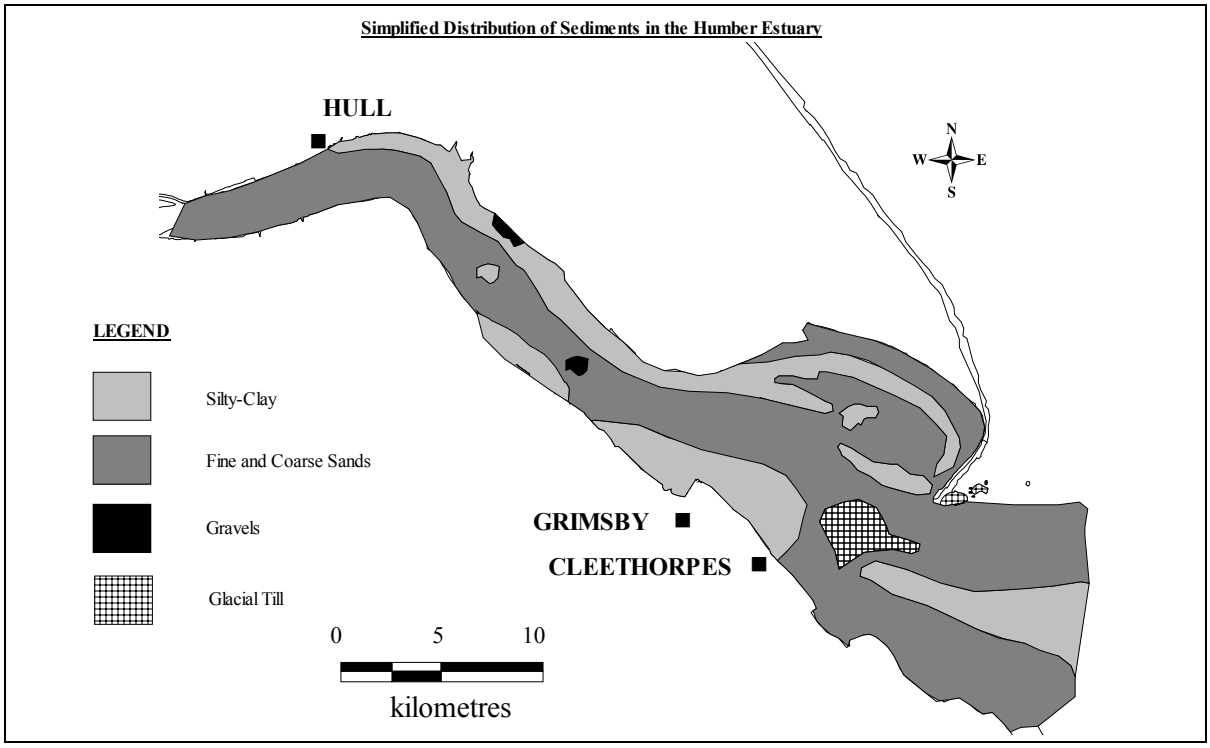
The Humber is one of the four largest British estuaries, draining a fifth of the land area of England, generating a freshwater flow of 250cumecs compared to 69cumecs in the Thames, whilst tidal amplitude of over 7m is second only to the Bristol Channel. Despite a substantial

industrial, port and navigation importance, the Humber remains one of the cleanest deep water estuaries in the British Isles (IECS 1987).

The general health of the estuary is underlined by a rich faunal community. The mudflats of the estuary are extremely productive, for instance at Saltend, 1ha of mudflat will contain over 100,000,000 invertebrates (small worms, molluscs and crustacea), weighing around 0.5 tonnes (IECS 1987). These biologically rich areas provide an important source of food for waterfowl when the tide is out, and for fishes when the tide is in. This rich food supply means that the estuary is currently the fifth most important, in numerical terms, for waterfowl in Britain, supporting over 150,000 wildfowl and waders (5 year average peak maxima), including eight species present in internationally important numbers. It is by far the single most important wetland site for wintering golden plover in the Britain, the fourth most important for lapwing and redshank and fifth for shelduck, knot and curlew (Musgrove *et al* 2001).




Adapted from The Humber Estuary Committee of the National Rivers Authority 1993. Humber Estuary-Quality Report 1993, Edition 2, UK: NRA

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## The Binks

**Site Location:** Located off the tip of Spurn Point - Easting: 540800 Northing: 410100.

### Description

The Binks is the seaward end of a moraine ridge which surrounds the tip of Spurn. It was formed during the retreating ice from the last ice age, which deposited a ridge of glacial sediments washed out from the glacier snout. Reports suggest that this moraine continues around the tip of Spurn and then northwards into the offshore zone of Holderness (IECS 1994).

Due to the sheltered hydrodynamic regime, provided by the Binks, eroded sand and shingle from the Holderness coast settled out of suspension, forming the foundations of the Spurn peninsula. Sand dunes then formed on this foundation material, raising the level of the surface above the highest tides, and allowing vegetation and human colonisation to take place. Currently, the Spurn peninsula is in a state of flux, with the southern end held within the curve of the Binks and the northern end attached to the Holderness coast, which is eroding westwards at a rate of 2m per year. The northern end of the peninsula is acting as a form of hinge, connecting the moving 'root' at Kilnsea with a stationary 'island' at the southern end (IECS 1994).

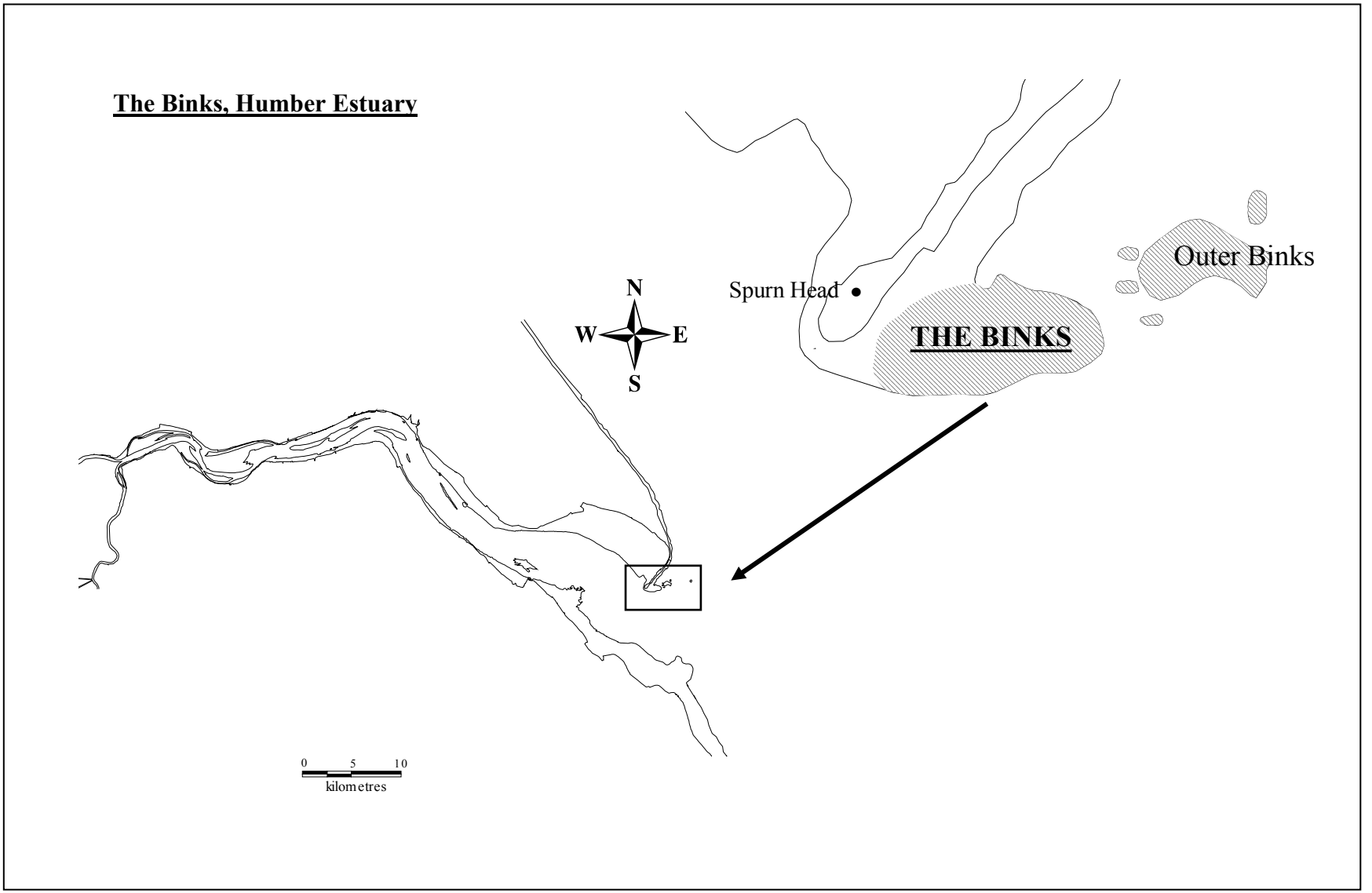
### History

Before the last glaciation, Holderness did not exist, with the coastline running along the eastern edge of the Yorkshire and Lincolnshire Wolds and the mouth of the Humber, intersecting the coastline almost exactly where the Humber Bridge now stands. However during the last ice age, at its maximum extent, the ice front ran along the edge of the Wolds and plugged the mouth of the estuary. The river water draining eastwards from central England ponded back behind this ice plug forming a lake over the Vale of York (IECS 1994).

The retreat of the glacier at the end of the ice age unplugged this lake and the river water discharged across the muddy waste of boulder clay left by the retreating ice. The ice front by this time lay along the north bank of the Humber, marked today by a ridge of mud and sand. One end of the ridge forms the church hill at Paull and the other end the Binks seaward of Spurn (IECS 1994).

### Conservation status

The conservation status of this subtidal feature is unknown. Seismic studies are currently being undertaken by the British Geological Survey (BGS) on behalf of the Environment Agency to ascertain the sediment transport on and around the Binks, the geology and geomorphology of this structure, and to determine the significance of the Binks to the Humber Estuary. All the information will be fed into the Humber Estuary Shoreline Management Plan (SMP) which is currently being prepared.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# 11. Glossary

**Berne Convention (1979).** Convention on the Conservation of European Wildlife and Natural Habitats. This imposes obligations to conserve wild plants, birds and other animals, with particular emphasis on endangered and vulnerable species and their habitats. The provisions of the Convention underlie the EC Habitats and Species Directive (92/43/EEC) as well as the UK's wildlife legislation.

- Appendix 1: strictly protected flora species.
- Appendix 2: strictly protected fauna species.
- Appendix 3: protected fauna species.
- Appendix 4: prohibited means and methods of killing, capture and other forms of exploitation.

**Bonn Convention.** The Convention on the Conservation of Migratory Species of Wild Animals, 1979. There is strict protection for species listed in Appendix I: migratory species that are in danger of extinction in a significant part of their range (provided that reliable scientific evidence is available to prove this). Appendix II lists migratory species which have an unfavourable conservation status and which require international agreements for their conservation and management. These species would benefit from international cooperation that could be achieved by international agreement.

**Brackish.** Water of a reduced salinity ("slightly salty") due to the mixing of sea water with fresh water, e.g. estuaries.

**CITES.** The Convention on International Trade in Endangered Species of Flora and Fauna. This is an international treaty established in 1975 to control and monitor trading in animals and plants throughout the world.

**Comes to light.** The species is attracted to light and is commonly recorded using various types of light trap.

**Conservation Regulations.** Known commonly as the Habitats Regulations, the Conservation (Natural Habitats & c) Regulations 1994 implement the requirements of the Habitats and Birds Directives into UK law.

**Habitats Directive (92/43/EEC).** Council Directive 92/43/EEC of 21 May 1992 on the Conservation of Natural Habitats and of Wild Flora and Fauna. This requires measures to be taken to maintain or restore to favourable conservation status in their natural range, habitats and species of flora and fauna of Community interest and listed in Annexes to the Directive. It provides for a European-wide ecological network of Special Areas of Conservation (SACs), which together with SPAs are known as Natura 2000.

**Imago.** The adult life-phase of a moth.

**Immature.** An immature bird is a juvenile that has undergone its first moult but does not yet have full adult plumage.

**Intertidal.** An area of coast or estuary which is only covered by water for part of a tide. On an estuary, the intertidal area often takes the form of an extensive mudflat.

**Invertebrate.** A small animal without a backbone. These can be found in a variety of habitats including on land (terrestrial), in the intertidal or subtidal environments (both marine and brackish) and in rivers and ponds (aquatic).

**Juvenile.** A young bird that is no longer dependent on its parents but has not gained its adult plumage.

**Nationally Scarce.** These species fall within the Nationally Notable categories introduced by Ball (1986). They are estimated to occur within the range of 16-100 10 km squares since 1970.

**National Status.** Na Nationally notable (occurring in 15-30 10km squares).
Nb Nationally notable (occurring in 31-100 10km squares).
Nr Regionally notable (occurring in 1-5 10 km squares in region).
L Local species.

**On the wing.** The adult flying life-phase of a moth.

**RAMSAR.** The Convention on Wetlands of International Importance, Especially as Waterfowl Habitats (The Ramsar Convention) is an inter-governmental treaty that aims to stem the progressive encroachment on and loss of wetlands now and in the future. The Convention has broadened its scope to cover all aspects of wetland conservation and wise use, recognising wetlands as ecosystems that are extremely important for biodiversity conservation and for the well-being of human communities.

**Red Data Book (RDB).** A list of species which are rare or in danger of becoming extinct within a particular area. Levels of threat and some information on their ecology and conservation are usually provided. These species require specific conservation measures to prevent their decline. Species are classified into four different categories of perceived risk:

- RDB1 (endangered);
- RDB2 (vulnerable);
- RDB3 (rare);
- RDBK (insufficiently known);
- pRDB Proposed for British Red Data List.

**Saltmarsh.** An area of intertidal habitat with a distinct flora, with plants being able to tolerate elevated salt levels.

**Special Area of Conservation (SAC).** See Habitats Directive (92/43/EEC).

**Site of Special Scientific Interest (SSSI).** Under Section 28 of the Wildlife and Countryside Act 1981 (as amended), English Nature has a duty to notify land that is of special interest for its plants, animals, geological or physiographical features. Areas of such land are called Sites of Special Scientific Interest (SSSIs).

**Special Protection Area (SPA).** See Wild Birds Directive (79/409/EEC).

**SPEC.** Species with unfavourable conservation status in Europe (SPEC - Species of European Conservation Concern). The SPEC categories are:

- SPEC 1 are species occurring in Europe which are of global conservation concern (threatened, conservation dependent or data deficient);
- SPEC 2 are species which are concentrated in Europe and have an unfavourable (i.e. Endangered, Vulnerable, Rare, Declining, Localized or Insufficiently Known) conservation status;
- SPEC 3 are species which are not concentrated in Europe but have an unfavourable (i.e. Endangered, Vulnerable, Rare, Declining, Localized or Insufficiently Known) conservation status;
- SPEC 4 are species which are concentrated in Europe but have a favourable conservation status.

**Subtidal.** The area of an estuary, coast or sea which has a tidal influence but is always covered by water.

**Vagrant.** An individual found outside of the normal range of a species.

**Wader.** A generic term for a group of often long-legged and/or long-billed birds which are often at least partially dependent on shallow water and adjacent wetland habitat.

**Waterfowl.** A collective term for all waterbirds, excluding gulls.

**Wetland Bird Survey (WeBS).** The Wetland Bird Survey (WeBS) is a joint scheme of the British Trust for Ornithology (BTO), the Wildfowl & Wetlands Trust (WWT), the Royal Society for the Protection of Birds (RSPB) and the Joint Nature Conservation Committee (JNCC) to monitor non-breeding waterfowl in the UK. The principal aims of the scheme are to identify population sizes, determine trends in numbers and distribution, and to identify important sites for waterfowl. WeBS Core Counts are undertaken at around 2,000 wetland sites of all habitats; estuaries and large still waters predominate. The monthly co-ordinated counts are made mostly by volunteers, principally from September to March, with fewer observations during summer months.

**WeBS Low Tide Counts Scheme.** The WeBS Low Tide Counts Scheme which was initiated in the winter of 1992-93, aims to monitor, assess and regularly update information on the relative importance of intertidal feeding areas of UK estuaries for wintering waterfowl and thus to complement the information gathered by WeBS Core Counts on estuaries. Co-ordinated counts of feeding and roosting waterfowl are made by volunteers each month between November and February on pre-established subdivisions of the intertidal habitat in the period two hours either side of low tide.

A modified Low Tide Count methodology, organised by English Nature, was employed on the Humber from September 1998 to August 1999. The results of this survey are reported in English Nature Research Report No. 339 (Catley 2000).

**Wild Birds Directive (79/409/EEC).** Council Directive 79/409/EEC of 2nd April 1979 on the Conservation of Wild Birds. This Directive aims to protect bird species within the European Union through the conservation of populations of certain birds and the habitats used by these species. States are required to classify Special Protection Areas (SPAs) to conserve the habitats of rare and vulnerable species listed in Annex 1 of the Directive, and of regularly occurring migratory species, to ensure their survival and reproduction in their area of distribution.

**Wildfowl.** A collective term for ducks, geese and swans.

**Wildlife and Countryside Act 1981 (amended).** This is the principle mechanism for the legislative protection of wildlife in Great Britain, but does not extend to Northern Ireland, the Channel Islands or the Isle of Man. The Act is the means by which the Convention on the Conservation of European Wildlife and Natural Habitats (the "Bern Convention") and the European Union Directives on the Conservation of Wild Birds (79/409/EEC) and Natural Habitats and Wild Fauna and Flora (92/43/EEC) are implemented in Great Britain. The Act is divided into four parts:

- Part I is concerned with the protection of wildlife;
- Part II relates to the countryside and national parks (and the designation of protected areas);
- Part III covers public rights of way;

- Part IV deals with miscellaneous provisions of the Act.

Listed species are specially protected by law primarily under Schedule 1 (birds), Schedule 5 (amphibians, reptiles and mammals), and Schedule 8 (plants).

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Front cover photographs:
Top left: Using a home-made moth trap.
Peter Wakely/English Nature 17,396
Middle left: $Co_2$ experiment at Roudsea Wood and Mosses NNR, Lancashire.
Peter Wakely/English Nature 21,792
Bottom left: Radio tracking a hare on Pawlett Hams, Somerset.
Paul Glendell/English Nature 23,020
Main: Identifying moths caught in a moth trap at Ham Wall NNR, Somerset.
Paul Glendell/English Nature 24,888