JOINT NATURE CONSERVATION COMMITTEE

An inventory of UK estuaries

Volume 5
Eastern England

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The embayment of the Wash has one of the largest intertidal areas in Britain. (Peter Wakely, English Nature.)

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1 Foreword

Professor Peter Evans
Chairman, Department of Biological Sciences, University of Durham

Viewed worldwide, estuaries are a scarce natural resource, even though some in the deltas of great rivers are of immense size. The British Isles are fortunate in holding a large number and variety of types of estuary, particularly when compared with the rest of temperate and Mediterranean Europe. Yet we have not used most of our estuaries either wisely or sustainably, probably for two reasons: first a lack of knowledge of the natural resources they contain and second a lack of understanding of the effects of the human uses to which they have been, or are being, put.

Pollution problems up-river have readily been apparent to anglers and recreational users alike and there have been long-standing campaigns to improve water quality in many of our rivers. These have begun to bear fruit. Many of the larger estuaries have not attracted such concern from the general public in relation to their water quality. People have increasingly turned their backs on the river corridors as they near the sea and looked further afield for clean recreational areas. As a result discharges of industrial and domestic wastes into estuaries have continued on a large scale, though restrictions are gradually being introduced (or even self-imposed by environmentally aware industrial concerns).

Even less obvious to the general public has been the steady loss of intertidal land within estuaries, to land-claim for industrial development and to dredging for the creation of wider and deeper shipping channels and berths needed to accept the larger vessels in which we import more raw material as our own accessible resources of many minerals and chemicals decline. Intertidal and even permanent shallow-water areas of estuaries have been buried under domestic rubbish and other solid wastes, or sometimes permanently flooded for water storage schemes. To these established, though often not sustainable, uses are being added new demands: barrage schemes for power generation, harbour developments for pleasure craft and many others.

Knowledge of the natural resources of the British estuaries has been slow to accumulate. Even one of the most obvious of the biological resources, the bird populations, had not been counted in more than a few of the smaller estuaries before the 'Birds of Estuaries Enquiry', now organised by the BTO, WWT, RSPB, and JNCC, was launched in 1969. The very idea of attempting a count of all the birds using the shores of the Wash in Lincolnshire and Norfolk was considered impractical before a Cambridge Bird Club team, of which I was a member, attempted the task in the mid-1950s. Quantification of other resources has proven even more difficult: fishery catch statistics do not necessarily permit identification of spawning and nursery areas, yet for several species these lie in estuaries and are vital for the continued health of our fish stocks. The role of algae and other plants in stabilising estuarine shores against erosion is only now becoming understood in a more quantitative way though it had been appreciated for more than half a century that planting of the cord-grass *Spartina* provided an extra line of defence against erosion of soft shores.

Now we are faced with the reality of sea level rise and the need for rethinking coastal defences. People have come to appreciate the value of the wildlife resources of estuaries, and industries located on estuaries increasingly appreciate the advantages of developing a 'green image' backed by actions such as the reduction of waste discharges to confirm it. This, therefore, is a particularly appropriate time to launch this *Inventory of UK estuaries*, building on the excellent publication *Nature conservation and estuaries in Great Britain* which appeared in 1991. That book, edited by Dr Davidson, who is a co-author of several of the chapters in these present inventory volumes, was the last major review published by the former Nature Conservancy Council. I am proud to have persuaded my fellow Council members in the mid-1980s to commission that work which has, I believe, influenced attitudes to estuary use in a most positive way.

I well recall, during the Examination in Public of the Teesside Structure Plan in 1975, appealing for a national planning policy to be developed for estuarine use. It was considered impossible at that time. But today there is great enthusiasm including guidance from government for coastal conservation and management, in part as a result of our growing international responsibilities for example in relation to the management of the North Sea, the implementation of the Ramsar Convention on Wetlands of International Importance and the acceptance of the EC Directives on the Conservation of Wild Birds (1979) and Habitats and Species (1992). The need for detailed information to enable sensible estuarine management plans to be formulated not only in a local but also a national and international context has never been greater. I commend these volumes to all interested in the planning, sustainable development, management and conservation of UK estuaries. It is an authoritative base-line from which to prepare for the 21st century.

Peter Evans

Durham, January 1993

2 Introduction

N.C. Davidson & A.L. Buck

Coastlines change continually under the forces of wave, tide, current and wind. In some places along the coast the hard rocks laid down millions of years ago or the softer, more recent, glacial deposits are being eroded. These eroded sediments are transported by currents, often for considerable distances, out into deeper water or along the shore. Much of this sediment is deposited along the coastline: coarse sediments forming shingle and sand beaches, and fine particles forming mudflats in sheltered bays, inlets and river estuaries. All these types of estuary act as 'sediment sinks' that trap much of the sediment moving along the coast. Where the estuary is formed by a river discharging into the sea, particles carried downstream by the rivers are deposited in the reduced currents and shelter of the river mouth, adding to the sediments of marine origin.

In time these sediments build up in estuaries, become stable and parts may become vegetated to provide a complex of habitats. Saltmarsh vegetation colonises intertidal flats that have accumulated to levels above mid-tide height. Where sand is blown onshore there is development of sand dunes, or where larger deposits move onshore shingle ridges develop. In the event of restricted drainage within sand dunes or shingle ridges, or even within saltmarshes, saline lagoons can form. This variety of coastal habitats is often in a state of change, adjusting to the short-term effects of winds, tides, waves and currents, and are shaped by the more gradual changes over periods of thousands of years as sea levels rise and fall.

The inflow of water from rivers and the sea brings a continual influx of nutrients. In river estuaries the freshwater brought down the river meets the saline water from the sea. In some estuaries these water bodies mix well, with tidal movements and variations in river flow creating large variations in water salinity over short periods of time.

The complex of estuarine habitats that develops under these conditions supports a variety of plants and animals which have adapted to exploit the nutrient-rich but continually changing tidal conditions. Relatively few species have evolved to cope with the extremes of constantly changing salinity and tidal levels of river estuaries but those that have often occur in great densities. As a result the estuarine mudflats and saltmarshes in temperate regions such as the United Kingdom are amongst the most productive ecosystems in the world. This rich plant and invertebrate life provides an abundant food supply for predators such as fish, which often use the shelter of estuaries for spawning and as nursery areas. Some species of birds and mammals feed on these fish, whilst many others feed directly on the saltmarsh vegetation and on the abundant molluscs, crustaceans and worms living in soft sediments. The relatively mild winter weather conditions of estuaries in the United Kingdom make them additionally attractive wintering grounds for migratory waterfowl from a large area of the northern hemisphere.

The coastline of the United Kingdom is particularly well endowed with estuaries, and these vary greatly in their geomorphological origins, size, shape, extent of freshwater influence, and the complex of marine and coastal habitats that occur there. These estuaries are widely recognised as one of the greatest natural assets in the UK.

UK estuaries vary greatly also in the extent to which they have been used, changed or destroyed by people exploiting their natural resources. People have used estuaries for many centuries and for many purposes. Some uses, such as ports, exploit the shelter offered by the physical structure of the estuary. Others, for example barrages, control or exploit tidal movements. Many traditional practices depend on sustainable use of the rich natural resources such as fish and shellfish found in estuaries. A recent trend has seen estuaries as the focus for leisure activities, in water, land and air. These range from organised activities such as sailing regattas to informal uses such as walking and the quiet enjoyment of these often spectacular wild landscapes and their wildlife.

Effective conservation of estuaries for their wildlife requires the maintenance of the diversity of the estuarine network throughout Britain and internationally, and the sustainable management of individual estuaries in this network. Yet many parts of estuaries have already been destroyed through human activities leading to land-claim and degradation. Such pressures continue and damage can arise through the subtle interaction of the human urge to control estuaries (e.g. by constructing sea defences against flooding) and the estuaries' natural movement in response to rising sea levels.

There is increasing recognition that managing and maintaining our coasts and estuaries for the future depends on co-operation between the groups of users, coastal managers and decision makers. This co-operation is increasingly being sought through processes of integrated coastal zone planning and management (CZM). Many CZM initiatives are focused on estuaries since it is often here that there is most overlap and potential conflict between people and the natural estuarine resource.

In developing estuary management plans there is a need for sound baseline information on the natural resource and how it is being used. Such information is needed both in detail for the estuary under consideration and more broadly so as to set a particular feature or site in its wider national and international context. To provide this British national context as a baseline for the development of sustainable use objectives, the Nature Conservancy Council (NCC) undertook an Estuaries Review which published *Nature conservation and estuaries in Great Britain* as a national overview of estuaries, their wildlife, their conservation and their human uses (Davidson *et al.* 1991).

An inventory of UK estuaries follows on from this national overview, and provides a summary of resource, wildlife, conservation status and human use features on each of the 163 estuaries identified by the Estuaries Review around the coasts of the United Kingdom. Much of the information presented in the inventory was collated between 1988 and 1991 during the work of the Estuaries Review. Where possible, however, we have included more up-to-date information. Where this more recent information is given the relevant dates are indicated in each display. The inventory thus provides a 'snap-shot' in time for the state of the UK estuarine resource at the end of the 1980s.

An inventory of UK estuaries takes the form of a series of standardised dossiers, taking each estuary (as defined by the Estuaries Review) in turn. Each of these reports gives a summary of the key features of interest or significance for estuary management from a nature conservation perspective. An inventory entry is designed to give initial summary information about a feature and to help direct users to more detailed sources of information should this be required. The inventory is not, however, intended to provide comprehensive listings of plant and animal species recorded on the estuary. Nor can it provide more than the initial basis for the development of practical coastal zone management initiatives such as integrated estuary management plans.

The inventory provides part of a sound information base for estuary management. Taken together with the national overview provided by *Nature conservation and estuaries in Great Britain,* the information in the inventory permits estuary managers to set the resource on a particular estuary in its national and international context - an important stage in the identification of management issues. The inventory should also help understanding of the great importance of the UK estuarine resource by the many user-groups and those involved in decision-making. Its availability for use in matters of development planning and control ensures that there is a readily available single source of summarised information, eliminating the need to search through a great variety of sources in many different styles of presentation. In addition the snap-shot information in the summary provides an easy-to-use basis for broad-scale monitoring of change in the estuarine resource and its human uses.

An inventory of UK estuaries is being published in six regional volumes, most including 20-30 estuary reports. The regions are shown in Figure 1. Boundaries have been chosen largely on topographical grounds to provide meaningful geographical zones. For England and Wales these boundaries coincide broadly with the known divisions of major coastal sediment cells.

There is also an introductory volume (volume 1). This provides more detail of the rationale of the inventory, explanations of the approach to site definition and selection, details of the information sources used for the inventory, and summary tables listing estuary locations and characteristics updated and corrected from those in Davidson *et al.* (1991). Users of the inventory are strongly urged to consult this volume for definitions before undertaking detailed interpretation of site reports. Since many people who have helped with the Estuaries Review and inventory work have contributed to more than one volume we have included a full Acknowledgements section in this introductory publication rather than in each regional volume.

We give below a brief overview of the overall estuarine resource in this Eastern England coastal area covered by Volume 5, then a short key to using and interpreting the information entries in each site report, followed by the site reports.

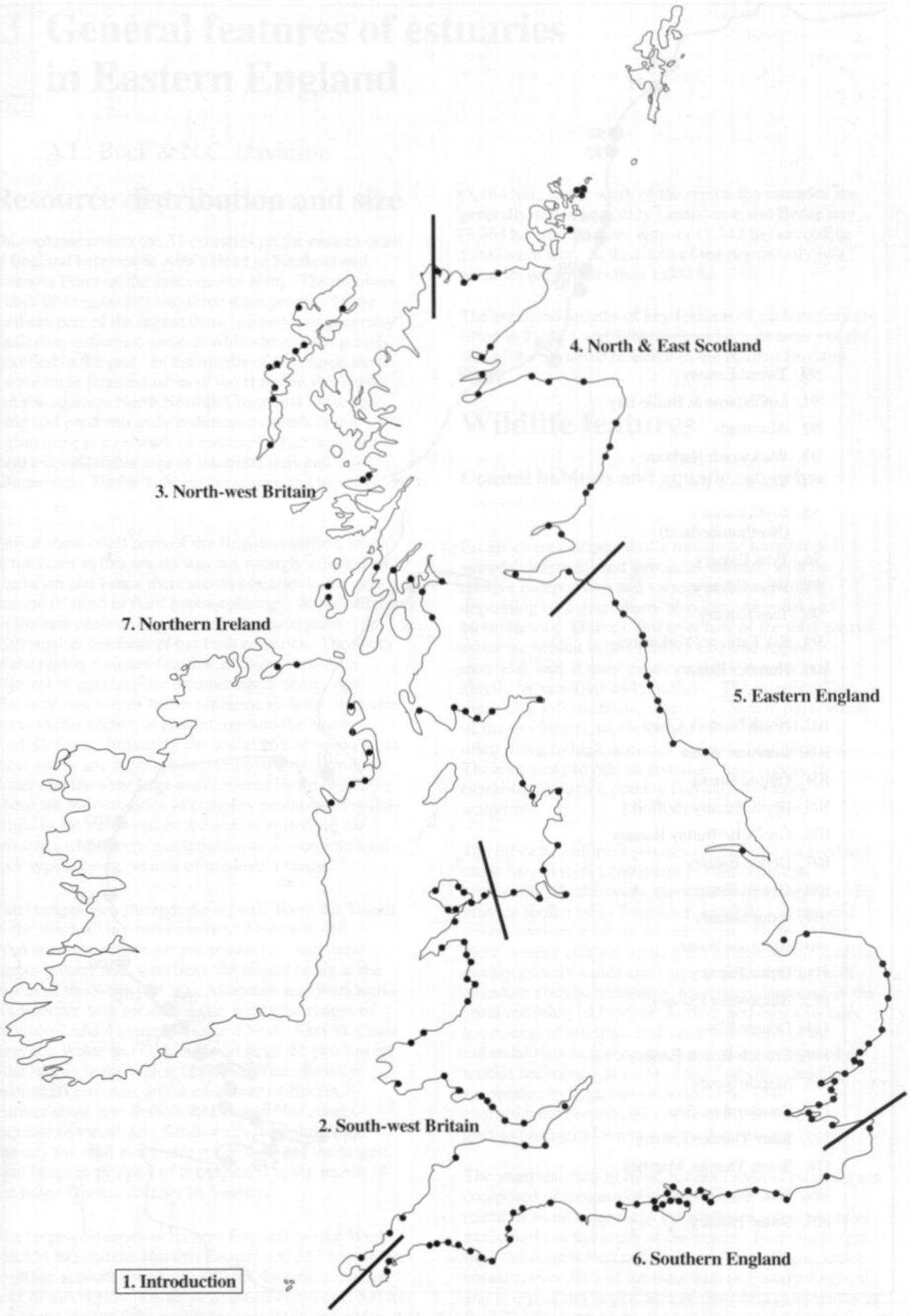

Figure 1 The regional volumes comprising *An inventory of UK estuaries*. Each estuary is marked by its centre grid reference.

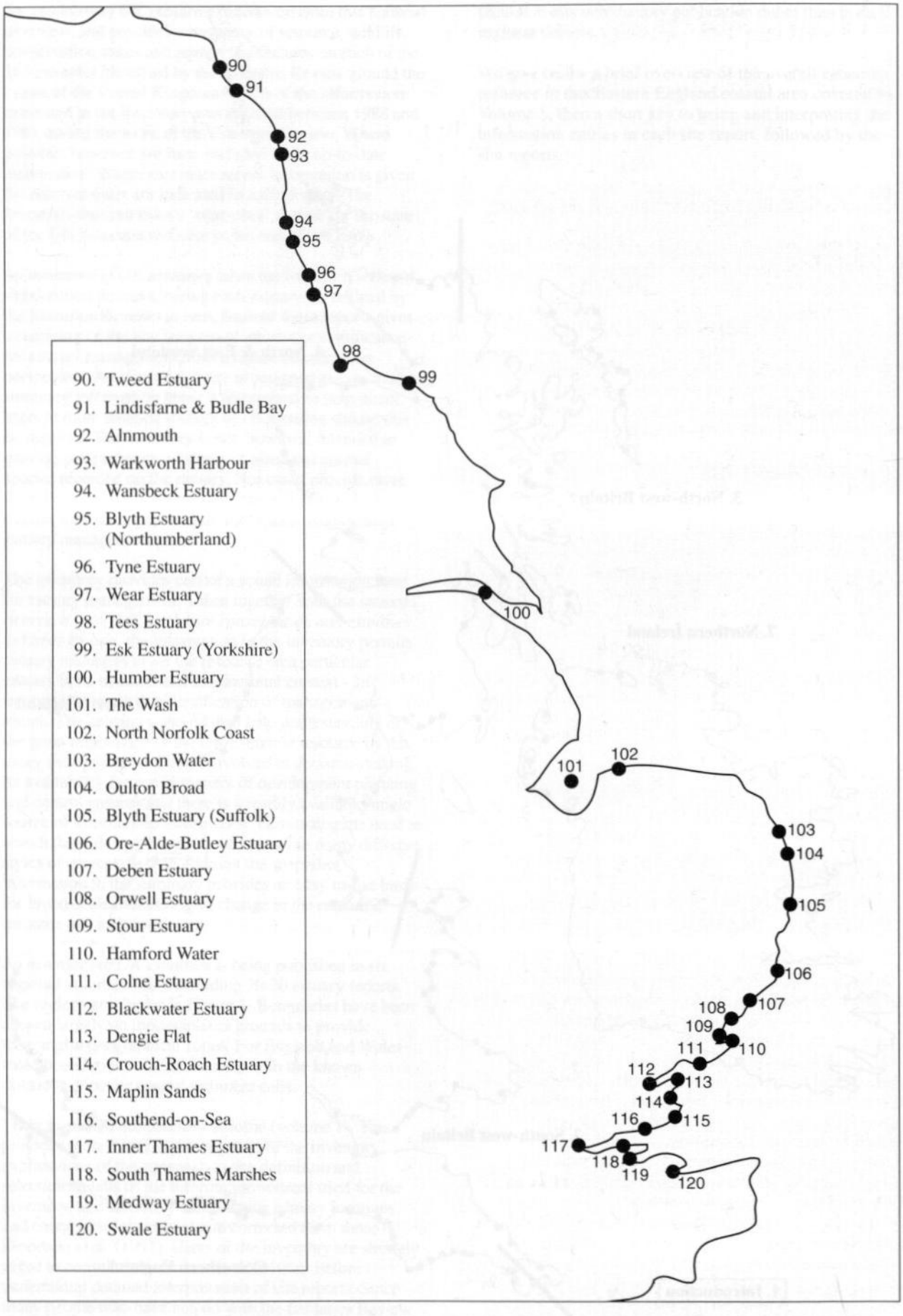

Figure 2 The locations and names of the 31 estuaries covered by Volume 5 of *An inventory of UK estuaries*. See the site map in each regional report for the precise boundaries of the site identified as the core estuary.

3 General features of estuaries in Eastern England

A.L. Buck & N.C. Davidson

Resource distribution and size

This volume covers the 31 estuaries on the eastern coast of England between St Abb's Head in Scotland and Foreness Point on the east coast of Kent. The estuaries within this region fall into three main groups. In the northern part of the region there is a series of generally small river estuaries, some of which have been greatly modified in the past. In the middle of the region there are the three large estuaries of the Humber, the Wash and the adjacent North Norfolk Coast, and in the low-lying and predominantly sedimentary south of the region there is a network of estuaries which together form a considerable area of intertidal flats and saltmarshes. Figure 2 shows the names and locations of the estuaries covered by this volume.

Unlike some other parts of the British coastline, much of the coast in this region was not strongly affected by glaciation and hence there are no estuaries in the region that are of fjord or fjard geomorphology. Most estuaries on the east coast of England are of coastal plain type, with smaller numbers of bar built estuaries. The south of the region contains four linear shore sites, each adjacent to coastal plain or other linear shore sites. The only two barrier beach estuarine systems in Britain occur in this region, at Lindisfarne and the North Norfolk Coast, indicating the abundance of sediment in these areas; and there are two embayments, Hamford Water and the very large area covered by the Wash. There are four estuaries of complex geomorphological origin in the north-east of the region, reflecting the influence of geology, glaciation and incision into hard rock types during periods of sea-level change.

Tidal ranges vary through the region. From the Tweed to the Wash all but two estuaries (Alnmouth and Warkworth Harbour) are macrotidal (i.e. with tidal ranges greater than 4 metres), the largest being at the mouth of the Wash (6.5 m). Alnmouth and Warkworth Harbour are both mesotidal (i.e. with tidal ranges of between 2 and 4 metres), as is the North Norfolk Coast. Breydon Water and Oulton Broad have the two lowest tidal ranges in the region (1.9 m) and are the only microtidal estuaries on the east coast of Britain. Further south into Suffolk and Essex, tidal ranges increase to mesotidal. Southwards from the Colne Estuary the tidal ranges are macrotidal and the largest tidal range in this part of the region is at the mouth of the Inner Thames Estuary (6.5 metres).

The largest estuaries in Eastern England are the Wash (66,654 ha) and the Humber Estuary (30,357 ha) which together account for almost 60% of the total estuarine area of this region. Other large estuaries (over 5,000 ha) are in the south of the region, namely Maplin Sands (11,519 ha), the Medway Estuary (6,441 ha), the North Norfolk Coast (6,292 ha) and the Blackwater Estuary (5,184 ha). In the north of the region the estuaries are generally small, with only Lindisfarne and Budle Bay (3,364 ha) and the Tees Estuary (1,347 ha) exceeding 1,000 ha in size. In the south of the region only two estuaries are smaller than 1,000 ha.

The areas and lengths of key features of each estuary are listed in Table 1 and Table 2 provides a summary of the size of the estuarine resource in the Eastern England region.

Wildlife features

Coastal habitats and aquatic estuarine communities

Estuaries are composed of a mosaic of inter-related subtidal, intertidal and terrestrial habitats, with the relative composition and variety of these habitats depending on a great many physical, chemical and biotic factors. Overall, just over half of the total area of estuarine habitat in this Eastern England region is intertidal, and in most estuaries this is represented chiefly by sandflats and mudflats. The intertidal flats, especially soft mudflats, support important populations of marine worms, molluscs and other invertebrates, often living in high densities and with high biomass. These in turn provide an abundant food supply for estuarine predators, notably fish and migratory waterfowl.

The offshore sediment sources off the Eastern England coast vary in their contribution to the sediment availability. In the north, there are no enclosed bays to provide shelter apart from local small headlands, and strong currents wash away sediments. Further south, there is more offshore sediment available in the form of muddy gravels, sands and clays which, together with abundant alluvial sediments, have been deposited in the sheltered inlets of Norfolk, Suffolk and Essex to form large areas of mudflats and sandflats. Parts of the intertidal flats in some estuaries here are composed of mobile sediments, as some of the fine silt is held in suspension by high current velocities. This characteristic contributes substantially to the geomorphological interest of such estuaries.

The intertidal flats of most eastern England estuaries are composed of mosaics of mud and sand, with soft mudflats more frequent in the sheltered inlets and bays, particularly in the south of the region. In terms of size, tidal flat distribution is dominated by the Wash, which contains over 30% of the tidal flats in Eastern England and is one of the largest area of tidal flats of estuaries in the UK. Between them, the six largest estuaries in the region (Humber Estuary, The Wash, North Norfolk Coast, Blackwater Estuary, Maplin Sands and Medway

Table 1. Areas, shoreline and channel lengths and mean spring tidal range measurements for estuaries in Eastern England.

Estuary	Area (ha)	Intertidal area (ha)	Saltmarsh (ha)	Shoreline (km)	Channel length (km)	Tidal range (m)
90. Tweed Estuary	199	68	0	27.7	9.9	4.1
91. Lindisfarne & Budle Bay	3,364	2,931	218	36.3	8.5	4.2
92. Alnmouth	135	111	24	12.7	4.4	3.3
93. Warkworth Harbour	75	45	15	12.9	5.0	3.3
94. Wansbeck Estuary	102	37	0	12.3	5.8	4.2
95. Blyth Estuary (Northumberland)	168	90	< 0.5	21.5	6.6	4.2
96. Tyne Estuary	792	60	3	83.1	32.7	4.3
97. Wear Estuary	200	29	6	37.5	17.0	4.4
98. Tees Estuary	1,347	471	34	121.4	38.3	4.8
99. Esk Estuary (Yorkshire)	30	9	0	8.5	3.8	4.6
100. Humber Estuary	30,357	13,521	1,419	675.5	144.7	6.0
101. The Wash	66,654	29,770	4,228	359.0	90.2	6.5
102. North Norfolk Coast	6,292	5,874	2,217	70.2	6.0	2.6
103. Breydon Water	1,534	769	< 0.5	317.0	46.8	1.9
104. Oulton Broad	129	30	0	6.8	20.1	1.9
105. Blyth Estuary (Suffolk)	311	235	79*	25.4	10.8	2.1
106. Ore-Alde-Butley Estuary	1,821	1,332	562	73.2	28.0	2.2
107. Deben Estuary	1,007	687	461	49.8	19.7	3.2
108. Orwell Estuary	1,786	576	119	50.7	20.1	3.6
109. Stour Estuary	2,531	1,637	297	48.1	19.6	3.6
110. Hamford Water	2,377	1,570	863	54.0	8.3	3.8
111. Colne Estuary	2,335	2,002	671	89.6	16.2	4.6
112. Blackwater Estuary	5,184	3,315	1,103	107.5	21.2	4.6
113. Dengie Flat	2,986	2,986	405	17.5	0	5.0
114. Crouch-Roach Estuary	2,754	1,536	838†	158.5	29.6	5.0
115. Maplin Sands	11,519	9,443	221†	18.2	0	4.6
116. Southend-on-Sea	2,737	2,528	395	71.7	8.8	5.2
117. Inner Thames Estuary	4,745	1,126	0	232.0	82.5	6.5
118. South Thames Marshes	2,487	2,439	78	30.6	4.7	5.2
119. Medway Estuary	6,441	4,008	754	143.4	40.9	5.1
120. Swale Estuary	3,283	2,696	414	79.3	18.4	4.9

* not covered by Burd (1989). Area calculated from 1991 aerial photographs.
† estimate based on Burd (1989) which surveyed Roach and Maplin Sands as one site.
N.B. Since Burd (1989) there have been substantial reductions in Essex and Kent saltmarshes (see Burd 1992).

Table 2. Total areas and lengths of the regional estuarine resource in Eastern England.

Total area (ha)	Subtidal area (ha)	Intertidal area (ha)	Intertidal flats (ha)	Saltmarsh (ha)	Shoreline (km)	Channel length (km)
165,682	73,751	91,931	76,506	15,425	3,051.9	768.6

Estuary) have over 75% of the total area of tidal flats in Eastern England. This region is of great significance in terms of its tidal flats, for Eastern England contains almost 30% of the total area in Great Britain.

Saltmarshes play a major role in estuarine processes, both through the cycling of nutrients within the estuary and through their role as 'soft' sea defences dissipating wave energy. In this Eastern England region saltmarshes are widespread, occurring on 30 estuaries but on some they form only a very small proportion of the intertidal area. On a small number of estuaries, the area of saltmarsh is smaller than the minimum area (0.5 ha) for inclusion in the Saltmarsh Survey of Great Britain (Burd 1989). During this survey, extensive areas of saltmarsh (> 1,000 ha in total) were recorded in The Wash, North Norfolk Coast, Humber Estuary and the Blackwater Estuary; in the North Norfolk Coast and the Blackwater Estuary these saltmarshes occupied over 30% of the intertidal area of the estuary. In total, fourteen estuaries in the region (Tees and Humber Estuaries, The Wash, North Norfolk Coast, Ore/Alde/Butley, Stour Estuary, Hamford Water, Colne and Blackwater Estuaries, Dengie Flat, Maplin Sands, Southend-on-Sea, Medway and Swale Estuaries) contain nationally important saltmarshes. That is, they support a full and representative sequence of plant communities covering the variation found in Great Britain. The total area of saltmarsh recorded in estuaries in the region (15,425 ha) was over 35% of the British saltmarsh resource. However, saltmarshes in the south of this region are suffering from erosion, mainly as a result of relative sea-level rise and associated changes in the wave climate. Between 1973 and 1988, saltmarshes from the Orwell to the Stour have shown substantial erosion, averaging a 20% loss of the original area (Burd 1992).

The cord-gass *Spartina anglica* is now found in many estuaries in Eastern England, particularly those in Suffolk, Essex and Kent. In Lindisfarne and Budle Bay, the Stour and Swale Estuaries *Spartina* forms more than 25% of the saltmarsh area. *Spartina* is still spreading in many estuaries in southern England, although generally it forms a smaller proportion of saltmarsh area than on the south coast of England. On at least thirteen estuaries in the region *Spartina* was deliberately planted between 1921 and 1951 to encourage shoreline stabilisation. Now attempts to control *Spartina* are occurring on three estuaries and there is a proposal for *Spartina* control on a fourth site in the region.

In many estuaries of the region there has been considerable human interference with saltmarshes. Few saltmarshes in Eastern England show the presence of natural transitions to non-tidal vegetation, such as grasslands. Historically many former areas of saltmarsh, particularly in the south of the region, were enclosed by the erection of earth banks or other sea walls. As a result, the land was flooded less frequently by sea water and used more extensively for grazing; many areas of upper saltmarshes were lost to grazing marsh or subsequently put to other agricultural uses.

The largest areas of coastal grazing marshes and other lowland grasslands in Great Britain occur in this region, particularly in the low-lying counties of Suffolk, Essex and Kent. Many of these marshes were created with the enclosure of saltmarshes, although in many places these are now fragmented through losses to intensified agriculture and urban and industrial developments. Together the remaining marshes form one of the most important areas of this habitat in Britain, particularly notable for their wetland plants and invertebrates and breeding waterfowl.

There are only a small number of extensive sand dune systems on the east coast of Britain, where a high-energy environment and the conditions of prevailing and dominant winds are able to form large accumulations of sand. Seven estuaries in Eastern England have associated sand dune systems, of which two (Holy Island Dunes and Ross Links on Lindisfarne and Budle Bay; and North Norfolk Coast) are of national importance. Overall, eleven estuaries have at least a small area of sand dunes within their habitat mosaic; these are mostly in the north of the region.

There are four substantial shingle structures associated with estuaries in Eastern England, namely Scolt Head/Blakeney Point on the North Norfolk Coast, Orfordness and Shingle Street on the Ore-Alde-Butley site, Landguard Shingle at the mouth of the Orwell and Colne Point at the mouth of the Colne Estuary. There are a number of other shingle structures within or adjacent to estuaries in the region, some with high proportions of shell and some which have become overtopped with sand and support vegetation. Many estuaries in Eastern England have patches of bare intertidal shingle. Altogether shingle is found on sixteen (approximately half) of the estuaries in this region.

Coastal saline lagoons occur adjacent to fourteen estuaries in Eastern England, with concentrations around the Humber and the Greater Thames Estuary. There are a number of naturally-occurring lagoons along the North Norfolk Coast in areas of saltmarsh or claimed grassland, while along the shore of the Humber Estuary there is a series of flooded clay pits behind sea walls. Some of these lagoon-like habitats support a relatively high species diversity including some rare and uncommon species. Along the shores of the South Thames Marshes there is a network of lagoons at Cliffe Marshes and Allhallows Marshes within the grasslands and grazing marshes that were created with the enclosure of former areas of saltmarsh.

The aquatic estuarine benthic communities of many of the estuaries in this Eastern England region have been studied, although at the time of publication data were not available for all sites. However, several sites are known to be of great marine biological and conservation importance. The diversity of both soft substrate and hard substrate communities within this region is generally lower than that of estuaries in Southern and South-west England, with the largest recorded diversity (nine communities) within this region found in Lindisfarne and Budle Bay, the Humber Estuary and The Wash. The diversity of communities within Lindisfarne and Budle Bay, the Wash and the Colne/Blackwater to Maplin Sands area is one of the features of interest that have led to their designation as Sensitive Marine Areas (SMAs). Orfordness is also a

SMA for its physiographic interest and the characteristic flora and fauna that its supports, including several uncommon or rare species.

Plant and animal species

At least ten estuaries in the Eastern England region support Red Data Book (RDB) or nationally rare species of plant. These plant species occur on a variety of estuarine habitats, including saltmarshes, sand dunes and adjacent marshes. The saltmarshes of the North Norfolk Coast support populations of the matted sea lavender *Limonium bellidifolium* and annual sea-purslane *Atriplex pedunculata* grows in the saltmarshes of the Crouch/Roach Estuary. The dune systems associated with Lindisfarne and Budle Bay support populations of the nationally rare endemic dune helleborine *Epipactis dunensis* and the liverwort *Petalophyllum ralfsii*, and the Jersey cudweed *Gnaphalium luteoalbum* grows on the dunes of the North Norfolk Coast. Also of note are the populations of least lettuce *Lactuca saligna* on Southend-on-Sea and South Thames Marshes, whose stronghold in Great Britain is along the Greater Thames. There are additional RDB or nationally rare plant species associated with Warkworth Harbour, the Humber Estuary, The Wash, Breydon Water, the Orwell Estuary and Maplin Sands.

Nationally scarce plants have been recorded on eleven estuaries within the region, with the largest numbers recorded on sites in the south. Many of these species are largely restricted to the grasslands and grazing marshes adjacent to the estuaries. Most of these rare plants are 'continental' species that have a south-eastern distribution in England.

The terrestrial invertebrate faunas of estuaries in Eastern England are relatively well-studied compared with other sites in Britain. Habitats on or adjacent to twelve estuaries in the region have recent records of Red Data Book (RDB) species, with a further five estuaries supporting species classified as Notable. The highest recorded numbers of nationally rare or scarce invertebrates are associated with Breydon Water, Colne Estuary, Southend-on-Sea, Inner Thames, Medway and Swale Estuaries. Of particular interest is the presence of the RDB 1 Essex emerald moth *Thetidia smaragdaria* which occurs on the edges of saltmarshes at a very small number of sites in Essex and north Kent; the RDB 2 Fisher's estuarine moth *Gortyna borelii lunata* which is found at only one site in Britain in Essex; and the RDB 3 scarce pug moth *Eupitheca extensaria* which in Britain is confined to estuarine saltmarshes in the south of the region.

The estuaries of Eastern England support a variety of adult fish species and are spawning and nursery areas for others. The Humber and the Wash, for example, are significant nursery areas of commercially important species such as plaice *Pleuronectes platessa* or cod *Gadus morhua*. With recent improvements in the water quality of many estuaries a number of fish species have returned: for example, after a notable absence, salmon *Salmo salar*, flounder *Platichtys flesus* and smelt *Osmerus eperlanus* have been recorded in the Thames Estuary in recent years. In the northern estuaries of Eastern England there have been recent records of sea lampreys *Petromyzon marinus* in Warkworth Harbour, the Blyth and Tees Estuaries and the lampern *Lampetra fluviatilis* has been recorded in the Blyth. Also of note within the region are the most easterly major nurseries in Britain for sea bass *Dicentrarchus labrax*, in the Blackwater and Medway Estuaries.

A small proportion of the British population of the natterjack toad *Bufo calamita* is present on sand dunes associated with the Humber Estuary, The Wash and the North Norfolk Coast. Each site supports only a relatively small population in comparison to sites in North-west England, which is the major stronghold for this species in Britain. Both populations on the Wash and North Norfolk coast are the result of reintroductions.

Many estuaries in the UK are of great importance to migratory and wintering waterfowl (waders and wildfowl), and the habitat mosaics of estuaries in this part of Eastern England provide feeding and roosting sites for major parts of the populations of many waterfowl species. Many of these birds, which come from a vast area of arctic and boreal breeding grounds between Canada and Siberia, are wholly or largely dependent on estuaries during their non-breeding period. The estuaries of the Humber and the Wash support extremely large waterfowl populations and the network of estuaries in Essex and Kent support considerable numbers of wintering waterfowl. Apart from Lindisfarne and Budle Bay, the estuaries along the northern shores of the region generally support smaller total numbers of waterfowl. Overall, the estuaries of Eastern England hold over 693,000 waterfowl in midwinter (January), around 40% of the British estuarine population in that month and 4% of the relevant European populations (Davidson *et al.* 1991). Consequently the estuaries of Eastern England are of outstanding importance in international terms for migratory waterfowl, particularly waders. The relatively mild winter weather on these estuaries compared to continental Europe can be of additional importance to the survival of wintering waterfowl during periods of severe weather. At such times waterfowl move west to escape freezing weather in continental Europe.

Since migratory waterfowl depend on a network of estuaries during their year, many birds move between estuaries, even during the winter period, so that the total number of individuals using a site is considerably higher than those present at any one time. Average peak winter counts of waterfowl suggest that at least 1,272,000 birds may be using the estuaries covered by this volume during the winter period, and as the bird populations of some sites in the northern parts of this region have not been counted regularly, this figure can be considered an underestimate.

Eighteen of the estuaries in Eastern England are of international importance by supporting over 1% of the flyway population of at least one waterfowl species or by supporting over 20,000 waterfowl during winter. Numbers of wintering waterfowl exceed 80,000 on four of these estuaries (Humber Estuary, The Wash, North Norfolk Coast and Maplin Sands). A further five estuarine sites in Eastern England (Tweed, Tees, Blyth (Suffolk), Orwell and the South Thames Marshes) support nationally important populations of waterfowl,

making this one of the most important parts of the British coastline for wintering waterfowl.

There is over 1% of the flyway population of at least 23 species of waterfowl on some of the estuaries in Eastern England. These species are: Bewick's swan *Cygnus columbianus bewickii*, pink-footed goose *Anser brachyrhynchus*, greylag goose *A. anser*, dark-bellied brent goose *Branta bernicla bernicla*, light-bellied brent goose *Branta bernicla hrota* (Svalbard population), shelduck *Tadorna tadorna*, wigeon *Anas penelope*, teal *A. crecca*, pintail *A. strepera*, shoveler *A. clypeata*, oystercatcher *Haematopus ostralegus*, avocet *Recurvirostra avosetta*, ringed plover *Charadrius hiaticula*, golden plover *Pluvialis apricaria*, grey plover *P. squatorola*, lapwing *Vanellus vanellus*, knot *Calidris canutus*, dunlin *C. alpina*, black-tailed godwit *Limosa limosa*, bar-tailed godwit *L. lapponica*, curlew *Numenius arquata*, redshank *Tringa totanus* and turnstone *Arenaria interpres*. Of particular significance is the Svalbard population of the light-bellied brent goose. Lindisfarne is the only British wintering site for this small population, and in some years (depending on weather severity on its other wintering grounds in Denmark) much of the world population occurs here.

The estuaries of Eastern England are of particular importance to certain other species. The Wash and North Norfolk Coast and the estuaries of Essex and Kent are major wintering areas for dark-bellied brent goose. The region also supports a large proportion of avocet wintering in Britain and large concentrations of dunlins and knots in particular winter on the Wash, the Humber, and Suffolk, Essex and north Kent Estuaries. The Suffolk and Essex Estuaries are a major wintering area for black-tailed godwit. In addition, the Wash and the Essex Estuaries are a stronghold in Britain for wintering twite *Carduelis flavirostris*.

Outside the wintering period, many estuaries throughout the Eastern England region have additional importance as staging and moulting areas in autumn and spring for their migratory waterfowl populations. During these periods birds pass through rapidly so that many more individuals depend on these estuaries than are present at any one time. Most estuaries are used as spring staging sites, but those in the southern part of the region, including the Wash, the Humber Estuary and the Essex estuaries, are known to be of particular importance (Davidson *et al.* 1991).

The saltmarshes, shingle banks and coastal grazing marshes around estuaries also support breeding populations of waders (chiefly redshank, oystercatcher, lapwing and ringed plover *Charadrius hiaticula*). The estuaries of Eastern England consistently support some of the most diverse assemblages of breeding birds in Britain, particularly the Wash, the North Norfolk Coast and the estuaries of Suffolk, Essex and Kent. The saltmarshes, grasslands and marshes associated with these estuaries support large numbers of breeding waders, including internationally important breeding populations of ringed plover. The coast between the Wash and North Kent is also the only part of the British coastline where avocets breed; most avocet breeding localities are associated with estuaries in the Eastern England region.

Groups of grey seals *Halichoerus gryphus* regularly use several estuaries within the region, feeding or hauling-out in the Tweed and Tees Estuaries and breeding at Donna Nook on the Humber Estuary. Common seals *Phoca vitulina* are the more common species in the Eastern England region. Together, the Wash and North Norfolk Coast support one of the largest breeding colonies of common seal in Europe and small numbers are known to breed on Lindisfarne and Budle Bay, the Humber Estuary and Dengie Flat. Small groups of common seals also use the Tweed and Tees Estuaries. Otters *Lutra lutra* are not common on estuaries in Eastern England but have been recorded on seven estuaries in the region. In the north they are known to occur on the Tweed Estuary and on Lindisfarne and Budle Bay, whereas in the south they are found on the Humber Estuary, the Wash, North Norfolk Coast, Breydon Water and the Blyth Estuary in Suffolk. South of the Blyth there are no recently confirmed records of otters on estuaries.

Conservation status

The important and diverse wildlife and landscape features of much of the UK estuarine resource has been recognised by many parts of estuaries and their surroundings being designated under a variety of local, national and international measures, both statutory and non-statutory. The estuaries of Eastern England are typical of this pattern in which there are often many overlapping site designations covering parts of an estuary. In addition to this site-based approach through which much of estuarine conservation has traditionally been delivered, many of the estuaries covered in this report are included in a variety of coastal zone planning and management initiatives.

Sites of Special Scientific Interest (SSSIs), the major statutory designations for the delivery of site-based wildlife conservation, cover many parts of the intertidal and associated terrestrial areas of Eastern England. At least one SSSI is associated with all 31 of the estuaries covered by this volume, although SSSIs, like most other designations, often cover only parts of each estuary. On some estuaries, such as the Tyne, Wear and Esk Estuaries, Oulton Broad and the Inner Thames Estuary, SSSIs cover little of the core estuary area. This was also true of many of the estuaries in the south of the region until the recent notification of extensive areas as SSSIs.

In all there are 86 SSSIs on estuaries in this region, around 24% of estuarine SSSIs in Great Britain. Breydon Water currently has the largest number of SSSIs (eleven) associated with estuaries in this area, all designated for their biological interest, followed by the Humber Estuary with ten SSSIs. The typical pattern of many estuaries is a mixture of small SSSIs notified for their geological and geomorphological features and a few larger sites of biological or mixed interest covering tidal flats, saltmarshes and associated terrestrial habitats. SSSIs associated with estuaries in this region cover a total of 164,046 ha (almost 40% of the British estuarine SSSI area), with by far the largest areas of SSSI being on The Wash, the Humber Estuary and Maplin Sands.

Twenty of the 80 declared coastal National Nature Reserves (NNRs) in Britain are on the intertidal or terrestrial habitats of the estuaries covered by this volume. These include several areas of intertidal flats or saltmarshes, e.g. The Wash, Dengie Flat, Teesmouth (Tees Estuary) and Hamford Water. Others include the extensive dunes of Saltfleetby-Theddlethorpe (Humber Estuary), Lindisfarne, Holkham and Holme Dunes (North Norfolk Coast) and the grazing marshes adjacent to the Colne, Blackwater and the Swale Estuaries.

Local Nature Reserves are statutory designations made by local authorities (in consultation with country conservation agencies) with objectives similar to those of NNRs but in the local interest of the site and its wildlife. Of the 100 designated LNRs on the coast of Great Britain, twelve lie within or adjacent to the estuaries of Eastern England. The Inner Thames Estuary has four LNRs (Ham Lands, Duke's Hollow, Chiswick Eyot and Leg of Mutton Reservoir) and the Swale Estuary two (South Swale, Oare Marshes and Oare Meadow). Six other estuaries in the south of the region have a single LNR associated with them (Breydon Water, Orwell and Stour Estuaries, Maplin Sands, Southend-on-Sea and Medway Estuary). At present there are no LNRs on estuaries in the north of Eastern England, but there is a proposal for a LNR on the Tees Estuary.

Two international designations are particularly relevant to estuarine habitats and their birds. The Ramsar Convention designates wetlands of international importance especially as waterfowl habitat (Ramsar sites) and Special Protection Areas (SPAs) are designated under the EC Directive on the conservation of wild birds. For estuarine waterfowl populations both designations often apply. There are 24 designated Ramsar sites covering parts of twenty estuaries in Eastern England, including four sites on the Wash, two on parts of Breydon Water and two on the Blackwater Estuary. The Stour-Orwell site covers parts of two estuaries, for single Ramsar sites (and SPAs) can include more than one estuary, since site boundaries are set to cover areas linked by known movements of bird populations. All of the Ramsar sites in this Eastern England region have also been designated as SPAs. Together with the Orfordness-Havergate SPA on the Ore-Alde-Butley Estuary, there are a total of 25 SPAs in Eastern England, covering parts of twenty estuaries. There are proposals for Ramsar and/or SPA sites which would include parts of the Tweed Estuary, Alnmouth, Warkworth Harbour, Wansbeck, Blyth, Tyne and Inner Thames Estuaries and South Thames Marshes.

Special Areas of Conservation (SACs) are a new designation under the EU Directive on the conservation of natural habitats and of wild flora and fauna (the 'Habitats Directive'). Under this Directive, sites may be designated as SACs for the habitats or species they support that are considered to be under threat. In total twelve estuaries or parts of these estuaries lie within proposed SACs. The outer parts of the Tweed Estuary and Lindisfarne and Budle Bay are within the marine Berwickshire and North Northumberland Shore proposed SAC (pSAC); the dunes of Lindisfarne are within the North Northumberland Dunes pSAC; the intertidal flats, saltmarshes and dunes of the Wash and North Norfolk Coast form the North Norfolk Coast and Gibraltar Point Dunes pSAC and The Wash and North Norfolk Coast pSAC; and the Ouse Washes adjacent to the upper tidal reaches of the Wash are proposed as a SAC for their species interest. The upper reaches of Breydon Water and parts of Oulton Broad lie within The Broads pSAC, and the Orfordness-Shingle Street pSAC that is proposed for its shingle vegetation and lagoonal interest overlaps with the Ore-Alde-Butley Estuary. The estuaries, intertidal flats and saltmarshes of the Colne and Blackwater Estuaries, Dengie Flat, the Crouch-Roach Estuary and Maplin Sands form the estuarine, intertidal flat and saltmarsh interest of the Essex Estuaries proposed SAC.

There are several landscape conservation designations that partly cover estuaries in Eastern England. The upper reaches of the Esk Estuary lies within the North York Moors National Park and the Norfolk Broad National Park covers parts of Breydon Water. There are five Heritage Coasts (HC) in the region, associated with ten estuaries: parts of the Tweed Estuary, Lindisfarne and Budle Bay, Alnmouth and Warkworth Harbour lie within the North Northumberland HC; the Esk Estuary is within the North Yorkshire and Cleveland HC; Spurn Point on the Humber Estuary and North Norfolk are Heritage Coasts; and the Blyth (Suffolk), Ore-Alde-Butley and Deben Estuaries form part of the Suffolk HC. All or part of eleven estuaries in the region lie within three Areas of Outstanding Natural Beauty (AONB): the Tweed Estuary, Lindisfarne and Budle Bay, Alnmouth and Warkworth Harbour are within the Northumberland Coast AONB; The Wash and North Norfolk Coast are within the Norfolk Coast AONB; and parts of the Blyth (Suffolk), Ore-Alde-Butley, Deben, Orwell and Stour Estuaries lie within the Suffolk Coast and Heaths AONB.

The Eastern England region holds a high proportion of the number of estuaries associated with Environmentally Sensitive Areas (ESAs). The Norfolk Broads ESA encompasses much of the grazing marshes surrounding Breydon Water and Oulton Broad, and the Suffolk River Valleys ESA overlaps the upper parts of the Blyth, Ore/Alde/Butley, Deben, Orwell and Stour Estuaries. The Essex Coast is one of the most recently designated ESAs and encompasses the coastal grazing marshes adjacent to Hamford Water, the Colne and Blackwater Estuaries, Crouch-Roach, Maplin Sands and Southend-on-Sea Estuaries. The North Kent ESA adjacent to the South Thames Marshes, Medway and Swale Estuaries encompasses coastal grazing marshes and their freshwater and brackish ditches.

Other wildlife conservation sites include 58 County Wildlife Trust reserves on 24 of the estuaries in this region, ranging from one reserve on several sites to nine County Wildlife Trust reserves on the Humber Estuary. There are RSPB reserves on or adjacent to nine estuaries in Eastern England, and there are Wildfowl and Wetlands Trust reserves at Washington adjacent to the Wear Estuary and the Ouse Washes at Welney, adjacent to the upper tidal reaches of the Wash.

There are Country Parks adjacent to nine estuaries in Eastern England and there are National Trust properties on seven estuaries; this includes eight separate National

Trust areas on the North Norfolk Coast. A small number of other reserves are also present on estuaries in the region, ranging from Ministry of Defence land to private reserves.

Ten estuaries within the region fall within the non-statutory Sensitive Marine Areas (SMAs): Lindisfarne and Budle Bay and Alnmouth are within the Holy Island and the Farnes SMA; the Wash and North Norfolk together form a SMA; Orfordness on the Ore-Alde-Butley is a SMA and the Colne and Blackwater Estuaries, Dengie Flat, Crouch-Roach, Maplin Sands and Southend-on-Sea form the Colne/Blackwater to Maplin Sands SMA.

Features of human use

The coastline of Eastern England varies from areas that are largely natural and little affected by damaging human activities, to estuaries that are dominated by large conurbations. London on the Thames Estuary supports the largest conurbation in Britain and this has had a significant effect on the estuary. The Humber supports the second largest population in the region of over half a million people, closely followed by the Tyne Estuary which flows past the city of Newcastle. Other estuaries supporting an adjacent population of more than 100,000 are the Wear Estuary, the Wash, the Orwell and Colne Estuaries, Southend-on-Sea on the outskirts of the Thames and the Medway Estuary. In other localities in the region rather few people live close to the estuaries. Lindisfarne and Budle Bay and Alnmouth in the north, the North Norfolk Coast, and the Blyth (Suffolk), Ore-Alde-Butley, Hamford Water, Dengie Flat and Maplin Sands support fewer than 5,000 people. Hence the estuarine resource in Eastern England is a mixture of estuaries that have been subjected to the major urban and industrial pressures, together with remote sites, largely unaffected by such influences.

Most estuaries in Eastern England have been subjected to some form of sea defence measures such as embankments or construction of sea walls. However, the extent to which the shoreline is defended varies considerably between sites in the north and those in the south. This is due, in part, to land areas rising or sinking relative to sea level (isostatic rebound after the last ice age). North of the Humber Estuary, the land is rising relative to sea level, with reduced potential for flooding; this lessens the need for sea defences. However, in the low-lying south of the region, the relative sea-level is rising, causing greater risk of flooding and erosion. From the Humber southwards, all but two estuaries have linear defences along more than 50% of their shoreline; for most of these estuaries this occurs over more than 80% of their shoreline. The loss of substantial areas of saltmarshes in Essex and Suffolk to erosion has stimulated some new approaches to sea defences. In some locations, this has involved managed retreat, where defences are set further back and tidal waters are allowed to flood pastures, that subsequently revert to intertidal land. This has been carried out at sites in the Blackwater Estuary and on the Dengie peninsula. Since the 1940s the lack of maintenance of the sea walls along the Blyth Estuary has allowed the incursion of sea water onto claimed agricultural land, where it has reverted to tidal mudflats. In Hamford Water and the Blackwater Estuary sea walls are also being breached in areas, allowing marshes to revert to intertidal land.

Considerable areas of The Wash have been lost to land-claim since Roman times, largely resulting from successive enclosure of areas of saltmarsh; over 3,500 ha of the intertidal area of the Wash has been lost in this century alone. The estuaries in Suffolk have also suffered extensive land-claim since the 12th Century, largely for agriculture (Beardall *et al.* 1988). These have been particularly extensive on the Blyth (Suffolk), Deben and the Orwell Estuaries, each of which is estimated to have lost over 60% of its intertidal area. Holland Haven, a former estuary that discharged into the sea between Hamford Water and the Colne Estuary, was wholly land-claimed for agriculture between the late 17th Century and early 18th Century.

In many areas in the south of this region, historical land-claim of saltmarshes for agricultural use created areas of lowland wet grasslands or coastal grazing marshes adjacent to a number of estuaries. Many of these coastal grazing marshes developed considerable wildlife interest, particularly their ditch flora and fauna. However, in this century many areas of these marshes have been subject to secondary land-claim, largely by agricultural intensification or, in the case of the Greater Thames Estuary, by urbanisation. Since the 1930s 70% of the grazing marsh in the Greater Thames Estuary area has been lost in this way (Davidson *et al.* 1991).

There are a number of places in the region where intensive human use occurs and where there has been substantial loss and damage to the estuarine resource. The Tees Estuary has been almost completely land-claimed for port and industrial development, losing over 85% of its intertidal area since the early 18th Century (Davidson *et al.* 1991). More recent examples of land-claim for industrial purposes in the region have occurred in the Orwell (around Ipswich and Felixstowe), the Stour Estuary (Bathside Bay, Harwich) and the Medway Estuary (Lappel Bank).

Heavy industrial activities have developed on a number of estuaries on the east coast of England. In the north there is an aluminium works, a power station and wind farm on the Blyth Estuary; the Tyne Estuary is dominated by large-scale industry that includes oil rig and platform construction yards, oil refineries and jetties; the Wear is the site of a metal industry and the Tees Estuary is dominated by industrial developments particularly chemical, petrochemical and steel works, and oil rig and platform construction yards. The Humber Estuary is a major base for industry with many chemical works, oil refinery complexes and several power stations. In the south of the region there are oil refineries and a chemical industry on Southend-on-Sea and there are engineering, manufacturing and chemical industries and power stations on the Inner Thames Estuary. Few other estuaries in the region are dominated by industry to the same extent, although several have industrial developments on them.

There are large docks or ports sited on many estuaries in the region: the Tyne, Wear and Tees Estuaries have

major dock complexes; the port of Harwich is on the Stour; the large container ports of Felixstowe and Ipswich are on the Orwell Estuary; there are major dock systems on the Medway Estuary and the Humber has the largest shipping complex in the UK. Most other estuaries in Eastern England have some port or harbour facilities.

Despite the intensive urban and industrial developments in some locations, parts of the coastline of Eastern England remain largely undeveloped and are popular spots for tourism and recreation. A wide variety of leisure pursuits, from general beach use and bathing to water-based recreation, take place on parts of these estuaries, especially during the summer months. In the far north of the region from the Tweed to the Wansbeck Estuaries, leisure and recreational pursuits are the dominant uses of the estuaries. In the south of the region, particularly on those estuaries that are easily accessible and close to large population centres, recreation is also a major use. There are concentrations of marinas and moorings in many estuaries in Suffolk, Essex and Kent and these areas are intensively used for water sports. On some sites these activities can be detrimental to the habitats and wildlife of the estuary.

Alongside recreation there are a variety of traditional land uses which exploit the natural plant and animal resources of these east coast estuaries. Stock grazing of saltmarshes, especially by sheep, is widespread, and there is some grazing of stable sand dunes adjacent to estuaries in the north of the region. Other resource use includes bait digging and wildfowling, which are widespread on estuaries in Eastern England, commercial fishing, and shellfisheries which are present in the south of the region.

As in other areas, attention has focused on the possibilities of creating barrages across the mouths of some estuaries. In 1989 potential for a tidal power generation had been identified on the Humber Estuary, and there was a proposal for a leisure barrage on the Tees Estuary. Since that time the barrage on the Tees Estuary has been built, effectively excluding the tide from the uppermost reaches of the estuary (approximately 20 kms). Although this did not incur major land-claim of intertidal areas, the barrage has effectively shortened the tidal length of the Tees by around one third. Active investigations on the effects of this barrage on the lower reaches of the estuary are ensuing.

Whilst this is only a brief overview of some of the key features of the estuaries of Eastern England and their human uses, it is clear that this network of estuaries is both of great interest and value for wildlife and has a wide variety of human uses. Despite some areas of considerable degradation and past land-claim, and some proposals that would further alter the ecosystem processes on important parts of the resource, most estuaries in this part of Britain have been subject to largely sustainable human exploitation. There is great opportunity therefore for all those involved in using and managing these estuaries to collaborate, through such approaches as integrated coastal zone management. Such future management can ensure that this wild and beautiful part of Britain's estuarine heritage continues to be used in sustainable ways that allow for the retention of its varied wildlife.

4 Using the inventory

A.L. Buck

This section provides some brief descriptions and keys to interpreting the presentations of information in the site reports. Full descriptions of the methodology, information sources and presentations are given in Volume 1 (Introduction) of the inventory.

The rationale for site definition and selection follows that developed by Davidson *et al.* (1991). It should be noted that some of the information collated by Davidson *et al.* (1991) has been updated and corrected in some instances, and that the core estuary sites as presented in the inventory now include some adjacent intertidal areas treated separately in the Estuaries Review (also see below).

A short key to the inventory

Inventory sites are numbered and presented in clockwise sequence from Land's End. Note, however, that the numbering of estuaries in Northern Ireland follows on from those in Great Britain. Where data was collected or measured from sources other than the Estuaries Review or Coastal Review Unit, these sources are identified below. Information refers to the period 1988-1990 unless otherwise stated.

Site map

Sites were selected for inclusion in the Estuaries Review and inventory using a definition of an estuary based on that developed by NERC (1975): a partially enclosed area at least partly composed of soft tidal shores, open to saline water from the sea, and receiving fresh water from rivers, land run-off or seepage.

For the inventory only sites with a tidal channel longer than 2 km or sites with a shore width of over 0.5 km at low water along a shoreline greater than 2 km are included. The upstream limit is normally taken as the Normal Tidal Limit (NTL), the upper shoreline limit is an interpreted high water mark approximating to the highest astronomical tides (EHWS), and seaward limits are set as either a 'bay closing line' or 'across mouth' (XM) or an 'along shore' (AS) set by the low water mark. On sites that are not isolated from their neighbours, an arbitrary boundary 'between adjacent estuaries' (BAE) has been set, usually at the mid-point of the shore between the sites, or where the intertidal zone is at its narrowest. Note that the low water mark is that shown on 1:50,000 O.S. maps - mean low water in England and Wales, low water spring tides in Scotland.

The approach used for the Estuaries Review and inventory has been to locate a 'core site' of intertidal and subtidal habitats. The core site boundary is shown on the site map. For a few estuaries we have, in addition, defined adjacent areas of 'associated intertidal' habitat where this is outside the inventory estuary mouth but has a functional link to the estuary, for example where the area forms part of an estuarine structure when considered at larger scale, or where there are links through area use by mobile wildlife.

It is difficult to define standard geographical zones for the inclusion of terrestrial habitats associated with estuaries. For this reason we have followed the Estuaries Review in collating information for an 'associated terrestrial' zone that varies in extent between sites, but which includes functional units of maritime-influenced wildlife habitat and areas of human use that closely affect the core estuary.

Estuary size characteristics and description

Measurements of *total area* and *intertidal area* have been rounded to the nearest 1 ha.

Shore length and *channel length* measurements have been rounded to the nearest 0.1 km.

Tidal ranges have been derived from High and Low Water for Mean Spring Tides for the site closest to the defined estuary mouth, from Hewitt & Lees-Spalding (1988).

Human population gives numbers of people living in towns reaching within 1 km of the tidal shore, from the results of the 1981 population census. Population figures greater than 5,000 have been rounded off to the nearest 1,000.

Water quality descriptions are from the DoE River Quality in England and Wales Survey 1991, (National Rivers Authority 1991) and the Water Quality Survey of Scotland 1985 (Scottish Development Department 1987).

Wildlife features

All *coastal habitat* areas are rounded to the nearest 1 ha. Areas for sandflats and mudflats were not measured separately, and are given as a combined figure. Saltmarsh areas are derived from NCC's *Saltmarsh survey of Great Britain* (Burd 1989) unless stated otherwise.

Aquatic estuarine communities. The classification of aquatic estuarine communities - subtidal and intertidal marine communities of substrates not vegetated by higher plants - was prepared by the Estuaries Review using methodology developed by the Marine Nature Conservation Review (MNCR). The Estuaries Review classification was prepared before completion of all relevant survey work by MNCR so this classification should be treated as preliminary. It is being developed further by MNCR. Information on the presence of these benthic communities (rather than the substrates on which they occur) was not available during the review for all sites, although further work is in progress. The benthic plant and animal communities are divided into two broad categories: those on soft substrates and those on hard substrates, and are further divided into communities describable largely on their physico-chemical characteristics. Some of the communities occur on both the intertidal and subtidal parts of estuaries. Communities are as follows:

Soft substrates

1. Gravel/shell gravel community
2. Maerl beds
3. Exposed sand community
4. Clean sand community
5. Common mussel beds
6. Horse mussel beds
7. European oyster beds
8. Surface algal community
9. Current-swept sand community
10. Sand/muddy sand community
11. Muddy gravel community
12. Muddy 'offshore' sand community
13. Normal/variable salinity muddy community
14. *Zostera* and *Ruppia* beds
15. Variable/reduced salinity mud community
16. Reduced salinity mud community

Hard substrates

17. Exposed rocky shore community
18. Moderately exposed rocky shore community
19. Sheltered rocky shore community
20. Variable salinity rocky shore community
21. Reduced (variable) salinity rocky shore community
22. Reduced salinity rocky shore community
23. *Sabellaria* reef community
24. Current-exposed sheltered rocky shore community
25. Exposed rock community
26. Sheltered rock community
27. Hydrozoan/bryozoan turf community
28. Slipper limpet beds
29. Artificial substrata community
30. Variable salinity rock community
31. Variable salinity clay community
32. Reduced (variable) salinity rock community
33. Reduced salinity rock community

Birds. Major sources of information on wintering waders and wildfowl are the Wetland Birds Survey (WeBS) counts organised and funded by the British Trust for Ornithology, the Wildfowl and Wetlands Trust, the Royal Society for the Protection of Birds and the Joint Nature Conservation Committee. Information in the inventory is calculated from five year peak monthly counts for waterfowl for the winters 1989/90 - 1993/94. The proportions of international and national populations of individual species are shown where these are of national or international importance (≥1% of the relevant population except where this value is <50 birds).

Information for some estuaries or parts of estuaries not regularly covered by the BoEE is included from the BTO/WSG Winter Shorebird Count from midwinter 1984/85. Breeding bird data comes from the JNCC/ Seabird Group's Seabird Colony Register and a variety of other national, regional and local surveys (see Volume 1 for details).

Additional wildlife features. Information presented here includes: nationally rare plants i.e. those found in fifteen or fewer 10 km squares in Great Britain (from the Rare Plants Database); Red Data Book (RDB) terrestrial invertebrates (from JNCC's Invertebrate Site Register - ISR); and a variety of other recorded features of conservation interest, for example rare fish, amphibians, reptiles and mammals. Note that 'recently recorded' species of terrestrial invertebrate have been recorded since 1970.

Conservation status

The presence of both statutory and non-statutory wildlife and landscape conservation sites is shown. Known proposals for Sites of Special Scientific Interest, National Nature Reserves, Local Nature Reserves, 'Ramsar' sites, Special Protection Areas and Special Areas of Conservation are also indicated.

Abbreviations to the designations are as follows:

NCR	Nature Conservation Review site
GCR	Geological Conservation Review site
SSSI (B)	Site of Special Scientific Interest (biological)
SSSI (G)	Site of Special Scientific Interest (geological and/or geomorphological)
SSSI (M)	Site of Special Scientific Interest (mixed biological and geological/geomorphological)
NNR	National Nature Reserve
LNR	Local Nature Reserve
Ramsar	Wetland of International Importance (Ramsar Convention)
SPA	Special Protection Area (EC Directive on the conservation of wild birds)
SAC	Special Area of Conservation (Habitats Directive)
AONB	Area of Outstanding Natural Beauty (Countryside Commission)
CWT	County Wildlife Trust reserve
RSPB	Royal Society for the Protection of Birds reserve
ESA	Environmentally Sensitive Area (MAFF)
NP	National Park (England and Wales only)
WWT	Wildfowl and Wetlands Trust centre/reserve
NT	National Trust land
NSA	National Scenic Area (Scotland only)
HC	Heritage Coast (Countryside Commission)
Other	Marine Nature Reserves, Areas of Special Protection, Country Parks etc.

Human use

Features of human use data were collected and collated largely between 1989 and 1993 (from a wide variety of sources chiefly through members of NCC's regional staff with responsibility for conservation management for each estuary). Activities listed as 'Present' and/or 'Proposed' indicate that status only during that period. Proposals include both those developments subject to consent applications and those subject to less formal public discussion and/or investigation. When more recent information is available, changes since 1989 in present activities or the status of proposals are noted in the text, as are major proposals that have arisen since 1989.

Categories of human use. The bar chart shows, for each broad use category, the percentage of activity types in that category listed as 'Present'. For a fuller explanation of this analysis see the introductory volume of the Inventory.

Further reading

Further reading lists selected references containing further information on the estuary and its wildlife. Note that not all this further reading refers to detailed scientific studies: some sources are general or are historical descriptions of life on these estuaries or are even part of the extensive fictional literature that describes estuaries.

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5 The estuaries

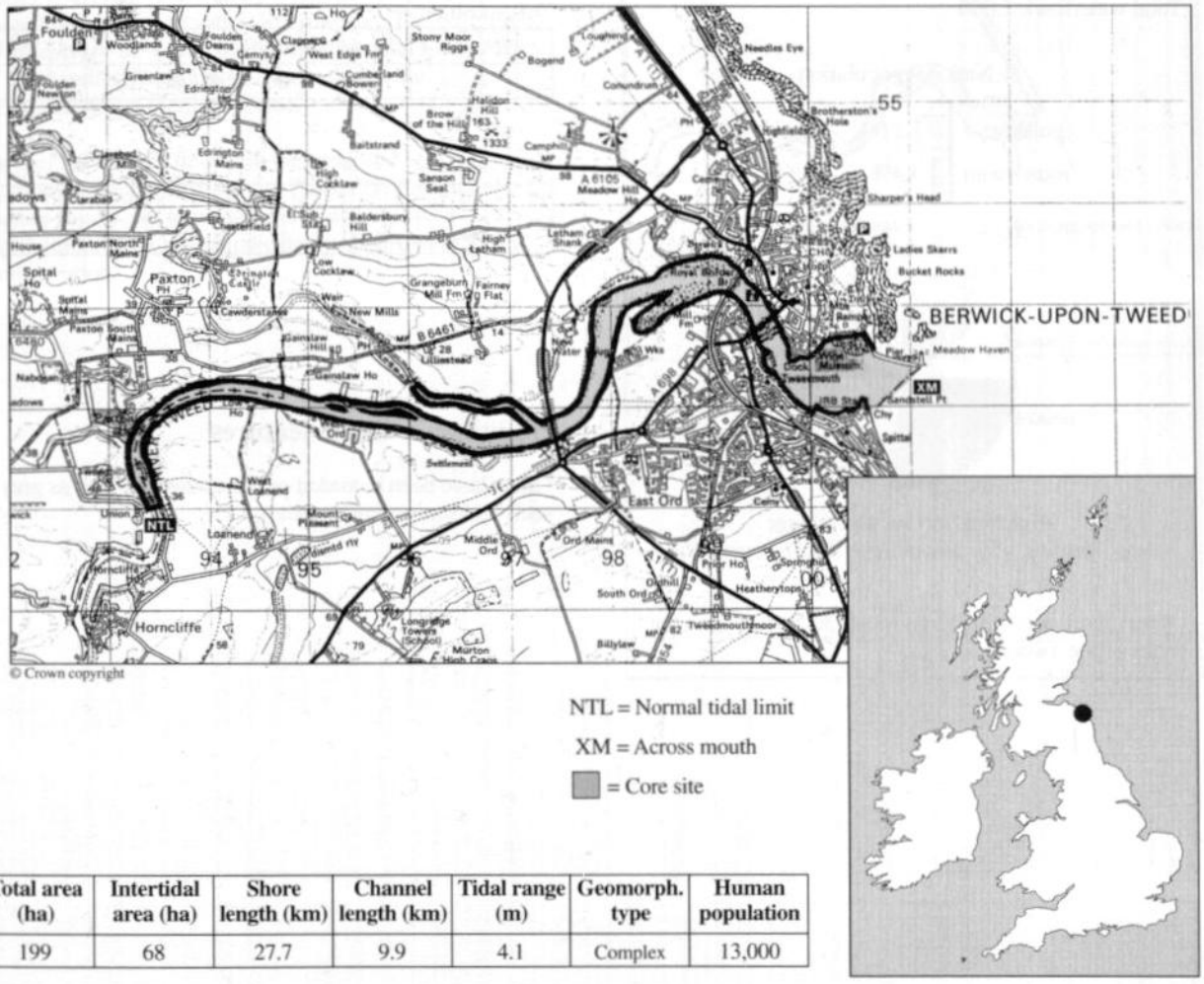
A.L. Buck

Many estuaries in south-east England have long lengths of sea defences. Due to sea level rising relative to the land, some sea defences are being breached or failing altogether, such as here on the Blackwater Estuary. (Peter Wakely, English Nature.)

90 Tweed Estuary

Centre grid: NT9853
Counties: Northumberland, Borders
Districts: Berwick-upon-Tweed, Berwickshire
SNH region: South-east Scotland
EN region: Northumbria

Review site location



NTL = Normal tidal limit
XM = Across mouth
= Core site

Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
199	68	27.7	9.9	4.1	Complex	13,000

Description

The upper reaches of the Tweed Estuary straddle the border between Scotland and England. This narrow estuary is predominantly subtidal, with only small fringes of intertidal flats exposed at low tide. In its middle reaches there are more extensive intertidal flats predominantly composed of mud and shingle, but close to the estuary mouth they become sandy. There is also a stretch of rocky shore at Berwick-on-Tweed. Water quality within the estuary has been classified as grade A.

At Yarrow Slake west of Tweedmouth there is a small, sheltered flat of mud and shingle, with some saltmarsh vegetation and good growths of the tasselweed *Enteromorpha*. This is an important feeding area for birds. The Tweed Estuary regularly supports nationally important populations of two species of wintering waterfowl: goldeneye and mute swan, whose numbers reach a peak in late summer/early autumn.

Wildlife features

Coastal habitats

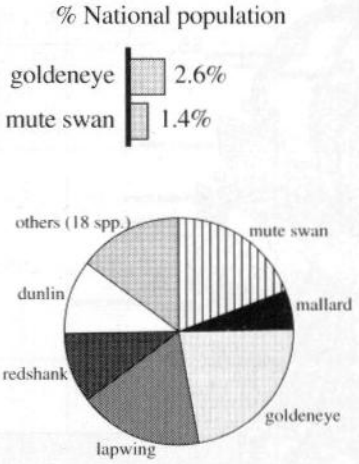
	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	◉	●	●		●				
Area (ha)	131	68								

● = major habitat ◉ = minor habitat

Birds

Wintering birds 1989/90 – 1993/94 data

Total waterfowl: 2,080



Wintering species assemblage
(Spp. forming >5% assemblage shown separately)

Other: there is a large heron roost (30-50 birds) on the banks of the Tweed.

Aquatic estuarine communities

Soft substrate

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
							●		●	●				●	

Hard substrate

17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
		●										●				

Additional wildlife features

Otters have been recorded on the estuary, as well as grey seals and some common seals.

Conservation status

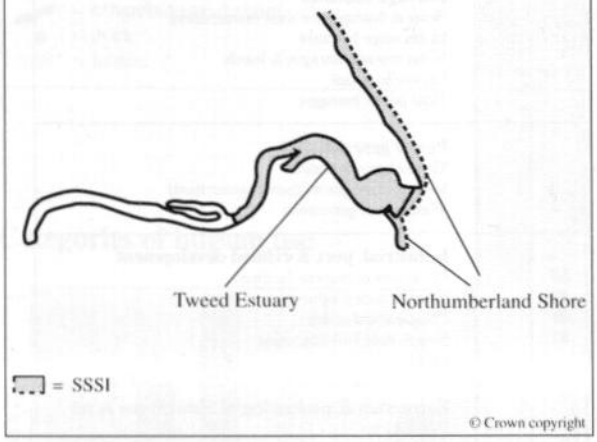
● = designated ● = proposed

	NCR	GCR	SSSI (B)	SSSI (G)	SSSI (M)	NNR	LNR	Ramsar	SPA	SAC	AONB	CWT	RSPB	ESA	NP	WWT	NT	NSA	HC	Other
	●		●						●	●	●								●	
No.	1		2						1	1	1								1	

The lower part of the estuary lies within the Tweed Estuary biological Site of Special Scientific Interest (154 ha) and is adjacent to the Northumberland Shore SSSI (1,926 ha). The estuary forms part of the River Tweed Nature Conservation Review site. The outer parts of the estuary lie within the Northumberland Coast Area of Outstanding Natural Beauty and within the Northumberland Heritage Coast.

Parts of the estuary lie within the proposed Northumberland Coast Special Protection Area and the estuary is adjacent to the Berwickshire and North Northumberland Coast candidate Special Area of Conservation.

Conservation status



Human activities (in 1991)

Present	Proposed	
●		**Coast protection & sea defences** Linear defences Training walls Groynes Brushwood fences *Spartina* planting Marram grass planting
		Barrage schemes Weirs & barrages for river management Storm surge barrages Water storage barrages & bunds Leisure barrages Tidal power barrages
		Power generation Thermal power stations Import/export jetties (power generation) Wind-power generation
● ● ● ●		**Industrial, port & related development** Dock, port & harbour facilities Manufacturing industries Chemical industries Ship & boat building/repair Others
		Extraction & processing of natural gas & oil Exploration Production Rig & platform construction Pipeline construction Pipeline installation Import/export jetties & single-point moorings Oil refineries Mothballing of rigs & tankers
		Military activities Overflying by military aircraft Others
● ● ● ●		**Waste discharge** Domestic waste disposal Sewage discharge & outfalls Sewage treatment works Rubbish tips Industrial & agricultural waste discharge Thermal discharges (power stations) Dredge spoil Accidental discharges Aerial crop spraying Waste incinerators Others
●		**Sediment extraction** Capital dredging Maintenance dredging Commercial estuarine aggregates extraction Commercial terrestrial aggregates extraction Non-commercial aggregates extraction Hard-rock quarrying
●		**Transport & communications** Airports & helipads Tunnels, bridges & aqueducts Causeways & fords Road schemes Ferries Cables
●		**Urbanisation** Land-claim for housing & car parks
●		**Education & scientific research** Sampling, specimen collection & observation Nature trails & interpretative facilities Seismic studies & geological test drilling Marine & terrestrial archaeology Fossil collecting

Present	Proposed	
		Tourism & recreation Infrastructure developments Marinas
● ●	●	Non-marina moorings Dinghy & boat parks Caravan parks & chalets Leisure centres, complexes & piers Aquatic-based recreation Power-boating & water-skiing
● ● ●		Jet-skiing Sailing Sailboarding & wind-surfing SCUBA & snorkelling Canoeing Surfing
●		Rowing Tourist boat trips/leisure barges
●		Angling Other non-commercial fishing
●		Bathing & general beach recreation Terrestrial & intertidal-based recreation
● ●		Walking, including dog walking Bird-watching Sand-yachting 4WD & trial-biking Car sand-racing Horse-riding Rock-climbing Golf courses Clay-pigeon shooting Others Airborne recreation
●		Overflying by light aircraft Radio-controlled model aircraft Others
●		**Wildfowling & hunting** Wildfowling Other hunting-related activities
●		**Bait-collecting** Digging & pumping for lugworms & ragworms Hydraulic dredging for worms Others
●		**Commercial fisheries** Fish-netting & trawling Fyke-netting for eels Fish traps & other fixed devices & nets Crustacea Molluscs – Hand-gathering Dredging Hydraulic dredging
		Cultivation of living resource Saltmarsh grazing Sand dune grazing Agricultural land-claim Fish-farming Shellfish farming Bottom & tray cultivation Suspended cultivation Crustacea farming Reeds for roofing *Salicornia* picking Others
●	●	**Management & killing of birds & mammals** Killing of mammals
●		Killing of birds Adult fish-eating birds Adult shellfish-eating birds
	●	Gulls Geese
		Wildlife habitat management *Spartina* control Habitat creation & restoration Marine Intertidal Terrestrial Habitat management
		Others

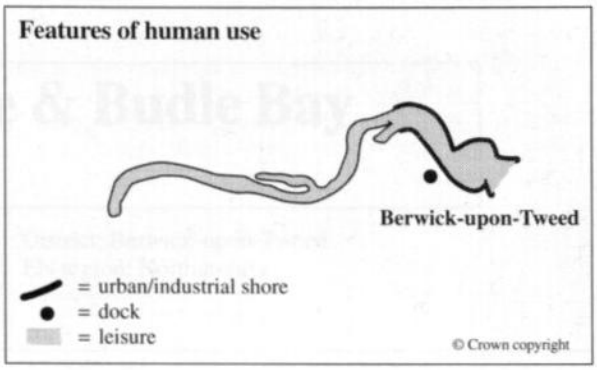
Features of human use

Most activities within the estuary involve leisure and recreation. Power-boating and water-skiing are concentrated in the upper estuary where there is a water-skiing club, while rowing occurs over most of the estuary. There are a small number of moorings in the docks, from which sailing and wind-surfing occur out to sea. Land-based pursuits such as walking and bird-watching occur over most of the shore, but beach recreation is limited to the estuary mouth.

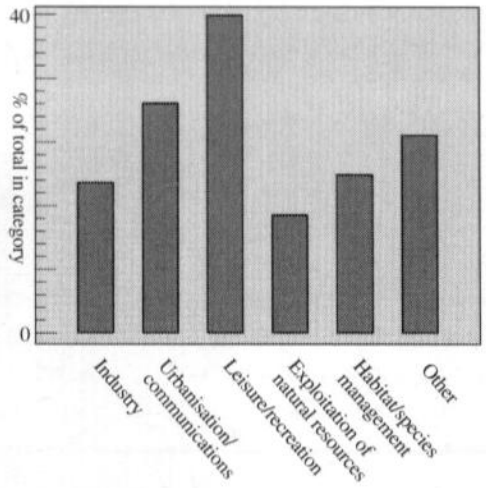
There is some industry present on the Tweed, with a small dock on the southern shore and a boat-building yard, and dredging occurs to maintain the shipping channel. Exploitation of the natural resources includes netting for salmon and trout, bait-digging on the intertidal flats just outside the estuary mouth, and wildfowling which occurs upstream of the railway bridge.

Habitat and species management includes culling of seals, goosander and red-breasted merganser to protect the salmon fishery.

In 1989 there was a proposal to repair the moorings at Berwick, and to cull seals and gulls. Following a feasibility study in 1991 the proposal to build a new marina was dropped.



Categories of human use



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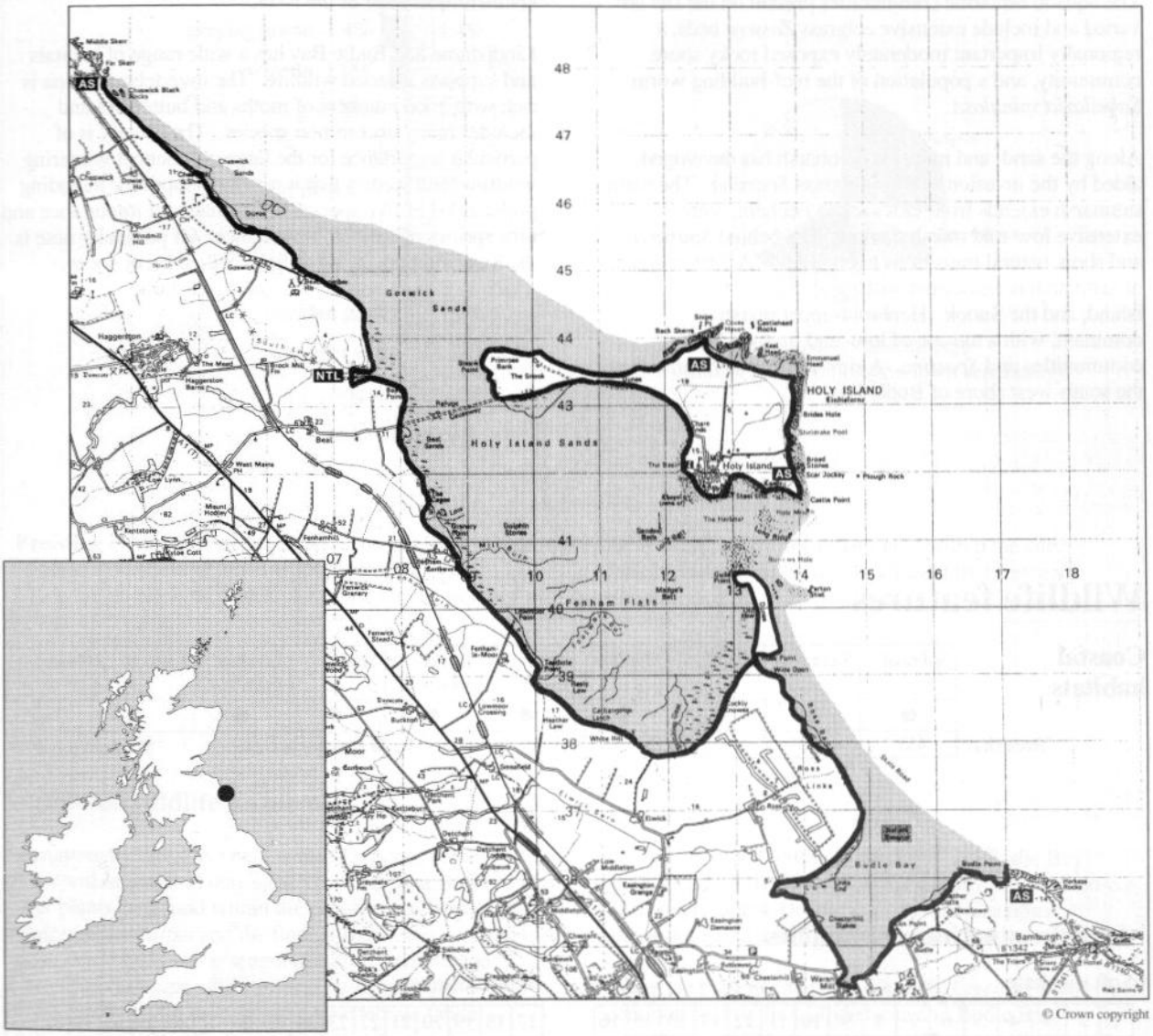
91 Lindisfarne & Budle Bay

Centre grid: NU1141
County: Northumberland

District: Berwick-upon-Tweed
EN region: Northumbria

Review site location



AS = Along shore

NTL = Normal tidal limit

= Core site

Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
3,364	2,931	36.3	8.5	4.2	Barrier beach	<5,000

Description

Lindisfarne and Budle Bay is one of only two barrier beach estuarine systems in the UK and it forms one of the largest intertidal areas in north-east England. Lindisfarne is largely protected from the effects of wave action by Holy Island, and by the offshore dunes to the east of Fenham Flats and to the north of Goswick Sands. Water quality has been classified as grade A.

A large proportion of the site is intertidal flats which are predominantly sandy, except for parts of Budle Bay and Fenham Flats, which are more muddy. In places these flats are traversed by freshwater creeks at low tide. The aquatic estuarine communities present on the site are varied and include extensive eelgrass *Zostera* beds, a regionally important moderately exposed rocky shore community, and a population of the reef-building worm *Sabellaria spinulosa*.

Along the sand- and mudflats saltmarsh has developed, aided by the invasion of the cordgrass *Spartina*. The main saltmarsh extends from Goswick to Fenham, with extensive low-mid marsh communities behind *Spartina*, and show natural transitions to grassland. A further area of saltmarsh is associated with the causeway to Holy Island, and the Snook. Here mid-upper marsh is dominant, with a mosaic of low- and mid-marsh communities and *Spartina*. A similar saltmarsh runs along the south-west shore of Budle Bay.

Sand dunes are extensive on the site. At Cheswick and Goswick sands the dunes and dune pasture back a clean, sandy foreshore, and a spit, which is still growing. The recent dune ridges at Ross Links shelter ancient and glacial sands, which grade to dune heath and dune grassland. As on Holy Island, slacks here are well-developed and support several rare plants. On Holy Island the dunes show successive stages from colonization to dune grassland and have a specialised flora; there is also an assemblage of lichens on patches of exposed shingle. The eastern shores of Holy Island are largely rocky with a few patches of shingle, and a whinstone ridge forms the southernmost edge of the island.

Lindisfarne and Budle Bay has a wide range of habitats and supports a varied wildlife. The invertebrate fauna is rich with good numbers of moths and butterflies and includes many uncommon species. The estuary is of particular importance for the large numbers of wintering wildfowl and waders that it regularly supports, including populations of five species of international importance and nine species of national importance. Of particular note is the Svalbard population of light-bellied brent goose, which in Britain winters only on Lindisfarne.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	●	●	●	●	●		
Area (ha)	433	218	2,713							

● = major habitat ● = minor habitat

Aquatic estuarine communities

Soft substrate

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	●								●			●	●	●	

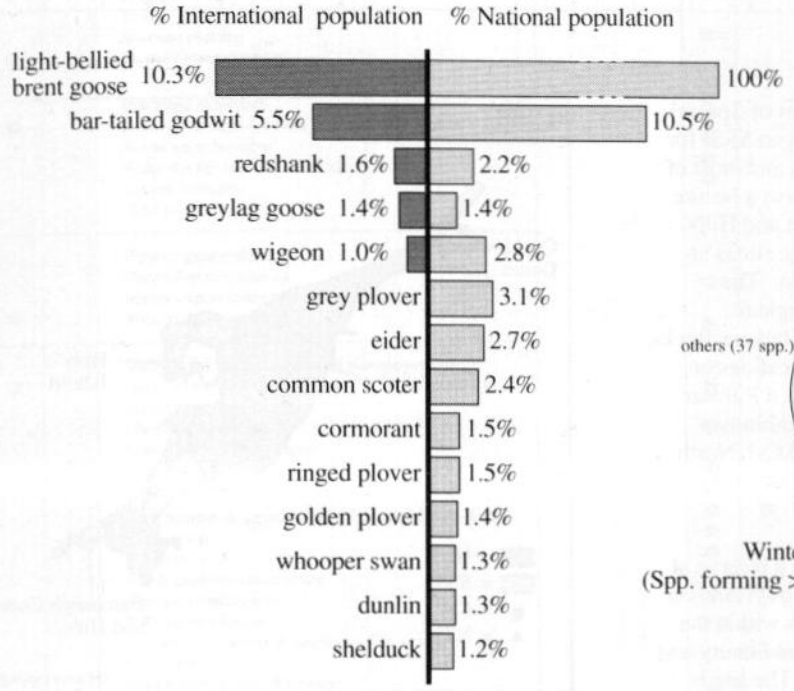
Hard substrate

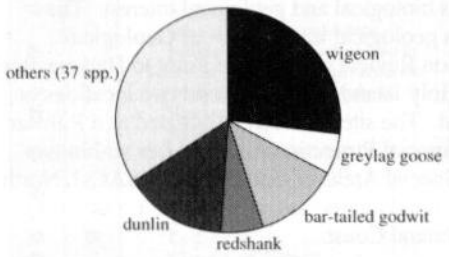
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
●	●	●	●					●	●	●						

Birds

Wintering birds 1989/90 – 1993/94 data

Total waterfowl: 43,500





Wintering species assemblage
(Spp. forming >5% assemblage shown separately)

Breeding birds: a moderate sized colony of black-headed gulls and a small colony of fulmar breed within the site. Moderate numbers of lapwing and low numbers of snipe and reshank breed on the grasslands adjacent to the estuary. Moderate numbers of ringed plover are known to breed on Lindisfarne.

Additional wildlife features

The nationally rare dune helleborine *Epipactis dunensis* grows within the sand dunes and two Red Data Book lower plants are found within the site: the liverwort *Petalophyllum ralfsii* and the fungus *Hebeloma vaccinum*. Large, dense beds of the seagrasses *Zostera noltii* and *Z. angustifolia* occur whilst unusually *Z. marina* is found in rock pools within the site. The invertebrate fauna recently recorded within Lindisfarne and Budle Bay includes the RDB 2 fly *Opomyza punctella*, the proposed RDB micromoths *Aphelia unitana* and *Crambus uliginosella* and a further 25 Notable species.

Otters are present and there is a small breeding colony of common seals within Lindisfarne and Budle Bay.

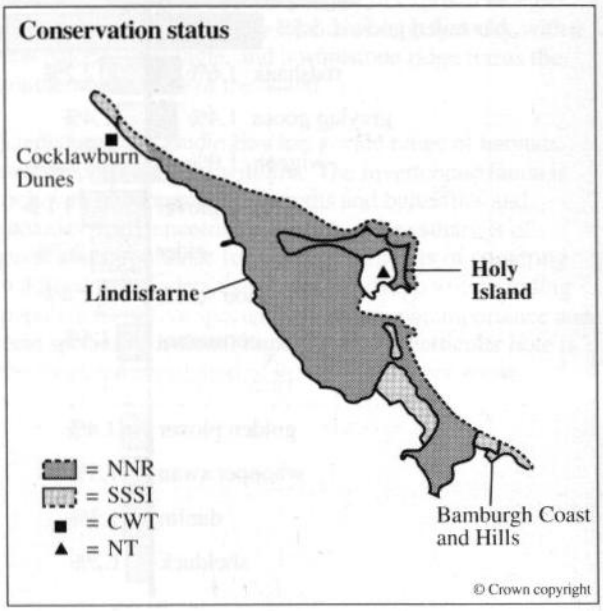
Conservation status

● = designated ● = proposed

	NCR	GCR	SSSI (B)	SSSI (G)	SSSI (M)	NNR	LNR	Ramsar	SPA	SAC	AONB	CWT	RSPB	ESA	NP	WWT	NT	NSA	HC	Other
	●	●			●	●		●	●	●	●	●					●		●	●
No.	1	4			2	1		1	1	2	1	1					1		1	1

All of the estuary lies within designated Sites of Special Scientific Interest. Lindisfarne (3,966 ha) is an SSSI for its biological and geomorphological interest and most of the site is a National Nature Reserve. It is also a Nature Conservation Review site. Bamburgh Coast and Hills (56 ha) which overlaps the eastern part of the site is an SSSI for its biological and geological interest. The estuary has geological interest in four Geological Conservation Review sites: Budle Point to Harkess Rocks, Goswick-Holy Island-Budle Bay and two localities on Holy Island. The site has been designated as a Ramsar site and a Special Protection Area and lies within two proposed Special Areas of Conservation (SACs): North Northumberland Dunes, and Berwickshire and North Northumberland Coast.

The Northumberland Wildlife Trust manage a reserve at Cocklawburn Dunes and the National Trust own land on Holy Island. Lindisfarne and Budle Bay lies within the Northumberland Area of Outstanding Natural Beauty and the North Northumberland Heritage Coast. The site is included in the Holy Island and the Farnes Sensitive Marine Area.



The dunes of Holy Island are well-developed and support a specialised flora. (Peter Wakely, English Nature.)

Human activities (in 1991)

Present	Proposed	
		Coast protection & sea defences
●		Linear defences
		Training walls
		Groynes
		Brushwood fences
		Spartina planting
●		Marram grass planting
		Barrage schemes
●		Weirs & barrages for river management
		Storm surge barrages
		Water storage barrages & bunds
		Leisure barrages
		Tidal power barrages
		Power generation
		Thermal power stations
		Import/export jetties (power generation)
●		Wind-power generation
		Industrial, port & related development
●		Dock, port & harbour facilities
		Manufacturing industries
		Chemical industries
		Ship & boat building/repair
		Others
		Extraction & processing of natural gas & oil
		Exploration
		Production
		Rig & platform construction
		Pipeline construction
		Pipeline installation
		Import/export jetties & single-point moorings
		Oil refineries
		Mothballing of rigs & tankers
		Military activities
		Overflying by military aircraft
●		Others
		Waste discharge
●		Domestic waste disposal
●		Sewage discharge & outfalls
		Sewage treatment works
●		Rubbish tips
		Industrial & agricultural waste discharge
		Thermal discharges (power stations)
		Dredge spoil
		Accidental discharges
●		Aerial crop spraying
		Waste incinerators
		Others
		Sediment extraction
		Capital dredging
		Maintenance dredging
		Commercial estuarine aggregates extraction
		Commercial terrestrial aggregates extraction
		Non-commercial aggregates extraction
		Hard-rock quarrying
		Transport & communications
●		Airports & helipads
●		Tunnels, bridges & aqueducts
●		Causeways & fords
		Road schemes
		Ferries
●		Cables
		Urbanisation
●		Land-claim for housing & car parks
		Education & scientific research
●		Sampling, specimen collection & observation
●		Nature trails & interpretative facilities
		Seismic studies & geological test drilling
●		Marine & terrestrial archaeology
		Fossil collecting

Present	Proposed	
		Tourism & recreation
		Infrastructure developments
		Marinas
●		Non-marina moorings
		Dinghy & boat parks
●		Caravan parks & chalets
		Leisure centres, complexes & piers
		Aquatic-based recreation
●		Power-boating & water-skiing
●		Jet-skiing
●		Sailing
●		Sailboarding & wind-surfing
●		SCUBA & snorkelling
		Canoeing
		Surfing
		Rowing
		Tourist boat trips/leisure barges
●		Angling
		Other non-commercial fishing
●		Bathing & general beach recreation
		Terrestrial & intertidal-based recreation
●		Walking, including dog walking
●		Bird-watching
		Sand-yachting
●		4WD & trial-biking
		Car sand-racing
●		Horse-riding
		Rock-climbing
●	●	Golf courses
●		Clay-pigeon shooting
●		Others
		Airborne recreation
●		Overflying by light aircraft
		Radio-controlled model aircraft
		Others
		Wildfowling & hunting
●		Wildfowling
		Other hunting-related activities
		Bait-collecting
●		Digging & pumping for lugworms & ragworms
		Hydraulic dredging for worms
		Others
		Commercial fisheries
●		Fish-netting & trawling
		Fyke-netting for eels
		Fish traps & other fixed devices & nets
		Crustacea
●		Molluscs – Hand-gathering
		Dredging
		Hydraulic dredging
		Cultivation of living resource
●		Saltmarsh grazing
●		Sand dune grazing
		Agricultural land-claim
		Fish-farming
		Shellfish farming
●	●	Bottom & tray cultivation
		Suspended cultivation
		Crustacea farming
		Reeds for roofing
●		*Salicornia* picking
		Others
		Management & killing of birds & mammals
●		Killing of mammals
		Killing of birds
		Adult fish-eating birds
		Adult shellfish-eating birds
		Gulls
		Geese
		Wildlife habitat management
●		*Spartina* control
		Habitat creation & restoration
		Marine
●		Intertidal
●		Terrestrial
●		Habitat management
		Others

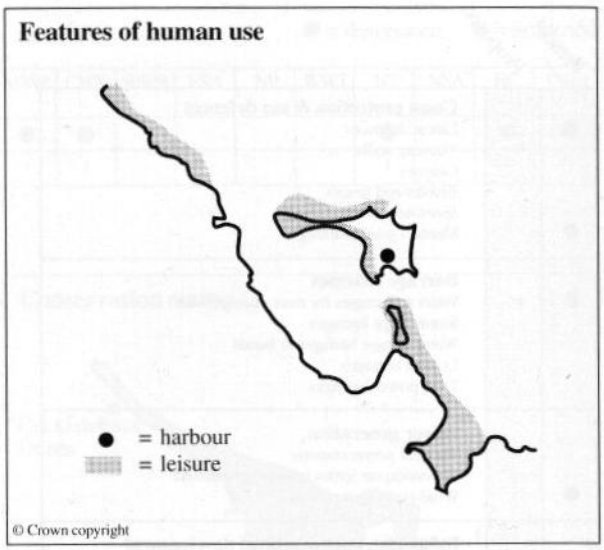
Features of human use

Most activities are recreational. Water-based sports such as power-boating, sailing and wind-surfing occur mainly in Budle Bay and SCUBA diving and snorkelling occur off the north and east shores of Holy Island. Beach recreation is more widespread, occurring over Cheswick Sands, Ross Back Sands, Budle Bay and the northern shore of Holy Island. Walking and bird-watching occur over most of the site.

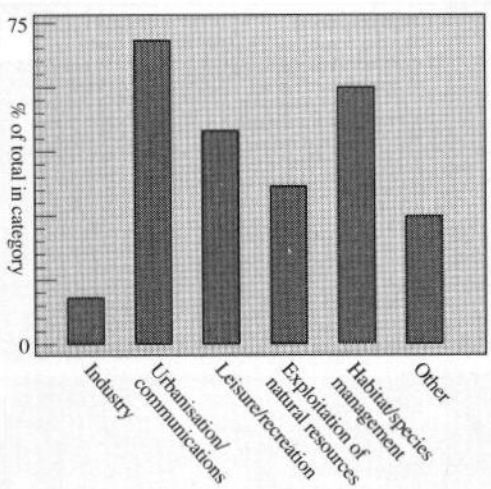
Exploitation of the natural resource includes grazing of 45 ha of saltmarsh on the mainland, grazing of sand dunes, bag-netting for salmon, and bottom/tray cultivation and hand-gathering of mussels. Wildfowling is strictly licenced: shooting is permitted on the main flats, but there is a refuge area at Budle Bay.

There is limited industrial activity on the estuary, where there is a small harbour on Holy Island which is used by fishing boats. Habitat and species management includes culling of rabbits, *Spartina* control and restoration of the dunes on the Snook. The estuary is used for education and research and studies have been undertaken on *Spartina* control on the intertidal flats.

Proposals in 1989 included oyster cultivation and a golf course on Holy Island.



Categories of human use



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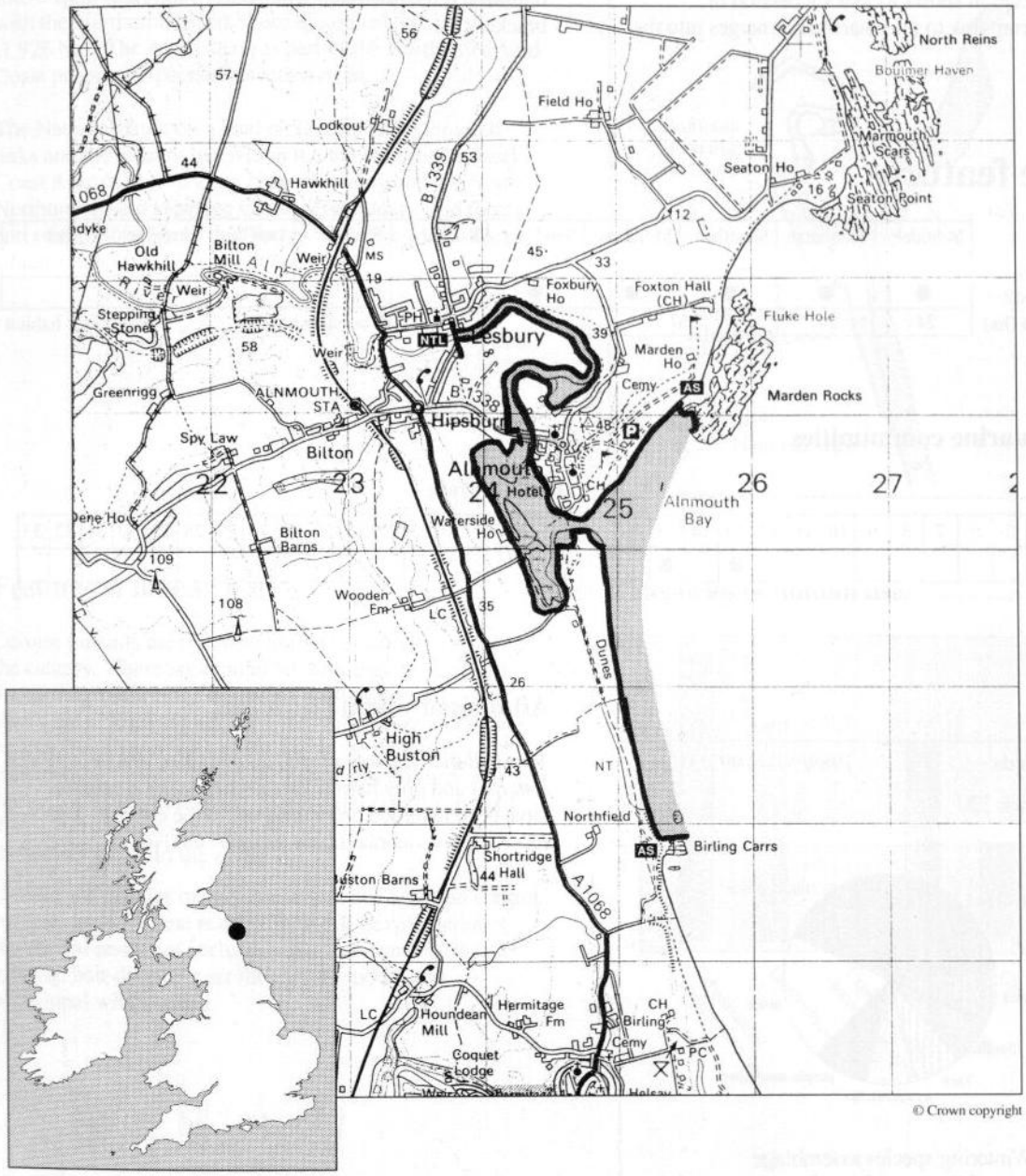
92 Alnmouth

Centre grid: NU2410
County: Northumberland

District: Alnwick
EN area: Northumbria

Review site location



AS = Along shore

NTL = Normal tidal limit

= Core site

Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
135	111	12.7	4.4	3.3	Bar built	<5,000

Description

The estuary of the River Aln is small and shallow, with its mouth constricted by a dune-covered spit. Historically, dunes which extended south from Alnmouth were breached in the early 1800's and this resulted in a change in the course of the river, which now discharges into the sea further north than previously. Eventually sediment accumulated across the former mouth and the development of dunes sealed the original mouth of the estuary. Water quality in the estuary has been classified as grade A.

The main area of saltmarsh is sheltered behind the dunes, where the vegetation shows a clear succession of communities from low to mid marsh and merges into the dunes. The saltmarsh extends almost 2 km upstream with scattered areas of mid-upper marsh, but becomes fragmented in its upper reaches; at Mount Pleasant there are stands of common reed due to the influence of freshwater. *Spartina* has colonised areas of the intertidal mudflats.

Outside the narrow estuary mouth along the shoreline there are two areas of sand dunes that have formed over an ancient shingle beach. To the north these form a narrow strip, while in the south a broad, high ridge of dunes support a rich flora. The vegetation here is largely tall, ungrazed dune grassland with areas of foredune and bracken.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	●	●					
Area (ha)	24	24	87							

● = major habitat ◍ = minor habitat

Aquatic estuarine communities

Soft substrate

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
												●		●	

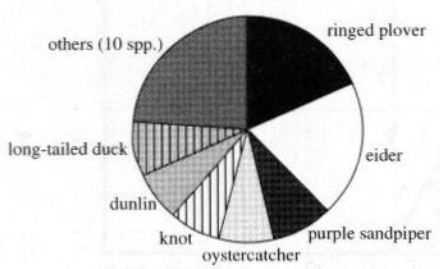
Hard substrate

17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

Birds

Wintering birds 1989/90 – 1993/94 data

Total waterfowl: 320



Wintering species assemblage
(Spp. forming >5% assemblage shown separately)

Breeding birds: low numbers of lapwing, redshank and oystercatcher breed on the grasslands adjacent to the estuary.

Additional wildlife features

Two nationally scarce plants, long-stalked orache *Atriplex longipes* and grey hair-grass *Corynephorus canescens* have been recorded on or adjacent to the estuary. The recorded invertebrate fauna includes ten Notable species.

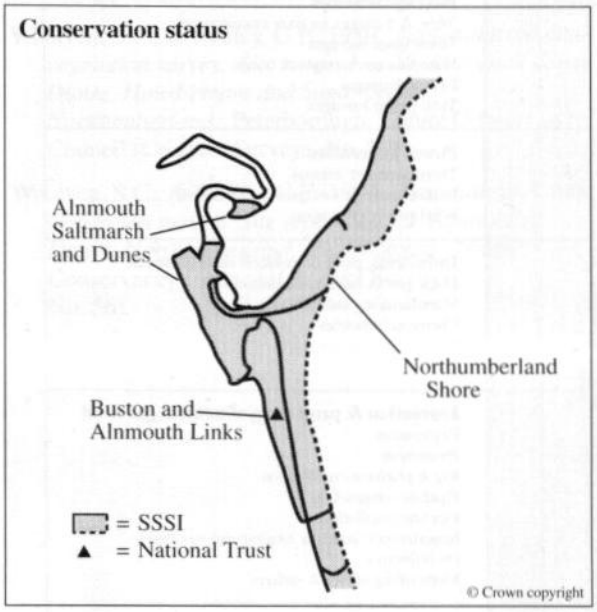
Conservation status

● = designated ● = proposed

	NCR	GCR	SSSI (B)	SSSI (G)	SSSI (M)	NNR	LNR	Ramsar	SPA	SAC	AONB	CWT	RSPB	ESA	NP	WWT	NT	NSA	HC	Other
			●						●		●						●		●	●
No.			2						1		1						1		1	1

Around two-thirds of the estuary is covered by Alnmouth Saltmarsh and Dunes biological Site of Special Scientific Interest (108 ha). The lower part of the estuary overlaps with the Northumberland Shore biological SSSI (1,926 ha). The Aln Estuary is part of the Northumberland Coast proposed Special Protection Area.

The National Trust own land on Buston and Alnmouth links and the estuary lies within the the Northumberland Coast Area of Outstanding Natural Beauty and the North Northumberland Heritage Coast. The estuary also forms part of the Holy Island and Farnes Sensitive Marine Area, which extends to the south of Alnmouth.

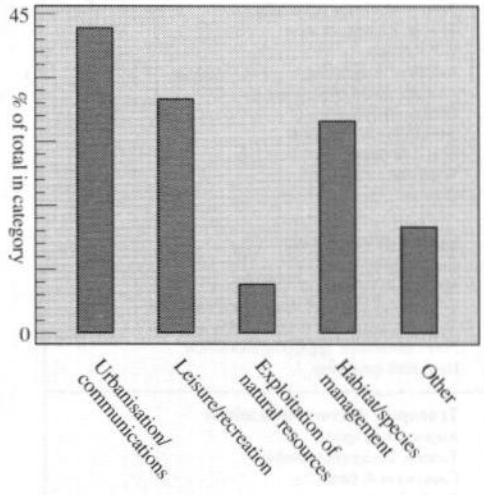


Features of human use

Leisure pursuits are the most numerous activity present on the estuary. There are around 50 moorings at Alnmouth and sailing takes place below the road bridge at High Water only. Walking and bird-watching occur along the estuary mouth and bank paths and at the mouth there is considerable pressure from car-parking as this area is a centre for beach recreation. Horse-riding occurs in the dunes and on the saltmarsh and there is a golf course on the former dunes to the north.

Habitat and species management includes *Spartina* control by spraying and dune restoration work. Exploitation of the natural resources includes some dune and saltmarsh grazing, bait-digging near the estuary mouth and occasional wildfowling.

Categories of human use



Human activities (in 1993)

Present	Proposed	
		Coast protection & sea defences
●		Linear defences
		Training walls
		Groynes
		Brushwood fences
		Spartina planting
●		Marram grass planting
		Barrage schemes
		Weirs & barrages for river management
		Storm surge barrages
		Water storage barrages & bunds
		Leisure barrages
		Tidal power barrages
		Power generation
		Thermal power stations
		Import/export jetties (power generation)
		Wind-power generation
		Industrial, port & related development
		Dock, port & harbour facilities
		Manufacturing industries
		Chemical industries
		Ship & boat building/repair
		Others
		Extraction & processing of natural gas & oil
		Exploration
		Production
		Rig & platform construction
		Pipeline construction
		Pipeline installation
		Import/export jetties & single-point moorings
		Oil refineries
		Mothballing of rigs & tankers
		Military activities
●		Overflying by military aircraft
		Others
		Waste discharge
●		Domestic waste disposal
●		Sewage discharge & outfalls
		Sewage treatment works
		Rubbish tips
		Industrial & agricultural waste discharge
		Thermal discharges (power stations)
		Dredge spoil
		Accidental discharges
		Aerial crop spraying
		Waste incinerators
		Others
		Sediment extraction
		Capital dredging
		Maintenance dredging
		Commercial estuarine aggregates extraction
		Commercial terrestrial aggregates extraction
		Non-commercial aggregates extraction
		Hard-rock quarrying
		Transport & communications
●		Airports & helipads
		Tunnels, bridges & aqueducts
		Causeways & fords
		Road schemes
		Ferries
●		Cables
		Urbanisation
●		Land-claim for housing & car parks
		Education & scientific research
		Sampling, specimen collection & observation
●		Nature trails & interpretative facilities
		Seismic studies & geological test drilling
		Marine & terrestrial archaeology
		Fossil collecting

Present	Proposed	
		Tourism & recreation
		Infrastructure developments
		Marinas
●		Non-marina moorings
		Dinghy & boat parks
		Caravan parks & chalets
		Leisure centres, complexes & piers
		Aquatic-based recreation
		Power-boating & water-skiing
●		Jet-skiing
●		Sailing
		Sailboarding & wind-surfing
		SCUBA & snorkelling
		Canoeing
		Surfing
		Rowing
		Tourist boat trips/leisure barges
●		Angling
		Other non-commercial fishing
●		Bathing & general beach recreation
		Terrestrial & intertidal-based recreation
●		Walking, including dog walking
●		Bird-watching
		Sand-yachting
		4WD & trial-biking
		Car sand-racing
●		Horse-riding
		Rock-climbing
●		Golf courses
		Clay-pigeon shooting
		Others
		Airborne recreation
●		Overflying by light aircraft
		Radio-controlled model aircraft
		Others
		Wildfowling & hunting
●		Wildfowling
●		Other hunting-related activities
		Bait-collecting
●		Digging & pumping for lugworms & ragworms
		Hydraulic dredging for worms
		Others
		Commercial fisheries
		Fish-netting & trawling
		Fyke-netting for eels
		Fish traps & other fixed devices & nets
		Crustacea
		Molluscs – Hand-gathering
		Dredging
		Hydraulic dredging
		Cultivation of living resource
●		Saltmarsh grazing
●		Sand dune grazing
		Agricultural land-claim
		Fish-farming
		Shellfish farming
		Bottom & tray cultivation
		Suspended cultivation
		Crustacea farming
		Reeds for roofing
		Salicornia picking
		Others
		Management & killing of birds & mammals
		Killing of mammals
		Killing of birds
		Adult fish-eating birds
		Adult shellfish-eating birds
		Gulls
		Geese
		Wildlife habitat management
●		*Spartina* control
		Habitat creation & restoration
		Marine
		Intertidal
●		Terrestrial
●		Habitat management
		Others

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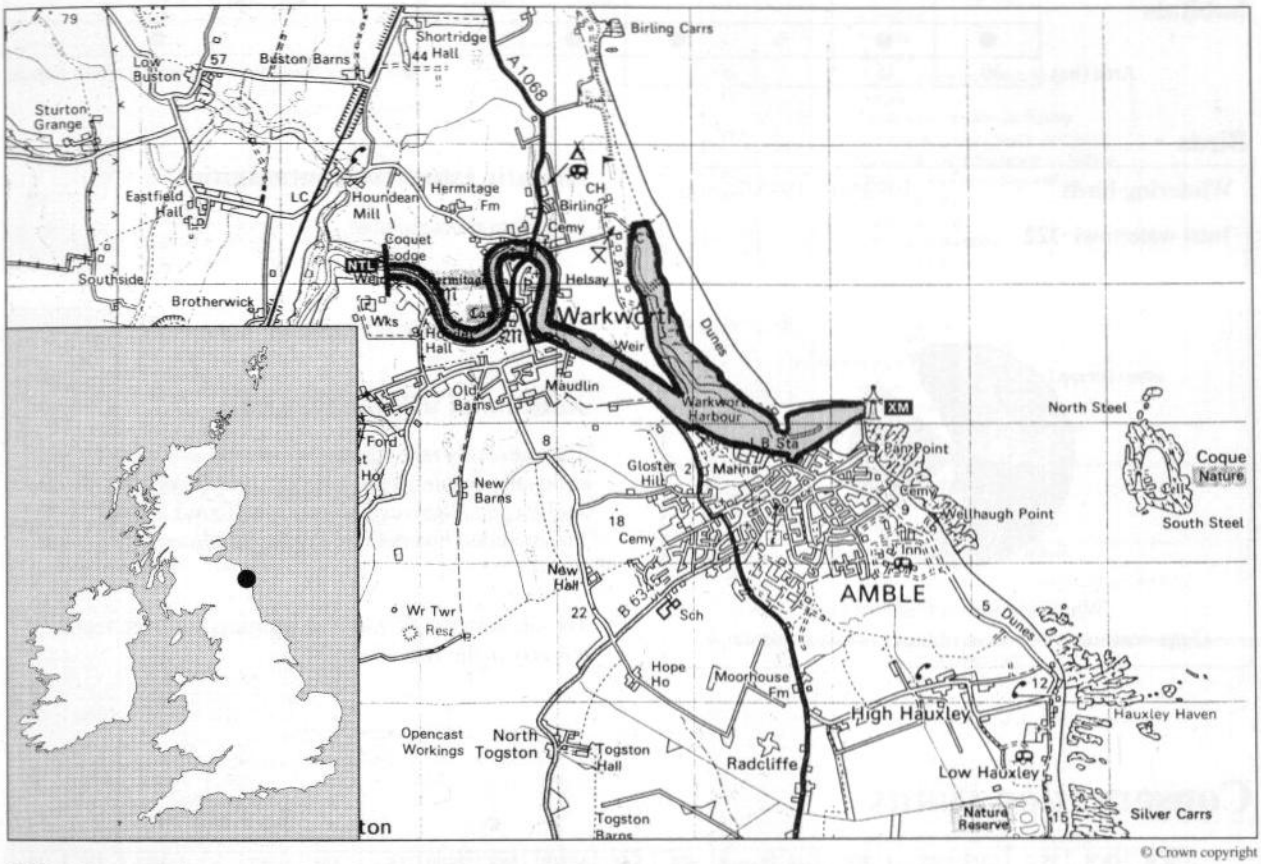
93 Warkworth Harbour

a.k.a. Coquet Estuary

Centre grid: NU2605
County: Northumberland

District: Alnwick
EN area: Northumbria

Review site location



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XM = Across mouth

NTL = Normal tidal limit

= Core site

Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
75	45	12.9	5.0	3.3	Bar built	5,000

Description

Warkworth Harbour is the estuary of the River Coquet, which discharges into the sea at Amble-by-the-sea. The mouth of the estuary is restricted by a dune ridge that extends into a 1 km long spit, and behind which the estuary is sheltered. Historically, the estuary discharged to the sea around 2 km north of the present channel. Water quality in the estuary has been classified as grade A.

Along the River Coquet saltmarsh is limited in extent with small areas of fringing upper marsh and freshwater transition communities. The largest area of saltmarsh is in the former river channel, now sheltered by the dune system. This saltmarsh is dominated by tall, mid-upper marsh communities, with the tidal creek locally colonised by *Spartina*. To the north of the creek and Castles Dike is a small brackish lagoon, where there is a small stand of common reed.

The sand dunes north of the estuary mouth have developed as a series of parabolic dune ridges, separated by lower areas of grassland and shingly hollows. To seaward, a narrow strip of yellow dunes grades rapidly

into a wide zone of species-rich, undulating fixed dunes. The southern end of the spit, with active dune-building and a vegetated strandline, has a higher diversity of plants and is an important area for invertebrates. The vegetation also shows the transition between dune and saltmarsh.

The mudflats of the estuary, with their dense growths of the green alga *Enteromorpha* and some eelgrass *Zostera*, are a key area for feeding by young eider ducks from the nearby Coquet Island. The mudflats and saltmarsh are also used by waterfowl in winter as a roosting and feeding site.

Wildlife features

Coastal habitats

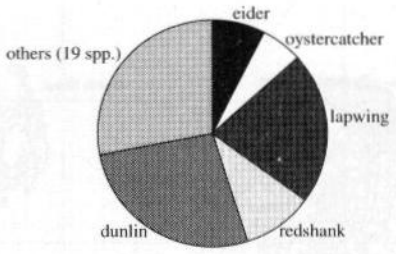
	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	◉	●	●				●	
Area (ha)	30	15	30							

● = major habitat ◉ = minor habitat

Birds

Wintering birds 1989/90 – 1993/94 data

Total waterfowl: 322



Wintering species assemblage
(Spp. forming >5% assemblage shown separately)

Aquatic estuarine communities

Information unavailable.

Additional wildlife features

The nationally rare lichen *Lecania chlorotiza* and two nationally scarce plants, maiden pink *Dianthus deltoides* and sea pea *Lathyrus japonicus* are found at Warkworth. The recorded invertebrate fauna includes seven Notable species.

The sea lamprey *Petromyzon marinus* has been recorded recently in the river Coquet.

Conservation status

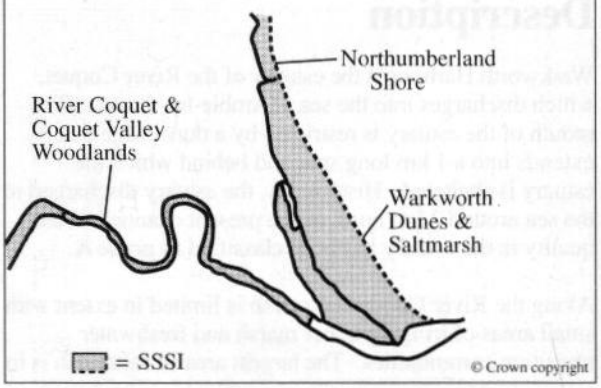
● = designated ◉ = proposed

	NCR	GCR	SSSI (B)	SSSI (G)	SSSI (M)	NNR	LNR	Ramsar	SPA	SAC	AONB	CWT	RSPB	ESA	NP	WWT	NT	NSA	HC	Other
			●						◉		●								●	
No.			3						1		1								1	

Parts of the estuary lie within the Warkworth Dunes and Saltmarsh biological Site of Special Scientific Interest (122 ha), the Northumberland Shore SSSI (1,926 ha) and the River Coquet and Coquet Valley Woodlands SSSI (1,250 ha) which extends upstream of the estuary. Warkworth Harbour is within the Northumberland Coast Area of Outstanding Natural Beauty and it is part of the North Northumberland Heritage Coast.

The Northumberland Shore SSSI is proposed as a Special Protection Area.

Conservation status



Human activities (in 1993)

Present	Proposed	
		Coast protection & sea defences
●		Linear defences
		Training walls
		Groynes
		Brushwood fences
		Spartina planting
		Marram grass planting
		Barrage schemes
●		Weirs & barrages for river management
		Storm surge barrages
		Water storage barrages & bunds
		Leisure barrages
		Tidal power barrages
		Power generation
		Thermal power stations
		Import/export jetties (power generation)
		Wind-power generation
		Industrial, port & related development
●		Dock, port & harbour facilities
		Manufacturing industries
		Chemical industries
●		Ship & boat building/repair
		Others
		Extraction & processing of natural gas & oil
		Exploration
		Production
		Rig & platform construction
		Pipeline construction
		Pipeline installation
		Import/export jetties & single-point moorings
		Oil refineries
		Mothballing of rigs & tankers
		Military activities
●		Overflying by military aircraft
		Others
		Waste discharge
●		Domestic waste disposal
●		Sewage discharge & outfalls
		Sewage treatment works
		Rubbish tips
		Industrial & agricultural waste discharge
●	●	Thermal discharges (power stations)
		Dredge spoil
		Accidental discharges
		Aerial crop spraying
		Waste incinerators
		Others
		Sediment extraction
		Capital dredging
		Maintenance dredging
	●	Commercial estuarine aggregates extraction
	●	Commercial terrestrial aggregates extraction
		Non-commercial aggregates extraction
		Hard-rock quarrying
		Transport & communications
●		Airports & helipads
●		Tunnels, bridges & aqueducts
		Causeways & fords
	●	Road schemes
		Ferries
		Cables
		Urbanisation
●		Land-claim for housing & car parks
		Education & scientific research
	●	Sampling, specimen collection & observation
		Nature trails & interpretative facilities
		Seismic studies & geological test drilling
		Marine & terrestrial archaeology
		Fossil collecting

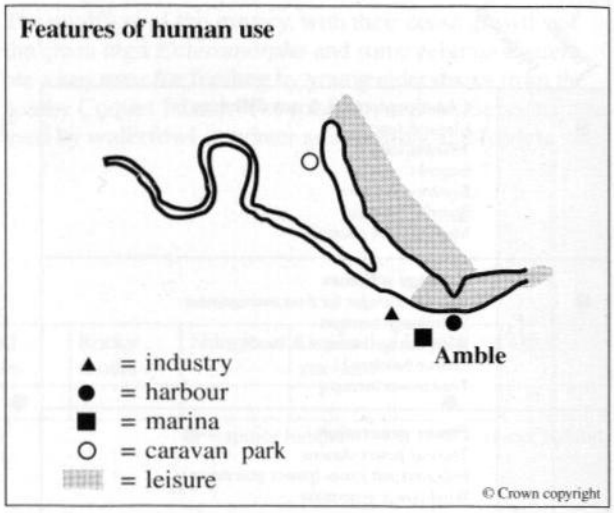
Present	Proposed	
		Tourism & recreation
		Infrastructure developments
●	●	Marinas
●	●	Non-marina moorings
●		Dinghy & boat parks
●		Caravan parks & chalets
		Leisure centres, complexes & piers
		Aquatic-based recreation
●		Power-boating & water-skiing
●		Jet-skiing
		Sailing
		Sailboarding & wind-surfing
		SCUBA & snorkelling
		Canoeing
		Surfing
		Rowing
●		Tourist boat trips/leisure barges
●		Angling
		Other non-commercial fishing
●		Bathing & general beach recreation
		Terrestrial & intertidal-based recreation
●		Walking, including dog walking
●		Bird-watching
		Sand-yachting
		4WD & trial-biking
		Car sand-racing
●		Horse-riding
		Rock-climbing
●	●	Golf courses
		Clay-pigeon shooting
		Others
		Airborne recreation
●		Overflying by light aircraft
		Radio-controlled model aircraft
		Others
		Wildfowling & hunting
●		Wildfowling
		Other hunting-related activities
		Bait-collecting
●		Digging & pumping for lugworms & ragworms
		Hydraulic dredging for worms
		Others
		Commercial fisheries
		Fish-netting & trawling
		Fyke-netting for eels
		Fish traps & other fixed devices & nets
		Crustacea
		Molluscs – Hand-gathering
		Dredging
		Hydraulic dredging
		Cultivation of living resource
		Saltmarsh grazing
		Sand dune grazing
		Agricultural land-claim
	●	Fish-farming
		Shellfish farming
		Bottom & tray cultivation
		Suspended cultivation
		Crustacea farming
		Reeds for roofing
		Salicornia picking
		Others
		Management & killing of birds & mammals
		Killing of mammals
		Killing of birds
		Adult fish-eating birds
		Adult shellfish-eating birds
		Gulls
		Geese
		Wildlife habitat management
		Spartina control
		Habitat creation & restoration
		Marine
		Intertidal
●		Terrestrial
		Habitat management
		Others

Features of human use

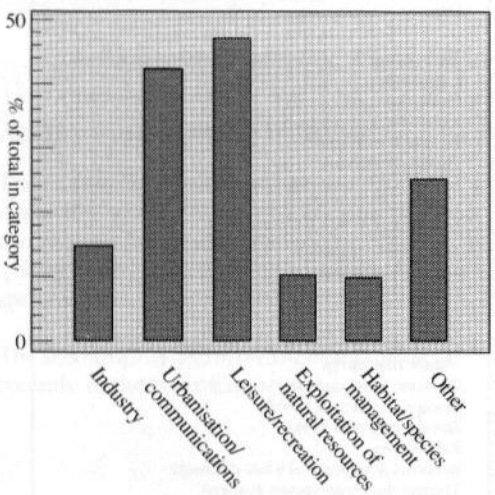
Leisure pursuits are the most numerous type of activity present and include a marina at Amble, with moorings along the quay and main river channel, and a dinghy park close by. Sailing occurs from the marina seawards and beach recreation takes place on the open coast north of the estuary mouth. Walking and bird-watching occur along the causeway and the south bank, and horse-riders use the dunes.

Industrial activity includes a harbour at Amble which is used by a fishing fleet, with an associated boatyard. Exploitation of the natural resource includes bait-digging on the intertidal flats and very occasional wildfowling. Habitat management involves restoration work on the sand dunes.

In 1989 there were proposals for alternative disposal of dredge spoil, a salmon fish farm and sand extraction. In 1996 sand extraction from the northern basin was taking place.



Categories of human use



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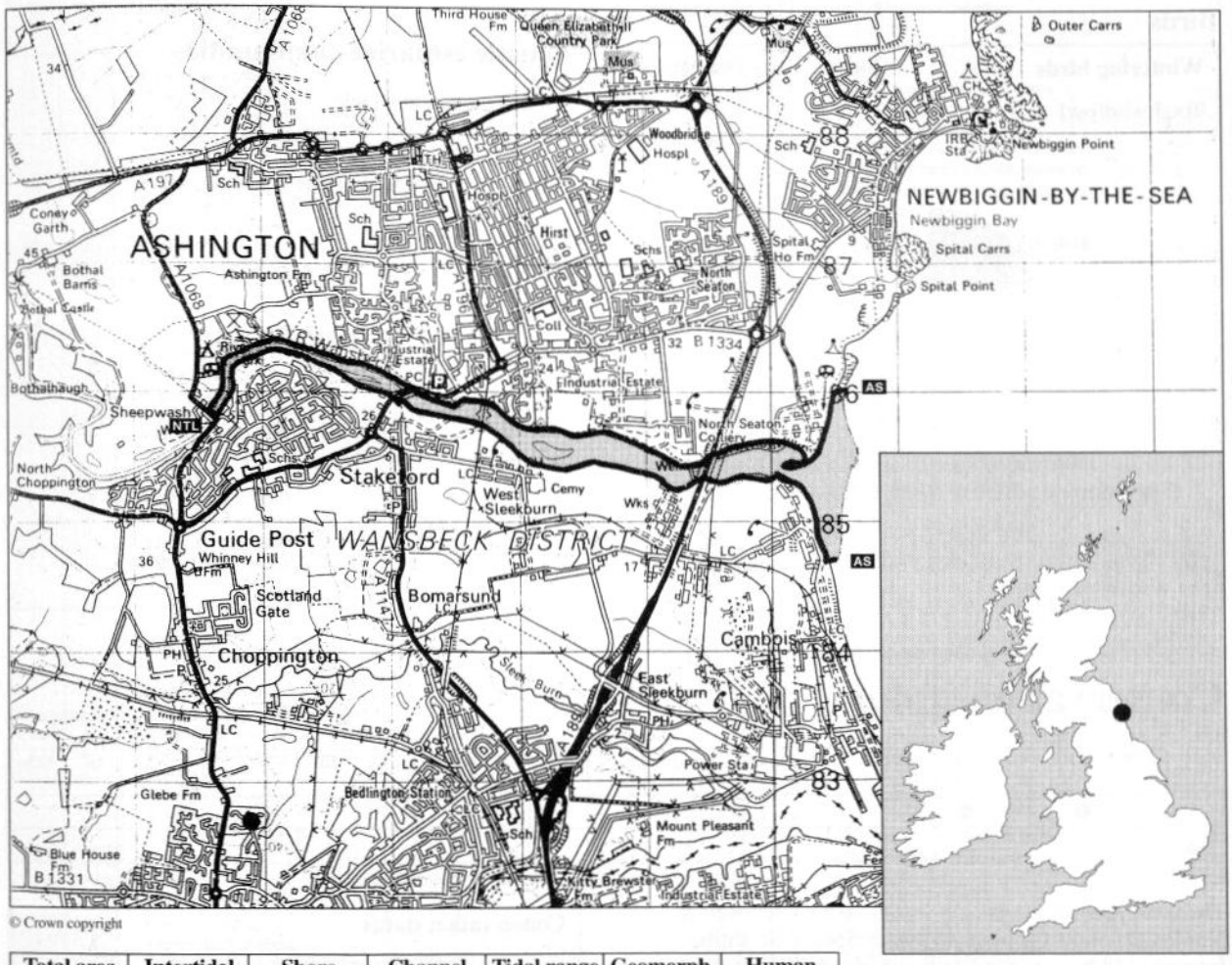
94 Wansbeck Estuary

Centre grid: NZ3085
County: Northumberland

District: Wansbeck
EN area: Northumbria

Review site location



Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
102	37	12.3	5.8	4.2	Coastal plain	8,000

AS = Along shore

NTL = Normal tidal limit

= Core site

Description

The estuary of the River Wansbeck is narrow and shallow and the upper limits of the estuary reach as far upstream as Sheepwash. With the building of a weir in 1969-70 around 80% of the estuary was barraged to create a deep-water facility for recreational use. However, neap tides overtop the barrage and the upper parts of the estuary remain tidal, although tidal and saline influences are greatly reduced in this area. Water quality in the estuary has been classified as grade A.

Only a small intertidal area remains in the lower estuary, with patches of saltmarsh fringing the shore. The mouth of the estuary is constricted by a small sand bar, which is accreting. To the north of this bar there is a small, but botanically rich, area of sand dunes. Just outside the estuary mouth there is a small sandy beach backed by low cliffs. These were eroding quite rapidly until the construction of coastal protection works in the mid 1980's.

Wildlife features

Coastal habitats

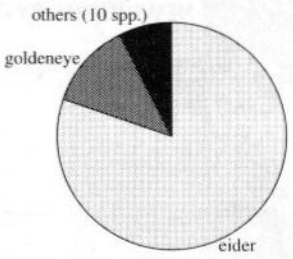
	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	◍		●	●					
Area (ha)	65		37							

● = major habitat ◍ = minor habitat

Birds

Wintering birds 1989/90 – 1993/94 data

Total wildfowl: 689



Wintering species assemblage
(Spp. forming >5% assemblage shown separately)

NB. There are no recent data available for waders on the Wansbeck Estuary.

Aquatic estuarine communities

No information available.

Conservation status

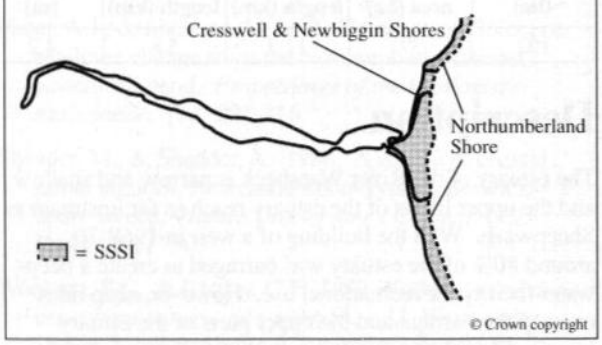
● = designated ◍ = proposed

	NCR	GCR	SSSI (B)	SSSI (G)	SSSI (M)	NNR	LNR	Ramsar	SPA	SAC	AONB	CWT	RSPB	ESA	NP	WWT	NT	NSA	HC	Other
		●	●	●					◍											
No.		1	1	1					1											

The outer parts of the estuary lie within the Cresswell & Newbiggin Shores geological Site of Special Scientific Interest (148 ha) and the Northumberland Shore biological SSSI (1,926 ha), which extends northwards and southwards beyond the estuary mouth. Sandy Bay, which is part of the Cresswell and Newbiggin Shores SSSI, is a Geological Conservation Review site.

The Northumberland Shore SSSI is proposed as a Special Protection Area.

Conservation status



Human activities (in 1993)

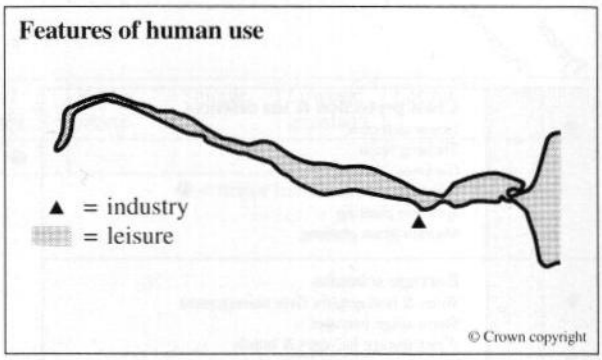
Present	Proposed	
		Coast protection & sea defences
●		Linear defences
		Training walls
		Groynes
		Brushwood fences
		Spartina planting
		Marram grass planting
		Barrage schemes
●		Weirs & barrages for river management
		Storm surge barrages
		Water storage barrages & bunds
●		Leisure barrages
		Tidal power barrages
		Power generation
		Thermal power stations
		Import/export jetties (power generation)
		Wind-power generation
		Industrial, port & related development
		Dock, port & harbour facilities
		Manufacturing industries
●		Chemical industries
		Ship & boat building/repair
		Others
		Extraction & processing of natural gas & oil
		Exploration
		Production
		Rig & platform construction
		Pipeline construction
		Pipeline installation
		Import/export jetties & single-point moorings
		Oil refineries
		Mothballing of rigs & tankers
		Military activities
		Overflying by military aircraft
		Others
		Waste discharge
●		Domestic waste disposal
		Sewage discharge & outfalls
		Sewage treatment works
		Rubbish tips
		Industrial & agricultural waste discharge
		Thermal discharges (power stations)
		Dredge spoil
		Accidental discharges
		Aerial crop spraying
		Waste incinerators
		Others
		Sediment extraction
		Capital dredging
		Maintenance dredging
		Commercial estuarine aggregates extraction
●		Commercial terrestrial aggregates extraction
		Non-commercial aggregates extraction
		Hard-rock quarrying
		Transport & communications
●		Airports & helipads
		Tunnels, bridges & aqueducts
		Causeways & fords
		Road schemes
●		Ferries
		Cables
		Urbanisation
		Land-claim for housing & car parks
		Education & scientific research
		Sampling, specimen collection & observation
		Nature trails & interpretative facilities
		Seismic studies & geological test drilling
		Marine & terrestrial archaeology
		Fossil collecting

Present	Proposed	
		Tourism & recreation
		Infrastructure developments
		Marinas
●		Non-marina moorings
		Dinghy & boat parks
●		Caravan parks & chalets
		Leisure centres, complexes & piers
		Aquatic-based recreation
		Power-boating & water-skiing
●		Jet-skiing
●		Sailing
		Sailboarding & wind-surfing
		SCUBA & snorkelling
		Canoeing
		Surfing
●		Rowing
		Tourist boat trips/leisure barges
●		Angling
		Other non-commercial fishing
●		Bathing & general beach recreation
		Terrestrial & intertidal-based recreation
●		Walking, including dog walking
●		Bird-watching
		Sand-yachting
●		4WD & trial-biking
		Car sand-racing
		Horse-riding
		Rock-climbing
		Golf courses
		Clay-pigeon shooting
		Others
		Airborne recreation
●		Overflying by light aircraft
		Radio-controlled model aircraft
		Others
		Wildfowling & hunting
		Wildfowling
		Other hunting-related activities
		Bait-collecting
●		Digging & pumping for lugworms & ragworms
		Hydraulic dredging for worms
		Others
		Commercial fisheries
		Fish-netting & trawling
		Fyke-netting for eels
		Fish traps & other fixed devices & nets
		Crustacea
		Molluscs – Hand-gathering
		Dredging
		Hydraulic dredging
		Cultivation of living resource
		Saltmarsh grazing
		Sand dune grazing
		Agricultural land-claim
		Fish-farming
		Shellfish farming
		Bottom & tray cultivation
		Suspended cultivation
		Crustacea farming
		Reeds for roofing
		Salicornia picking
		Others
		Management & killing of birds & mammals
		Killing of mammals
		Killing of birds
		Adult fish-eating birds
		Adult shellfish-eating birds
		Gulls
		Geese
		Wildlife habitat management
		Spartina control
		Habitat creation & restoration
		Marine
		Intertidal
		Terrestrial
		Habitat management
		Others

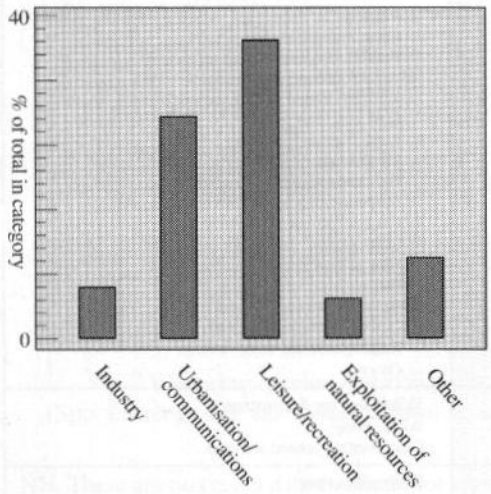
Features of human use

Leisure pursuits are the most numerous form of activity. Upstream of the weir, rowing and jet-skiing occurs. The lower parts of the estuary downstream of the wier are used mainly for access to the open sea. Beach recreation, angling and walking occur along most of the shore.

The only industrial activity that occurs is small-scale collection of sea coal from the beach at the mouth of the estuary, and there is a pharmaceutical works situated on the south side of the estuary. In 1996 there were proposals for water-skiing upstream of the weir.



Categories of human use



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Northumberland Coast Project. In prep. *Wansbeck Estuary management plan.* Morpeth, Northumberland County Council.

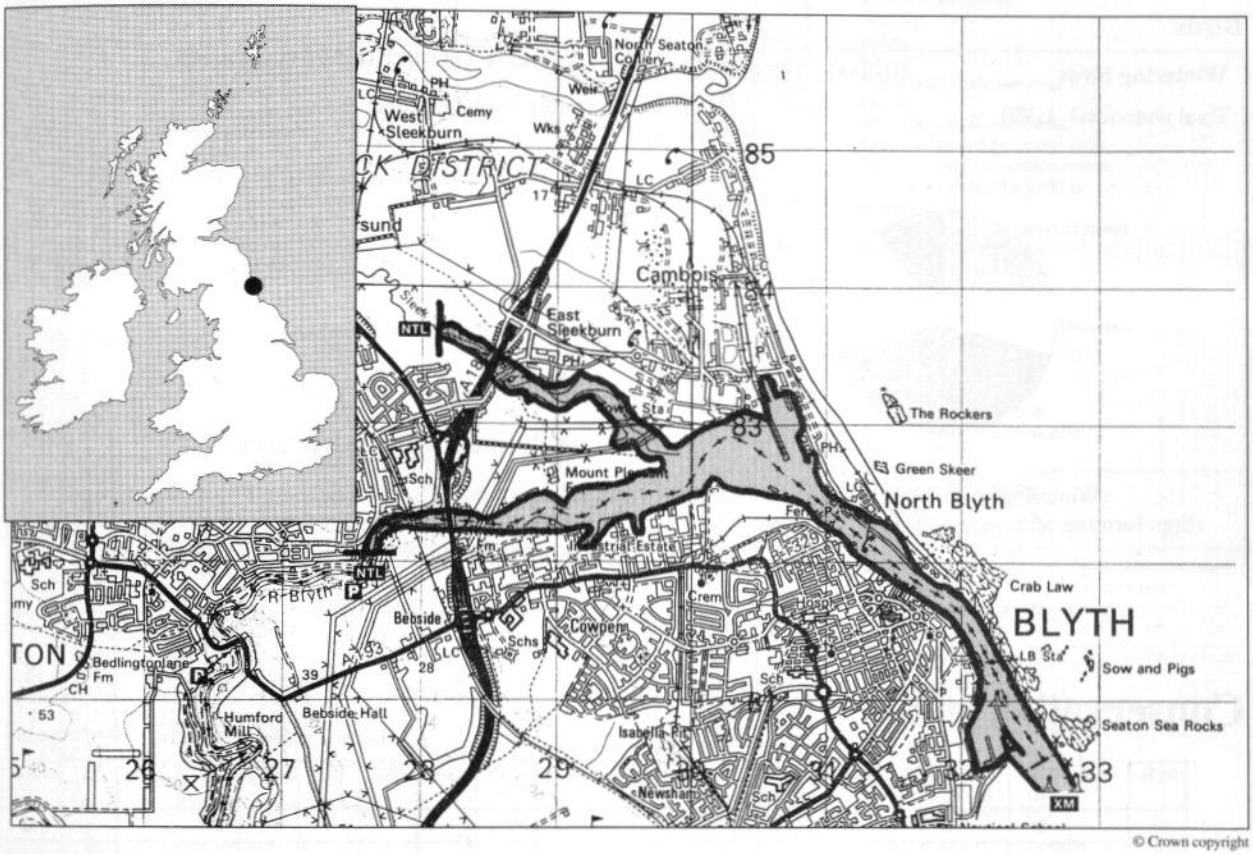
Plater, A.J., & Shennan, I. 1992. Evidence of Holocene sea-level change from the Northumberland coast, eastern England. *Proceedings of the Geologist's Association, 103:* 201-216.

95 Blyth Estuary (Northumberland)

Centre grid: NZ3082
County: Northumberland

Districts: Blyth Valley, Wansbeck
EN area: Northumbria

Review site location



XM = Across mouth

NTL = Normal tidal limit

= Core site

Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
168	90	21.5	6.6	4.2	Bar built	50,000

Description

The Blyth and its tributary Sleek Burn flow past a predominantly industrial landscape, the estuary deflected south-east at the mouth by a low spit adjoining a rocky shore. Water quality in the Blyth has been classified as grade B, becoming grade A towards the mouth.

Upstream the estuary has large areas of intertidal mud with shelly gravel. Sleek Burn is a small, muddy tributary with a patchwork of habitats including freshwater marsh, wetland and saltmarsh. The saltmarsh has both pioneer and mid-upper marsh communities. The sandy shingle spit supports a sparse pioneer vegetation.

The mudflats of the Blyth support dense populations of worms and molluscs, which attract waterfowl. Wintering bird populations are characterised by waders. In spring, East Pier forms an important roost site for purple sandpipers which feed on the nearby coastal rocks.

Wildlife features

Coastal habitats

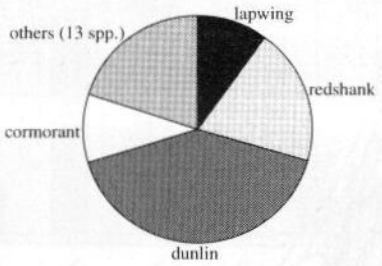
	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	◍	◍	●		●				
Area (ha)	78	<0.5	90							

● = major habitat ◍ = minor habitat

Birds

Wintering birds 1989/90 – 1993/94 data

Total waterfowl: 1,380



Wintering species assemblage
(Spp. forming >5% assemblage shown separately)

Aquatic estuarine communities

Information unavailable.

Additional wildlife features

A sea lamprey *Petromyzon marinus* was recorded in the Blyth in 1984 and single records of the lampern *Lampetra fluviatilis* have been noted, most recently in 1982.

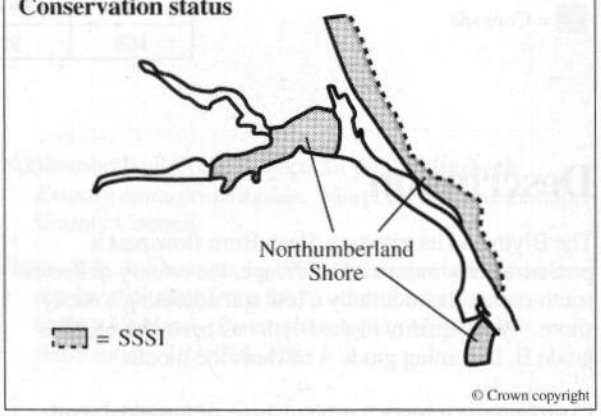
Conservation status

● = designated ◍ = proposed

	NCR	GCR	SSSI (B)	SSSI (G)	SSSI (M)	NNR	LNR	Ramsar	SPA	SAC	AONB	CWT	RSPB	ESA	NP	WWT	NT	NSA	HC	Other
			●						◍											●
No.			1						1											1

The intertidal areas of the mid-estuary are part of the Northumberland Shore (1,926 ha) biological Site of Special Scientific Interest. The Northumberland Shore SSSI is proposed as a Special Protection Area. The estuary has been noted as a Site of Nature Conservation Importance by the Northumberland Wildlife Trust.

Conservation status



Human activities (in 1993)

Present	Proposed	
		Coast protection & sea defences
●		Linear defences
●		Training walls
		Groynes
		Brushwood fences
		Spartina planting
		Marram grass planting
		Barrage schemes
		Weirs & barrages for river management
		Storm surge barrages
		Water storage barrages & bunds
		Leisure barrages
		Tidal power barrages
		Power generation
●		Thermal power stations
●		Import/export jetties (power generation)
●		Wind-power generation
		Industrial, port & related development
●		Dock, port & harbour facilities
●		Manufacturing industries
		Chemical industries
●		Ship & boat building/repair
	●	Others
		Extraction & processing of natural gas & oil
		Exploration
		Production
		Rig & platform construction
		Pipeline construction
		Pipeline installation
		Import/export jetties & single-point moorings
		Oil refineries
		Mothballing of rigs & tankers
		Military activities
		Overflying by military aircraft
		Others
		Waste discharge
●		Domestic waste disposal
●		Sewage discharge & outfalls
●		Sewage treatment works
●		Rubbish tips
		Industrial & agricultural waste discharge
		Thermal discharges (power stations)
●		Dredge spoil
		Accidental discharges
		Aerial crop spraying
	●	Waste incinerators
		Others
		Sediment extraction
●		Capital dredging
		Maintenance dredging
		Commercial estuarine aggregates extraction
		Commercial terrestrial aggregates extraction
		Non-commercial aggregates extraction
		Hard-rock quarrying
		Transport & communications
●		Airports & helipads
		Tunnels, bridges & aqueducts
		Causeways & fords
		Road schemes
		Ferries
●		Cables
		Urbanisation
●		Land-claim for housing & car parks
		Education & scientific research
●		Sampling, specimen collection & observation
		Nature trails & interpretative facilities
		Seismic studies & geological test drilling
		Marine & terrestrial archaeology
		Fossil collecting

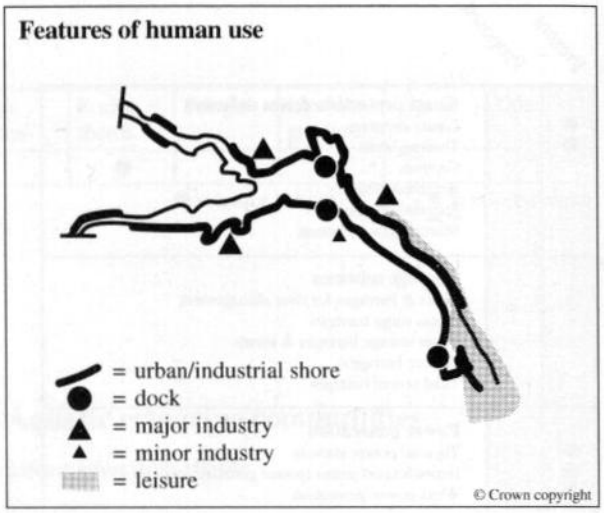
Present	Proposed	
		Tourism & recreation
		Infrastructure developments
		Marinas
●		Non-marina moorings
●		Dinghy & boat parks
		Caravan parks & chalets
		Leisure centres, complexes & piers
		Aquatic-based recreation
		Power-boating & water-skiing
		Jet-skiing
●		Sailing
		Sailboarding & wind-surfing
		SCUBA & snorkelling
		Canoeing
		Surfing
		Rowing
		Tourist boat trips/leisure barges
●		Angling
		Other non-commercial fishing
		Bathing & general beach recreation
		Terrestrial & intertidal-based recreation
●		Walking, including dog walking
●		Bird-watching
		Sand-yachting
	●	4WD & trial-biking
		Car sand-racing
		Horse-riding
		Rock-climbing
		Golf courses
		Clay-pigeon shooting
●		Others
		Airborne recreation
●		Overflying by light aircraft
		Radio-controlled model aircraft
		Others
		Wildfowling & hunting
		Wildfowling
		Other hunting-related activities
		Bait-collecting
●		Digging & pumping for lugworms & ragworms
		Hydraulic dredging for worms
		Others
		Commercial fisheries
		Fish-netting & trawling
●		Fyke-netting for eels
		Fish traps & other fixed devices & nets
		Crustacea
●		Molluscs – Hand-gathering
		Dredging
		Hydraulic dredging
		Cultivation of living resource
●		Saltmarsh grazing
		Sand dune grazing
		Agricultural land-claim
		Fish-farming
		Shellfish farming
		Bottom & tray cultivation
		Suspended cultivation
		Crustacea farming
		Reeds for roofing
		Salicornia picking
		Others
		Management & killing of birds & mammals
		Killing of mammals
		Killing of birds
		Adult fish-eating birds
		Adult shellfish-eating birds
		Gulls
		Geese
		Wildlife habitat management
		Spartina control
		Habitat creation & restoration
		Marine
		Intertidal
		Terrestrial
		Habitat management
		Others

Features of human use

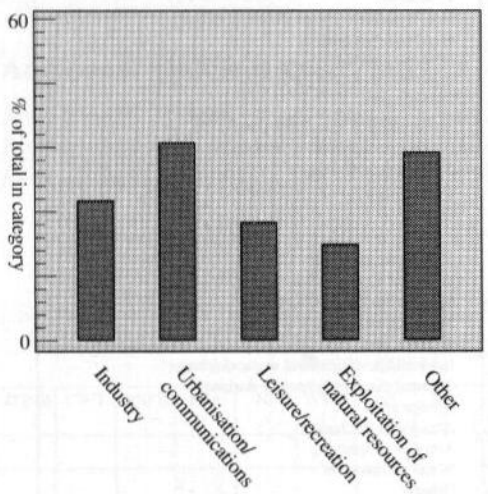
Leisure activities include sailing, mainly out to sea from boats moored in the mid-estuary and in the South Harbour. Walking, bird-watching and sea angling occur on the piers at the estuary mouth.

Industrial activities include dock facilities and power generation. There is an engineering works on the southern shore, a bulk loading terminal and a coal-fired power station on the north shore. A wind farm with nine turbines was commissioned along East Pier in 1993. The estuary channel is dredged to maintain the shipping channel.

Exploitation of the natural resource includes grazing of saltmarsh at the upper limit of Sleek Burn and fyke-netting for eels. Proposals include diverting the discharge of trade effluents and a waste incineration plant. In 1993 there was a proposal to infill intertidal land behind the north side of Staith.



Categories of human use



Further reading

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Northumberland Coast Project. In prep. *Blyth Estuary management plan*. Morpeth, Northumberland County Council.

96 Tyne Estuary

Centre grid: NZ3466
Counties: Tyne & Wear, Northumberland

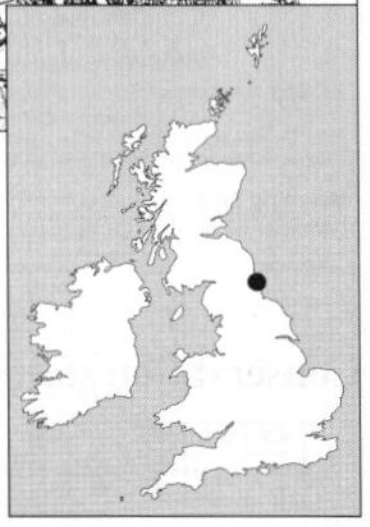
Districts: Gateshead, Newcastle-upon-Tyne, North Tyneside, South Tyneside
EN region: Northumbria

Review site location

XM = Across mouth

NTL = Normal tidal limit

= Core site



Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
792	60	83.1	32.7	4.3	Complex	454,000

Description

The Tyne is a long, narrow estuary dominated by an urban and industrial shore. Water quality varies along its length; the upper reaches have been classified as grade A, but deteriorates to grade D around Blaydon where the Derwent flows into the Tyne. Further downstream, water quality improves through grades C and B, becoming grade A near the mouth.

The estuary is largely subtidal with very little intertidal flats. There are small patches of mudflat on the southern shores at Blaydon, Dunston and Jarrow, and at Willington Gut near Wallsend there is a small saltmarsh with middle, upper marsh and strandline vegetation communities. Inside the two breakwaters which border the mouth there are stretches of sandflat; on the northern side there is a rocky shore.

Wildlife features

Coastal habitats

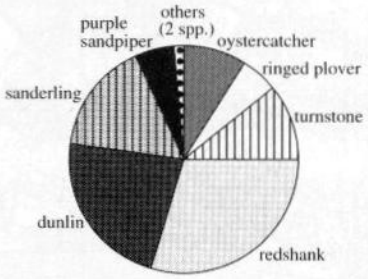
	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	◍	●	●		◍				
Area (ha)	732	3	57							

● = major habitat ◍ = minor habitat

Birds

Wintering birds 1989/90 – 1993/94 data

Total waders: 300



Wintering species assemblage
(Spp. forming >5% assemblage shown separately)

N.B. The estuary of the Tyne is not a regularly counted site; hence there are no recent data for wildfowl available.

Breeding birds: a small colony of kittiwakes breeds on buildings adjacent to the estuary.

Aquatic estuarine communities

Soft substrate

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
				●			●		●			●		●	●

Hard substrate

17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
		●										●				

Additional wildlife features

The invertebrate fauna recorded adjacent to the estuary includes three Notable species of beetle. Offshore from Tynemouth the scarce marine benthic species of sea squirt *Molgula oculata* has been recorded.

Conservation status

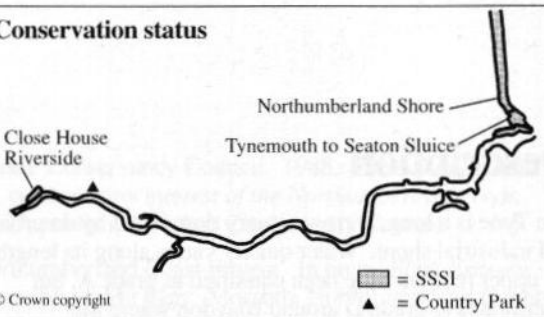
● = designated ◍ = proposed

	NCR	GCR	SSSI (B)	SSSI (G)	SSSI (M)	NNR	LNR	Ramsar	SPA	SAC	AONB	CWT	RSPB	ESA	NP	WWT	NT	NSA	HC	Other
			●	●					◍			●								●
No.			2	1					1			1								2

A small area adjacent to the estuary mouth lies within the Tynemouth to Seaton Sluice geological Site of Special Scientific Interest (98 ha) and in the upper reaches of the estuary is the Close House Riverside (3 ha) biological SSSI. The outermost part of the estuary mouth lies within the Northumberland Shore biological SSSI (1,926 ha), which is also a proposed Special Protection Area.

Close House Riverside is also a Northumberland Wildlife Trust reserve. Tyne Riverside Country Park is adjacent to the estuary near Newburn.

Conservation status



Human activities (in 1991)

Present	Proposed	
		Coast protection & sea defences
●		Linear defences
		Training walls
		Groynes
		Brushwood fences
		Spartina planting
		Marram grass planting
		Barrage schemes
		Weirs & barrages for river management
		Storm surge barrages
		Water storage barrages & bunds
		Leisure barrages
		Tidal power barrages
		Power generation
		Thermal power stations
		Import/export jetties (power generation)
		Wind-power generation
		Industrial, port & related development
●		Dock, port & harbour facilities
●		Manufacturing industries
●		Chemical industries
●		Ship & boat building/repair
		Others
		Extraction & processing of natural gas & oil
		Exploration
		Production
●		Rig & platform construction
		Pipeline construction
		Pipeline installation
●		Import/export jetties & single-point moorings
●		Oil refineries
●		Mothballing of rigs & tankers
		Military activities
		Overflying by military aircraft
		Others
		Waste discharge
		Domestic waste disposal
●		Sewage discharge & outfalls
●		Sewage treatment works
		Rubbish tips
		Industrial & agricultural waste discharge
		Thermal discharges (power stations)
		Dredge spoil
●		Accidental discharges
		Aerial crop spraying
		Waste incinerators
		Others
		Sediment extraction
		Capital dredging
●		Maintenance dredging
		Commercial estuarine aggregates extraction
●		Commercial terrestrial aggregates extraction
		Non-commercial aggregates extraction
		Hard-rock quarrying
		Transport & communications
		Airports & helipads
●		Tunnels, bridges & aqueducts
		Causeways & fords
		Road schemes
●		Ferries
●		Cables
		Urbanisation
●		Land-claim for housing & car parks
		Education & scientific research
●		Sampling, specimen collection & observation
●		Nature trails & interpretative facilities
		Seismic studies & geological test drilling
		Marine & terrestrial archaeology
		Fossil collecting

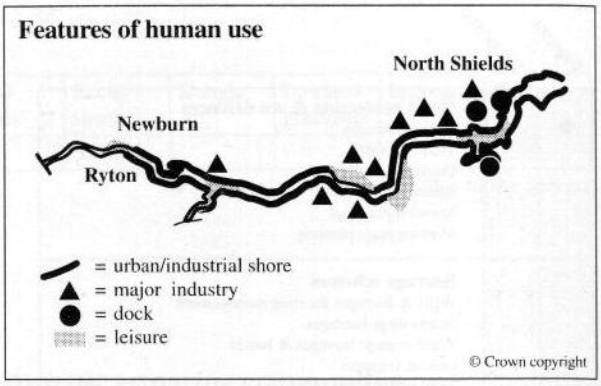
Present	Proposed	
		Tourism & recreation
		Infrastructure developments
●	●	Marinas
●		Non-marina moorings
●		Dinghy & boat parks
●		Caravan parks & chalets
●		Leisure centres, complexes & piers
		Aquatic-based recreation
●		Power-boating & water-skiing
		Jet-skiing
●		Sailing
●		Sailboarding & wind-surfing
		SCUBA & snorkelling
●		Canoeing
		Surfing
●		Rowing
●		Tourist boat trips/leisure barges
●		Angling
		Other non-commercial fishing
●		Bathing & general beach recreation
		Terrestrial & intertidal-based recreation
●		Walking, including dog walking
●		Bird-watching
		Sand-yachting
		4WD & trial-biking
		Car sand-racing
●		Horse-riding
		Rock-climbing
●		Golf courses
		Clay-pigeon shooting
		Others
		Airborne recreation
		Overflying by light aircraft
		Radio-controlled model aircraft
		Others
		Wildfowling & hunting
		Wildfowling
		Other hunting-related activities
		Bait-collecting
●		Digging & pumping for lugworms & ragworms
		Hydraulic dredging for worms
		Others
		Commercial fisheries
		Fish-netting & trawling
		Fyke-netting for eels
		Fish traps & other fixed devices & nets
		Crustacea
		Molluscs – Hand-gathering
		Dredging
		Hydraulic dredging
		Cultivation of living resource
●		Saltmarsh grazing
		Sand dune grazing
		Agricultural land-claim
		Fish-farming
		Shellfish farming
		Bottom & tray cultivation
		Suspended cultivation
		Crustacea farming
		Reeds for roofing
		Salicornia picking
		Others
		Management & killing of birds & mammals
		Killing of mammals
		Killing of birds
		Adult fish-eating birds
		Adult shellfish-eating birds
		Gulls
		Geese
		Wildlife habitat management
		Spartina control
		Habitat creation & restoration
		Marine
●	●	Intertidal
		Terrestrial
		Habitat management
●		**Others**

Features of human use

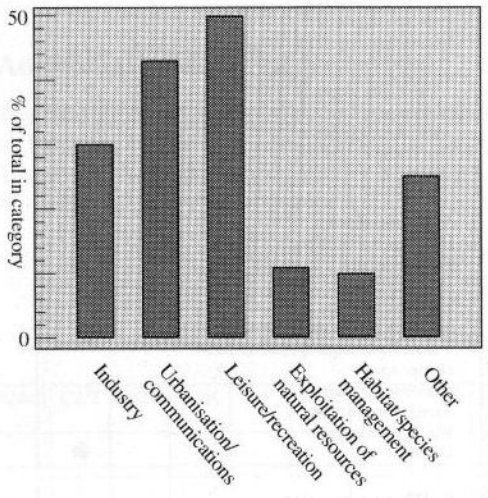
The estuary is dominated by industry. There are major docks at Tyne Dock and North Shields, large-scale industries at Felling Shore and Scotswood, and numerous shipbuilding/repair yards along the shore from Howdon to Bill Quay. There is oil rig and platform construction at Howdon, Willington Quay and at St Anthony's, and there is an oil refinery and aggregates jetty at Gateshead, and a grain berth at Newcastle.

Leisure activities are predominatly water-based pursuits. There are several marinas on the Tyne at South Shields, Tynemouth, Hebburn, Friars Goose, St Peter's Basin, Derwenthaugh and Lemington and most leisure boats sail out to sea; there is some power-boating at Tyne bridge. Other water-based pursuits occur predominantly in the upper reaches of the estuary, such as canoeing and rowing. Horse-riding occurs at Ryton and Newburn and trial-biking occurs at St Peter's on the northern shore. There is very little exploitation of natural resource; horses graze on the saltmarsh at Willington.

Proposals in 1989 included a chemical works and waste incineration plant, a marina at Dunston Staithes and oil rig and platform construction at Jarrow slake which would involve 2 ha of land-claim and creation of mudflats. More recently there have been proposals for marinas at North Tyneside Royal Quays.



Categories of human use



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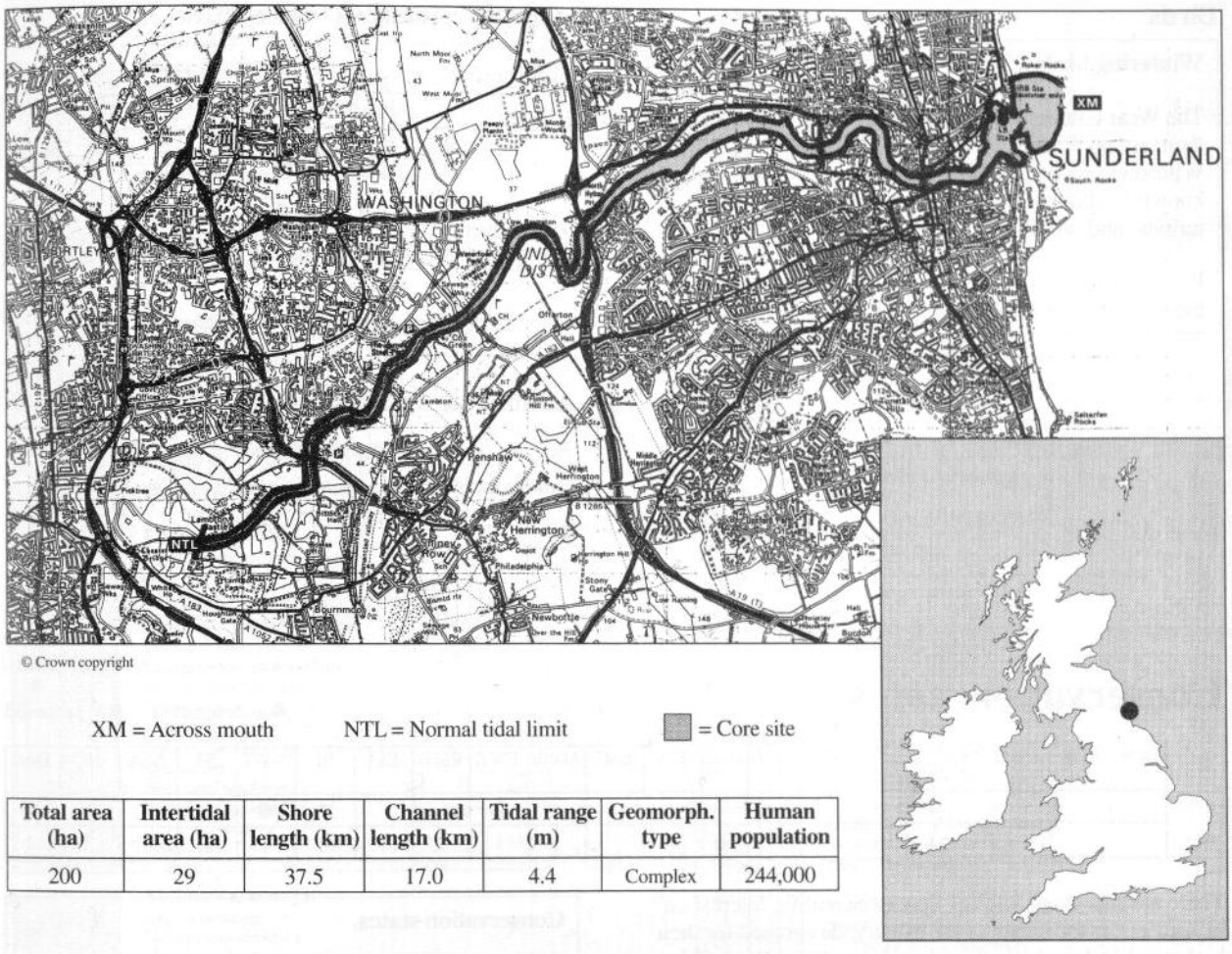
97 Wear Estuary

Centre grid: NZ3958
County: Tyne & Wear

District: Sunderland
EN area: Northumbria

Review site location



XM = Across mouth NTL = Normal tidal limit = Core site

Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
200	29	37.5	17.0	4.4	Complex	244,000

Description

The estuary of the River Wear is a long, narrow channel which for much of its length flows past the city of Sunderland before reaching the sea. The estuary comprises largely subtidal habitat and water quality has been classified as grade A in its upper reaches and grade B in its lower reaches.

There are strips of intertidal mudflat in the middle section of the estuary, where there is a small area of saltmarsh. The saltmarsh is small and fragmented and restricted to three discrete areas. Two patches at North Hylton are dominated by mid-upper marsh vegetation communities, with a narrow fringe of low-mid marsh along its front edge. The third patch at Timber Beach contains several communities in a small area, with low-mid marsh, mid-upper marsh, grassland transition and *Phragmites* reed.

Protected by the breakwaters that form the estuary mouth are small strips of sandflat.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	◉	●	●						
Area (ha)	171	6	23							

● = major habitat ◉ = minor habitat

Birds

Wintering birds

The Wear Estuary is not a regularly counted site, hence there are no waterfowl data available. However, the Wildfowl and Wetlands Trust reserve at Washington is known to attract migrant waders (including some rarities) and wildfowl.

Breeding birds: there is a significant tern colony on the south side of the estuary mouth.

Aquatic estuarine communities

Soft substrate

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
			●						●			●		●	●

Hard substrate

17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
												●				

Additional wildlife features

The invertebrate fauna recorded on or adjacent to the estuary include seven Notable species.

Conservation status

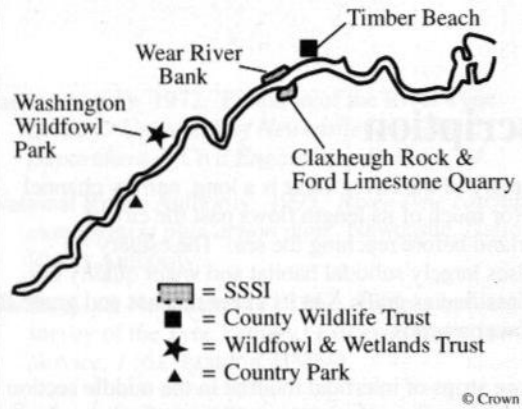
● = designated ◉ = proposed

	NCR	GCR	SSSI (B)	SSSI (G)	SSSI (M)	NNR	LNR	Ramsar	SPA	SAC	AONB	CWT	RSPB	ESA	NP	WWT	NT	NSA	HC	Other
					●							●				●				●
No.					2							1				1				1

There are two small Sites of Special Scientific Interest on or adjacent to the banks of the estuary, designated for their biological and geological interest: Wear River Bank (5 ha) and Claxheugh Rock and Ford Limestone Quarry (7 ha).

Washington Wildfowl Park is a Wildfowl and Wetlands Trust reserve, and Durham Wildlife Trust have a reserve at Timber Beach. Sir James Steel Riverside Park is a Country Park.

Conservation status



Human activities (in 1991)

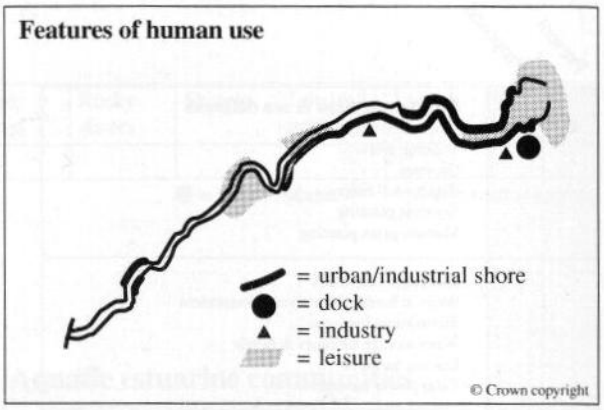
Present	Proposed	
		Coast protection & sea defences
●		Linear defences
		Training walls
		Groynes
		Brushwood fences
		Spartina planting
		Marram grass planting
		Barrage schemes
		Weirs & barrages for river management
		Storm surge barrages
		Water storage barrages & bunds
		Leisure barrages
		Tidal power barrages
		Power generation
		Thermal power stations
		Import/export jetties (power generation)
		Wind-power generation
		Industrial, port & related development
●		Dock, port & harbour facilities
●		Manufacturing industries
		Chemical industries
		Ship & boat building/repair
		Others
		Extraction & processing of natural gas & oil
		Exploration
		Production
		Rig & platform construction
		Pipeline construction
		Pipeline installation
		Import/export jetties & single-point moorings
		Oil refineries
		Mothballing of rigs & tankers
		Military activities
		Overflying by military aircraft
		Others
		Waste discharge
●		Domestic waste disposal
●		Sewage discharge & outfalls
		Sewage treatment works
		Rubbish tips
		Industrial & agricultural waste discharge
		Thermal discharges (power stations)
		Dredge spoil
		Accidental discharges
		Aerial crop spraying
		Waste incinerators
		Others
		Sediment extraction
●		Capital dredging
		Maintenance dredging
		Commercial estuarine aggregates extraction
		Commercial terrestrial aggregates extraction
		Non-commercial aggregates extraction
		Hard-rock quarrying
		Transport & communications
●		Airports & helipads
		Tunnels, bridges & aqueducts
		Causeways & fords
		Road schemes
●		Ferries
		Cables
		Urbanisation
		Land-claim for housing & car parks
		Education & scientific research
●		Sampling, specimen collection & observation
		Nature trails & interpretative facilities
		Seismic studies & geological test drilling
		Marine & terrestrial archaeology
		Fossil collecting

Present	Proposed	
		Tourism & recreation
		Infrastructure developments
		Marinas
●		Non-marina moorings
●		Dinghy & boat parks
		Caravan parks & chalets
		Leisure centres, complexes & piers
		Aquatic-based recreation
●		Power-boating & water-skiing
		Jet-skiing
●		Sailing
		Sailboarding & wind-surfing
		SCUBA & snorkelling
		Canoeing
		Surfing
●		Rowing
●		Tourist boat trips/leisure barges
●		Angling
		Other non-commercial fishing
		Bathing & general beach recreation
		Terrestrial & intertidal-based recreation
●		Walking, including dog walking
●		Bird-watching
		Sand-yachting
		4WD & trial-biking
		Car sand-racing
		Horse-riding
		Rock-climbing
●		Golf courses
		Clay-pigeon shooting
		Others
		Airborne recreation
		Overflying by light aircraft
		Radio-controlled model aircraft
		Others
		Wildfowling & hunting
		Wildfowling
		Other hunting-related activities
		Bait-collecting
●		Digging & pumping for lugworms & ragworms
		Hydraulic dredging for worms
		Others
		Commercial fisheries
		Fish-netting & trawling
		Fyke-netting for eels
		Fish traps & other fixed devices & nets
		Crustacea
		Molluscs – Hand-gathering
		Dredging
		Hydraulic dredging
		Cultivation of living resource
●		Saltmarsh grazing
		Sand dune grazing
		Agricultural land-claim
		Fish-farming
		Shellfish farming
		Bottom & tray cultivation
		Suspended cultivation
		Crustacea farming
		Reeds for roofing
		Salicornia picking
●		Others
		Management & killing of birds & mammals
		Killing of mammals
		Killing of birds
		Adult fish-eating birds
		Adult shellfish-eating birds
		Gulls
		Geese
		Wildlife habitat management
		Spartina control
		Habitat creation & restoration
		Marine
		Intertidal
●		Terrestrial
		Habitat management
		Others

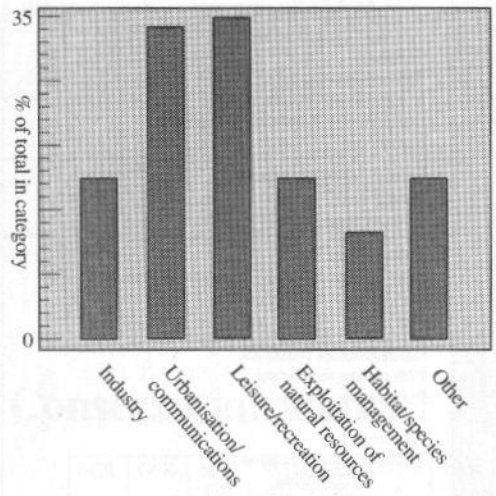
Features of human use

Leisure pursuits are the most numerous activity and include sailing in the mouth of the estuary and out to sea, water-skiing, rowing, and walking and bird-watching in the middle reaches of the estuary. Exploitation of the natural resource includes grazing most of the saltmarsh by cattle and horses, turf-cutting, bait-digging at Timber Beach and there are nature trails at Timber Beach, Washington Wildfowl Park and Sir James Steel Park.

Industrial activity is limited and includes a large dock at Sunderland and a metal industry at Pallion. Since 1989 the shipbuilding yards have closed and the local coal mine at Wearmouth has ceased working. There are proposals to reopen a shipyard for repair work. Some new developments of the riverside are under construction.



Categories of human use



Further reading

National Rivers Authority. 1995. *River Wear catchment management plan. Action plan.* Newcastle, National Rivers Authority.

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98 Tees Estuary

Centre grid: NZ5326
County: Cleveland

Districts: Hartlepool, Middlesbrough, Stockton-on-Tees
EN area: Northumbria

Review site location

Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
1,347	471 (454)*	121.4 (19.1)*	38.3	4.8	Coastal plain	1,317,000

* = associated intertidal

XM = Across mouth
AS = Along shore
NTL = Normal tidal limit
= Core site
= Associated shoreline
= Associated intertidal

Description

The estuary of the river Tees has been completely changed by industrial development on land claimed from the estuary. The original estuary was much broader but with successive land-claim the estuary was narrowed and it now flows into Tees Bay past two breakwaters at the mouth. The lower parts of the Tees are surrounded by Middlesbrough, Billingham and Stockton-on-Tees and their towering industrial buildings. Water quality in the estuary varies, for the upper reaches have been classified as grade B, but declines to grades C and D further downstream.

With the loss of a large proportion of the original intertidal area (around 90% in the last 120 years), much of the remaining estuary is subtidal. There are narrow strips of mudflat along the shores with the only extensive area of mudflat at Seal Sands. These intertidal flats support populations of invertebrates and, since the installation of a sewage treatment works and improving water quality, the benthic fauna of the Tees has increased in diversity and abundance.

The only remaining saltmarsh is Cowpen Marsh, which lies along the Greatham Creek tributary. The vegetation here is composed of pioneer, low-mid, mid-upper vegetation and driftline vegetation communities. Many areas of former saltmarsh were enclosed by sea walls and have reverted to grazing marshes, with some brackish pools. The relict saltmarsh creeks, or fleets, which remain in this area have a relatively diverse flora. A number of grazing marsh species reach their northern limit here.

In the lower reaches of the estuary the intertidal flats become more sandy. On either side of the estuary mouth sandy beaches stretch north-westwards to Hartlepool and eastwards to Redcar; these beaches were once an integral part of the original estuary. To the west of the estuary mouth the sandy foreshore of Seaton Sands grades into dunes, and towards Hartlepool there is a submerged forest on the shore. On the opposite side of the estuary mouth lies South Gare and Coatham Sands, an extensive tract of intertidal sand and sand dunes, with marram and one of the largest stands of lyme-grass *Elymus arenarius* in England. At low tide small areas of rocky foreshore are exposed at Hartlepool and Redcar.

The Tees Estuary is of particular importance for its wintering bird populations, which congregate on the intertidal flats at Seal Sands and adjacent marshes. The estuary regularly supports nationally important populations of three species of wintering waterfowl and important roosts of terns on passage migration during late summer.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	●	●	●	◉	●		
Area (ha)	876	34	437							

● = major habitat ◉ = minor habitat

Aquatic estuarine communities

Soft substrate

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
		●		●			●		●			●		●	

Hard substrate

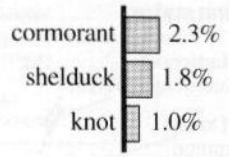
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
									●			●				

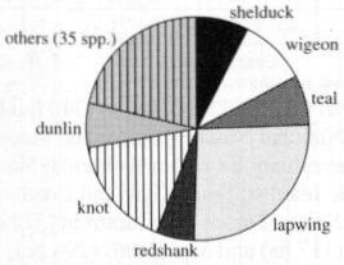
Birds

Wintering birds

1989/90 – 1993/94 data

Total waterfowl: 19,600





Wintering species assemblage
(Spp. forming >5% assemblage shown separately)

Breeding birds: little terns breed at sites on both sides of the estuary mouth and low numbers of lapwing, redshank and snipe breed on the grasslands adjacent to the estuary.

Other: the Tees supports important roosts of Sandwich terns on passage migration.

Additional wildlife features

Four nationally scarce plants have been found within the estuary: stiff saltmarsh grass *Puccinellia rupestris,* rush-leaved fescue *Festuca juncifolia,* long-stalked orache *Atriplex longipes* and seaside centaury *Centaurium littorale.*

The invertebrate fauna recently recorded on the estuary includes 24 Notable species. There have been a number of historical observations of the lampern *Lampetra fluviatilis* in the Tees and recent records of the sea lamprey *Petromyzon marinus.* Numbers of grey and common seals feed and haul up on Seal Sands.

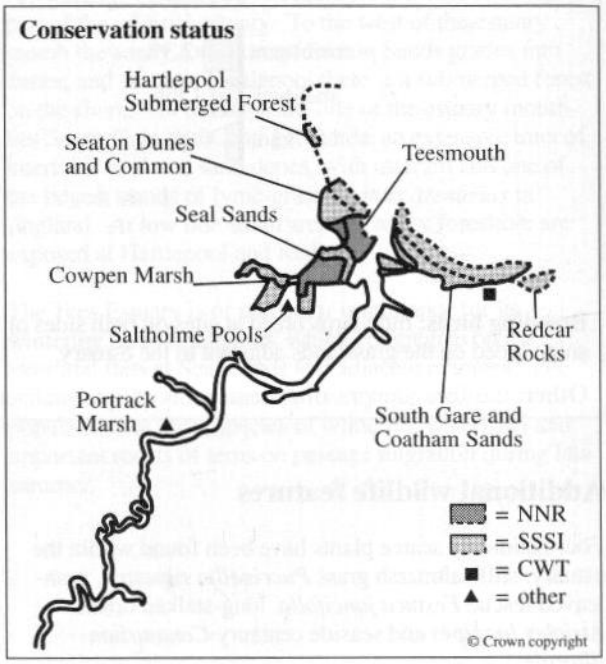
Conservation status

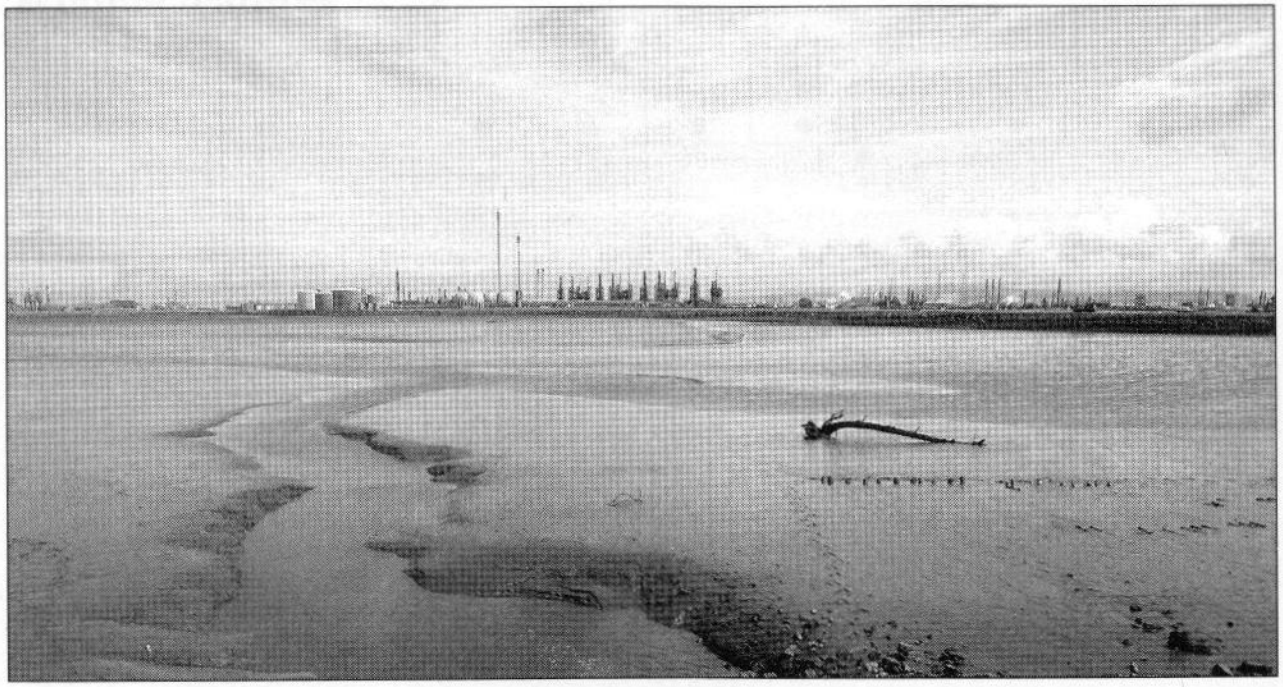
● = designated ● = proposed

	NCR	GCR	SSSI (B)	SSSI (G)	SSSI (M)	NNR	LNR	Ramsar	SPA	SAC	AONB	CWT	RSPB	ESA	NP	WWT	NT	NSA	HC	Other
	●	●	●	●		●		●	●			●								●
No.	1	2	4	2		1		1	1			1								2

Teesmouth (North Gare and Seal Sands) (340 ha) has been designated as a National Nature Reserve and much of the lower parts of the estuary lie within biological Sites of Special Scientific Interest: South Gare and Coatham Sands (381 ha), Seaton Dunes and Common (312 ha), Cowpen Marsh (117 ha) and Seal Sands (294 ha). These four biological SSSIs comprise the Teesmouth Flats and Marshes Nature Conservation Review site. There are two geological SSSIs within the estuary, Redcar Rocks (31 ha) and Hartlepool Submerged Forest (20 ha), which are also Geological Conservation Review sites.

Parts of the Tees Estuary lie within the Teesmouth and Cleveland Coast Ramsar site and Special Protection Area. The Cleveland Wildlife Trust has a reserve at Coatham Marsh and Saltholme Pools and Portrack Marsh are privately owned reserves. There is a proposal to designate a 'Teeside International Nature Reserve' on land in the Haverton/Saltholme district.





The Tees is dominated by the industry which has claimed a large proportion of the estuary. Seal Sands (above) is the only extensive area of intertidal flat remaining. (Peter Wakely, English Nature.)

Human activities (in 1996)

Present	Proposed	
		Coast protection & sea defences
●		Linear defences
●		Training walls
●		Groynes
		Brushwood fences
		Spartina planting
●		Marram grass planting
		Barrage schemes
		Weirs & barrages for river management
		Storm surge barrages
		Water storage barrages & bunds
●		Leisure barrages
		Tidal power barrages
		Power generation
●		Thermal power stations
		Import/export jetties (power generation)
		Wind-power generation
		Industrial, port & related development
●		Dock, port & harbour facilities
●	●	Manufacturing industries
●		Chemical industries
		Ship & boat building/repair
		Others
		Extraction & processing of natural gas & oil
		Exploration
		Production
●		Rig & platform construction
●		Pipeline construction
		Pipeline installation
●		Import/export jetties & single-point moorings
●		Oil refineries
		Mothballing of rigs & tankers
		Military activities
		Overflying by military aircraft
		Others
		Waste discharge
●		Domestic waste disposal
●		Sewage discharge & outfalls
●		Sewage treatment works
●		Rubbish tips
●		Industrial & agricultural waste discharge
		Thermal discharges (power stations)
		Dredge spoil
●		Accidental discharges
		Aerial crop spraying
●	●	Waste incinerators
●		Others
		Sediment extraction
	●	Capital dredging
●		Maintenance dredging
		Commercial estuarine aggregates extraction
●		Commercial terrestrial aggregates extraction
		Non-commercial aggregates extraction
		Hard-rock quarrying
		Transport & communications
●		Airports & helipads
●	●	Tunnels, bridges & aqueducts
		Causeways & fords
		Road schemes
		Ferries
●		Cables
		Urbanisation
		Land-claim for housing & car parks
		Education & scientific research
●		Sampling, specimen collection & observation
●	●	Nature trails & interpretative facilities
		Seismic studies & geological test drilling
●		Marine & terrestrial archaeology
●		Fossil collecting

Present	Proposed	
		Tourism & recreation
		Infrastructure developments
●	●	Marinas
●		Non-marina moorings
●		Dinghy & boat parks
●	●	Caravan parks & chalets
		Leisure centres, complexes & piers
		Aquatic-based recreation
●		Power-boating & water-skiing
●		Jet-skiing
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●		Sailboarding & wind-surfing
●		SCUBA & snorkelling
		Canoeing
		Surfing
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●		Angling
		Other non-commercial fishing
●		Bathing & general beach recreation
		Terrestrial & intertidal-based recreation
●		Walking, including dog walking
●		Bird-watching
		Sand-yachting
●		4WD & trial-biking
		Car sand-racing
●		Horse-riding
		Rock-climbing
●		Golf courses
		Clay-pigeon shooting
		Others
		Airborne recreation
		Overflying by light aircraft
●		Radio-controlled model aircraft
		Others
		Wildfowling & hunting
●		Wildfowling
		Other hunting-related activities
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●		Digging & pumping for lugworms & ragworms
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		Habitat creation & restoration
		Marine
	●	Intertidal
	●	Terrestrial
	●	Habitat management
●		**Others**

Features of human use

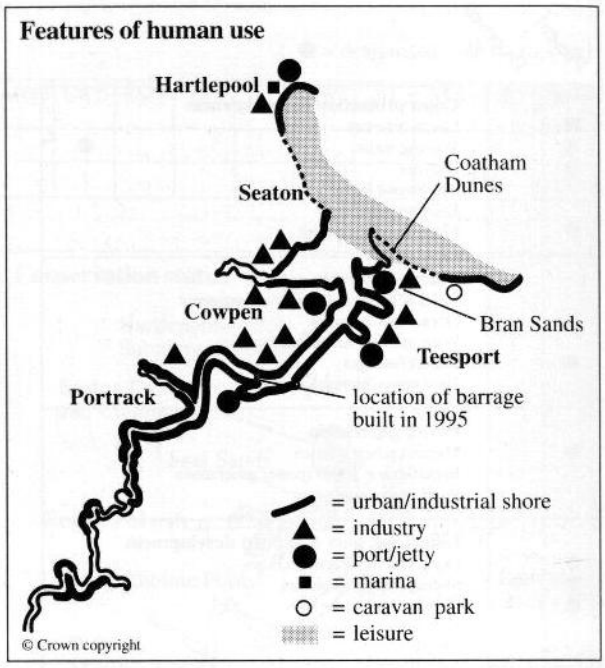
The Tees is dominated by industry. There is a large steelworks at Bran Sands with its own jetty for importing iron ore and coal, and large dock complexes at Hartlepool and Teesport. Tees and Hartlepool Port Authority have several jetties around the estuary and there are jetties at Portrack and a further jetty for storage of chemical imports. Industry includes six major chemical complexes and four oil rig and platform construction sites around the estuary; there are also two oil refineries. Sand extraction occurs at North Gare.

The construction in 1995 of a barrage at Portrack (see map) now excludes the tide from the uppermost reaches of the estuary (approximately 20 kms). This has effectively shortened the length of the tidal Tees by around one third.

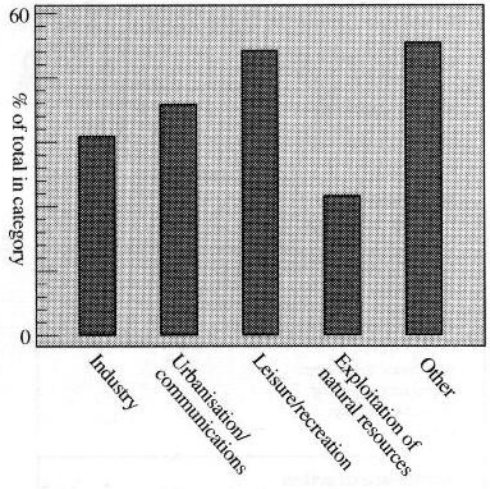
Leisure activities take place around the mouth of the estuary and include sailing, wind-surfing, SCUBA diving, snorkelling and fishing. Other activities, such as walking and beach recreation, occur along the beaches outside the estuary mouth and on Coatham Dunes. 4WD and trial-biking occur and horse-riders use Coatham Sands. Other recreational activities are concentrated at the barrage or further upstream and include rowing, water-skiing, angling, cruising, boat trips and use of the purpose-built canoe slalom at the barrage.

There is very little exploitation of the natural resources on the Tees Estuary, but bait-digging occurs throughout and wildfowlers shoot over parts of the marsh at Cowpen. The estuary is also much used for studies by universities and schools and there is a Field Centre at Teesmouth.

In 1991 there were proposals for an extension to the existing steelworks, a waste incineration plant, a marina at Redcar and a leisure centre on the old Stockton race-course. Creation of mudflats and brackish lagoons on Sneaton Snook, Greenabella Marsh and Bran Sands was proposed, with a freshwater reedbed proposed at Saltholme. In 1996 a large effluent treatment plant was under construction at Bran Sands to treat sewage and industrial effluents currently discharged to the estuary. This is expected to result in significant water quality improvements in the estuary.



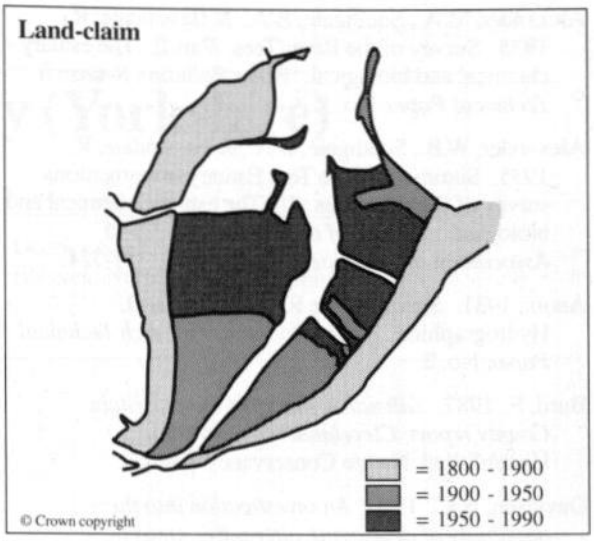
Categories of human use



Land-claim

The Tees has been subject to considerable land-claim, with over 3,300 ha lost since 1720 - an overall reduction of the total estuary area by 83%. In the 18th and early 19th Century there was extensive land-claim of saltmarsh on both sides of the estuary, for agricultural purposes. In the 1850s there remained a large expanse of intertidal mudflat and sandflat with fringing saltmarsh, but the total intertidal area had been reduced to around 2,740 ha.

From the late 19th Century onwards there were progressive excursions, claiming land for the construction of docks and jetties, and more recently, the large industrial complexes present today. The last major land-claim was on Seal Sands in 1971 and 1974, which claimed over 400 ha of mudflat for the petrochemical industry. This coincided with a marked decrease in the number of wintering waders on this part of the estuary. There has been no further major land-claim since 1974. However, in 1989 there was a proposal to extend the existing steelworks that would involve the loss of a further 75 ha of intertidal area and 25 ha of associated terrestrial land. Another proposal to extend the docks on Seal Sands peninsula and cause the loss of 40 ha intertidal area, was dropped in 1988.



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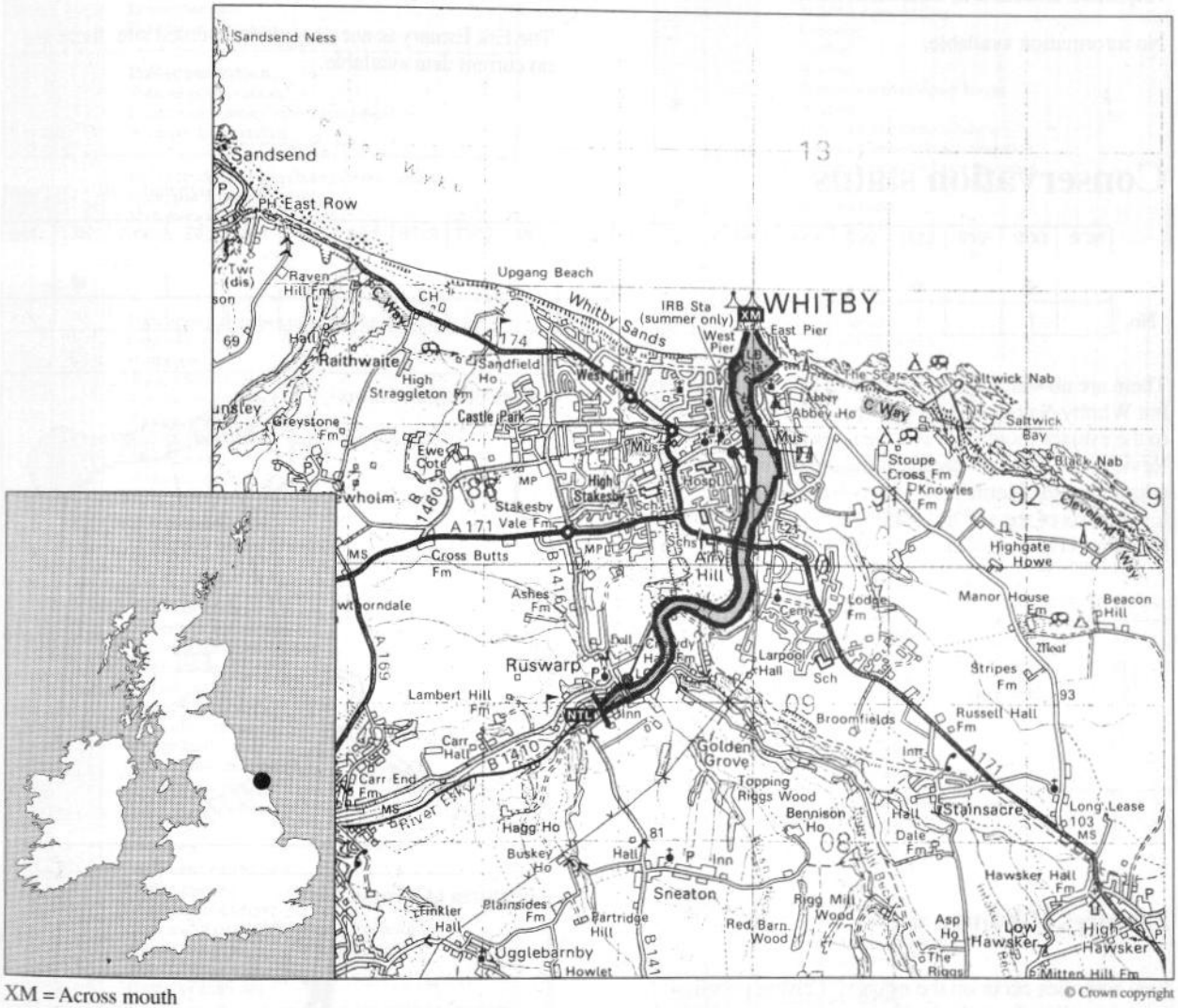
99 Esk Estuary (Yorkshire)

Centre grid: NZ9010
County: North Yorkshire

District: Scarborough
EN area: North & East Yorkshire

Review site location



XM = Across mouth

NTL = Normal tidal limit

= Core site

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Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
30	9	8.5	3.8	4.6	Complex	13,000

Description

The Esk is a small, narrow estuary that flows into the sea at Whitby, with its narrow, upper reaches widening only slightly towards the mouth. The intertidal area is small, with a sandflat on the western shore in the middle reaches of the estuary, and another sandflat with boulders on the eastern shore just inside the mouth. Much of the lower Esk is lined with the harbour walls of Whitby and the mouth very much constricted by the two breakwaters on either side. Water quality in the estuary has been classified as grade A.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●		●							
Area (ha)	21		9							

● = major habitat ◍ = minor habitat

Aquatic estuarine communities

No information available.

Birds

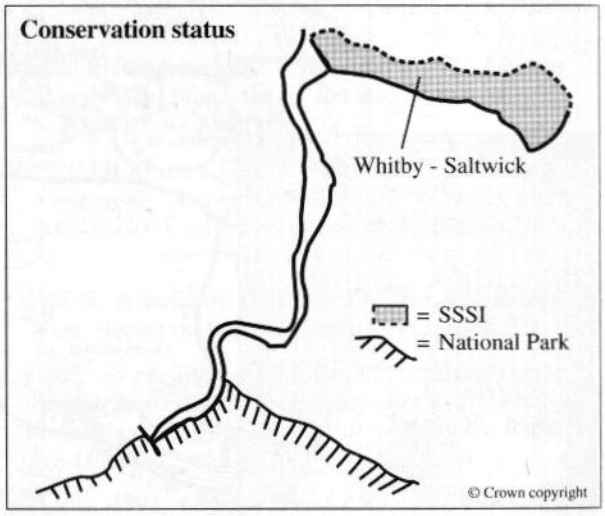
The Esk Estuary is not a regularly counted site; there are no current data available.

Conservation status

● = designated ◍ = proposed

	NCR	GCR	SSSI (B)	SSSI (G)	SSSI (M)	NNR	LNR	Ramsar	SPA	SAC	AONB	CWT	RSPB	ESA	NP	WWT	NT	NSA	HC	Other
		●		●											●				●	
No.		1		1											1				1	

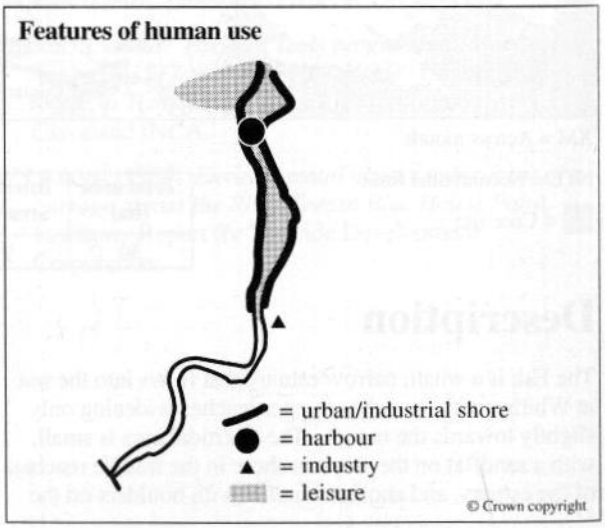
There are no statutory designations covering the estuary, but Whitby-Saltwick geological SSSI (42 ha) is adjacent to the estuary mouth and is a Geological Conservation Review site. A short stretch of the upper estuary lies adjacent to the North York Moors National Park and the lower parts of the site lie within the North Yorkshire and Cleveland Heritage Coast.



Features of human use

Few activities occur on the estuary. Leisure pursuits include sailing from the harbour area out to sea, canoeing, angling, bird-watching and walking. Whitby is a very popular tourist area.

Most of the estuary lies within Whitby harbour, which has a fishing fleet and two cargo wharfs. There is also a boatyard on the upper estuary. Exploitation of the natural resources includes boulder turning for crabs for bait.



Human activities (in 1991)

Present	Proposed	
●		**Coast protection & sea defences** Linear defences Training walls Groynes Brushwood fences *Spartina* planting Marram grass planting
●		**Barrage schemes** Weirs & barrages for river management Storm surge barrages Water storage barrages & bunds Leisure barrages Tidal power barrages
		Power generation Thermal power stations Import/export jetties (power generation) Wind-power generation
●		**Industrial, port & related development** Dock, port & harbour facilities Manufacturing industries Chemical industries Ship & boat building/repair Others
		Extraction & processing of natural gas & oil Exploration Production Rig & platform construction Pipeline construction Pipeline installation Import/export jetties & single-point moorings Oil refineries Mothballing of rigs & tankers
		Military activities Overflying by military aircraft Others
		Waste discharge Domestic waste disposal Sewage discharge & outfalls Sewage treatment works Rubbish tips Industrial & agricultural waste discharge Thermal discharges (power stations) Dredge spoil Accidental discharges Aerial crop spraying Waste incinerators Others
		Sediment extraction Capital dredging Maintenance dredging Commercial estuarine aggregates extraction Commercial terrestrial aggregates extraction Non-commercial aggregates extraction Hard-rock quarrying
●		**Transport & communications** Airports & helipads Tunnels, bridges & aqueducts Causeways & fords Road schemes Ferries Cables
		Urbanisation Land-claim for housing & car parks
		Education & scientific research Sampling, specimen collection & observation Nature trails & interpretative facilities Seismic studies & geological test drilling Marine & terrestrial archaeology Fossil collecting

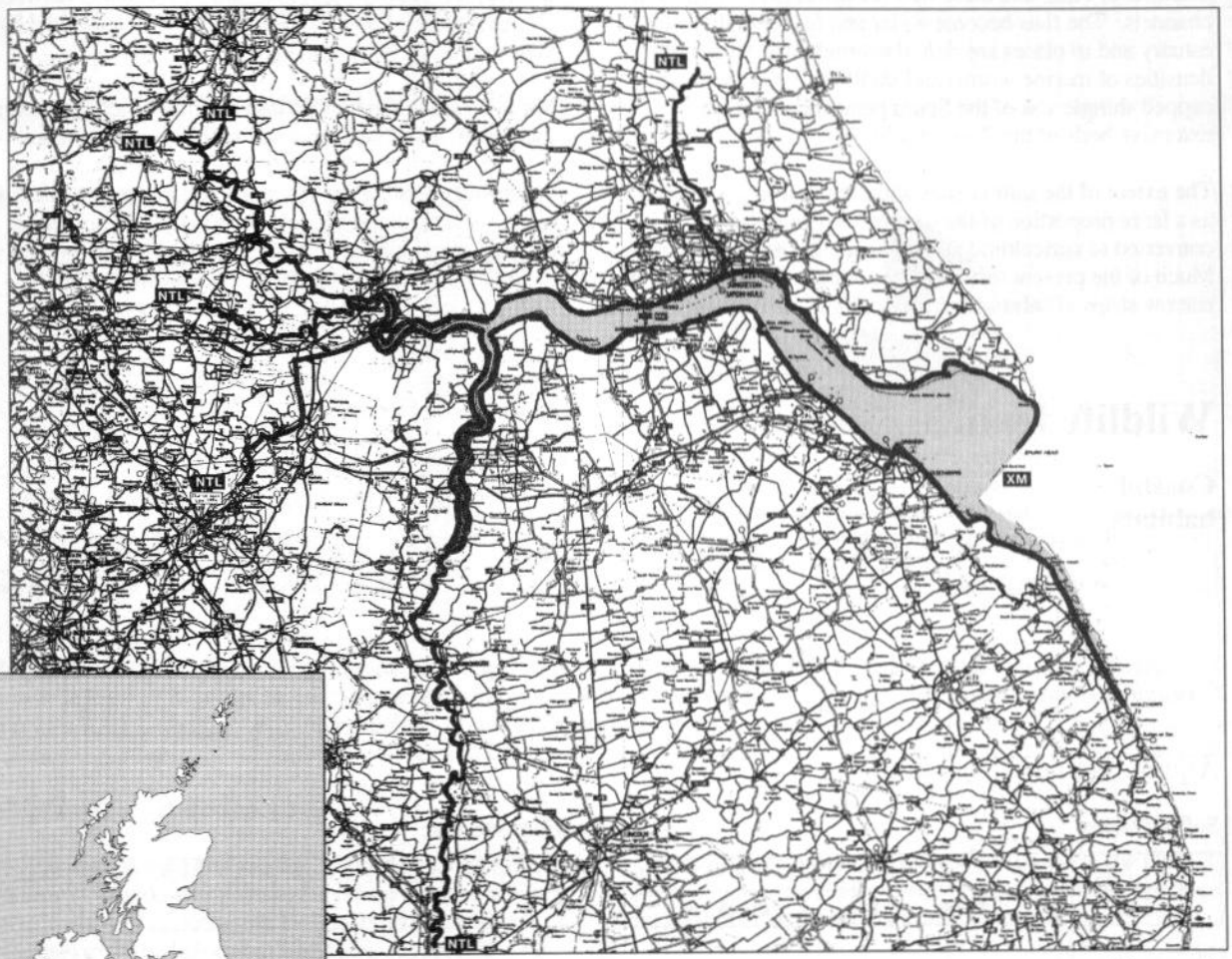
Present	Proposed	
		Tourism & recreation Infrastructure developments Marinas Non-marina moorings Dinghy & boat parks Caravan parks & chalets Leisure centres, complexes & piers Aquatic-based recreation Power-boating & water-skiing Jet-skiing Sailing Sailboarding & wind-surfing SCUBA & snorkelling Canoeing Surfing Rowing Tourist boat trips/leisure barges Angling Other non-commercial fishing Bathing & general beach recreation Terrestrial & intertidal-based recreation Walking, including dog walking Bird-watching Sand-yachting 4WD & trial-biking Car sand-racing Horse-riding Rock-climbing Golf courses Clay-pigeon shooting Others Airborne recreation Overflying by light aircraft Radio-controlled model aircraft Others
		Wildfowling & hunting Wildfowling Other hunting-related activities
		Bait-collecting Digging & pumping for lugworms & ragworms Hydraulic dredging for worms Others
		Commercial fisheries Fish-netting & trawling Fyke-netting for eels Fish traps & other fixed devices & nets Crustacea Molluscs – Hand-gathering Dredging Hydraulic dredging
		Cultivation of living resource Saltmarsh grazing Sand dune grazing Agricultural land-claim Fish-farming Shellfish farming Bottom & tray cultivation Suspended cultivation Crustacea farming Reeds for roofing *Salicornia* picking Others
		Management & killing of birds & mammals Killing of mammals Killing of birds Adult fish-eating birds Adult shellfish-eating birds Gulls Geese
		Wildlife habitat management *Spartina* control Habitat creation & restoration Marine Intertidal Terrestrial Habitat management
●		**Others**

100 Humber Estuary

Centre grid: TA2118
Counties: North-east Lincolnshire, North Lincolnshire, North Yorkshire, Nottinghamshire

Districts: Bassetlaw, City of York, East Lindsey, East Riding of Yorkshire Council, Kingston upon Hull City Council, Newark & Sherwood, North East Lincolnshire, North Lincolnshire, Selby
EN areas: North & East Yorkshire, Humber to Pennines, East Midlands

Review site location



Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
30,357	13,521	675.5	144.7	6.0	Coastal plain	551,000

XM = Across mouth

NTL = Normal tidal limit

= Core site

Description

The Humber is a very large estuary, encompassing the outflow from the rivers Trent, Ouse, Don and Hull and providing the largest single input of freshwater from Britain into the North Sea. Today the Humber Estuary is a busy commercial waterway, with parts of its shores (Goole, Hull, Grimsby and Immingham) dominated by major ports and industrial complexes. Water quality within the estuary varies. In the upper tidal reaches of the Rivers Don and Ouse it has been classified as grade C, with the middle section and most of the southern shore as grade B. The estuary mouth and parts of the northern shore have been classified as grade A, strongly influenced by the tidal currents that circulate in the outer estuary.

At low tide the intertidal flats of the Humber extend from the confluence of the Rivers Trent and Ouse to the western outskirts of Hull, and these flats are dissected by two main channels. The flats become wider and firmer in the outer estuary and in places are rich in invertebrates, with high densities of marine worms and shellfish. Near the sand-capped shingle spit of the Spurn peninsula there are extensive beds of the *Zostera* eelgrass.

The extent of the saltmarshes within the estuary is limited, as a large proportion of the former saltmarsh was converted to agricultural and subsequently industrial land. Much of the present saltmarsh lies outside of sea walls and narrow strips of saltmarsh fringe parts of the north and south shores of the inner estuary. The vegetation communities vary and in places the saltmarsh is botanically diverse. Of note are the large reedbeds at Blacktoft Sands and Broomfleet, and at Welwick the vegetation is dominated by a large driftline community and *Spartina*. At various localities along the shore of the estuary are a number of saline-pools or lagoon-like habitats, largely resulting from the flooding of former clay pits.

Extending south-eastwards from Cleethorpes to Mablethorpe is a broad, sandy beach backed by saltmarsh and sand dunes, protected from wave action by a series of submerged offshore bars. The protection afforded by these bars means that the saltmarshes and sand dunes are rapidly accreting in places. A number of sandy shingle features are developing to seaward of the marsh between Donna Nook and Saltfleetby and are being colonised by vegetation.

Various sites around the estuary support a rich invertebrate fauna that includes several rare species and the dunes support a small breeding population of natterjack toads. The Humber Estuary is of great significance for wintering birds, for it regularly supports internationally important populations of nine species of wintering waterfowl and nationally important populations of eleven species.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	●	●		●	●	●	
Area (ha)	16,836	1,419	12,102							

● = major habitat ● = minor habitat

Aquatic estuarine communities

Soft substrate

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
		●		●		●	●		●			●	●	●	

Hard substrate

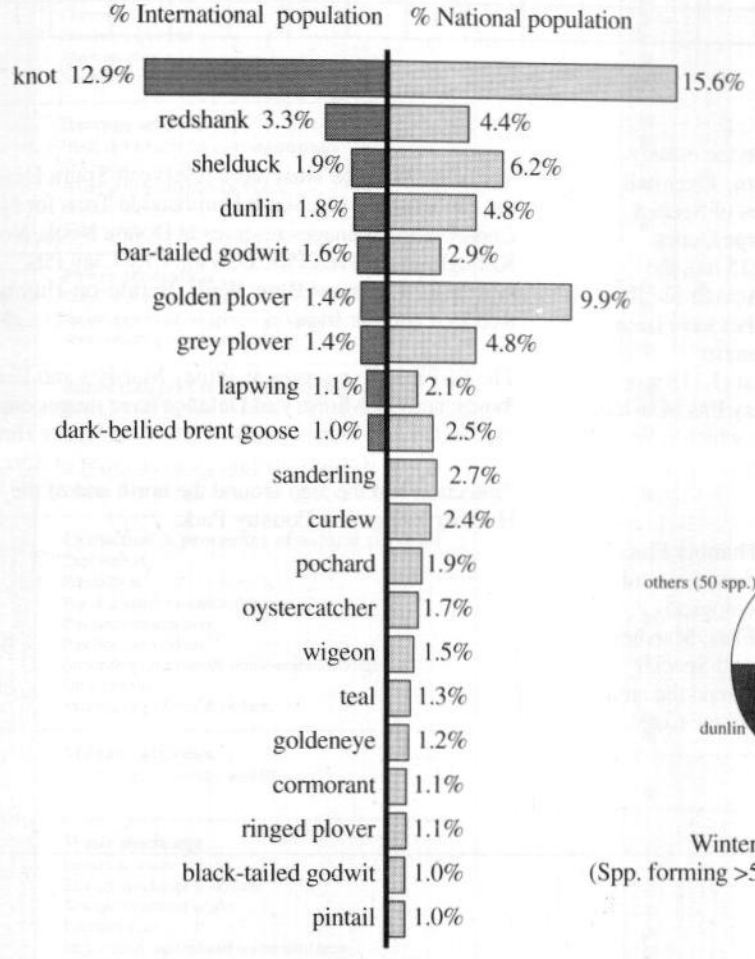
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
												●				

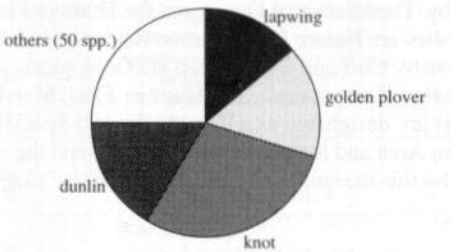
Birds

Wintering birds

1989/90 – 1993/94 data

Total waterfowl: 143,000





Wintering species assemblage
(Spp. forming >5% assemblage shown separately)

Breeding birds: there is a small colony of common terns and a large colony of little terns breeding on the estuary. Low numbers of lapwing, snipe, curlew and redshank breed in the grasslands adjacent to the estuary and the Humber supports internationally important numbers of breeding ringed plover.

Additional wildlife features

The Red Data Book plant yarrow broomrape *Orobanche purpurea* is found in the Humber area and two nationally scarce grasses have been recorded on the dunes adjacent to the estuary. The lagoons at Easington support the nationally scarce spiral tasselweed *Ruppia cirrhosa*.

The invertebrate fauna of the lagoons around the estuary includes three nationally scarce species: the lagoon sand shrimp *Gammarus insensibilis*, the tentacled lagoon worm *Alkmaria romijni* and the starlet sea anemone *Nematostella vectensis*. Elsewhere, the invertebrate fauna of the estuary is very rich and recently recorded species include the RDB 2 beetles *Bledius dissimilis* and *Dromius longiceps;* the RDB 2 fly *Dolichopus agilis*; the RDB 3 moth *Eupithecia extensaria;* the RDB 3 beetles *Graptodytes bilineatus* and *Macroplea mutica*, the RDB 3 bee *Coelioxys quadridentata*, two proposed RDB species and a further 80 Notable species.

The Humber Estuary is a significant nursery area for sole *Solea solea* and plaice *Pleuronectes platessa* and smelt *Osmerus eperlanus* have been recorded in the estuary. There is also a small population of natterjack toads *Bufo calamita* which breed in the dunes adjacent to the estuary.

Otters are present on the upper reaches of the Humber Estuary, grey and common seals breed on Donna Nook and harbour porpoises are observed throughout the year off Spurn Head and the entrance to the estuary.

Conservation status

● = designated ● = proposed

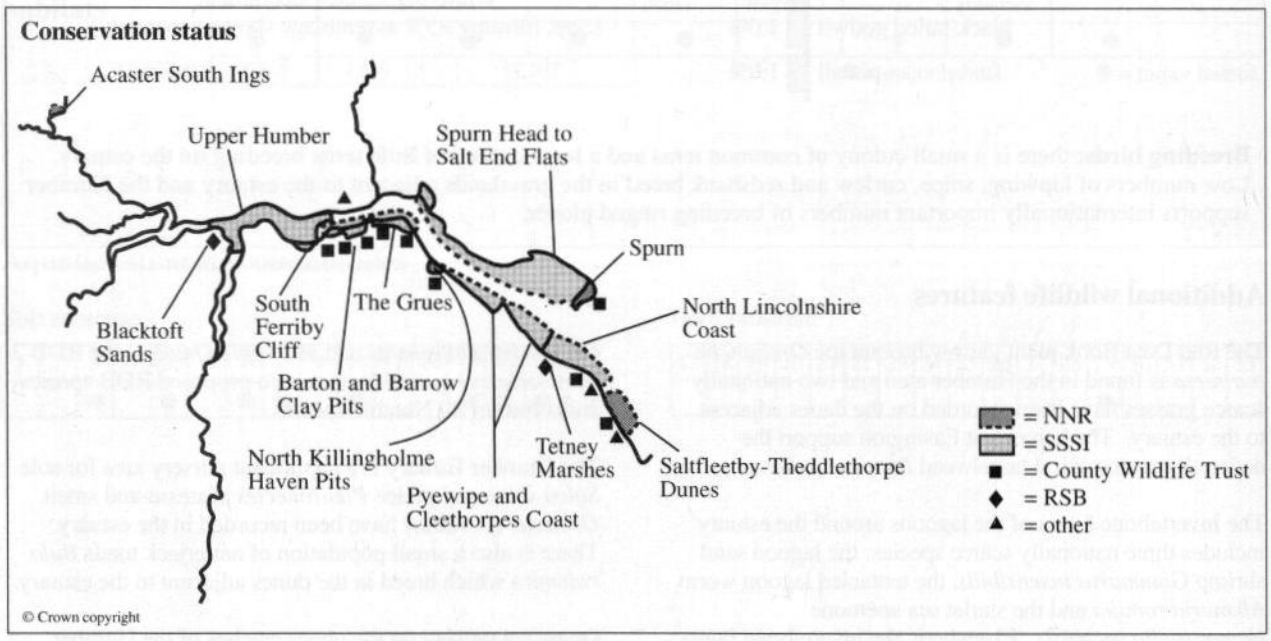
	NCR	GCR	SSSI (B)	SSSI (G)	SSSI (M)	NNR	LNR	Ramsar	SPA	SAC	AONB	CWT	RSPB	ESA	NP	WWT	NT	NSA	HC	Other
	●	●	●	●	●	●		●	●			●	●						●	●
No.	2	2	8	1	1	2		1	1			8	2						1	4

There are two National Nature Reserves on the estuary, Saltfleetby-Theddlethorpe Dunes and Spurn. Over half of the estuary is covered by biological Sites of Special Scientific Interest: Saltfleetby-Theddlethorpe Dunes (952 ha), North Killingholme Haven Pits (15 ha), the North Lincolnshire Coast (3,458 ha) and Acaster South Ings (38 ha). The Humber Flats and Marshes have been designated under several SSSIs: Upper Humber (4,762 ha), Pyewipe and Cleethorpes Coast (1,118 ha), the Grues (219 ha), Barton and Barrow Clay Pits (435 ha), and Spurn Head to Saltend Flats (5,442ha) which is an SSSI for its biological and geological interest. South Ferriby Cliff (26 ha) is a geological SSSI.

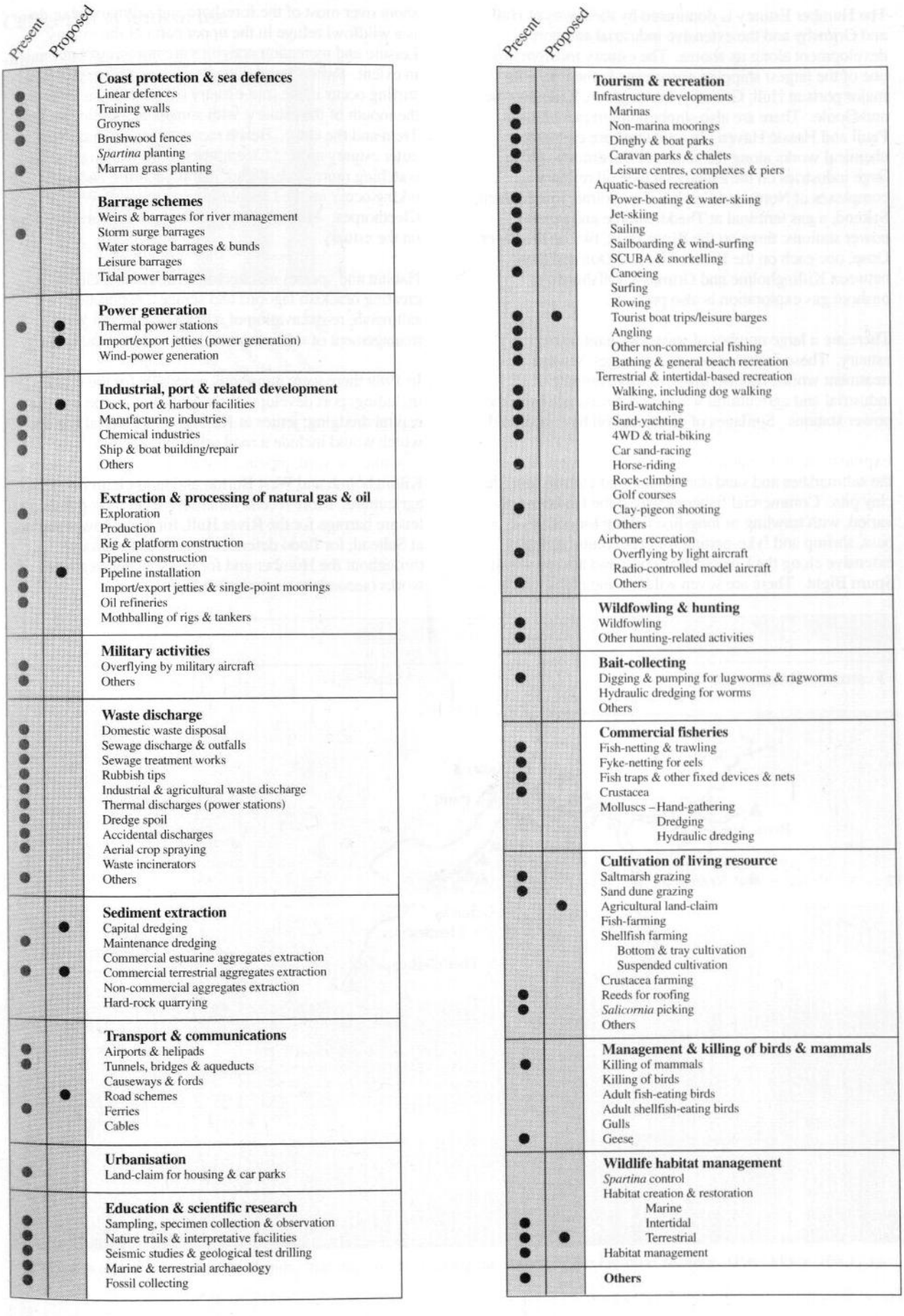
Saltfleetby-Theddlethorpe Dunes and the Humber Flats and Marshes are Nature Conservation Review sites and South Ferriby Cliff and Spurn Head are Geological Conservation Review sites. The Humber Flats, Marshes and Coast are designated as a Ramsar site and Special Protection Area and there is a proposal to extend the area covered by this designation. Spurn is a Heritage Coast.

Yorkshire Wildlife Trust has a reserve at Spurn Head and the Lincolnshire and South Humberside Trust for Nature Conservation manages reserves at Donna Nook, North Killingholme Haven Pits, Dawson City Clay Pits, Fairfield Pit, Barrow Blow Wells, Barton-on-Humber Reedbed and Far Ings.

The RSPB have reserves at Tetney Marshes and Blacktoft Sands, and the Ministry of Defence have ranges on Saltfleetby and Donna Nook. Part of the Upper Humber is a Wildfowl Refuge designated as an Area of Special Protection and the area around the north end of the Humber Bridge is a Country Park.



Human activities (in 1992)



Features of human use

The Humber Estuary is dominated by the towns of Hull and Grimsby and the extensive industrial and port development along its shores. The estuary incorporates one of the largest shipping complexes in the UK, with major ports at Hull, Grimsby, Immingham, Killingholme and Goole. There are also shipbuilding/repair yards at Paull and Hessle Haven. In total there are eighteen chemical works along the shores of the estuary. Other large industries on the estuary include oil refinery complexes at North and South Killingholme, Immingham, Saltend, a gas terminal at Theddlethorpe and several power stations: three on the River Trent, two on the River Ouse, one each on the Rivers Aire and Don and three between Killingholme and Grimbsy. Offshore and onshore gas exploration is also present.

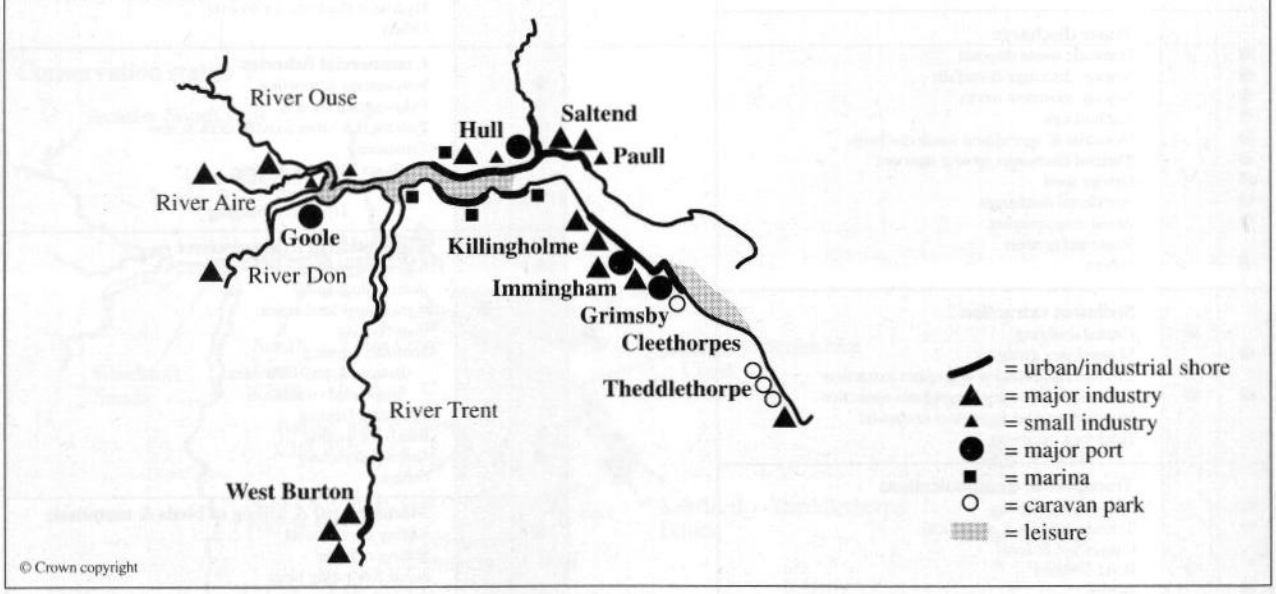
There are a large number of waste discharges into the estuary. These include sewage discharges, sewage treatment works, rubbish tips, extensive outputs of industrial and agricultural waste, and discharges from the power stations. Spillages of diesel and oil have occurred.

Exploitation of the natural resources includes grazing of the saltmarshes and sand dunes, and reed-cutting from the clay pits. Commercial fisheries within the Humber are varied, with trawling or long-line fishing for cod, sole, bass, shrimp and fyke-netting for eels. Bait-digging is extensive along the Lincolnshire coast and also occurs at Spurn Bight. There are seven wildfowling clubs which shoot over most of the foreshore and saltmarsh, but there is a wildfowl refuge in the upper parts of the estuary. Leisure and recreation activities are numerous but limited in extent. Water-based pursuits such as sailing and wind-surfing occur in the mid-estuary between Trent Falls and the mouth of the estuary, with some water-skiing on the Trent and the Ouse. Beach recreation is limited to the outer estuary around Cleethorpes, with walking and bird-watching more widespread. Sand-yachting and trial-biking occur on the Lincolnshire coast, with 4WD at Cleethorpes. More recently jet-skiing has been occurring on the estuary.

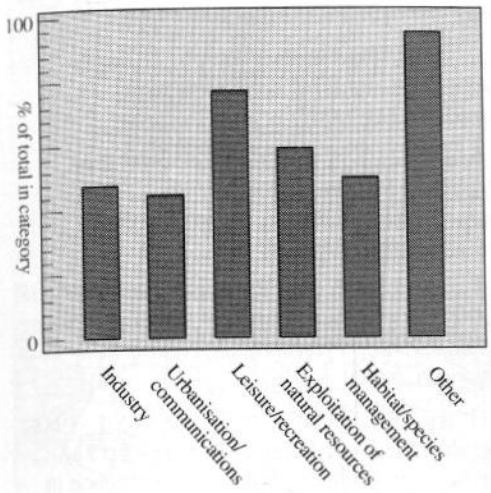
Habitat and species management activities include creating brackish lagoons and scrapes, restoration of saltmarsh, re-excavation of a brackish pit, and management of saltmarsh creeks to reduce tidal scour.

In 1989 there were numerous proposals for the estuary, including: port development at Hull that would involve capital dredging; jetties at Killingholme; a tidal barrage which would include a road scheme; a pipeline construction yard; pipeline installations; power stations at Killingholme and West Burton and land-claim for agriculture. More recently there have been proposals for a leisure barrage for the River Hull, for a gas power station at Saltend, for flood defences at various locations throughout the Humber and for waste water treatment works (secondary treatment) at Hull.

Features of human use



Categories of human use



Pyewipes is one of several areas of industrial development along the shores of the Humber Estuary. (Pat Doody, JNCC.)

Further reading

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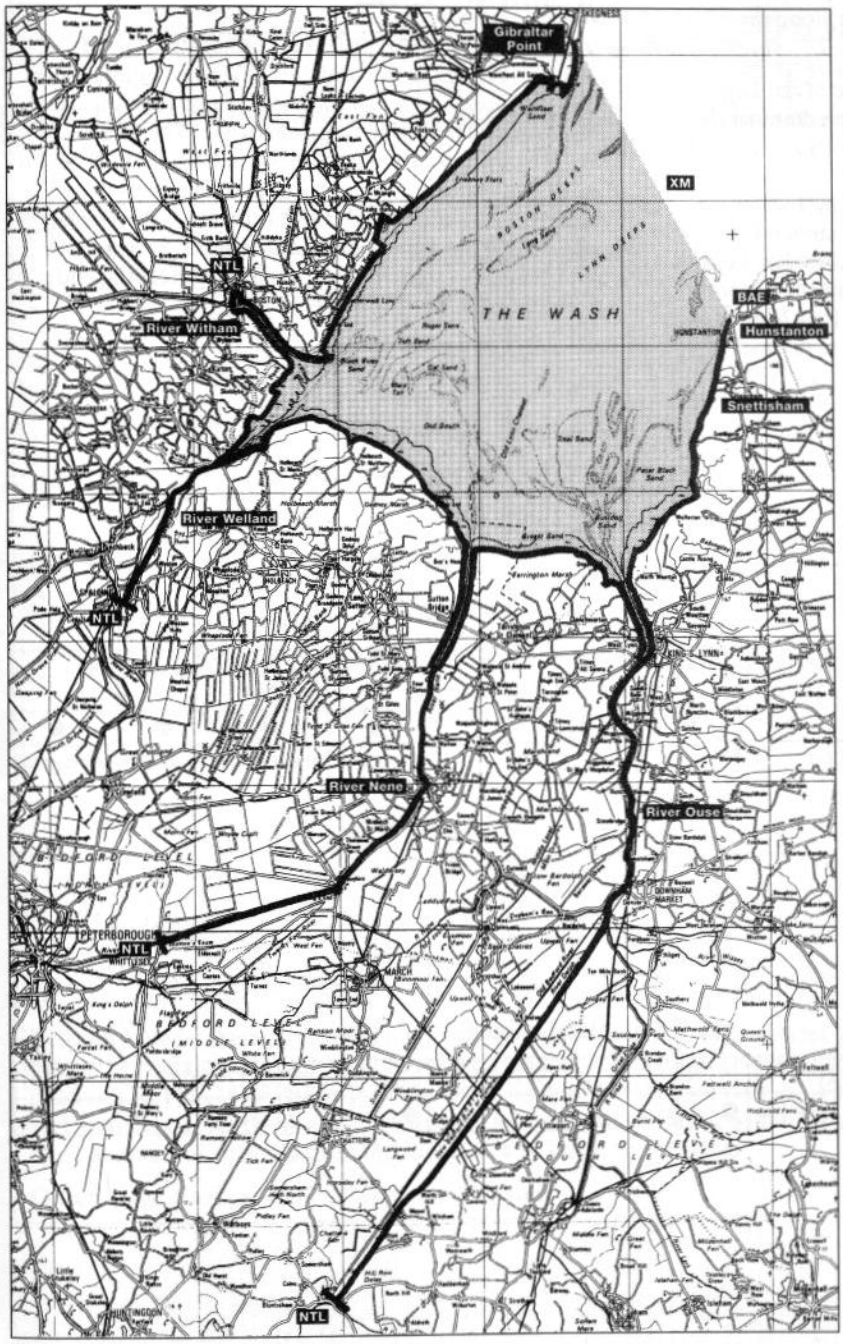
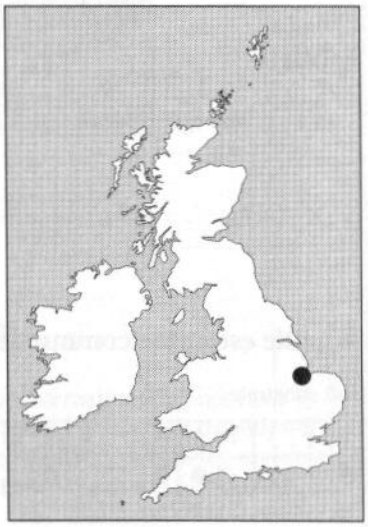
101 The Wash

Centre grid: TF5540
Counties: Lincolnshire, Norfolk, Cambridgeshire

Districts: Boston, East Lindsey, Fenland, King's Lynn, Peterborough, South Cambridge, South Holland, West Norfolk
EN areas: East Midlands, Norfolk

Review site location





= Core site

NTL = Normal tidal limit

XM = Across mouth

BAE = Boundary with adjacent site

Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
66,654	29,770	359.0	90.2	6.5	Embayment	127,000

Description

The Wash is the largest estuary in Britain and lies adjacent to the North Norfolk Coast to the east. The Wash forms an embayment at the mouth of its four tributaries, the Rivers Ouse, Nene, Welland and Witham, and its tidal influence is felt far inland: the River Ouse is tidal for approximately 60 kms. Water quality within the estuary has been classified as grade A apart from the lower sections of the Nene which are grade C, and the lower section of the River Ouse which is grade B. The four rivers are not a major source of sediment, supplying only a small proportion of the 30,000 - 80,000 tonnes of sediment carried over the intertidal flats by the tide. The predominant source of sediments are the glacial offshore banks along the Lincolnshire coast.

The intertidal flats of the Wash form one of the largest intertidal areas in Britain and these are predominantly sandy. The flats support high concentrations of marine worms and the Wash is an important area for mussel, cockle and shrimp fisheries. The intertidal flats of the bay are fringed with saltmarshes, which stretch from Snettisham on the east shore around to Gibraltar Point on the west. Much of the older and botanically more diverse saltmarsh has been lost due to a long history of land-claim on the Wash, but some areas of diverse saltmarsh remain.

On the east coast at Snettisham there are two saline lagoons. Heacham Harbour lagoon has formed behind the natural shingle barrier of a former estuary mouth and Snettisham lagoon formed as a result of the extraction of shingle. The shingle barrier is known to support an interesting invertebrate fauna.

On either side of the bay mouth there are sand dunes. At Gibraltar Point the dunes are lime-rich and support a range of sand dune vegetation communities and at Hunstanton there is a narrow strip of dunes that widen beyond the estuary mouth and continue along the North Norfolk Coast. There is a small area of cliffs at Hunstanton.

Abundant growth of algae, high concentrations of marine invertebrates and the large area of saltmarsh on the Wash provide a rich food source and roosting area for over 300,000 wintering waterfowl. The Wash regularly supports internationally important populations of thirteen species of waterfowl and nationally important populations of eleven species. The Washes adjacent to the upper tidal reaches of the Rivers Ouse and Nene also support large numbers of feeding and roosting waterfowl in winter.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	●	●		●	●	●	●
Area (ha)	36,884	4,228	25,542							

● = major habitat ◍ = minor habitat

Aquatic estuarine communities

Soft substrate

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
●				●	●			●				●	●	●	

Hard substrate

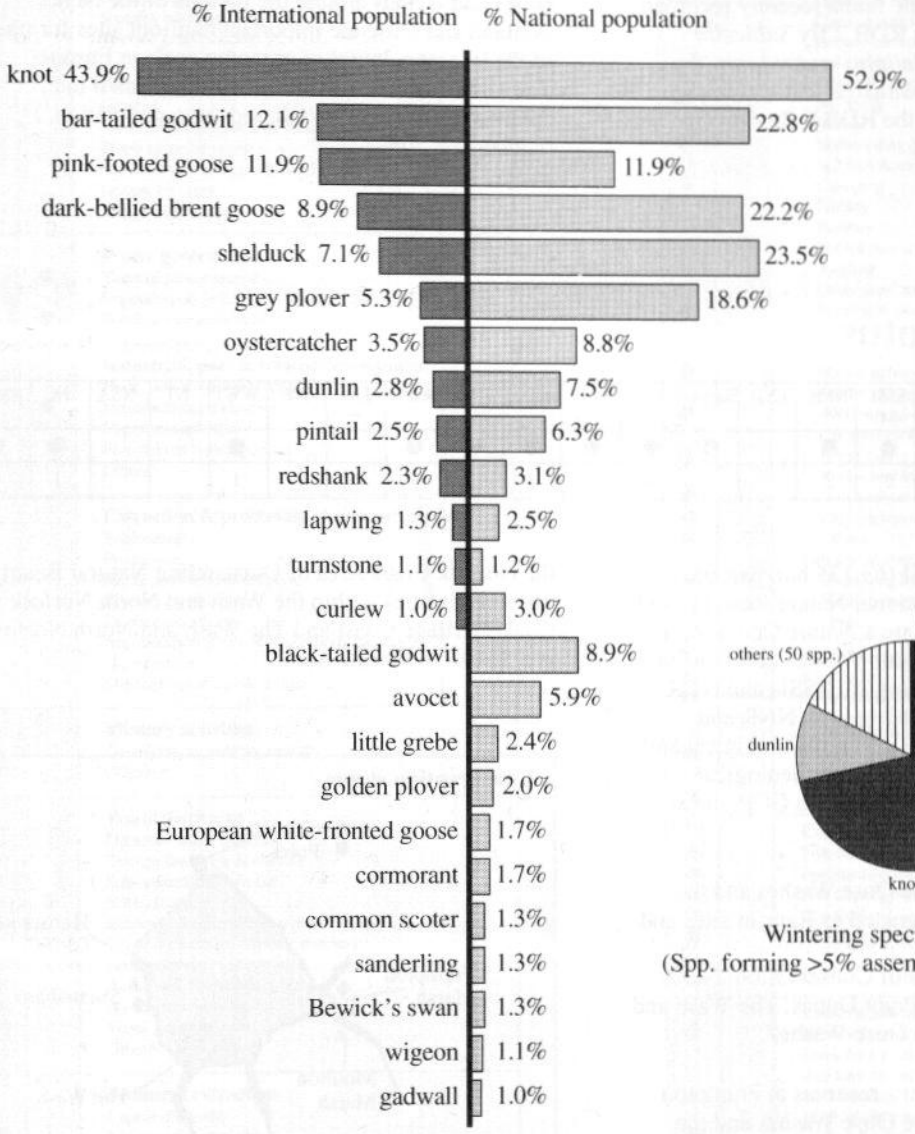
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
					●								●			

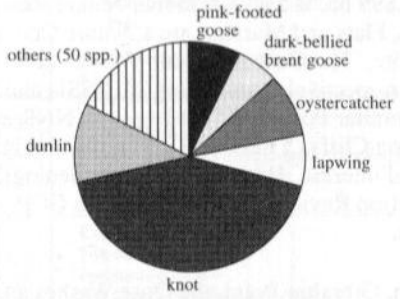
Birds

Wintering birds

1989/90 – 1993/94 data

Total waterfowl: 346,000





Wintering species assemblage
(Spp. forming >5% assemblage shown separately)

Breeding birds: there are several moderate or large colonies of black-headed gull, an internationally important colony of common tern and small colonies of herring gull and fulmar breeding within the Wash. High densities of redshank and moderate densities of oystercatcher breed in the saltmarshes. Very high numbers of lapwing and snipe, high numbers of redshank and low numbers of oystercatcher breed within the grasslands adjacent to the estuary. High numbers of ringed plover and shelduck also breed on the Wash.

Other: large numbers of twite winter on the Wash.

Additional wildlife features

The nationally rare rock sea lavender *Limonium binervosum* grows on Gibraltar Point, which is the only known British site for the rare fungus *Tubaria hiemale*. A further five nationally scarce species are found around the the Wash. The invertebrate fauna recently recorded from the estuary includes the RDB 2 fly *Salticella fasciata*, the RDB 3 beetle *Haliplus mucronatus*, the RDB 3 marsh moth *Athetis pallustris* and scarce pug moth *Eupithecia extensaria*, the RDB 3 fly *Phaonia fusca* and 57 Notable species.

The Wash is an extensive nursery ground for fish such as plaice *Pleuronectes platessa*, cod *Gadus morhua* and sole *Solea solea*. Gibraltar Point supports populations of natterjack toads *Bufo calamita*. The offshore sand banks and islands around the mouths of the Nene, Welland and Ouse are important haul-out sites for one of the largest colonies of common seals in Europe. The viral epidemic in 1988 severely affected the common seals on the Wash, reducing population numbers by 50%.

Conservation status

● = designated ◍ = proposed

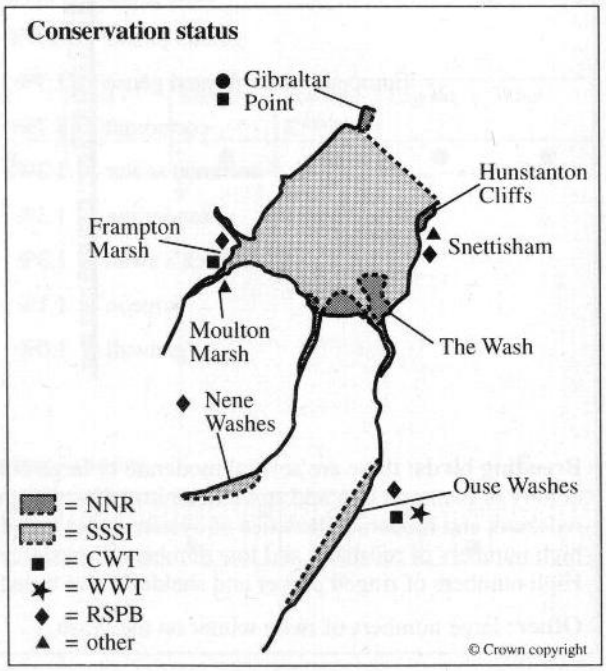
	NCR	GCR	SSSI (B)	SSSI (G)	SSSI (M)	NNR	LNR	Ramsar	SPA	SAC	AONB	CWT	RSPB	ESA	NP	WWT	NT	NSA	HC	Other
	●	●	●		●	●		●	●	◍	●	●	●			●			●	●
No.	3	3	3		2	2		4	4	3	1	3	4			1			1	4

The Wash is a biological SSSI (63,135 ha), part of which (9,899 ha) is also a National Nature Reserve, and the Wash, Flats and Marshes are a Nature Conservation Review site. The Ouse and Nene Washes (2,403 ha and 1,310 ha respectively) are biological SSSIs and NCR sites. Gibraltar Point SSSI (581 ha) is a NNR and Hunstanton Cliffs (5 ha) is a SSSI for its biological and geological interest. Both sites are also Geological Conservation Review sites and there is a GCR site at Heacham.

The Wash, Gibraltar Point, the Ouse Washes and the Nene Washes have been designated as Ramsar sites and Special Protection Areas. Three areas around the Wash are proposed as Special Areas of Conservation: North Norfolk Coast and Gibraltar Point Dunes; The Wash and North Norfolk Coast; and the Ouse Washes.

There are County Wildlife Trust reserves at Frampton Marsh, Gibraltar Point and the Ouse Washes and the RSPB has reserves at Frampton Marsh, Snettisham, the Nene Washes and the Ouse Washes. The Wildfowl and Wetlands Trust has a reserve on the Ouse Washes. Gibraltar Point has been designated as an Area of Special Protection and Moulton Marsh is a private reserve.

Snettisham Coastal Park on the east coast is a Country Park and the easternmost part of the Wash lies within the Norfolk Coast Area of Outstanding Natural Beauty. The site also lies within the Wash and North Norfolk Coast Heritage Coast and The Wash and North Norfolk is a Sensitive Marine Area.



Human activities (in 1992)

Present	Proposed	
		Coast protection & sea defences
●		Linear defences
●		Training walls
●		Groynes
		Brushwood fences
		Spartina planting
		Marram grass planting
		Barrage schemes
		Groynes
		Weirs & barrages for river management
●		Storm surge barrages
		Water storage barrages & bunds
		Leisure barrages
	●	Tidal power barrages
		Power generation
	●	Thermal power stations
		Import/export jetties (power generation)
	●	Wind-power generation
		Industrial, port & related development
●		Dock, port & harbour facilities
●	●	Manufacturing industries
●		Chemical industries
●		Ship & boat building/repair
		Others
		Extraction & processing of natural gas & oil
●		Exploration
		Production
		Rig & platform construction
		Pipeline construction
		Pipeline installation
		Import/export jetties & single-point moorings
		Oil refineries
		Mothballing of rigs & tankers
		Military activities
●		Overflying by military aircraft
●		Others
		Waste discharge
●		Domestic waste disposal
●		Sewage discharge & outfalls
●		Sewage treatment works
	●	Rubbish tips
		Industrial & agricultural waste discharge
		Thermal discharges (power stations)
●		Dredge spoil
●		Accidental discharges
●		Aerial crop spraying
		Waste incinerators
		Others
		Sediment extraction
		Capital dredging
●		Maintenance dredging
		Commercial estuarine aggregates extraction
		Commercial terrestrial aggregates extraction
		Non-commercial aggregates extraction
		Hard-rock quarrying
		Transport & communications
		Airports & helipads
●		Tunnels, bridges & aqueducts
		Causeways & fords
		Road schemes
●		Ferries
●		Cables
		Urbanisation
		Land-claim for housing & car parks
		Education & scientific research
●		Sampling, specimen collection & observation
●		Nature trails & interpretative facilities
		Seismic studies & geological test drilling
		Marine & terrestrial archaeology
		Fossil collecting

Present	Proposed	
		Tourism & recreation
	●	Infrastructure developments
		Marinas
●		Non-marina moorings
●		Dinghy & boat parks
●		Caravan parks & chalets
		Leisure centres, complexes & piers
		Aquatic-based recreation
●		Power-boating & water-skiing
●		Jet-skiing
●		Sailing
●		Sailboarding & wind-surfing
		SCUBA & snorkelling
●		Canoeing
		Surfing
		Rowing
●		Tourist boat trips/leisure barges
●		Angling
		Other non-commercial fishing
●		Bathing & general beach recreation
		Terrestrial & intertidal-based recreation
●		Walking, including dog walking
●		Bird-watching
		Sand-yachting
●		4WD & trial-biking
		Car sand-racing
●		Horse-riding
		Rock-climbing
●		Golf courses
●		Clay-pigeon shooting
●		Others
		Airborne recreation
●		Overflying by light aircraft
		Radio-controlled model aircraft
		Others
		Wildfowling & hunting
●		Wildfowling
●		Other hunting-related activities
		Bait-collecting
●		Digging & pumping for lugworms & ragworms
		Hydraulic dredging for worms
●		Others
		Commercial fisheries
●		Fish-netting & trawling
●		Fyke-netting for eels
●		Fish traps & other fixed devices & nets
●		Crustacea
●		Molluscs – Hand-gathering
●		Dredging
●		Hydraulic dredging
		Cultivation of living resource
●		Saltmarsh grazing
		Sand dune grazing
		Agricultural land-claim
		Fish-farming
		Shellfish farming
●		Bottom & tray cultivation
		Suspended cultivation
		Crustacea farming
		Reeds for roofing
●		*Salicornia* picking
●		Others
		Management & killing of birds & mammals
●		Killing of mammals
		Killing of birds
		Adult fish-eating birds
		Adult shellfish-eating birds
		Gulls
●		Geese
		Wildlife habitat management
		Spartina control
		Habitat creation & restoration
		Marine
●		Intertidal
		Terrestrial
●	●	Habitat management
●		**Others**

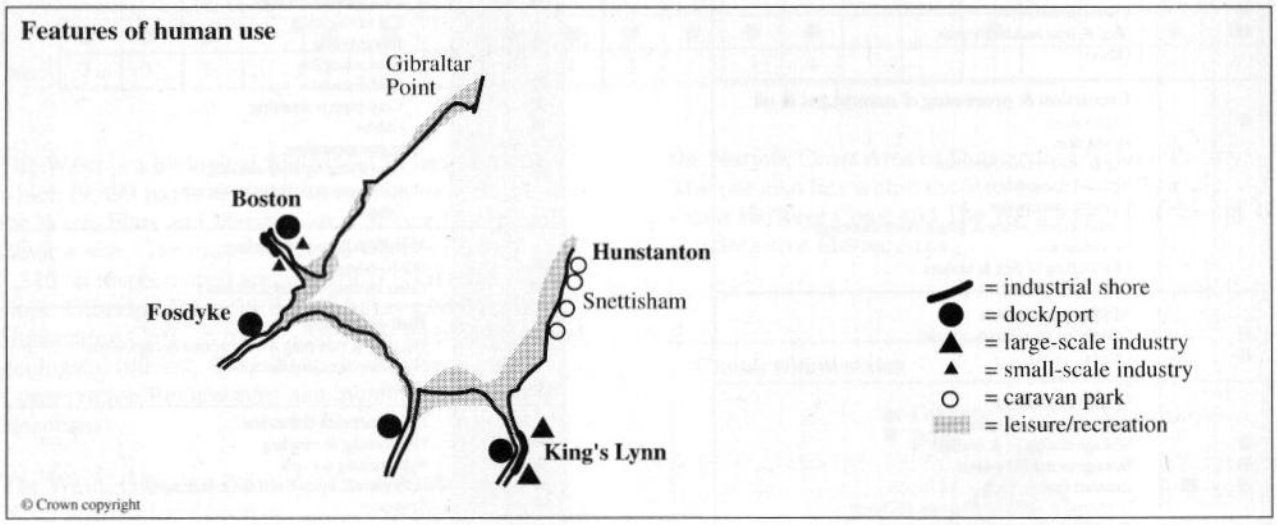
Features of human use

Human activities are concentrated around the bay rather than inland along the length of the four rivers. Industry is concentrated around the mouths of the rivers, especially around King's Lynn and Boston, and includes dock and port facilities, a small steel-processing plant, chemical industries and food processing/packing plants. The coast between Heacham and Snettisham is the subject of a beach recharge scheme.

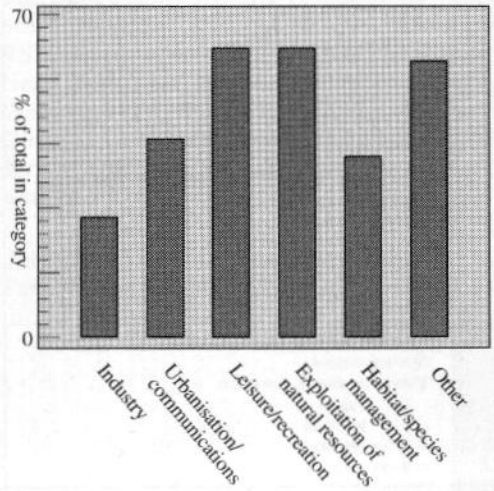
The majority of activities are leisure and recreation, with some exploitation of the natural resource. Most leisure pursuits such as sailing, windsurfing, horse-riding, water-skiing and beach recreation occur on the east shore from Hunstanton to Snettisham, where there are several caravan parks. Bird-watching, horse-riding and beach recreation also take place at Gibraltar Point, but on a small scale.

Wildfowling is extensive, occurring over 75% of the saltmarsh and areas of the tidal flats. Ten wildfowling clubs exist and no-shooting areas cover part of the estuary. Bait-digging for lugworms is widespread over most of the intertidal area. Commercial fisheries are of great importance, for of all England and Wales landings the Wash accounts for 60% mussels, 12-40% cockles, 100% pink shrimps and 22-25% brown shrimps. Boston and King's Lynn are the main fishing ports.

Recent proposals for the Wash include gas turbine power stations to be located at King's Lynn, on the Nene River at Sutton Bridge and at Spalding on the Welland River.

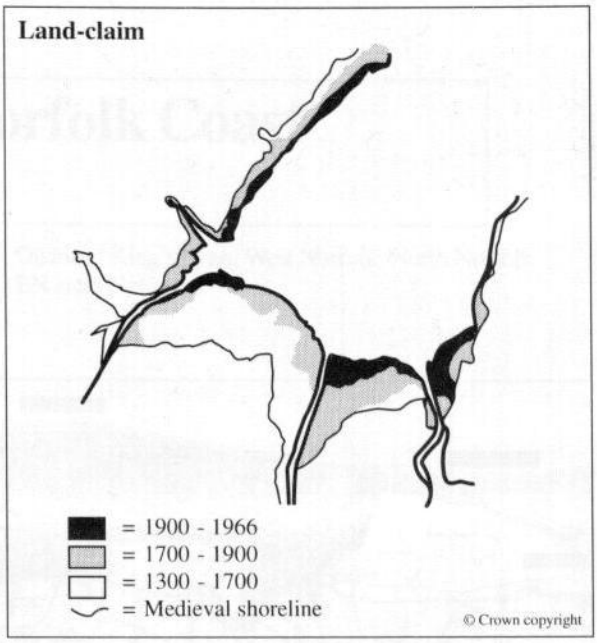


Categories of human use



Land-claim

The saltmarshes on the Wash have a longer history than most of being altered by man. Major losses occurred mainly by agricultural activity - the older, more diverse marsh enclosed by sea walls to leave younger, more dynamic saltmarsh which continued to accrete. In this Century alone 1,141 ha of saltmarsh on the Wash were claimed for agriculture up to 1940, while from 1940-1960 a further 2,500 ha were taken.



Further reading

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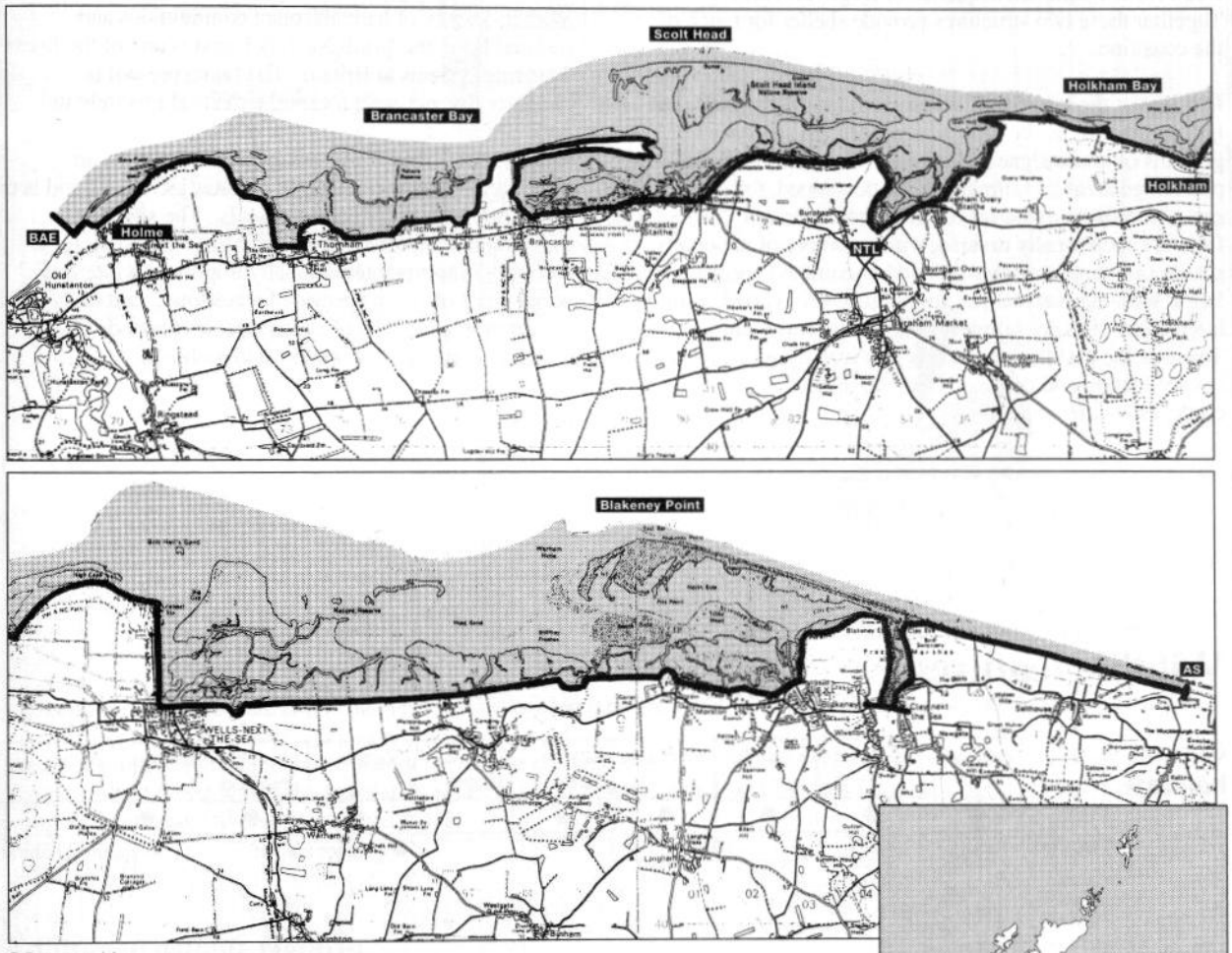
102 North Norfolk Coast

Centre grid: TF8946
County: Norfolk

Districts: King's Lynn, West Norfolk, North Norfolk
EN area: Norfolk

Review site location



Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
6,292	5,874	70.2	6.0	2.6	Barrier beach	<5,000

NTL = Normal tidal limit

AS = Along shore

BAE = Boundary with adjacent estuary

= Core site

Description

The North Norfolk Coast is one of the most diverse coastal systems in Britain. A number of small freshwater streams flow into the sea along this coastline, which has extensive sand and shingle banks, spits and offshore islands sheltering a complex zone of intertidal flats, saltmarshes and sand dunes. Water quality along the coast has been classified as grade A.

The extensive offshore barrier island of Scolt Head and the large, shingle spit of Blakeney Point dominate the North Norfolk Coast. Both are actively accreting westwards and are topped by sand dunes, which on Scolt Head form a complex sequence of ridges and dunes. Together these two structures provide shelter for much of the coastline.

In the west the intertidal flats are predominantly sandy but become muddy in the east, where there are seasonal growths of green algae and eelgrass. In more sheltered parts large areas of saltmarsh have developed, forming one of the finest expanses of saltmarsh in Britain. The flora is exceptionally diverse, with a number of nationally scarce saltmarsh communities and uncommon species. In the west the marshes are structurally very varied, with large areas of many saltmarsh vegetation communities. Towards the east the structure is less well developed, but is very mature and diverse. Here, large beds of the cordgrass *Spartina* are present.

Sand dunes occur at various locations along the North Norfolk Coast, but are best developed at Holme and Holkham. Here several stages of dune development are present, with calcareous foredunes, yellow dunes and stable grey dunes which support the most diverse vegetation. There are dune slacks at Holme and Holkham, for most dune hollows along the North Norfolk Coast support saltmarsh vegetation. There are also several lagoons along the coast which have formed either in depressions within previously claimed saltmarsh, or immediately landwards of barrier shingle ridges. Several lagoons are considered to support a relict marine fauna.

With its variety of habitats, plant communities and unusual flora, the North Norfolk Coast is one of the finest estuarine systems in Britain. The fauna present is similarly diverse, with a varied terrestrial invertebrate population that includes a great number of uncommon species. The North Norfolk Coast also supports an important breeding population of natterjack toads and is of major importance for common seals. The site is of international importance for wintering waterfowl, for it regularly supports internationally important wintering populations of seven species of waterfowl, nationally important populations of eleven species and a diverse breeding population of waders and seabirds.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	●	●		●	●	●	
Area (ha)	418	2,217	3,657							

● = major habitat ● = minor habitat

Aquatic estuarine communities

Soft substrate

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
				●				●				●		●	

Hard substrate

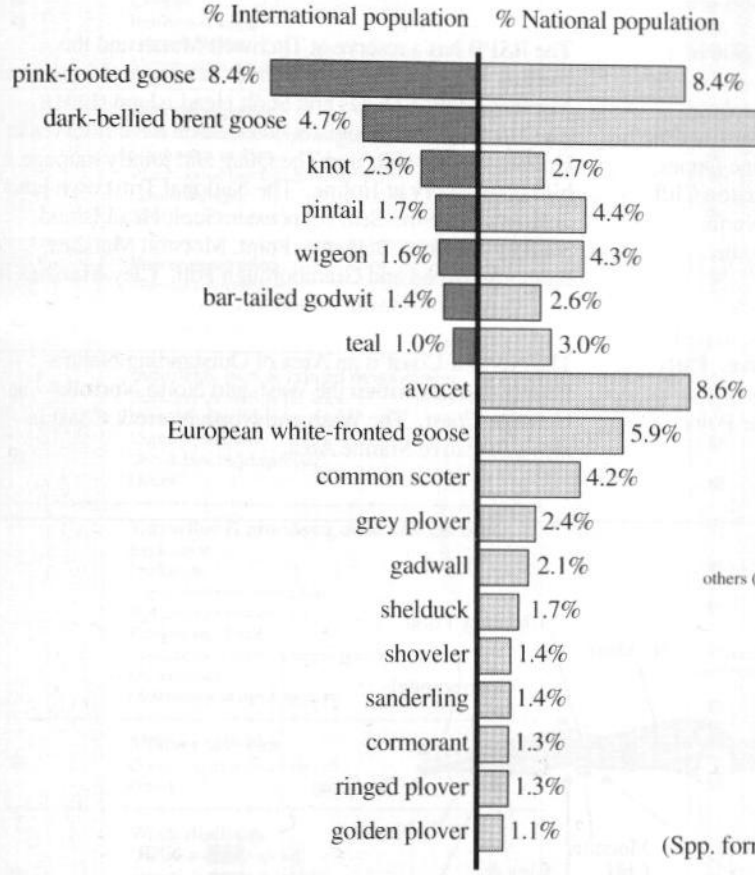
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
														●		

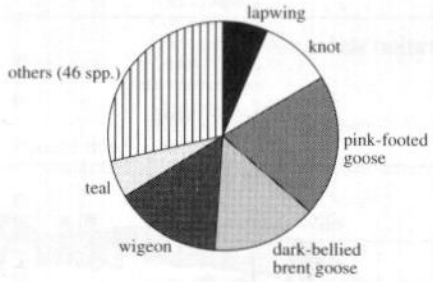
Birds

Wintering birds

1989/90 – 1993/94 data

Total waterfowl: 82,200





Wintering species assemblage
(Spp. forming >5% assemblage shown separately)

Breeding birds: there are large colonies of black-headed gull, sandwich tern, common tern and little tern and small colonies of arctic tern, common gull and lesser black-backed gull on the North Norfolk Coast. Moderate densities of redshank and oystercatcher breed within the saltmarshes and small numbers of lapwing, snipe, curlew, redshank and oystercatcher breed within the grasslands adjacent to the estuary. The North Norfolk Coast also supports internationally important numbers of breeding ringed plover.

Additional wildlife features

The Red Data Book plant Jersey cudweed *Gnaphalium luteoalbum* grows on the dunes and the nationally rare plant matted sea lavender *Limonium bellidifolium* grows at the transition between saltmarshes and dunes. At least seven nationally scarce plants are found on the North Norfolk Coast.

The invertebrate fauna recently recorded includes the RDB 1 fly *Parochthiphila coronata*; the RDB2 beetles *Dromius longiceps* and *Hypocaccus metallicus*, the RDB 2 flies *Eriophera bivittata* and *Salticella fasciata*, the RDB 2 scarce vapourer moth *Orgyia recens*; RDB 3 species include the beetle *Malachius barnevillei*; the scarce pug moth *Eupithecia extensaria* and the flame wainscot moth *Senta flammea*, the fly *Atylotus latistriatus*, the sand wasp *Podalonia affinis*, the spiders *Clubiona similis*, *Euphrys browningi* and *Arctosa fulvolineata* and the amphipod *Gammarus insensibilis*. A further three proposed RDB species and 72 Notable species have been recorded within the site.

Up to 10% of the British population of natterjack toad *Bufo calamita* breeds on the estuary and otters have also been recorded on the shore. The North Norfolk Coast is of major importance for common seals and together with the Wash supported around 27% of the British population and 7% of the East Atlantic subspecies, prior to the recent outbreak of phocine distemper virus.

Conservation status

● = designated ● = proposed

	NCR	GCR	SSSI (B)	SSSI (G)	SSSI (M)	NNR	LNR	Ramsar	SPA	SAC	AONB	CWT	RSPB	ESA	NP	WWT	NT	NSA	HC	Other
	●	●		●	●	●		●	●	●	●	●	●				●		●	●
No.	1	2		1	1	4		1	1	2	1	3	1				8		1	7

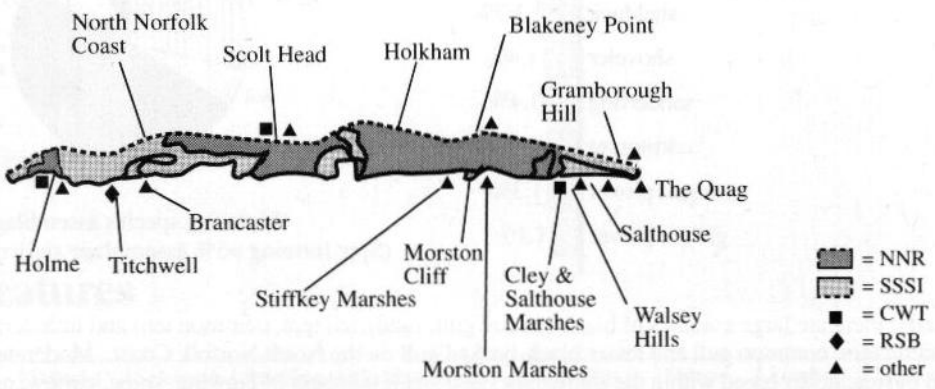
The estuary lies within the North Norfolk Coast Site of Special Scientific Interest (7,701 ha) which was designated for its biological and geomorphological interest and is also a Geological Conservation Review site. There are four National Nature Reserves at Holme Dunes, Scolt Head Island, Holkham and Blakeney. Morston Cliff (1 ha) is a geological SSSI and GCR site. The North Norfolk Coast is a Nature Conservation Review site.

The North Norfolk Coast has been designated as a Ramsar site and Special Protection Area and has, in part, been designated as a UNESCO Biosphere Reserve. Parts of the site lie within two proposed Special Areas of Conservation: North Norfolk Coast and Gibraltar Point Dunes, and The Wash and North Norfolk Coast.

The RSPB has a reserve at Titchwell Marsh and the Norfolk Wildlife Trust has reserves at Cley and Salthouse Marshes, Holme Dunes and Scolt Head Island (East). The Norfolk Ornithologist's Association have reserves at Holme, Walsey Hills and The Quag and jointly manage a bird observatory at Holme. The National Trust own land at Holme-next-the-Sea, Brancaster, Scolt Head Island, Stiffkey Marshes, Blakeney Point, Morston Marshes, Salthouse Broad and Gramborough Hill. Cley Marshes is also an Area of Special Protection.

The Norfolk Coast is an Area of Outstanding Natural Beauty and lies within the Wash and North Norfolk Heritage Coast. The Wash and North Norfolk Coast is also a Sensitive Marine Area.

Conservation status



Human activities (in 1992)

Present	Proposed	
		Coast protection & sea defences
●		Linear defences
●		Training walls
●		Groynes
		Brushwood fences
		Spartina planting
		Marram grass planting
		Barrage schemes
●		Weirs & barrages for river management
		Storm surge barrages
		Water storage barrages & bunds
		Leisure barrages
		Tidal power barrages
		Power generation
		Thermal power stations
		Import/export jetties (power generation)
	●	Wind-power generation
		Industrial, port & related development
●		Dock, port & harbour facilities
		Manufacturing industries
		Chemical industries
●		Ship & boat building/repair
		Others
		Extraction & processing of natural gas & oil
		Exploration
		Production
		Rig & platform construction
		Pipeline construction
		Pipeline installation
		Import/export jetties & single-point moorings
		Oil refineries
		Mothballing of rigs & tankers
		Military activities
●		Overflying by military aircraft
		Others
		Waste discharge
●		Domestic waste disposal
●		Sewage discharge & outfalls
		Sewage treatment works
		Rubbish tips
		Industrial & agricultural waste discharge
		Thermal discharges (power stations)
●		Dredge spoil
		Accidental discharges
●		Aerial crop spraying
		Waste incinerators
		Others
		Sediment extraction
		Capital dredging
●	●	Maintenance dredging
●		Commercial estuarine aggregates extraction
	●	Commercial terrestrial aggregates extraction
		Non-commercial aggregates extraction
		Hard-rock quarrying
		Transport & communications
		Airports & helipads
●		Tunnels, bridges & aqueducts
		Causeways & fords
●		Road schemes
		Ferries
	●	Cables
		Urbanisation
		Land-claim for housing & car parks
		Education & scientific research
●		Sampling, specimen collection & observation
●		Nature trails & interpretative facilities
		Seismic studies & geological test drilling
●		Marine & terrestrial archaeology
		Fossil collecting

Present	Proposed	
		Tourism & recreation
		Infrastructure developments
●		Marinas
●		Non-marina moorings
●		Dinghy & boat parks
		Caravan parks & chalets
		Leisure centres, complexes & piers
		Aquatic-based recreation
●		Power-boating & water-skiing
●		Jet-skiing
●		Sailing
●		Sailboarding & wind-surfing
		SCUBA & snorkelling
●		Canoeing
		Surfing
		Rowing
●		Tourist boat trips/leisure barges
●		Angling
		Other non-commercial fishing
●		Bathing & general beach recreation
		Terrestrial & intertidal-based recreation
●		Walking, including dog walking
●		Bird-watching
		Sand-yachting
●		4WD & trial-biking
		Car sand-racing
●		Horse-riding
		Rock-climbing
●		Golf courses
		Clay-pigeon shooting
●		Others
		Airborne recreation
●		Overflying by light aircraft
		Radio-controlled model aircraft
●		Others
		Wildfowling & hunting
●		Wildfowling
●		Other hunting-related activities
		Bait-collecting
●		Digging & pumping for lugworms & ragworms
		Hydraulic dredging for worms
		Others
		Commercial fisheries
●		Fish-netting & trawling
		Fyke-netting for eels
●		Fish traps & other fixed devices & nets
●		Crustacea
●		Molluscs – Hand-gathering
		Dredging
		Hydraulic dredging
		Cultivation of living resource
		Saltmarsh grazing
		Sand dune grazing
		Agricultural land-claim
		Fish-farming
		Shellfish farming
●	●	Bottom & tray cultivation
		Suspended cultivation
		Crustacea farming
●		Reeds for roofing
●		*Salicornia* picking
●		Others
		Management & killing of birds & mammals
●		Killing of mammals
		Killing of birds
		Adult fish-eating birds
	●	Adult shellfish-eating birds
●		Gulls
●		Geese
		Wildlife habitat management
		Spartina control
		Habitat creation & restoration
		Marine
●		Intertidal
●	●	Terrestrial
		Habitat management
		Others

Features of human use

Leisure activities on the North Norfolk Coast are numerous and in places are quite intensive. There are moorings, dinghy or boat parks at Burnham Overy, Morston, Blakeney, Brancaster, Thornham and Wells and these are the areas from which water-based pursuits, such as sailing and wind-surfing, are most intensive. Water-skiing occurs from Brancaster, Blakeney and Wells and canoeing takes place in the harbours. Walking, bird-watching and beach recreation are widespread along the coast. 4WD occurs at Holkham and on Stiffkey and Morston Marshes and trial-biking is a minor problem on the dunes and shingle. Mountain-biking, jet-skiing and paragliding are also commonplace activities.

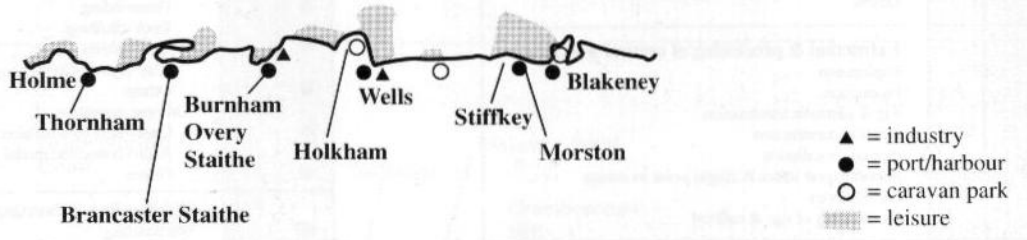
Exploitation of the natural resources is also a feature of the North Norfolk Coast and includes cultivation of oysters and mussels, cutting reeds for roofing and *Salicornia* and lavender picking. Five wildfowling clubs shoot over parts of the intertidal flats, dunes and grazing marsh.

Habitat and species management include creation of freshwater and brackish lagoons, restoration of grazing marsh and reedbeds, and culling of foxes and geese.

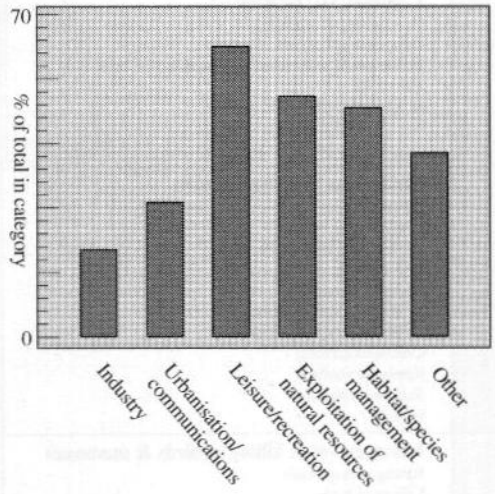
There is very little industrial activity on the estuary. There is a small port at Wells and fishing jetties at Thornham, Brancaster Staithe, Burnham Overy Staithe, Morston and Blakeney, and small boat repair yards at Wells and Burnham Overy Staithe.

In 1989 there were proposals for sediment extraction at Burnham Overy Staithe; oyster cultivation and culling of oystercatchers; creation of grazing marsh; and for a wind-power generator 5 km offshore from Wells.

Features of human use



Categories of human use



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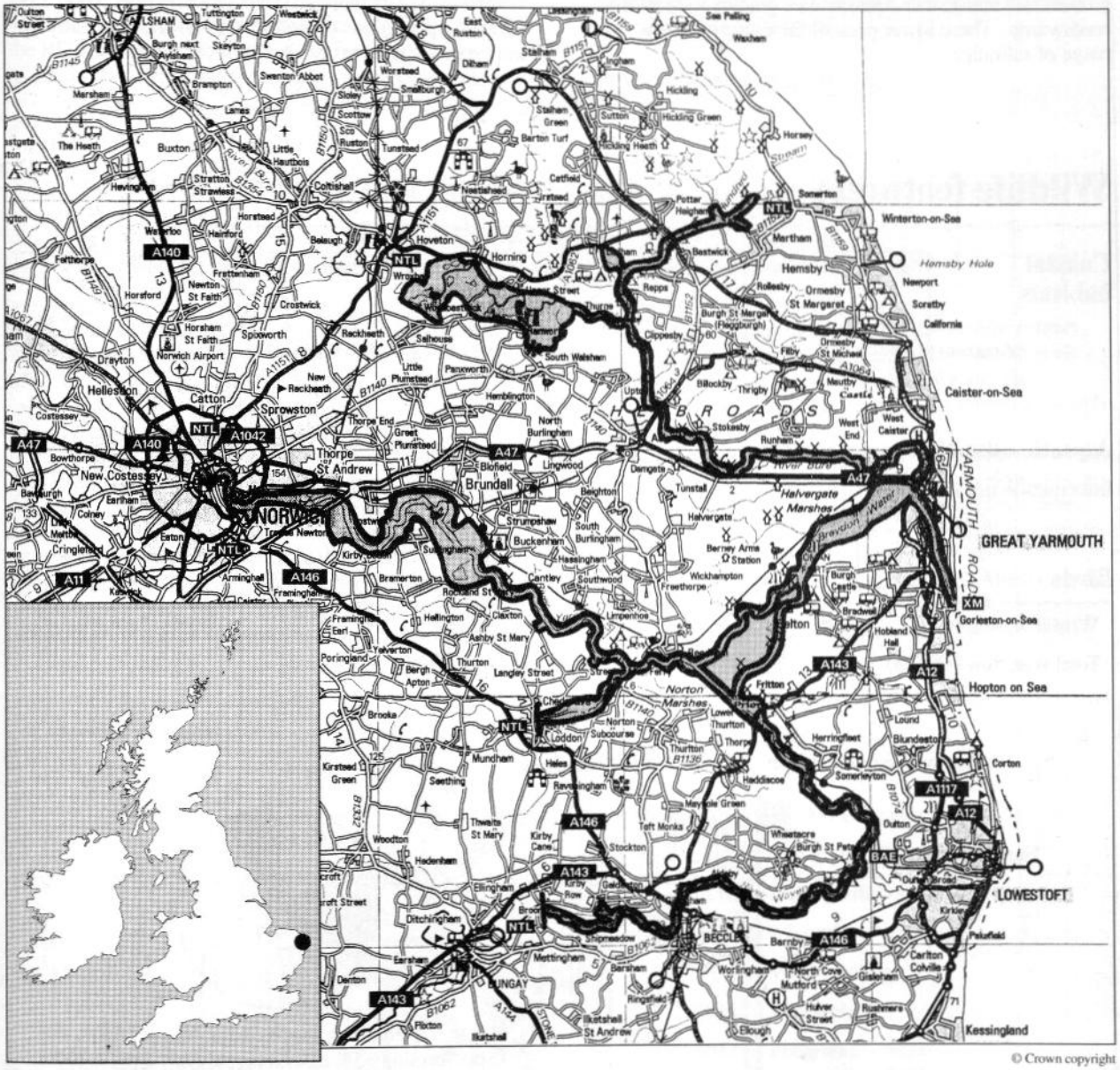
103 Breydon Water

Centre grid: TG4907
Counties: Norfolk, Suffolk

Districts: Broads Authority, Broadland, Great Yarmouth, South Norfolk, Waveney
EN area: Norfolk

Review site location



XM = Across mouth
NTL = Normal tidal limit
BAE = Boundary with adjacent estuary
= Core site

Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
1,534	769	317.0	46.8	1.9	Bar built	55,000

Description

Breydon Water is the inland tidal estuary of the River Yare and its confluence with the Rivers Bure and Waveney. The tidal reaches of the rivers are extensive, reaching as far upstream as Norwich, Wroxham, Martham and Lodden. The southern reaches of the River Waveney are adjacent to the Oulton Broad estuary.

At low water the only exposed areas of mud and sand lie downstream of Burgh Castle and these intertidal flats support growths of green algae, eelgrasses and an abundant invertebrate fauna. Towards the mouth of the estuary there are very small areas of saltmarsh, with pioneer and mid-marsh communities grading to brackish reedswamp. These lower parts of the estuary show a range of salinities.

For much of their length the upper parts of the rivers are embanked narrow channels of fresh water, subject to tidal flooding. These rivers are surrounded by large areas of fen and grazing marshes that are drained by an extensive network of ditches. Both the grazing marshes and fens are known to support a wide range of wetland plant communities and animal species that includes many scarce or uncommon species.

The lower parts of the estuary form one of the few areas of intertidal flats exposed at low tide on this part of the Norfolk coast. The estuary regularly attracts wintering waterfowl that includes an internationally important wintering population of Bewick's swan and nationally important populations of six species of waterfowl.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	◍	●	●				●		●
Area (ha)	765		769							

● = major habitat ◍ = minor habitat

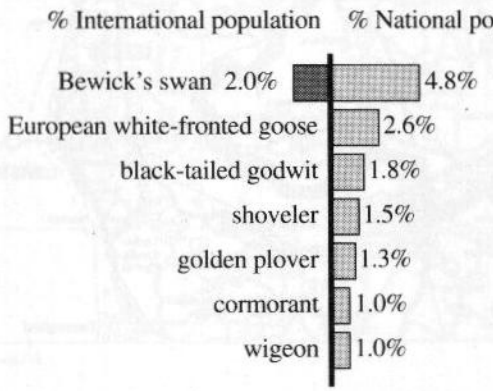
Aquatic estuarine communities

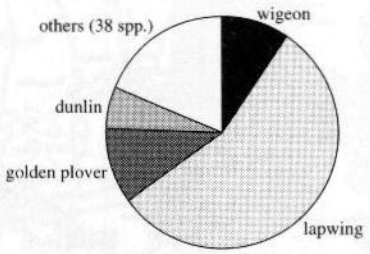
Information unavailable.

Birds

Wintering birds 1989/90 – 1993/94 data

Total waterfowl: 30,900





Wintering species assemblage
(Spp. forming >5% assemblage shown separately)

Breeding birds: large numbers of lapwing, redshank and oystercatcher and small numbers of snipe breed within the grasslands adjacent to the estuary. Small numbers of ringed plover also breed on Breydon Water.

Additional wildlife features

Two nationally rare plants, the crested buckler fern *Dryopteris cristata* and holly-leaved naiad *Najas marina* and a very large number of nationally scarce aquatic and wetland fen species are found within the site. The nationally scarce tentacled lagoon worm *Alkmaria romijni* has been recorded in Breydon Water.

The invertebrate fauna of the marshes alongside the rivers is extremely rich with many Red Data Book species. These include the RDB 1 flies *Dolichopus laticola* and *Dolichopus nigripes*, the RDB 2 snail *Valvata macrostoma* and beetles *Agabus striolatus* and *Ceutorhynchus querceti*, the RDB 2 scarce vapourer moth *Orgyea recens*, reed leopard moth *Phragmataecia castaneae* and the marsh carpet moth *Perizoma sagittata*, the RDB 2 flies *Cephalops perspicuus, Phaonia nymphaerum* and *Phebellia nigripalpis* and the RDB 2 spiders *Centromerus incultus* and *Clubiona juvensis*. RDB 3 species include the bee *Macropis europaea*, the beetles *Hydrochus brevis, Helophorus dorsalis* and *Hippodamis tredecimpunctata*, the marbled clover moth *Heliothis viriplaca*, Fenn's wainscot moth *Photedes brevilinea* and the flame wainscot moth *Senta flammea*, the flies *Tetanocera freyi, Thrypticus divisus* and *Lonchoptera scutellata*. A further eight proposed RDB species and 151 Notable species have been recorded recently.

Otters frequently use the estuary.

Conservation status

● = designated ● = proposed

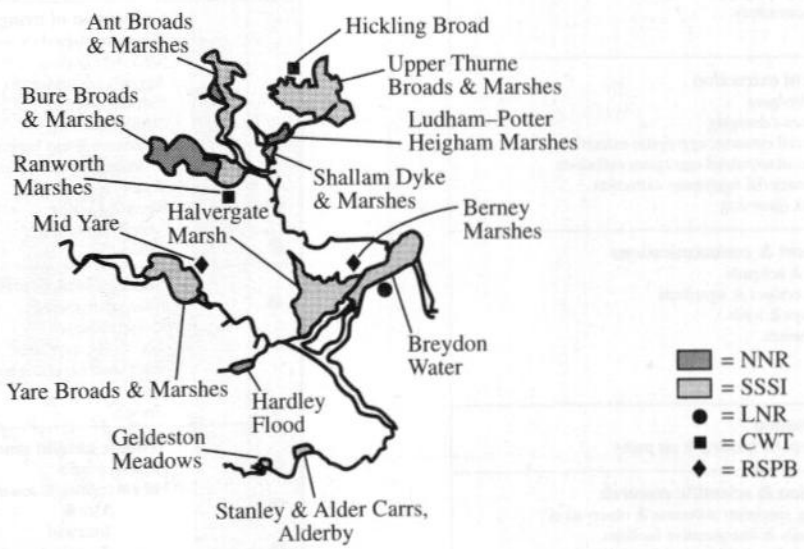
	NCR	GCR	SSSI (B)	SSSI (G)	SSSI (M)	NNR	LNR	Ramsar	SPA	SAC	AONB	CWT	RSPB	ESA	NP	WWT	NT	NSA	HC	Other
	●		●			●	●	●	●	●		●	●	●	●					
No.	1		11			3	1	2	2	1		2	2	1	1					

Parts of the estuary have been designated as biological Sites of Special Scientific Interest, namely Bure Broads and Marshes (741 ha), Ant Broads and Marshes (735 ha), Upper Thurne Broads and Marshes (1,159 ha), Ludham-Potter Heigham Marshes (99 ha), Shallam Dyke Marshes (72 ha), Breydon Water (507 ha), Halvergate Marshes (1,430 ha), Hardley Flood (48 ha), Yare Broads and Marshes (736 ha), Geldeston Meadows (3 ha) and Stanley and Alder Carrs (43 ha). Parts of some of these SSSIs have been designated as National Nature Reserves: Ant Broads and Marshes, Bure Marshes and Ludham-Potter Heigham Marshes. Part of Hickling Broad outside the estuary has also been designated as NNR (not shown).

Two designated Ramsar sites cover parts of the estuary, namely Breydon Water and Broadland, which have also been designated as Special Protection Areas. The uppermost parts of the site lie within the proposed Broads Special Area of Conservation.

Breydon Water is a Local Nature Reserve and parts of the estuary lie within the Hickling Broad and Horsey Mere Nature Conservation Review site. The RSPB has reserves at Berney Marshes and Mid Yare and the Norfolk Naturalist's Trust has reserves at Ranworth Marshes and Hickling Broad. Parts of the site lie within the Norfolk Broads Environmentally Sensitive Area and the Norfolk Broads National Park.

Conservation status



Human activities (in 1993)

Present	Proposed	
		Coast protection & sea defences
●		Linear defences
		Training walls
		Groynes
		Brushwood fences
		Spartina planting
		Marram grass planting
		Barrage schemes
		Weirs & barrages for river management
	●	Storm surge barrages
●		Water storage barrages & bunds
		Leisure barrages
		Tidal power barrages
		Power generation
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		Industrial, port & related development
●		Dock, port & harbour facilities
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		Others
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		Exploration
		Production
		Rig & platform construction
		Pipeline construction
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		Import/export jetties & single-point moorings
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		Overflying by military aircraft
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●		Domestic waste disposal
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●		Sewage treatment works
●		Rubbish tips
		Industrial & agricultural waste discharge
		Thermal discharges (power stations)
		Dredge spoil
●		Accidental discharges
		Aerial crop spraying
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		Others
		Sediment extraction
●		Capital dredging
		Maintenance dredging
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		Commercial terrestrial aggregates extraction
		Non-commercial aggregates extraction
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●		Road schemes
●		Ferries
●		Cables
		Urbanisation
		Land-claim for housing & car parks
		Education & scientific research
●	●	Sampling, specimen collection & observation
●	●	Nature trails & interpretative facilities
●	●	Seismic studies & geological test drilling
●		Marine & terrestrial archaeology
	●	Fossil collecting

Present	Proposed	
		Tourism & recreation
		Infrastructure developments
●		Marinas
●		Non-marina moorings
●		Dinghy & boat parks
●		Caravan parks & chalets
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		Sand-yachting
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		Rock-climbing
		Golf courses
●		Clay-pigeon shooting
		Others
		Airborne recreation
●		Overflying by light aircraft
		Radio-controlled model aircraft
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		Wildfowling & hunting
●		Wildfowling
●		Other hunting-related activities
		Bait-collecting
		Digging & pumping for lugworms & ragworms
		Hydraulic dredging for worms
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		Fish-netting & trawling
●		Fyke-netting for eels
		Fish traps & other fixed devices & nets
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		Hydraulic dredging
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		Shellfish farming
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●		Others
		Management & killing of birds & mammals
●		Killing of mammals
		Killing of birds
		Adult fish-eating birds
		Adult shellfish-eating birds
		Gulls
●		Geese
		Wildlife habitat management
●		*Spartina* control
		Habitat creation & restoration
●		Marine
		Intertidal
●		Terrestrial
●		Habitat management
		Others

Features of human use

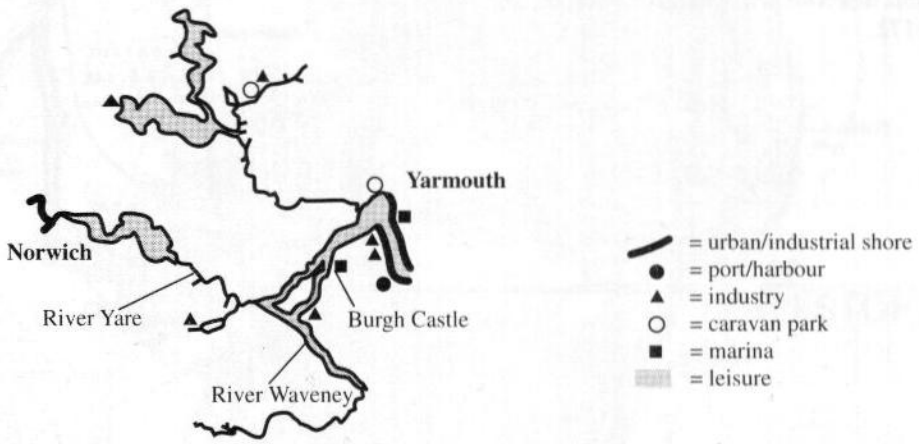
Breydon Water is not an urbanised site but has an extensive network of roads and bridges to enable crossing of the waterways. Industrial activity on Breydon Water is concentrated around Yarmouth where there is a large port, several metal industries and shipbuilding/repair yards. There are further small boat-building/repair yards along the upper reaches of the rivers.

Leisure activities are numerous and widespread. There are a number of marinas in Yarmouth and Burgh Castle and many pleasure boatyards within the rivers. Sailing is extensive throughout the tidal system but power-boating is limited to the main Breydon Water area and water-skiing occurs only on licensed sections of the River Yare, River Waveney and Breydon Water. There are many boat trip operations on the Broads and walking is widespread along the river banks.

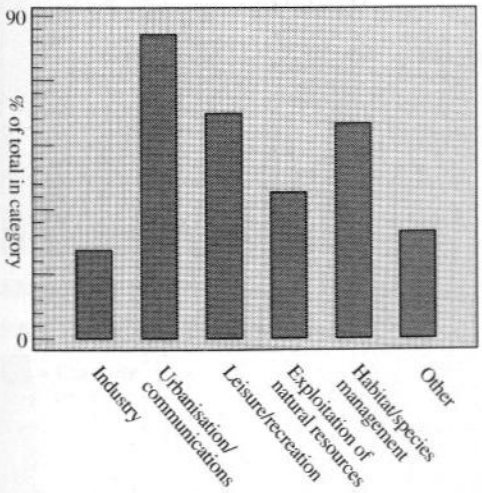
Exploitation of the natural resources includes extensive reed-cutting for roofing from reedbeds and sedgebeds, turf-cutting, wildfowling and fyke-netting for eels.

Recent development proposals include a road scheme at Yarmouth on the Bure loop, industrial land allocation and a new outer harbour. A previous proposal for a storm surge barrage for flood alleviation could be raised again in the future.

Features of human use



Categories of human use



Further reading

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George, M. 1992. *The land use, ecology and conservation of Broadland.* Chichester, Packard.

Tickner, M., Evans, C., & Blackburn, M. 1991. Restoration of a Norfolk Broad: a case study of Strumpshaw Fen. *RSPB Conservation Review, 5*: 72-77.

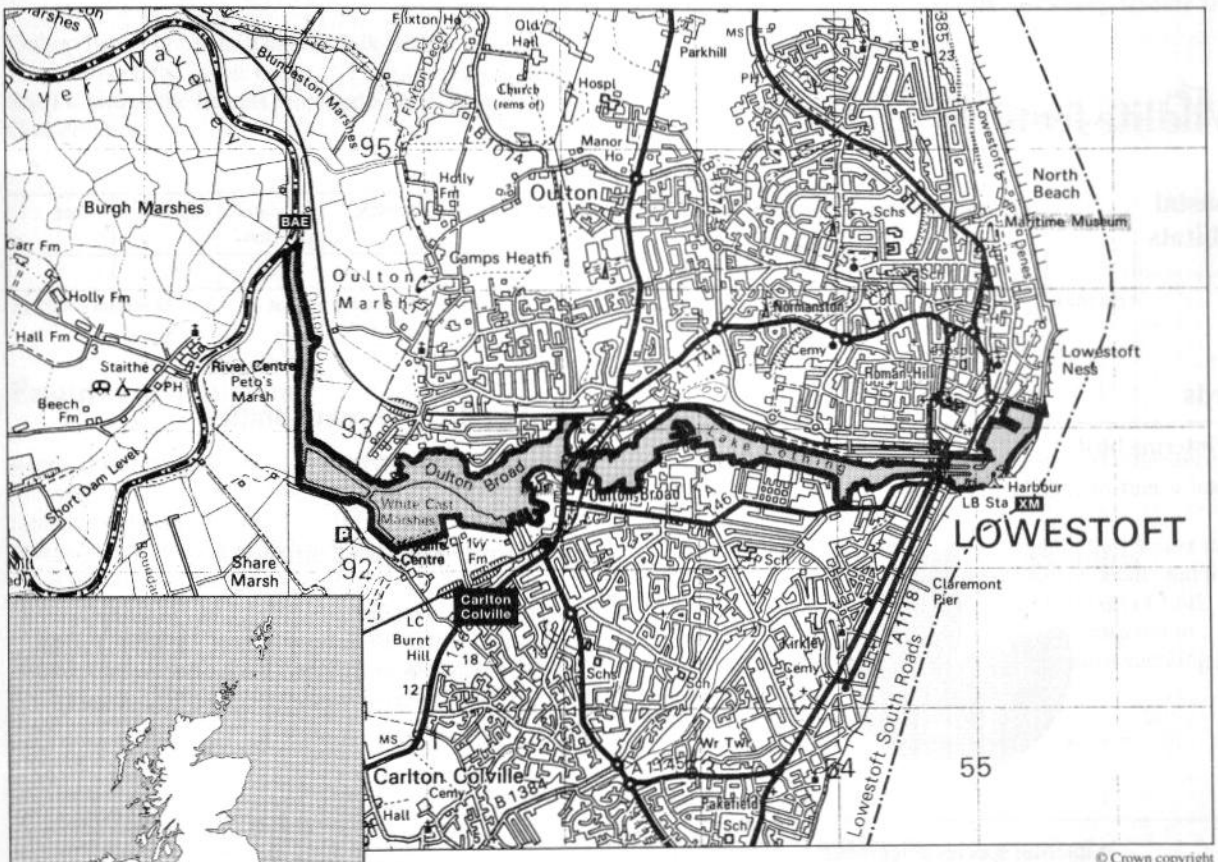
Tickner, M., Blackburn, M., & Evans, C.E. 1990. *The rehabilitation of a Norfolk Broad at Strumpshaw Fen reserve.* Sandy, Royal Society for the Protection of Birds.

104 Oulton Broad

Centre grid: TM5192
Counties: Norfolk, Suffolk

Districts: South Norfolk, Waveney
EN areas: Norfolk, Suffolk

Review site location



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Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
129	30	6.8	20.1	1.9	Bar built	50,000

XM = Across mouth

BAE = Boundary with adjacent site

= Core site

Description

The estuary of Oulton Broad extends from the River Waveney, where it is adjacent to the Breydon Water site, and flows into the North Sea at Lowestoft. The estuary receives little tidal influence from the River Waveney. Water quality within the estuary has been classified as grade A.

Much of the estuary is subtidal, for the intertidal flats of the lower reaches of the estuary (known as Lake Lothing) were claimed many years ago. The upper reaches of the estuary are a narrow dyke which widens at Oulton Broad. Here, an area of intertidal marshes has developed on the southern shore, dominated by *Phragmites* reed and showing a transition to wet grazing marsh. The flora here is very rich and includes several uncommon species and the well-developed system of drainage dykes support a varied aquatic fringing vegetation. There are further marshes adjacent to the estuary at Carlton Colville, which are known to support small populations of breeding waders.

Wildlife features

Coastal habitats

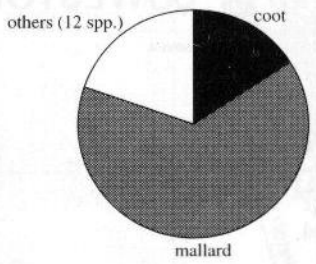
	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	◍	●	●				●		
Area (ha)	129		30							

● = major habitat ◍ = minor habitat

Birds

Wintering birds 1989/90 – 1993/94 data

Total waterfowl: 850



Wintering species assemblage
(Spp. forming >5% assemblage shown separately)

Breeding birds: low numbers of lapwing and snipe breed on the grasslands adjacent to the estuary.

Aquatic estuarine communities

Information unavailable.

Additional wildlife features

The terrestrial invertebrate fauna recently recorded on the marshes adjacent to the estuary include the RDB 1 snail *Pseudamnicola confusa*, the RDB 2 snail *Oxyloma sarsi*, the RDB 3 snail *Vertigo moulinsiana* and four Notable species.

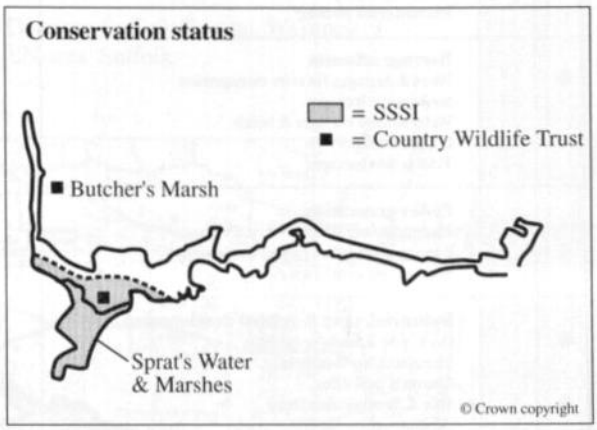
Conservation status

● = designated ● = proposed

	NCR	GCR	SSSI (B)	SSSI (G)	SSSI (M)	NNR	LNR	Ramsar	SPA	SAC	AONB	CWT	RSPB	ESA	NP	WWT	NT	NSA	HC	Other
			●							●		●		●						
No.			1							1		2		1						

Part of the estuary lies within the Sprat's Water and Marshes biological Site of Special Scientific Interest (55 ha), most of which is owned by the Suffolk Wildlife Trust. The Trust also have a reserve at Butcher's Marsh.

Oulton Broad lies within the Norfolk Broads Environmentally Sensitive Area. Part of Sprat's Water SSSI is within the Broads proposed Special Area of Conservation.



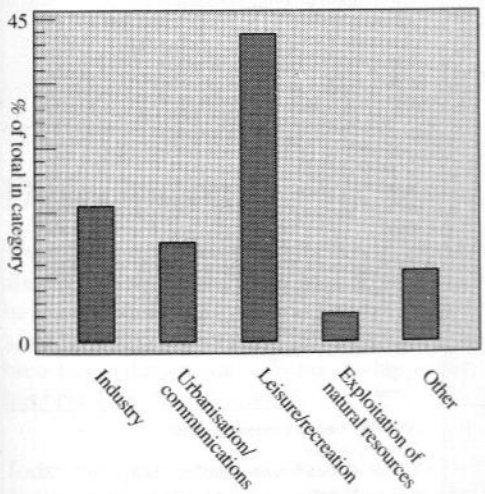
Features of human use

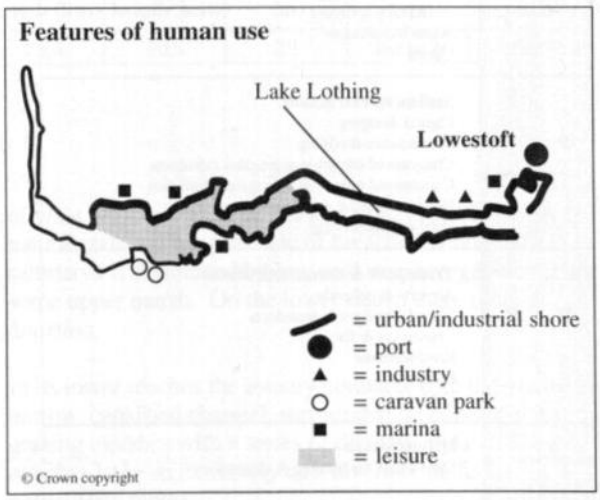
Recreational pursuits are numerous within Oulton Broad, for there are a large number of marinas and moorings. Leisure boats, sailing, windsurfing and canoeing occur extensively over the site. Walking occurs mainly along the sea walls.

Industrial activity includes the port at Lowestoft which is largely used by fishing craft, a ship-building yard in the harbour, an oil rig construction yard and two oil storage/handling jetties in Lake Lothing. Maintenance dredging occurs in the lower reaches of the site.

In 1989 there were proposals for a nature trail across the grazing marsh as part of the interpretative centre and for development of the road across the lower part of Lake Lothing. More recently there has been a proposal to dredge an area of the lower docks to create a yachting basin.

Categories of human use





Human activities (in 1993)

Present	Proposed	
●		**Coast protection & sea defences** Linear defences Training walls Groynes Brushwood fences *Spartina* planting Marram grass planting
●		**Barrage schemes** Weirs & barrages for river management Storm surge barrages Water storage barrages & bunds Leisure barrages Tidal power barrages
		Power generation Thermal power stations Import/export jetties (power generation) Wind-power generation
●		**Industrial, port & related development** Dock, port & harbour facilities Manufacturing industries Chemical industries
●		Ship & boat building/repair Others
		Extraction & processing of natural gas & oil Exploration Production
●		Rig & platform construction Pipeline construction Pipeline installation
●		Import/export jetties & single-point moorings Oil refineries Mothballing of rigs & tankers
		Military activities Overflying by military aircraft Others
●		**Waste discharge** Domestic waste disposal Sewage discharge & outfalls Sewage treatment works Rubbish tips Industrial & agricultural waste discharge Thermal discharges (power stations) Dredge spoil Accidental discharges Aerial crop spraying Waste incinerators Others
●		**Sediment extraction** Capital dredging Maintenance dredging Commercial estuarine aggregates extraction Commercial terrestrial aggregates extraction Non-commercial aggregates extraction Hard-rock quarrying
●	●	**Transport & communications** Airports & helipads Tunnels, bridges & aqueducts Causeways & fords Road schemes Ferries Cables
		Urbanisation Land-claim for housing & car parks
●	●	**Education & scientific research** Sampling, specimen collection & observation Nature trails & interpretative facilities Seismic studies & geological test drilling Marine & terrestrial archaeology Fossil collecting

Present	Proposed	
		Tourism & recreation Infrastructure developments
●		Marinas
●		Non-marina moorings
		Dinghy & boat parks
●		Caravan parks & chalets
		Leisure centres, complexes & piers
		Aquatic-based recreation
●		Power-boating & water-skiing
		Jet-skiing
●		Sailing
●		Sailboarding & wind-surfing
		SCUBA & snorkelling
●		Canoeing
		Surfing
		Rowing
●		Tourist boat trips/leisure barges
●		Angling
		Other non-commercial fishing
●		Bathing & general beach recreation
		Terrestrial & intertidal-based recreation
●		Walking, including dog walking
●		Bird-watching
		Sand-yachting
		4WD & trial-biking
		Car sand-racing
●		Horse-riding
		Rock-climbing
		Golf courses
		Clay-pigeon shooting
		Others
		Airborne recreation
		Overflying by light aircraft
		Radio-controlled model aircraft
		Others
		Wildfowling & hunting Wildfowling Other hunting-related activities
		Bait-collecting Digging & pumping for lugworms & ragworms Hydraulic dredging for worms Others
		Commercial fisheries Fish-netting & trawling Fyke-netting for eels Fish traps & other fixed devices & nets Crustacea Molluscs – Hand-gathering Dredging Hydraulic dredging
		Cultivation of living resource Saltmarsh grazing Sand dune grazing Agricultural land-claim Fish-farming Shellfish farming Bottom & tray cultivation Suspended cultivation Crustacea farming Reeds for roofing *Salicornia* picking Others
		Management & killing of birds & mammals Killing of mammals Killing of birds Adult fish-eating birds Adult shellfish-eating birds Gulls Geese
		Wildlife habitat management *Spartina* control Habitat creation & restoration Marine Intertidal Terrestrial
●		Habitat management
		Others