JOINT NATURE CONSERVATION COMMITTEE

An inventory of UK estuaries

Volume 2
South-west Britain

Compiled by A.L. Buck

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An inventory of UK estuaries is being produced in seven volumes. The inventory is compiled by the Coastal Review Unit of JNCC's Coastal Conservation Branch. Further reports are in preparation.

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Saltmarsh and tidal flats at Avonmouth on the Severn Estuary. The Severn has the largest tidal range of any British estuary. (Photo: Nick Davidson)

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1 Foreword

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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 South-west British coastal area covered by Volume 2, 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.

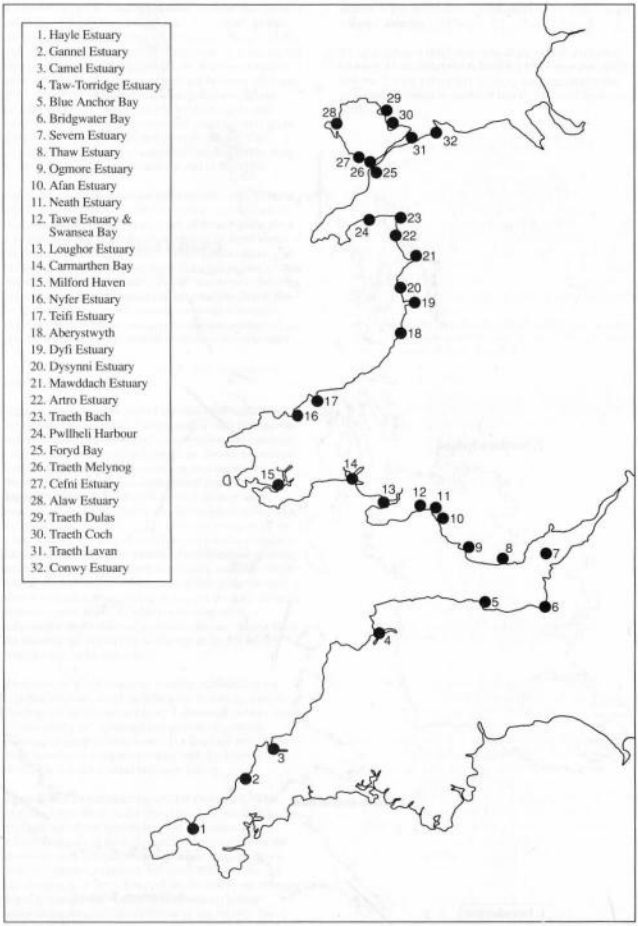


Figure 2 The locations and names of the 32 estuaries covered by Volume 2 of *An inventory of UK estuaries*. See the site map in each regional report for the precise boundaries of the site identified as the core estuary.

3 General features of estuaries in South-west Britain

A.L. Buck & N.C. Davidson

Resource distribution and size

This volume covers the 32 estuaries on the west coast of England and Wales from Land's End in the south northwards to the Great Orme in North Wales. The estuaries on this coastline include the few on the generally rocky and exposed north coast of Cornwall, the estuarine complexes in the Bristol Channel and South-west Approaches, the nine river estuaries flowing into the broad sweep of Cardigan Bay, the inlets and tidal flats fringing the Menai Strait and the estuaries and embayments on the north and west coasts of Anglesey and North Wales. Figure 2 shows the names and locations of the estuaries covered by this volume. Note that the sheltered rias and other inlets of the south coast of Devon and Cornwall are covered in Volume 6 (Southern England) of the inventory.

Half the estuaries in this region are of predominantly bar built geomorphology, with a smaller number of embayments, coastal plain estuaries and rias. All estuaries along this coast are macrotidal (i.e. with tidal ranges greater than 4 metres). The smallest tidal ranges are found within Cardigan Bay (less than 4.5 metres on mean spring tides), and the region includes the 12.3 metres tidal range at the mouth of the Severn Estuary - the largest tidal range of any estuary in Britain, and the second largest (after the Bay of Fundy in Canada) in the world.

Of the estuaries in this region only Milford Haven, the Loughor Estuary and the Severn Estuary are particularly deep. Most estuaries are predominantly shallow reflecting the largely depositional nature of the coast, and this feature is most marked on the Cardigan Bay coast where there are also large shallow subtidal features stretching several kilometres offshore.

The Severn Estuary (almost 55,700 ha) is by far the largest single estuary in the region, with the large expanse of Bridgwater Bay (over 6,500 ha) contiguous with the Severn along its southern shore. Elsewhere the only other large estuaries (of over 5,000 ha) are the Loughor Estuary, Carmarthen Bay and Milford Haven, grouped together on the south-west peninsula of Wales. Traeth Lafan (just over 3,000 ha) is the only sizeable estuary in North Wales. Amongst the other 24 estuaries many are very small with less than 500 ha of intertidal and subtidal habitats within the estuary mouth, but these contribute significantly to the great variety of scale and form of estuaries on the South-west British coastline. These south-western sites include some of the least spoilt estuaries in the southern half of Britain and all contribute importantly to the network of estuaries around the UK coasts.

The areas and length of key features of each estuary are listed in Table 1, and Table 2 provides a regional summary of the size of the estuarine resource.

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 about half of the total area of estuarine habitat in this South-west Britain region is intertidal and in many estuaries this is chiefly represented by sandflats and mudflats. The intertidal flats, especially soft mudflats, of estuaries support important populations of marine worms, molluscs and other invertebrates often living in very high densities and with high biomass. These in turn provide an abundant food supply for estuarine predators, notably fish and migratory waterfowl.

The intertidal flats of the most south-westerly estuaries are composed of mosaics of mud and sand. These include the extensive intertidal flats of Bridgwater Bay, the Severn Estuary, Carmarthen Bay and the Loughor Estuary. Many parts of the intertidal flats in these high tidal range estuaries, and especially the Severn Estuary, are composed of highly mobile sediments, since much of the fine silt that would otherwise deposit to form mudflats is held in suspension by high current velocities. This characteristic contributes substantially to the geomorphological interest of such estuaries. Soft mudflats in these estuaries are confined to their more sheltered inlets and bays. Further north along the Welsh coast the intertidal flats of the estuaries discharging into Cardigan Bay are predominantly sandy. The Dyfi Estuary, Traeth Bach and Traeth Lafan provide the largest areas of intertidal flats in the northern parts of the region.

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 South-west Britain region saltmarshes are widespread, occurring on 29 estuaries, but they generally form only a small proportion of the total intertidal area. Only in the Loughor Estuary, Carmarthen Bay and the Dyfi and Severn Estuaries are there extensive areas of saltmarsh, and in the Loughor and Dyfi these occupy over 30% of the intertidal area of the estuary. The saltmarshes of the Loughor Estuary are not only extensive but also particularly important for their wide variety of plant communities. In total six estuaries in the region (Bridgwater Bay, Severn Estuary, Loughor Estuary, Carmarthen Bay, Dyfi Estuary and Traeth Melynog) contain nationally important saltmarshes. That is, they support a full and representative sequence of plant communities covering the variation in Great Britain. The total area of saltmarsh in the region (7,147 ha) is over 16% of the British saltmarsh resource.

Table 1 Areas, shoreline and channel lengths and mean spring tidal range measurements for estuaries in South-west Britain.

Estuary	Area (ha)	Intertidal area (ha)	Saltmarsh (ha)	Shoreline (km)	Channel length (km)	Tidal range (m)
1. Hayle Estuary	358	321	19	19.5	2.4	5.0
2. Gannel Estuary	122	85	20	9.2	3.7	6.4
3. Camel Estuary	839	610	50	43.0	15.3	5.9
4. Taw-Torridge Estuary	2,463	2,018	240	87.9	20.8	7.3
5. Blue Anchor Bay	350	350	0	8.9	0	9.7
6. Bridgwater Bay	6,529	5,147	487	109.4	46.3	11.1
7. Severn Estuary	55,684	16,890	933	353.0	111.2	12.3
8. Thaw Estuary	160	160	8	4.7	0	10.5
9. Ogmore Estuary	187	173	15	8.0	1.6	8.9
10. Afan Estuary	38	18	0	4.9	2.5	8.6
11. Neath Estuary	1,129	1,079	159	26.9	10.6	8.6
12. Tawe & Swansea Bay	785	748	0	22.8	6.5	8.6
13. Loughor Estuary	9,524	6,553	2,187	84.7	30.2	7.1
14. Carmarthen Bay	8,295	5,369	910	115.7	30.7	7.5
15. Milford Haven	5,448	1,710	385	170.7	35.4	6.3
16. Nyfer Estuary	100	75	10	6.1	3.1	4.0
17. Teifi Estuary	302	181	46	21.0	10.0	4.1
18. Aberystwyth	18	5	1	7.1	2.4	4.3
19. Dyfi Estuary	1,954	1,524	546	52.2	19.6	4.3
20. Dysynni Estuary	117	69	22	9.9	4.4	4.3
21. Mawddach Estuary	1,159	976	219	37.7	13.8	4.3
22. Artro Estuary	120	114	10	7.4	1.7	4.4
23. Traeth Bach	2,050	1,750	348	54.0	15.7	4.4
24. Pwllheli Harbour	85	60	3	4.6	2.4	4.5
25. Foryd Bay	343	285	123	9.4	4.5	4.7
26. Traeth Melynog	365	314	66	10.9	5.4	4.7
27. Cefni Estuary	744	614	111	26.1	12.7	4.7
28. Alaw Estuary	1,085	721	63	38.2	10.4	5.0
29. Traeth Dulas	103	103	21	5.2	2.9	6.4
30. Traeth Coch	583	583	31	10.0	4.4	6.4
31. Traeth Lafan	3,040	2,932	9	16.1	2.9	6.9
32. Conwy Estuary	1,494	1,081	105	55.8	24.7	7.1

Table 2 Total areas and lengths of the regional estuarine resource in South-west Britain.

Total area (ha)	Subtidal area (ha)	Intertidal area (ha)	Intertidal flats (ha)	Saltmarsh (ha)	Shoreline (km)	Channel length (km)
105,573	52,955	52,618	45,471	7,147	1,440.6	458.2

The cord-grass *Spartina anglica* is now widely distributed in estuaries in this region from Bridgwater Bay northwards, and in some (Bridgwater Bay, Milford Haven, Dyfi Estuary, Foryd Bay and Conwy Estuary) *Spartina* now forms over half the saltmarsh area. Invading *Spartina* is considered a problem on some sites, particularly on the Dyfi where it makes up 57% of the total saltmarsh area.

Fifteen estuaries in South-west Britain have associated major sand dune systems. In many bar built estuaries the sand dunes form a major part of the bar that partially closes the estuary mouth. In some places these bars are composed entirely of sand, but in others the sand dune system has developed over an earlier shingle ridge. Many of the best examples in Britain of well-developed sand dune systems are associated with the estuaries of Wales and the Bristol Channel and nine of these estuaries have nationally important dune systems. These include Braunton Burrows on the Taw-Torridge Estuary, Merthyr Mawr at the mouth of the Ogmore Estuary, Morfa Harlech at the mouth of Traeth Bach, Tywyn Gwendraeth bordering Carmarthen Bay and Ynyslas at the mouth of the Dyfi Estuary. Overall 27 South-west British estuaries have at least a small area of sand dunes forming part of their habitat mosaic.

Substantial shingle structures are associated with fewer estuaries in South-west Britain, notably on Bridgwater Bay, the Dysynni Estuary and at Traeth Tanybwylch bordering Aberystwyth. In addition Blue Anchor Bay and the shores around the largely land-claimed Thaw Estuary are intertidal flats largely composed of shingle. Although many of the bar built estuaries in Wales have shingle spits at their mouth which have been capped with sand, within the Dysynni Estuary and at Aberystwyth there are shingle spits that have become vegetated. Many other estuaries have patches or banks of bare intertidal shingle, and shingle is found on over half (nineteen) of the estuaries in this region.

Coastal lagoons are associated with seven estuaries in the region. Morfa Gwllt is a lagoon within the shingle spit at the mouth of the Dysynni Estuary, and there are lagoons on the Camel Estuary, Taw-Torridge Estuary, Bridgwater Bay, Severn Estuary and Milford Haven. Horsey Island Pool on the Taw-Torridge Estuary is a lagoon considered to be of particular conservation importance in this region.

Although the largest areas of coastal grazing marshes are outside the South-west Britain area covered in this volume, fourteen of the estuaries have some associated coastal grazing marsh remaining. Of particular conservation importance are the Gwent Levels on the Welsh shore of the Severn Estuary and the Somerset Levels, some parts of which are adjacent to the tidal River Parrett flowing into Bridgwater Bay. As elsewhere in Britain much former coastal grazing marsh has ceased to be of conservation importance through increased drainage, intensified grassland management and conversion to arable farmland.

The aquatic estuarine benthic communities of many of the estuaries within South-west Britain have been well-studied, and the Bristol Channel and Western Approaches and Menai Strait are considered to be of great marine biological and conservation importance. The aquatic estuarine communities of estuaries in this region are dominated by communities on soft substrates, although a number of sites, notably Milford Haven, Camel Estuary, Taw-Torridge Estuary and Severn Estuary, have areas of rocky shore and subtidal rock which support a variety of hard substrate-based communities. Most studied estuaries in this region have a lower diversity of benthic communities than the more sheltered rias and other estuaries of the south coast of England, but the Severn Estuary and Milford Haven are known to have particularly large diversities of such communities. Milford Haven is, for example, the only estuary in the region to have beds of the calcareous alga maerl. Other estuaries with high recorded diversity (>11 aquatic estuarine communities) are the Camel Estuary and Taw-Torridge Estuary.

Plant and animal species

The estuaries of South-west Britain are particularly important nationally for the variety of nationally rare species of vascular plants that depend on their habitats. Almost half (fifteen) estuaries covered in this volume support a population of at least one national rarity. Plant species restricted to estuaries in South-west Britain include the round-headed club-rush *Scirpus holoschoenus*, perennial centaury *Centaurium scilloides*, sea stock *Matthiola sinuata*, dune gentian *Gentianella uliginosa* (restricted to South Wales), and Welsh mudwort *Limosella australis* (found only at two sites in Britain, both the muddy parts of estuaries within this region). In addition one of only four estuarine populations of the nationally rare endemic dune helleborine *Epipactis dunensis* grows on Newborough Warren (Traeth Melynog). Several estuarine areas, notably the Gwent Levels, which are coastal grazing marshes on the former floodplains of the Severn Estuary, also support nationally scarce plants.

Of the terrestrial invertebrates associated with estuaries the sand dune fauna has been studied the most. Sand dunes in South-west Britain are known to support diverse assemblages of invertebrates that include many species with regionally or nationally restricted distributions. A notable example is an isolated subspecies of the sandhill rustic moth *Luperina nickerlii gueneei*, known only from sand dunes associated with two North Wales estuaries and two others in North-west England. Other species of interest include *Armadillidium album*, a woodlouse living on the strandline of foredunes and saltmarshes, with nine of the fifteen estuaries on which it has been recorded being on the Bristol Channel and Welsh coasts; and the strandline beetle *Nebria complanata* which is restricted to dune strandlines of the North Devon, Somerset and South Wales coast, including at least seven estuaries. Many nationally rare and scarce invertebrates live also on grazing marshes and the Gwent and Somerset Levels are both known to support important assemblages of both aquatic and terrestrial species, the former including the scarce diving beetle *Hydaticus transversalis* which is now almost restricted to the Gwent and Somerset Levels and Moors.

The estuaries of South-west Britain support a diversity of adult fish species and are spawning and nursery areas for others. The Severn Estuary is of particular importance for its assemblage of fish, which includes several migratory species. The Severn Estuary is also one of the few estuaries in which there are recent records for several scarce species, notably the sturgeon *Acipenser sturio*, and

allis shad *Alosa alosa*. Other estuaries in the region are also important for some species: of the 32 British estuaries that provide nursery areas for significant numbers of young sea bass *Dicentrarchus labrax*, nine are within this South-west Britain region.

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 South-west Britain provide feeding grounds and roosting sites for 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. Although the small, sandy estuaries of South-west Britain generally support relatively small waterfowl populations, overall in mild winters the region's estuaries hold over 210,000 waterfowl in midwinter (January), some 12 % of the British estuarine population. The relatively mild winter weather on these west coast estuaries is of critical importance to the survival of wintering waterfowl during periods of severe weather. At such times many waterfowl move south and west to estuaries such as the Severn to escape freezing weather in continental Europe and eastern Britain.

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 252,000 birds are using the estuaries covered by this volume during the winter period. Ten of these estuaries are nationally important for at least one waterfowl species, and seventeen species attain national importance on at least one estuary in the region. Four of these estuaries currently support internationally important waterfowl populations: the total population in these places exceeds 20,000 birds and there is over 1% of the flyway population of at least eight different species (dunlin *Calidris alpina*, knot *Calidris canutus*, redshank *Tringa totanus*, oystercatcher *Haematopus ostralegus*, Bewick's swan *Cygnus columbianus bewickii*, European white-fronted goose *Anser a. albifrons*, gadwall *Anas strepera* and pintail *A. acuta*). Many of the other 22 estuaries in the region contribute towards the geographical network of estuaries and together provide wintering habitat for at least 74,000 waterfowl.

In addition there are periods of rapid turnover of individuals of other migratory waterfowl populations from more southerly wintering grounds during spring and autumn. Estuaries in this region, particularly the Severn Estuary, provide important migratory staging areas for several wader species including dunlin and ringed plover *Charadrius hiaticula*, this estuary being one of only four British estuaries regularly to support a large migrant ringed plover population in spring. In addition the Severn Estuary and Bridgwater Bay and their surrounding grazing marshes are the only major staging area in Britain for spring migrant whimbrel *Numenius phaeopus*. In autumn estuaries provide safe moulting places for migratory waterfowl, and Bridgwater Bay is notable as one of the few British estuaries to which shelduck *Tadorna tadorna* undertake a moult migration, with the estuary supporting up to 2,000 birds, the largest number in Britain.

The saltmarshes, shingle banks and coastal grazing marshes around the estuaries also support small breeding populations of breeding waders (chiefly redshank, oystercatcher, lapwing *Vanellus vanellus* and ringed plover). The most diverse assemblages are on the Severn Estuary (six species) and Traeth Bach (five species). The largest estuarine populations of breeding ringed plovers in the region are associated with Carmarthen Bay and the Artro Estuary. Breeding seabird populations are also generally small although the islands in the Severn Estuary have one of the five largest breeding population of lesser black-backed gulls *Larus fuscus*, and shelducks also breed on many of the region's estuaries, notably the Dyfi, Severn and Taw-Torridge Estuaries and Bridgwater Bay.

Grey seals *Halichoerus gryphus* breed on the rocky shores of Anglesey and Dyfed largely outside estuaries, although there is a small colony on the coast adjacent to the mouth of the Nyfer Estuary. Otters *Lutra lutra* are generally scarce on estuaries in South-west Britain; although they have been recorded upstream of the tidal limit on seventeen of these estuaries there are recent records within the tidal estuary only for the Taw-Torridge, Mawddach and Dyfi Estuaries, Milford Haven, Foryd Bay and Carmarthen Bay. There has, however, been a recent range expansion downstream recorded on the River Severn and the use of such estuaries is undoubtedly increasing.

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 South-west Britain 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 now also 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 South-west British estuaries. At least one SSSI is associated with all but two (Afan Estuary and Pwllheli Harbour) of the estuaries covered by this volume, although SSSIs, like most other designations, cover only parts of each estuary. Indeed on some estuaries, such as the Hayle, Mawddach and Conwy Estuaries and Traeth Melynog, SSSIs cover little or none of the core estuary area.

In all there are 96 SSSIs in this region, 28.5% of estuarine SSSIs in Great Britain. The Severn Estuary currently has the largest number (24) of SSSIs associated with any British estuary, an indication of this estuary's major and varied wildlife interest. SSSIs on the Severn Estuary are typical of those on many estuaries - a mixture of generally 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. Other estuaries in the region covered by more than four SSSIs

are the Taw-Torridge and Loughor Estuaries, and Milford Haven. SSSIs associated with estuaries in this region cover a total of 72,011 ha (18.5% of the British estuarine SSSI area), with by far the largest areas of SSSI being on the Severn, Loughor and Dyfi Estuaries.

Eight of the 42 declared estuarine National Nature Reserves (NNRs) in Britain are on the intertidal or terrestrial habitats of the estuaries covered by this volume. These include several of the major sand dune systems, e.g. Braunton Burrows (Taw-Torridge Estuary), Whiteford Burrows (Loughor Estuary), Morfa Dyffryn (Artro Estuary), Morfa Harlech (Traeth Bach) and Newborough Warren (Traeth Melynog and Cefni Estuary). Others include important areas of intertidal flats and saltmarshes, notably the Dyfi Estuary NNR and Bridgwater Bay NNR. The eighth NNR in the region is the Avon Gorge, a terrestrial site associated with the southern shore of the Severn Estuary. There are also two Areas of Special Protection (AoSPs - formerly Bird Sanctuaries) affording further safeguard to bird populations on Welsh estuaries: Cleddau (Milford Haven) and Burry Estuary (Loughor Estuary).

Two of the four British estuarine Biosphere Reserves (designated through UNESCO) are NNRs in the region: Braunton Burrows (Taw-Torridge Estuary) and Dyfi Estuary.

One of six proposed Marine Nature Reserves (MNRs) falls within the region. This is the proposed Menai Strait MNR which would include parts of four estuaries covered in this volume - Foryd Bay, Traeth Melynog, Cefni Estuary and Traeth Lafan - as well as the rocky marine habitats of the Strait itself. In addition several parts of the coastline including estuaries are within the proposals for non-statutory Marine Consultation Areas (MCAs) currently being considered for England and Wales.

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 33 designated LNRs which occur on estuaries, only three lie within the region, two in North Wales (Traeth Lafan and Great Orme's Head, adjacent to the outer Conwy Estuary), and a small part of the Avon Gorge adjacent to the Severn Estuary.

Two international designations are particularly relevant to estuarine habitats and their birds. These are wetlands of international importance designated under the Ramsar Convention on wetlands of international importance especially as waterfowl habitat (Ramsar sites) and Special Protection Areas (SPAs) designated under the EC Directive on the conservation of wild birds. Several parts of the estuarine resource of South-west Britain have already been designated as Ramsar sites and/or SPAs (for estuarine waterfowl populations both designations often apply), and other parts of estuaries are currently proposed for designation. Parts of Bridgwater Bay, the upper Severn Estuary and the Dyfi Estuary are designated Ramsar sites, the first two being also SPAs. Traeth Lafan also is a designated SPA. There are proposals for Ramsar/SPA sites which would include parts of the Taw-Torridge Estuary, the Neath Estuary and Tawe Estuary and Swansea Bay, the Loughor Estuary and Carmarthen Bay, and for a single Severn Estuary Ramsar/SPA site incorporating those parts of Bridgwater Bay and the Severn Estuary already designated and other large parts of the Severn Estuary. Milford Haven is also being investigated further for possible designation. Note that single Ramsar/SPA sites can include more than one estuary since international site boundaries are set to cover areas linked by known movements of bird populations.

Other wildlife conservation sites include county wildlife trust reserves on seven estuaries, RSPB reserves on the Dyfi and Mawddach Estuaries, and the Wildfowl & Wetlands Trust reserve at Penclacwydd on the Loughor Estuary and its headquarters at Slimbridge on the Severn Estuary.

There are, in addition, several landscape conservation designations that partly cover estuaries in South-west Britain. These include parts of the Pembrokeshire Coast and Snowdonia National Parks overlapping with seven of the estuaries of West Wales and Cardigan Bay; parts of the Hayle, Camel, Taw-Torridge and Severn Estuaries falling within Areas of Outstanding Natural Beauty; parts of six estuaries lying within Heritage Coasts; and the presence of Country Parks adjacent to three estuaries (Taw-Torridge and Conwy Estuaries and Carmarthen Bay). There are also National Trust properties on six estuaries in the southern half of the region from the Hayle Estuary to Milford Haven.

Features of human use

Many parts of the coastline of South-west Britain are largely natural and little affected by damaging human activities. Rather few people live close to many of the estuaries covered in this volume. A major exception is the Severn Estuary (>1 million population). Elsewhere only the South Wales estuaries of the Neath Estuary, Tawe Estuary & Swansea Bay (172,000) and the Loughor Estuary (60,000) have nearby urban populations exceeding 50,000 people. Hence there are few parts of the estuarine resource in South-west Britain that have been subjected to the major urban and industrial pressures characteristic of estuaries close to large conurbations. Human uses of many estuaries are more typically the exploitation of natural resources and recreation.

Although there is a general tendency for slight sea level rise many parts of the estuarine shoreline in South-west Britain rise relatively steeply and have not therefore been subjected to sea defence measures such as construction of sea walls. Few estuaries in this region have sea defences along more than 50 % of their shoreline so in many areas there are long stretches of natural transitions from intertidal to terrestrial habitats.

Despite this overall pattern of low-intensity use of estuaries, there are a number of places on the estuaries of South-west Britain where intensive human use occurs and where there has been substantial loss and damage to the estuarine resource. For example there have been very extensive areas of historical land-claim on some estuaries such as the Severn Estuary, where around 8,000 ha have been claimed since Roman times. Substantial further land-claim of saltmarshes for agricultural use has historically created coastal grazing marshes on a number of Welsh estuaries, but as elsewhere considerable parts of this

resource have been subsequently further altered through intense agricultural use or urban spread.

Heavy industrial activities are concentrated on the larger estuaries, notably on the Severn Estuary where there are several power stations and also the large port and industrial complexes at Avonmouth and Cardiff. Milford Haven has several dock and harbour facilities and a major oil refinery with associated jetties, a power station and chemical industries. Beside the Neath Estuary is the Crymlyn oil refinery and power station. Several other estuaries have smaller ports and harbour facilities. Two small estuaries have been very extensively altered by human activity: the Thaw Estuary underwent very extensive land-claim during the building of two power stations such that almost none of the tidal estuary remains, and the estuary at Pwllheli is now almost entirely a harbour.

Other urban and infrastructure developments have, and are, altering estuarine features. Nine of the estuaries on which housing and car-park developments were taking place in 1989 were in South-west Britain. Some were associated with marina developments; others such as on the Teifi Estuary were being constructed on land previously claimed from the estuary; and others such as on the Ogmore Estuary were on adjacent sand dune areas. There have also been substantial numbers of further proposals for such developments in this region, more than elsewhere in Britain. Several estuaries have been affected by road and rail construction: the steep terrain surrounding estuaries in West Wales caused the construction last century of railway lines along the shoreline of several estuaries, notably the Mawddach and Dyfi Estuaries and parts of Carmarthen Bay. Recent road tunnel construction on the Conwy Estuary has also involved substantial areas of land-claim.

The coastlines of North and West Wales within the region covered by this volume are largely undeveloped, and their long beaches and extensive sandflats and dune systems make these areas popular spots for tourism and recreation. A wide variety of leisure pursuits, from general beach use and bathing to increasing amounts of water-based recreation, take place on parts of these estuaries especially during the summer months. Sailing is becoming particularly intensive in some areas in North Wales. Associated with this increase in sailing is a number of proposals for new marina facilities, often involving other infrastructure developments such as housing. These have been proposed recently for nine of the estuaries in the region, with fourteen proposals on ten estuaries during the last four years adding to the eleven marinas already present on eight estuaries. Seven of these proposals were on estuaries which have no existing marina facilities.

Alongside recreational use of estuaries there are a variety of traditional land uses which exploit the natural plant and animal resources of these west coast estuaries. Stock grazing of saltmarshes, especially by sheep, is widespread, as is grazing of stable sand dunes. Other resource use includes cockle fisheries on the Loughor Estuary and Lavan Sands, although many other traditional fisheries such as those on the Severn Estuary for salmon and eels have largely disappeared. There is, however, still substantial fishery activity during the annual run of elvers up the River Parrett (Bridgwater Bay).

The high levels of tidal energy in some of these west coast estuaries has led in the last ten years to proposals for a number of barriers and barrages. The largest is the proposal for a tidal power barrage across the mouth of the Severn Estuary. Extensive studies into the environmental impact of this barrage are continuing and it is proving complex and difficult to predict in detail the ecological changes that would be likely to occur. It is clear, however, that any such development would substantially alter the estuarine ecosystem of the whole estuary and would remove the characteristic features arising from the extremely large tidal range in this area of international conservation importance. Other estuaries and shores, notably Bridgwater Bay downstream of the barrage, may also be affected by altered tidal regimes after its construction.

In addition to the Severn tidal power barrage, the estuaries of South Wales and western England are subject to schemes for a variety of barrages for different purposes. Several of these barrages are designed to create a freshwater or brackish impoundment from a tidal part of the estuary to provide leisure and recreational facilities, often associated with attempts to revitalise degraded industrial and dock systems. A widely known example is the plan to construct a barrier across the mouth of Cardiff Bay on the north shore of the Severn Estuary. If constructed this barrier would entirely inundate an important part of the tidal flat mosaic of the estuary, and an area of considerable importance to migratory waterfowl. Another barrier designed for a similar purpose but with less dramatic wildlife impact has recently been completed across the upper part of the Tawe Estuary in Swansea, and there have also been recent proposals for leisure barrages on parts of the Hayle, Camel and Loughor Estuaries and Milford Haven.

Several other South-west British estuaries have been identified as having potential for tidal power generation, notably the Camel Estuary, Bridgwater Bay and the Conwy Estuary, but these proposals are not being actively pursued at present.

Whilst this is only a brief overview of some of the key features of the estuaries of South-west Britain 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 such as barrages that would further alter the ecosystem processes on important parts of the resource, many 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, and where possible with enhanced natural estuarine functions, that allow for the retention of the 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).

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 BTO/JNCC/RSPB Birds of Estuaries Enquiry (BoEE) co-ordinated by the British Trust for Ornithology, and the National Wildfowl Count (NWC) operated by the Wildfowl and Wetlands Trust. Information in the inventory is calculated from five year peak monthly counts for waterfowl for the winters 1986/87 - 1990/91. 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 and Special Protection Areas are also indicated where these were in their final stages of preparation for designation during completion of the inventory.

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)
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 February and June 1989 (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 known to occur in 1989. 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.

References

Buck, A.L. In prep. *An inventory of UK estuaries. Volume 6. Southern England.* Peterborough, Joint Nature Conservation Committee.

Burd, F. 1989. *Saltmarsh survey of Great Britain.* Peterborough, Nature Conservancy Council. (Research and survey in nature conservation, No. 17.)

Davidson, N.C., & Buck, A.L. 1993. *An inventory of UK estuaries. Volume 1. Introduction.* Peterborough, Joint Nature Conservation Committee.

Davidson, N.C., Laffoley, D.A., Doody, J.P., Way, L.S., Gordon, J., Key, R., Drake, C.M., Pienkowski, M.W., Mitchell, R., & Duff, K.L. 1991. *Nature conservation and estuaries in Great Britain.* Peterborough, Nature Conservancy Council.

Hewitt, R.L., & Lees-Spalding, I.J. *eds*. 1988. *The Macmillan & Silk Cut Almanac.* London, Macmillan.

National Rivers Authority. 1991. *The quality of rivers, canals and estuaries in England and Wales.* Bristol, National Rivers Authority. (Water quality series, No. 4)

Natural Environment Research Council. 1975. *Estuaries research.* NERC Publications Series 'B', No. 9.

Scottish Development Department. 1987. Water quality survey of Scotland 1985. Edinburgh, HMSO.

5 The estuaries

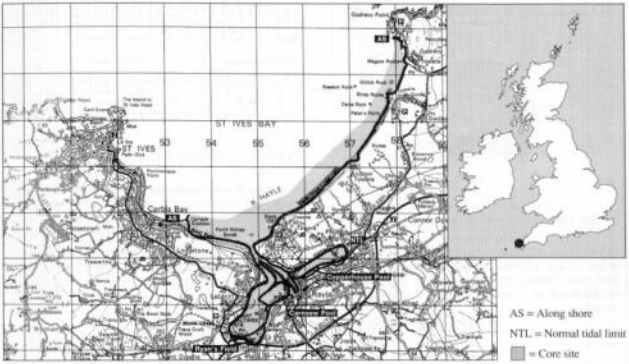
A.L. Buck

Sheep grazing on saltmarsh, Traeth Bach. (Photo: Peter Wakely, English Nature)

1 Hayle Estuary

Centre grid: SW5538 District: Penwith
County: Cornwall EN region: South-west England

Review site location



Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
358	321	19.5	2.4	5.0	Bar built	15,000

Description

The Hayle is a relatively small, sheltered estuary, formed from the infilled valleys of the rivers Hayle and Angarrack, and stretching along the shore of St Ives Bay. The inner estuary has been largely modified by man, with a deep water reservoir of Carnsew Pool bunded behind the central triangular spit, and the storage reservoir of Copperhouse Pool to the east. Water quality has been classified as grade A, although the estuary is recovering from pollution by heavy metals.

At low tide much of the estuary is exposed as intertidal mudflat, except for part of Carnsew Pool which retains some open water. At the extremes of both arms of the estuary there are small areas of saltmarsh, and at Ryan's Field there is an area of saltings that is occasionally flooded by the tide. The saltmarshes consist of small areas of upper marsh vegetation truncated by unnatural landward transitions of sea walls and the railway. Behind Lelant there is an area of dunes, dune grassland and dune scrub, with a rich and diverse flora that has developed on calcareous blown sand.

Either side of the mouth there are sandy beaches backed by dunes. To the west lies Porth Kidney Sands, and to the east is a complex and extensive sand dune system stretching from Mexico Towans to Gwithian. The dunes are composed of calcareous shell sand and show both erosional and depositional phases, and there are also large exposed blow-outs and dune slacks. The dunes support a diverse flora and a rich invertebrate fauna, particularly of butterflies and moths.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	●	●					●
Area (ha)	37	19	301							

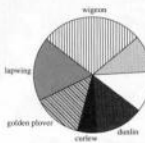
● = major habitat ◉ = minor habitat

Birds

Wintering birds 1986/87 – 1990/91 data

Total waterfowl: 4,640

BoEE	NWC	WSC
●	●	



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

Other: The Hayle is the most south-westerly estuary in Britain, adjacent to bird migration routes along the west coast of Britain. It escapes extremes of weather and has a rich and varied bird life for such a small 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 nationally rare plants Babington's leek *Allium ampeloprasum babingtonii*, western ramping fumitory *Fumaria occidentalis* and balm-leaved figwort *Scrophularia scorodonia* are found within the estuary.

The invertebrate fauna recently recorded on the estuary includes the RDB 2 snail *Lymnaea glabra*, one proposed RDB species and nine Notable species.

Conservation status

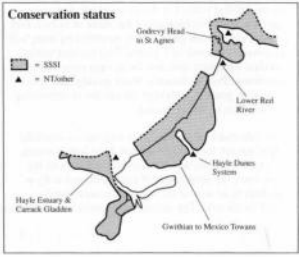
● = designated ◉ = proposed

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

A large proportion of the estuary is covered by Sites of Special Scientific Interest. The Hayle Estuary and Carrock Gladden (167 ha) is a biological SSSI, for which there is a proposed extension. Gwithian to Mexico Towans (371 ha) and Godrevy Head to St Agnes (627 ha) are SSSIs for their biological and geological or geomorphological interest. There are two Geological Conservation Review sites within the estuary, Upton and Gwithian Towans, and Godrevy Point and Strap Rocks.

The National Trust own land on Godrevy Point. The Hayle lies partly within the Cornwall Area of Outstanding Natural Beauty, and the Cornwall Trust for Nature Conservation have identified three areas of nature conservation interest within the review site: Hayle Estuary, Hayle Dunes System, and Lower Red River.

Conservation status



Human activities

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
		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 & trail-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

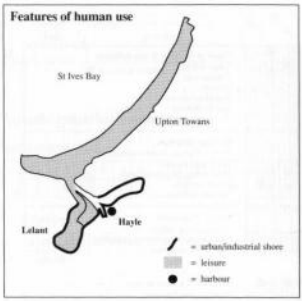
Features of human use

The Hayle has been highly modified by man, with a large number of urbanisation/communications activities and sea defences along much of the shore. Industrial activities include the harbour at Hayle with its resident fishing fleet, maintenance dredging, large-scale extraction of sand from Upton Towans, small-scale extraction of tin-rich sediment, and sand extraction for the golf course.

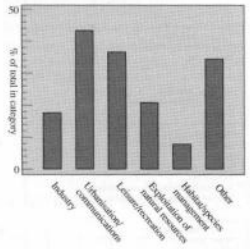
Leisure pursuits are numerous and the estuary is heavily used for water-based activities such as sailing, power-boating and water-skiing, and beach recreation occurs over most of St Ives Bay. The estuary is also intensively used by bird-watchers, especially during autumn migrations.

Exploitation of the natural resources includes fyke-netting for eels, bait-digging, grazing of the saltings, and turf-cutting for the golf course.

In 1989 there were proposals for the Hayle Harbour Bill, an extensive and complex proposal for Hayle Harbour which included improving port facilities, leisure barrage schemes, dredging, a new road system, land-claim for the building of 600 new houses, and various forms of habitat creation. Since 1989 the Hayle Harbour Bill has passed through parliament, and there is an agreement for strict controls over some recreational activities and bait-digging on the estuary. More recent proposals include marram grass planting and *Spartina* control.



Categories of human use



Further reading

David Bellamy Associates. 1989. *Environmental impact assessment for the Hayle Harbour Development.* David Bellamy Associates, in Association with Sir Alexander Gibb and Partners and Andrews Downie and Partners.

Davies, J. 1991. Benthic marine ecosystems in Great Britain: a review of current knowledge. Western channel and Bristol channel and approaches (MNCR Coastal sectors 8 and 9). *Nature Conservancy Council, CSD report*, No. 1,173. (Marine Nature Conservation Review Report, No. MNCR/OR/9)

Flumm, D.S. [1985]. *Hayle estuary ornithological survey winter 1984/85*. Unpublished, Nature Conservancy Council South-west Region.

Gill, C. 1989. Surveys of harbours, rias and estuaries in southern Britain. The Hayle estuary. (Contractor: Oil Pollution Research Unit, Field Studies Council.) *Nature Conservancy Council, CSD report*, No. 1,003.

Jenkins, A.L., Rigby, C., & Tregenza, N. 1985. *Hayle estuary: a report on the wildlife and ecology of the estuary*. Truro, Cornwall Trust for Nature Conservation.

Murphy, R.J. 1974. The ecology of the Hayle saltmarsh: its history and present condition. *Cornish Studies*, 2: 41–44.

Powell, H.T., Holme, N.A., Knight, S.J.T., & Harvey, R. 1978. Survey of the littoral zone of the coast of Great Britain: report of the shores of Devon and Cornwall. (Contractor: Scottish Marine Biological Association/Marine Biological Association Intertidal Survey Unit.) *Nature Conservancy Council, CSD Report*, No. 209.

Radley, G.P. 1988. *National sand dune vegetation survey. Site report No. 12: Lelant dunes, Cornwall.* Peterborough, Nature Conservancy Council.

2 Gannel Estuary

Centre grid: SW8061 District: Restormel Borough
County: Cornwall EN region: South-west England

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
122	85	9.2	3.7	6.4	Ria	14,000

Description

The Gannel is a small estuary lying between the two exposed headlands of Pentire Point East and Pentire Point West, near Newquay. It is a shallow inlet that has been rapidly silting up with sand in recent times, and the river channel has been shifting its course and undercutting banks, eroding substrates and forming bare sandbanks. Water quality in the estuary has been classified as grade A, although studies have shown that the estuary contains high concentrations of heavy metals, particularly lead. Further upstream the catchment of the River Gannel drains an old lead mine.

The largest area of subtidal habitat is at Vugga Cove at the mouth of the estuary, where the channel is at its deepest. Sheltered by the headlands is Crantock Beach, a broad, calcareous sandflat, which is backed by a small area of dunes. In the upper parts of the estuary there is an extensive area of saltmarsh, which has a wide variety of pioneer, middle and upper marsh vegetation communities and a number of pans and linear creeks. Close to the normal tidal limit of the Gannel the vegetation shows good transitions to freshwater marsh.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	●	●	●				●
Area (ha)	37	20	65							

● = major habitat ● = minor habitat

Birds

Wintering birds 1986/87 – 1990/91 data

Total waterfowl: 790

BoEE	NWC	WSC
●	●	

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

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 recently recorded on the estuary includes six Notable species.

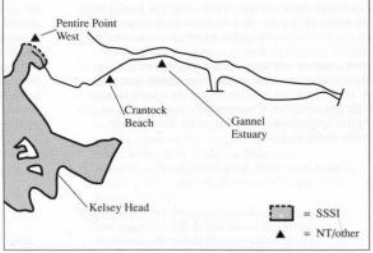
Conservation status

● = designated ● = proposed

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

Only the westernmost point at the mouth of the estuary is covered by a Site of Special Scientific Interest, Kelsey Head (228 ha) which is an SSSI for its biological interest. The Gannel Estuary is a proposed SSSI. Much of the land at Crantock Beach is owned by the National Trust, and Pentire Point West and the Gannel Estuary have been identified as areas of nature conservation interest by the Cornwall Trust for Nature Conservation.

Conservation status



Human activities

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
		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

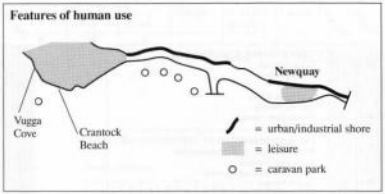
Present	Proposed	
		Tourism & recreation
		Infrastructure developments
		Marinas
●		Non-marina moorings
		Dinghy & boat parks
●		Caravan parks & chalets
		Leisure centres, complexes & piers
		Aquatic-based recreation
		Power-boating & water-skiing
		Jet-skiing
●		Sailing
●		Sailboarding & wind-surfing
		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

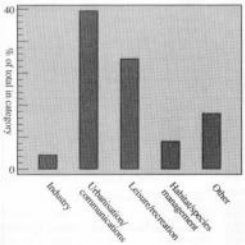
Leisure activities are the most numerous activity present, for there is a large number of summer visitors to the caravan parks that stretch along most of the south coast of the Gannel. Water sports are generally not intensive and occur around Crantock Beach and Vugga Cove, which are popular with surfers. Horse riding affects an area in the upper reaches of the estuary, and there is also a leisure barrage adjacent to the estuary at Newquay.

Habitat management includes sand stabilisation on Crantock Beach dunes by planting marram grass and footpath fencing.

In 1989 proposals for a tidal barrage and leisure barrage had recently been dropped. Since 1989, a footpath has been constructed across intertidal mud in the upper estuary to avoid damage by horses.



Categories of human use



Further reading

Browne, B.E. 1977. Uptake of copper and lead by a metal-tolerant isopod *Asellus meridianus*. *Freshwater Biology*, 7: 235-244.

Bryan, G.W., & Hummerstone, L.G. 1978. Heavy metals in the burrowing bivalve *Scrobicularia plana* from contaminated and uncontaminated estuaries. *Journal of the Marine Biological Association of the United Kingdom*, 58: 793-802.

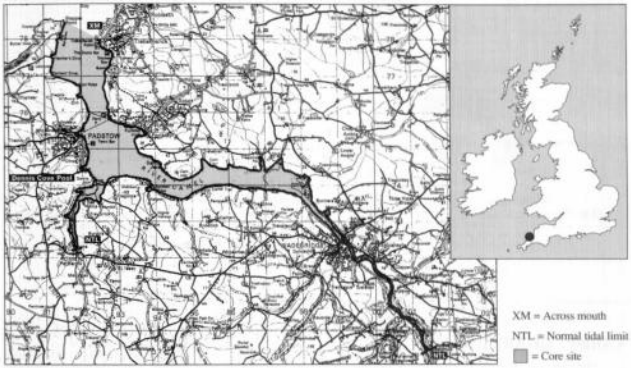
Powell, H.T., Holme, N.A., Knight, S.J.T., & Harvey, R. 1978. Survey of the littoral zone of the coast of Great Britain: report of the shores of Devon and Cornwall. (Contractor: Scottish Marine Biological Association/Marine Biological Association Intertidal Survey Unit.) *Nature Conservancy Council, CSD Report*, No. 209.

Turr, S. 1950. *The Gannel Estuary*. Unpublished note by the Cornish Biological Records Unit, Redruth, Cornwall.

3 Camel Estuary

Centre grid: SW9375 District: North Cornwall
County: Cornwall EN region: South-west England

Review site location



Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
839	610	43.0	15.3	5.9	Ria	<5,000

Description

The Camel is the largest and most sheltered inlet on the north Cornwall coast. It is shallow and sandy, deepening only at the mouth, with a narrow channel at low water that meanders from one side of the estuary to the other. Water quality has been classified as grade A.

The Camel has a large range of aquatic estuarine communities, and is considered to be of major marine biological importance. Aquatic estuarine communities present include a variable salinity rock community which is considered to be of regional importance, and a variant of the variable salinity rocky shore community which is covered by growths of the alga *Enteromorpha*. At Trebetherick there is an extensive area of rocky intertidal shore with mussel beds, and at Rock populations of the common mussel *Mytilus edulis* occurs alongside populations of the southern species of mussel, *M. galloprovincialis*.

At low water, a large area of the estuary is extensive intertidal flats. The outer flats are sandy and very mobile, and the innermost flats are muddy and more sheltered, but subject to tidal scour. In the small bays and inlets there are small patches of saltmarsh, and it is only in the uppermost parts of the site that there are more extensive areas. The largest continuous saltmarsh has developed at Burniere, where the River Amble joins the Camel, and *Spartina* now forms an extensive stand in this part of the estuary.

On the southern shore of the Camel estuary the railway has separated several creeks from the main estuary, one of which, Dennis Cove Pool, is now considered a lagoon. On the northern shore of the estuary at Rock there is a small system of dunes that is slowly accreting, upon which the vegetation shows transition to maritime grassland. Of further interest are the marshes that have developed along the enclosed floodplain of the River Amble, which are a valuable habitat for wintering wildfowl.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	●	●	●		●	●	
Area (ha)	229	49	561							

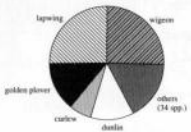
● = major habitat ● = minor habitat

Birds

Wintering birds 1986/87 – 1990/91 data

Total waterfowl: 7,140

BoEE	NWC	WSC
●	●	



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

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

Three species of nationally rare plant grow on the estuary: Babington's leek *Allium ampeloprasum babingtonii*, water germander *Teucrium scordium*, and early meadow-grass *Poa infirma*. The invertebrate fauna recently recorded on the estuary includes two notable species.

The Camel estuary is also a nursery for sea bass *Dicentrarchus labrax*.

Conservation status

● = designated ● = proposed

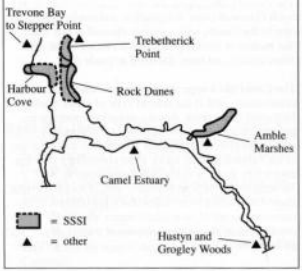
	NCR	GCR	SSSI (B)	SSSI (G)	SSSI (M)	NNR	LNR	Ramsar	SPA	AONB	CWT	RSPB	ESA	NP	WWT	NT	NSA	HC	Other
		●	●	●	●					●						●		●	●
No.		5	1	1	2					1						1		1	5

Only a small proportion of the estuary is covered by Sites of Special Scientific Interest. Amble Marshes (57 ha) adjacent to the estuary is a biological SSSI, Harbour Cove (75 ha) is a geological SSSI, and Rock Dunes (68 ha) and Trebetherick Point (21 ha) are SSSIs for their biological and geological interest. Within these SSSIs are five Geological Conservation Review sites.

The Camel Estuary is a proposed SSSI, and lies within an Area of Outstanding Natural Beauty. Part of the review site lies within designated Heritage Coast, and some land at Trebetherick is leased by the National Trust.

In addition Walmsley Bird Sanctuary lies within the Amble Marshes SSSI, and Trevore Bay to Stepper Point, the Camel Estuary, Amble Marshes and Hustyn and Grogley Woods have been identified as areas of nature conservation interest by the Cornwall Trust for Nature Conservation.

Conservation status



Human activities

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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		Import/export jetties (power generation)
		Wind-power generation
		Industrial, port & related development
●		Dock, port & harbour facilities
	●	Manufacturing industries
		Chemical industries
●		Ship & boat building
		Others
		Extraction & processing of natural gas & oil
		Exploration
		Production
		Rig & platform construction
		Pipeline construction
		Pipeline installation
		Import/export jetties & single-point moorings
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		Dredge spoil
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		Capital dredging
●		Maintenance dredging
●		Commercial estuarine aggregates extraction
		Commercial terrestrial aggregates extraction
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		Causeways & fords
●		Road schemes
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		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

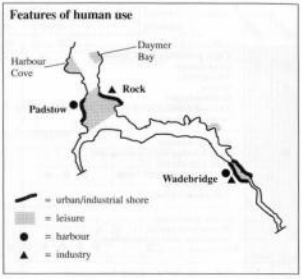
Present	Proposed	
		Tourism & recreation
		Infrastructure developments
		Marinas
●		Non-marina moorings
		Dinghy & boat parks
●		Caravan parks & chalets
		Leisure centres, complexes & piers
		Aquatic-based recreation
●		Power-boating & water-skiing
		Jet-skiing
●		Sailing
●		Sailboarding & wind-surfing
		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

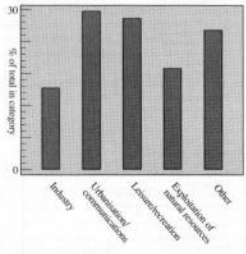
Leisure activities are numerous but not extensive. There are two harbours with moorings at Padstow and Wadebridge which are a focus for sailing and wind-surfing, and there is also a sailing and water-skiing school at Rock. Beach recreation is most intensive at Rock, Daymer Bay and Harbour Cove.

Exploitation of the natural resources includes fisheries for oysters and mussels, lobster and crab potting, and wildfowling. The Camel Trail is a nature trail along the estuary which is promoted as a tourist feature. Industrial activity on the estuary includes two docks at Wadebridge and Padstow which are used primarily for fish and shellfish landings, and there are two small boat-building yards at Rock and Wadebridge.

Proposals in 1989 included off-shore tin mining, a tidal power barrage across the estuary mouth, a leisure barrage at Wadebridge, and a rainbow trout fish farm. There was also a proposal for the Wadebridge by-pass road scheme, which was under construction in 1992.



Categories of human use



Further reading

Akers, P. 1987. *The wintering birds of the Camel estuary 1986/87*. Truro, Cornwall Trust for Nature Conservation.

Beaumont, A.R., Seed, R., & Garcia-Martinez, P. 1989. Electrophoretic and morphometric criteria for the identification of the mussels *Mytilus edulis* and *M. galloprovincialis*. *In*: *Reproduction, genetics and distributions of marine organisms*, ed. by J.S. Ryland and P.A. Tyler, 251-258. Proceedings of the 23rd European Marine Biological Symposium. Denmark, Olsen and Olsen.

Bryan, G.W., & Hummerstone, L.G. 1978. Heavy metals in the burrowing bivalve *Scrobicularia plana* from contaminated and uncontaminated estuaries. *Journal of the Marine Biological Association of the United Kingdom*, *58*: 793-802.

Crawford, I.C., & Waite, A.R. 1987. *National sand dune vegetation survey. Site report No. 18, Rock Dunes, Cornwall*. Peterborough, Nature Conservancy Council. (Contract Surveys, No. 50.)

Fox, P. 1991. Studies within sites of distribution effects of shooting on overwintering waterfowl. *In*: *Shooting disturbance*, ed. by D.V. Bell and P.J.A. Fox, 117-152. WWT/BASC report to NCC/RSPB.

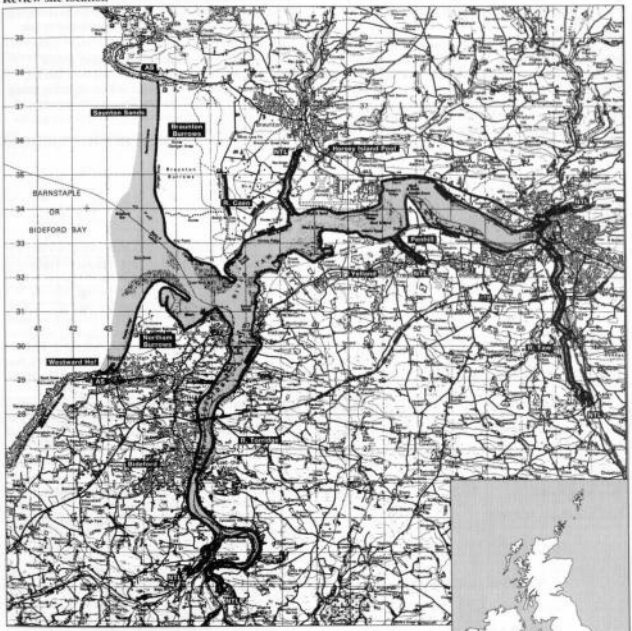
Gill, C., & Mercer, T. 1989. Surveys of harbours, rias and estuaries in southern Britain. The Camel estuary. (Contractor: Oil Pollution Research Unit, Field Studies Council.) *Nature Conservancy Council, CSD Report*, No. 953.

Powell, H.T., Holme, N.A., Knight, S.J.T., & Harvey, R. 1978. Survey of the littoral zone of the coast of Great Britain: report of the shores of Devon and Cornwall. (Contractor: Scottish Marine Biological Association/Marine Biological Association Intertidal Survey Unit.) *Nature Conservancy Council, CSD Report*, No. 209.

4 Taw-Torridge Estuary

Centre grid: SS4631 Districts: North Devon, Torridge
County: Devon EN region: South-west England

Review site location



NTL = Normal tidal limit AS = Along shore = Core site

Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
2,463	2,018	87.9	20.8	7.3	Bar built	47,000

Description

The review site is a joint estuary of the rivers Taw and Torridge which extends some distance inland beyond the towns of Bideford and Barnstaple, and stretches to Westward Ho! in the south and to Saunton in the north. Water quality within the estuary has been classified as grade A.

The estuary supports a variety of soft and hard substrate-based aquatic estuarine communities, which includes rocky outcrops and sea-walls with algal growths and mussel beds, and a reef of *Sabellaria alveolata*.

A large proportion of the estuary is intertidal flats, and towards the mouth the foreshore is sandy with areas of shingle. In the narrow Torridge the intertidal flats are predominantly mud-and-sand, while in the Taw there are extensive mudflats and sandbanks which support many marine worms and other invertebrates. There are also large areas of saltmarsh around Yelland and Penhill which show typical zonation of saltmarsh vegetation through lower, mid and upper marsh communities.

In addition there is a lagoon known as Horsey Island pool, on the northern shore east of the River Caen.

To the north of the estuary Braunton Burrows is one of the largest dune systems in Britain, reaching 30m high in places and with an extensive system of flooded slacks, grassland and scrub. To the south of the estuary mouth are the low-lying dunes of Northam Burrows, which lie behind a sandflat and cobble ridge. Both areas of sand dunes support a variety of flowering and lower plants, and invertebrates, which include several uncommon or rare species.

The Taw-Torridge is also known to support several species of fish, such as bass, salmon, sea trout and eel, and it is also a known focal point of bird migration routes down the west coast of Britain. The estuary regularly supports nationally important populations of two species of wintering waterfowl.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	●	●	●	●	●	●	
Area (ha)	445	240	1,778							

● = 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 1986/87 – 1990/91 data

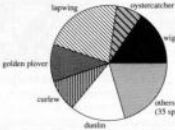
Total waterfowl: 14,400

BoEE	NWC	WSC
●	●	

% National population

curlew 1.3%

grey plover 1%



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

Breeding birds: small numbers of ringed plover are known to breed on the estuary.

Additional wildlife features

Three nationally rare plants grow on the Taw-Torridge; the shore dock *Rumex rupestris*, water germander *Teucrium scordium* and sea stock *Matthiola sinuata*.

The invertebrate fauna recently recorded within the estuary includes the RDB 1 sandbowl snail *Catinella arenaria*, the RDB 2 beetle *Dicronychus equiseti*, the moth *Monochroa elongella* and the flies *Myopa vicaria* and *Synortham mikii*, the RDB 3 fly *Linnaemya comta* and 58 Notable species.

The estuary is also a major nursery for sea bass *Dicentrarchus labrax*, and otters regularly feed and breed within the site.

Conservation status

● = designated ◉ = proposed

	NCR	GCR	SSSI (B)	SSSI (G)	SSSI (M)	NNR	LNR	Ramsar	SPA	AONB	CWT	RSPB	ESA	NP	WWT	NT	NSA	HC	Other
	●	●		●	●	●			◉	●		●				●			●
No.	1	8		2	4	1			1	1		1				1			5

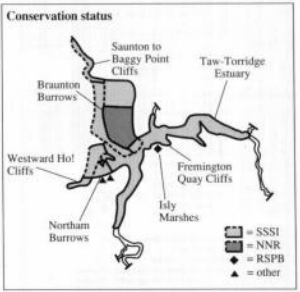
Much of the estuary is covered by Sites of Special Scientific Interest. Fremington Quay Cliffs (11 ha) and Westward Ho! Cliffs (34 ha) are geological SSSIs, and Taw-Torridge Estuary (1,336 ha), Northam Burrows (420 ha), Saunton to Baggy Point Cliffs (153 ha) and Braunton Burrows (1,357 ha) are SSSIs for their biological, geological and/or geomorphological interest. Braunton Burrows is also a National Nature Reserve in part, a Nature Conservation Review site and has been designated by UNESCO as a Biosphere Reserve.

Within the SSSIs there are eight Geological Conservation Review sites: Croyde-Saunton Coast, Downend, Braunton Burrows, Westward Ho! Cobble Ridge, Westward Ho! Cliffs, Westward Ho!, Fremington Quay, and Fremington Quay South.

In addition the RSPB have a reserve at Isley Marshes and the National Trust own land at Burrough Farm near Northam. There is also a Country Park at Northam Burrows, and the Tarka Trail Country Park runs along the southern shores of the Taw.

The mouth of the estuary has been designated as an Area of Outstanding Natural Beauty, and is considered by Devon County Council as a Coastal Protection Area. The DCC have also declared the entire estuary a Nature Conservation Zone, and the lower reaches of the Torridge around Northam Burrows an Area of Great Landscape Value.

Conservation status



Human activities

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
		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

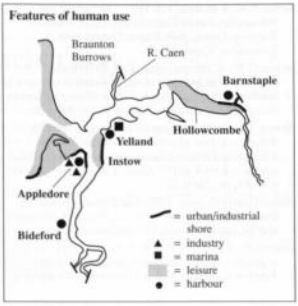
Features of human use

Leisure activities are numerous and are particularly intensive in summer, when there is an increased population of tourists. Water-based sports such as sailing, wind-surfing, water-skiing and surfing generally occur around the mouth of the estuary and along the sea front, where there is a yacht club at Instow and various moorings at Barnstaple, Appledore and Bideford. Beach recreation, sand-yachting, horse-riding and other land-based pursuits more often occur on the sandy shores along the sea front and at Instow.

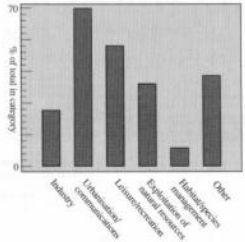
Exploitation of the natural resources include grazing of parts of the saltmarsh and sand dunes, oyster and mussel fisheries, bait-digging and collection of mussels for bait. Wildfowlers shoot over parts of the estuary, namely on either side of the mouth of the River Caen and an area north of Hollowcombe. In total around 300 ha are shot over.

Industrial activities include harbours at Appledore, Bideford, Barnstaple and an oil jetty at Yelland, and there are ship and boat building/repair yards at Appledore and Watertown. Sediment extraction and maintenance dredging also occur. In addition Braunton Burrows is used for military exercises.

Proposals in 1989 included a holiday village at Yelland, land-claim for housing and carparks at Appledore, Bideford and the marina at Yelland, a rainbow trout fish farm and a mussel fishery, and beach feeding south of the estuary mouth.



Categories of human use



Further reading

Brind, R.A., & Bratton, J.H. 1991. *The current status of the sandbowl snail* Catinella arenaria *at Braunton Burrows, Devon.* Joint Nature Conservation Committee, Report No. 54.

Bryan, G.W., & Hummerstone, L.G. 1973. Brown seaweed as an indicator of heavy metals in estuaries in south-west England. *Journal of the Marine Biological Association of the United Kingdom, 53*: 705-720.

Davies, J. 1991. Benthic marine ecosystems in Great Britain: a review of current knowledge. Western Channel and Bristol Channel and approaches (MNCR coastal sectors 8 and 9). *Nature Conservancy Council, CSD Report*, No. 1,173.

Devon County Council. 1979. *Taw-Torridge estuary. A study of recreation opportunities.* Report of the survey and the options. Exeter, Devon County Council.

Gateley, P., & Sturgess, P. In prep. *National sand dune vegetation survey. Site report, Braunton Burrows.* Peterborough, Joint Nature Conservation Committee.

Gateley, P., & Sturgess, P. In prep. *National sand dune vegetation survey. Site report, Instow Sands.* Peterborough, Joint Nature Conservation Committee.

Gateley, P., & Sturgess, P. In prep. *National sand dune vegetation survey. Site report, Northam Burrows.* Peterborough, Joint Nature Conservation Committee.

Harris, T. 1985. *A littoral ecological survey of the lower Torridge estuary.* A report to the Torridge Action Group.

Kingsley, C. 1906. *Westward Ho!* London and Glasgow, Collins.

Little, A.E. 1989. Surveys of harbours, rias and estuaries in Southern Britain. Taw and Torridge estuary. (Contractor: Field Studies Council Research Centre.) *Nature Conservancy Council, CSD report*, No. 1,002.

Parkinson, M. 1976. A tentative historical ecology of parts of the Taw Estuary, Braunton Marsh. *Report and Transactions of the Devonshire Association for the Advancement of Science, 108*: 37-60.

Powell, H.T., Holme, N.A., Knight, S.J.T., & Harvey, R. 1978. Survey of the littoral zone of the coast of Great Britain: report of the shore of Devon and Cornwall. (Contractor: Scottish Marine Biological Association/Marine Biological Association Intertidal Survey Unit) *Nature Conservancy Council, CSD Report*, No. 269.

Seaward, D.R. 1986. Survey of coastal lagoons. Somerset and North Devon. *Nature Conservancy Council, CSD Report*, No. 754.

Slee, A.H. 1968. Braunton Marshes. *Report and Transactions of the Devonshire Association for the Advancement of Science, 100*: 101-110.

Stuart, A., & Hookaway, R.J.S. 1954. *Coastal erosion at Westward Ho!.* Report to the coastal protection committee of Devon County Council.

Williamson, H. 1985. *Tarka the otter.* Harmondsworth, Penguin.

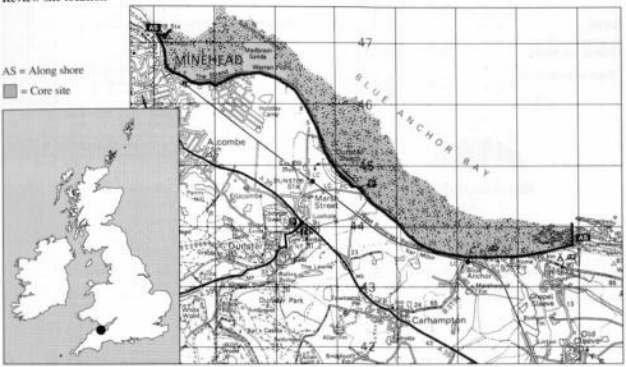
Wills, G., *ed.* 1985. *Devon estuaries. A collection of essays on the estuaries of Devon prepared by local amenity societies and conservation groups.* Exeter, Devon Books.

5 Blue Anchor Bay

Centre grid: STO244 District: West Somerset
County: Somerset EN region: South-west England

Review site location

AS = Along shore
= Core site



Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
350	350	8.9	–	9.7	Embayment	8,000

Description

Stretching eastwards from the town of Minehead is Blue Anchor Bay, a large area of intertidal mud and shingle. On the foreshore at Minehead there is a patch of shingle and a small sandy beach which is under pressure from large numbers of visitors in summer. There is also a small mudflat and a submarine forest close to low water mark in the northernmost part of the estuary, and a small area of flat rocky shore continues eastwards from the review site.

Blue Anchor Bay is of geomorphological interest as it forms part of a series of well-developed intertidal shore platforms which vary from 200 metres to 600 metres in width, which are an unusual feature in a macrotidal environment.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
			●	●		●	●			
Area (ha)			350							

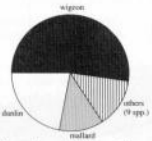
● = major habitat ◍ = minor habitat

Birds

Wintering birds 1986/87 – 1988/89 data

Total waterfowl: 360

BoEE	NWC	WSC
	●	



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

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
	●	●														

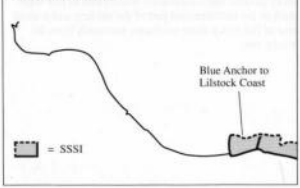
Conservation status

● = designated ◍ = proposed

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

A small area of the site is covered by Blue Anchor to Lilstock Coast geological Site of Special Scientific Interest (743 ha), which extends eastwards beyond the review site. The SSSI contains three Geological Conservation Review sites.

Conservation status



Human activities

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
		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

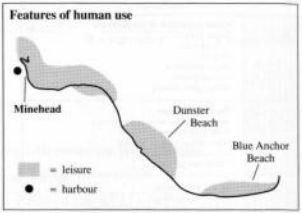
Present	Proposed	
		Tourism & recreation
		Infrastructure developments
		Marinas
●		Non-marina moorings
		Dinghy & boat parks
●		Caravan parks & chalets
●		Leisure centres, complexes & piers
		Aquatic-based recreation
		Power-boating & water-skiing
		Jet-skiing
●		Sailing
		Sailboarding & wind-surfing
		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 & trail-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

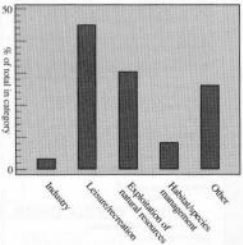
Leisure activities are the most numerous activities present, and both Dunster Beach and Blue Anchor Beach are heavily used during the summer season. Sailing occurs from the harbour and moorings at Minehead out to the west of the site, and there are coastline cruises in summer and some angling. Bird-watching, trial-biking and horse-riding also occur but are not intensive.

Exploitation of the natural resources includes occasional wildfowling by locals, and some bait-digging and boulder turning for crabs. The shore is also used for field studies and marine archaeology.

Other activities include periodic dredging of the harbour, extraction of shingle from Dunster beach for building, and occasional beach feeding to counteract long-shore drift. In 1989 a recent proposal for a tidal power barrage had been dropped.



Categories of human use



Further reading

Bassindale, R. 1941. Studies on the biology of the Bristol Channel. IV. The invertebrate fauna of the southern shores of the Bristol Channel and Severn Estuary. *Proceedings of the Bristol Naturalist's Society*, *4*: 143-201.

Boyden, C.R., & Little, C. 1973. Faunal distributions in soft sediments of the Severn estuary. *Estuarine and Coastal Marine Science*, *1*: 203-223.

Boyden, C.R., Crothers, J.H., Little, C., & Mettam, C. 1977. The intertidal invertebrate fauna of the Severn estuary. *Field Studies*, *4*: 477-554.

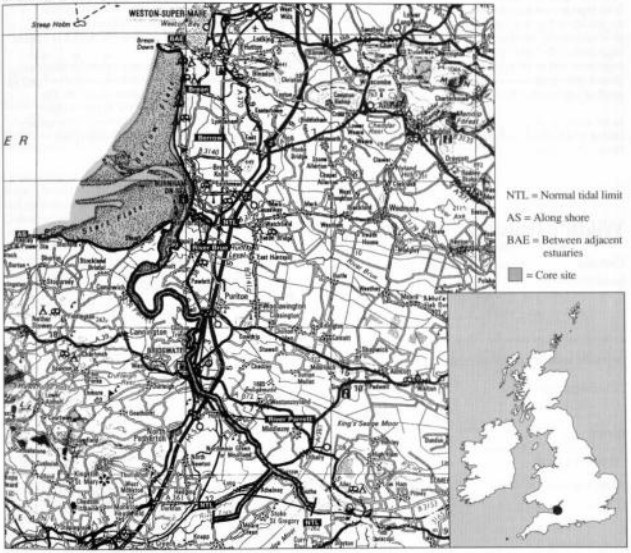
Crothers, J.H. 1976. On the distribution of some common animals and plants along the rocky shores of west Somerset. *Field Studies*, *4*: 369-389.

Hiscock, K. 1981. South West Britain sublittoral survey. Final report. (Contractor: Pollution Research Unit, Field Studies Council, Pembroke, Dyfed.) *Nature Conservancy Council, CSD Report*, No. 327.

6 Bridgwater Bay

Centre grid: ST2947 Districts: Sedgemoor, West Somerset
County: Somerset EN region: South-west England

Review site location



NTL = Normal tidal limit

AS = Along shore

BAE = Between adjacent estuaries

= Core site

Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
6,529	5,147	109.4	46.3	9.7	Embayment	48,000

Description

The estuary of the River Parrett flows into the arc of coastline known as Bridgwater Bay, and lies adjacent to the Severn Estuary review site. The River Parrett is the main freshwater source for Bridgwater Bay. The water quality of its upper tidal limits has been classified as grade A, and its lower reaches together with the Bay as grade B.

At low tide the narrow channel of the River Parrett meanders across a broad intertidal flat of silt and clay, which is highly mobile but receives a degree of protection from erosive currents by the peninsula of Brean Down. At the mouth of the river there is a spit, and saltmarsh has developed along the seaward side of the spit and inside the mouth of the river. *Spartina* dominates the marsh vegetation and is still spreading, but there is also some grazed mid-upper marsh vegetation. In addition there is a patch of saltmarsh at Berrow.

In the north of the site a strip of sandflat fronts the shore, behind which dunes extend from Burnham-on-Sea to Brean. The dunes are varied with fore-, grey and yellow dunes with a range of dune vegetation which includes slacks, grassland and saltmarsh vegetation. This dune system has an extremely rich flora with some uncommon plant species, and it is also rich in invertebrates. In the south-west of the dunes at Berrow a large lagoon has developed on saltmarsh that became enclosed by dunes in the early 1900s. The lagoon has some maritime influence but flooding by sea-water is very infrequent, and the lagoon is becoming increasingly freshwater.

To the west of the mouth of the River Parrett there is a large-pebbled shingle beach, with a series of shingle ridges that are active. Landward of these ridges the shingle flora shows full succession from pioneer communities to scrub, and is known to be rich in lichens.

Bridgwater Bay regularly supports nationally important populations of two species of wintering waterfowl and an internationally important population of dunlin. The estuary forms an integral part of the Severn Estuary complex, and the Somerset Levels inland of the estuary offer alternative feeding grounds for waders and wildfowl.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other (cliff)
	●	●	●	●	●	●	●	●	◉	●
Area (ha)	1,382	487	4,660							

● = major habitat ◉ = minor habitat

Aquatic estuarine communities

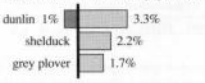
Information unavailable.

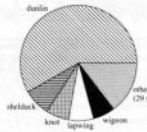
Birds

Wintering birds 1986/87 – 1990/91 data

Total waterfowl: 21,900

BoEE	NWC	WSC
●	●	





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

Other: the estuary is known to regularly support an internationally important flock of moulting shelduck.

Additional wildlife features

Two nationally rare plants are found on the estuary: the round-headed club-rush *Scirpus holoschoenus* and the long-stalked orache *Atriplex longipes*. In addition the nationally rare white rockrose *Helianthemum apenninum* and Somerset hair grass *Koeleria vallesiana* have been recorded from Brean Down adjacent to the estuary.

The invertebrate fauna recently recorded on the estuary includes the RDB 3 beetle *Bledius diota*, one proposed RDB species and 55 Notable species.

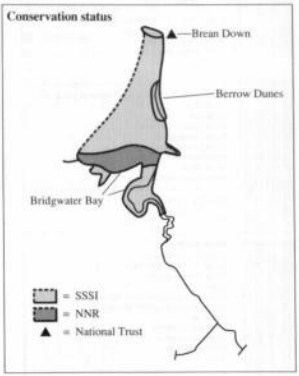
Conservation status

● = designated ● = proposed

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

Much of the estuary is covered by Sites of Special Scientific Interest. Bridgwater Bay (3,570 ha) is a biological SSSI, National Nature Reserve and Nature Conservation Review site, and Berrow Dunes is a biological SSSI (200 ha) of which part is a Nature Conservation Review site. Adjacent to the estuary is Brean Down (65 ha), which is an SSSI for its biological and geological interest. It is also an NCR and Geological Conservation Review site, and part of Brean Down is owned by the National Trust. It is also covered by a Wild Birds Sanctuary Order.

Bridgwater Bay has been designated as a Ramsar site, and forms part of the proposed Severn Estuary Special Protection Area and Ramsar site.



Human activities

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
		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

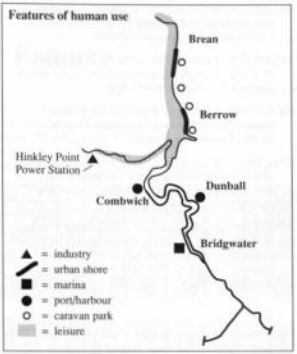
Present	Proposed	
		Tourism & recreation
		Infrastructure developments
●		Marinas
●		Non-marina moorings
●		Dinghy & boat parks
●		Caravan parks & chalets
●		Leisure centres, complexes & piers
		Aquatic-based recreation
●		Power-boating & water-skiing
		Jet-skiing
●		Sailing
		Sailboarding & wind-surfing
		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

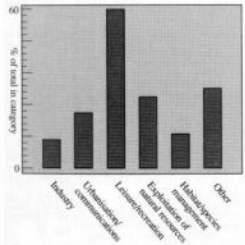
Leisure and recreation activities are numerous and north of Berrow there is considerable pressure from visitors in summer. Water-based pursuits include power-boating and sailing in the mouth of the Parrett, and there are wharfs and moorings at Combwich, Dunball and on the Brue. Bridgwater dock is now used as a marina. Beach recreation is most intensive from Berrow to Brean, and the sandflats are a focus for sand-racing, sand-yachting, 4WD and horse-riding.

Exploitation of the natural resources includes grazing of some areas of saltmarsh, fishing for eels and Crustacea, and bait-digging on Berrow shore. There are two wildfowling clubs which shoot over areas of the estuary (135 ha in total), but not intensively. Industrial activities include the power station at Hinkley Point, dredging to maintain access to Dunball wharf, and extraction of small quantities of gravel from Berrow dunes.

In 1989 there were proposals for wharfs at Combwich and Hinkley Point which would involve maintenance dredging, a tidal barrage stretching across from Brean Down, and a road scheme for the Bridgwater North Orbital Route.



Categories of human use



Further reading

Boyden, C.R., & Little, C. 1973. Faunal distributions in soft sediments of the Severn estuary. *Estuarine and Coastal Marine Science, 1*: 203-223.

Boyden, C.R., Crothers, J.H., Little, C., & Mettam, C. 1977. The intertidal invertebrate fauna of the Severn estuary. *Field Studies, 4*: 477-554.

Burd, F. 1986. *Saltmarsh survey of Great Britain. County report, Somerset.* Unpublished report, Nature Conservancy Council.

Cadwalladr, D.A., *et al.* 1972. Wigeon conservation and salting pasture management at Bridgwater Bay National Nature Reserve, Somerset. *Journal of Applied Ecology, 9*: 417-425.

Cadwalladr, D.A., & Morley, J.V. 1973. Sheep grazing preferences on a saltings at Bridgwater Bay National Nature Reserve, Somerset, and their significance for wigeon conservation. *Journal of the British Grasslands Society, 28*: 235-242.

Cadwalladr, D.A., & Morley, J.V. 1974. Further experiments on the management of saltings pasture for wigeon conservation at Bridgwater Bay National Nature Reserve, Somerset. *Journal of Applied Ecology, 11*: 461-466.

Carr, A.P. 1964. Coastal changes at Bridgwater Bay: 1956-64. *Proceedings of the Bristol Naturalist's Society, 31*: 90-100.

Crothers, J.H. 1976. On the distribution of some common animals and plants along the rocky shores of west Somerset. *Field Studies, 4*: 369-389.

Doarks, C., Holder, C., & Radley, G.P. 1990. *National sand dune vegetation survey. Site report No. 90, Berrow Dunes, Somerset.* Peterborough, Nature Conservancy Council.

Kidson, C. 1960. The shingle complexes of Bridgwater Bay. *Transactions of the Institute of British Geographers, 28*: 75-87.

Nature Conservancy Council. 1981. *Bridgwater Bay National Nature Reserve – the effects of Hinkley Point nuclear power station.* Unpublished report, produced for the Central Electricity Generating Board.

Ranwell, D.S. 1964. *Spartina* saltmarshes in southern England. III. Rates of establishment, succession and nutrient supply at Bridgwater Bay, Somerset. *Journal of Ecology, 52*: 95-105.

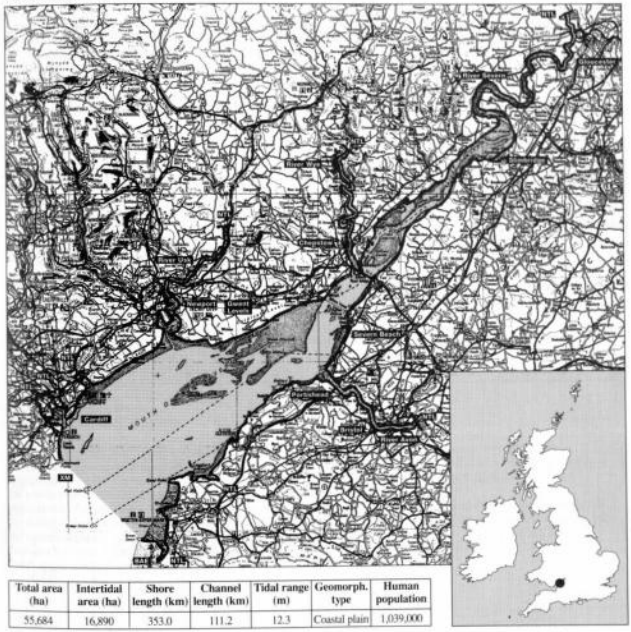
Warren, A. 1956. *The coast of Bridgwater Bay.* Ph.D. thesis, Fitzwilliam House, Cambridge.

7 Severn Estuary

Centre grid: ST4080
Counties: Avon, Gloucestershire, Somerset, Gwent, South Glamorgan

Districts: Bristol, Northavon, Woodspring, Forest of Dean, Gloucester, Stroud, Sedgemoor, West Somerset, Monmouth, Newport, Cardiff, Vale of Glamorgan
EN, CCW regions: South-west England, West Midlands, South Wales

Review site location



Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
55,684	16,890	353.0	111.2	12.3	Coastal plain	1,039,000

NTL = Normal tidal limit
XM = Across mouth
BAE = Between adjacent estuaries
= Core site

Description

The Severn is one of the largest estuaries in Britain, flowing past the cities of Bristol, Cardiff, Gloucester and Newport, and is adjacent to the Bridgwater Bay review site. The Severn Estuary receives its main freshwater input from the rivers Wye, Usk, Severn and Avon, and water quality varies within the estuary between grades A and B. The Severn has the second largest tidal range in the world, and consequently is very turbulent; it is estimated that the estuary carries 10 million tons of suspended sediments on spring tides.

A high proportion of the estuary is subtidal, with a variety of aquatic estuarine communities present that include the only extensive subtidal *Sabelleria alveolata* reef in Britain. The broad intertidal flats consist of unstable sand on the inner and outer areas, with muddy flats on the upper shores and further upstream. These intertidal flats support high densities of invertebrates. There is also a wide variety of invertebrate species on the intertidal rock platforms on the southern shores around Severn Beach and the bays south of Portishead.

Large areas of saltmarsh fringe the estuary, which are mostly grazed and contain a range of vegetation communities, with both gradual and stepped transitions between bare mudflat and upper marsh, which in places have some highly saline drying pans. *Spartina* is abundant on the sward fringes. Other habitats around the estuary include the low-lying pastures around Slimbridge, and the Gwent levels. These latter lowlands between Cardiff and Chepstow are the result of land-claim, and form an extensive area of wet pasture drained by an ordered network of ditches. Rich in plant species and communities, they have diverse aquatic invertebrate communities with many nationally rare or notable species.

In addition the Severn Estuary is known to support more than 80 species of fish, which include seven different species of migratory fish, more than any other British estuary. It also has the largest eel run in the country. The Severn also regularly supports very large populations of wintering waterfowl, which include populations of five species of international importance and eleven species of national importance.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other (cliff)
	●	●	●	●	●	●	●	●	●	●
Area (ha)	38,794	933	15,957							

● = 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
	●	●	●	●	●	●				●		●			●	

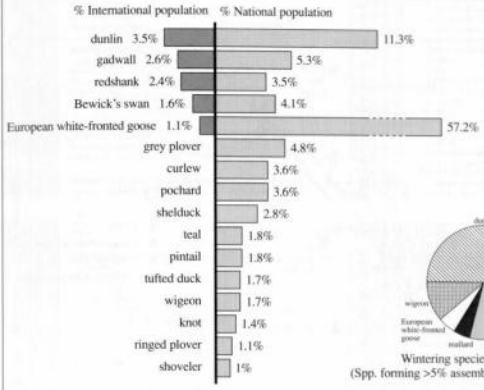
Birds

Wintering birds

1986/87 – 1990/91 data

Total waterfowl: 64,200

BoEE	NWC	WSC
●	●	



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

Breeding birds: moderate-sized colonies of herring gull and lesser black-backed gull and small colonies of greater black-backed gull are known to breed within the estuary. In addition moderate numbers of lapwing and redshank and small numbers of snipe, curlew, oystercatcher and ringed plover breed on the grasslands around the Severn.
Other: there is a large gull roost on the Taff/Ely, and the Severn is known to be of great importance for migrant waders: ringed plover and dunlin are abundant in spring and autumn, and there is a large spring passage of whimbrel.

Additional wildlife features

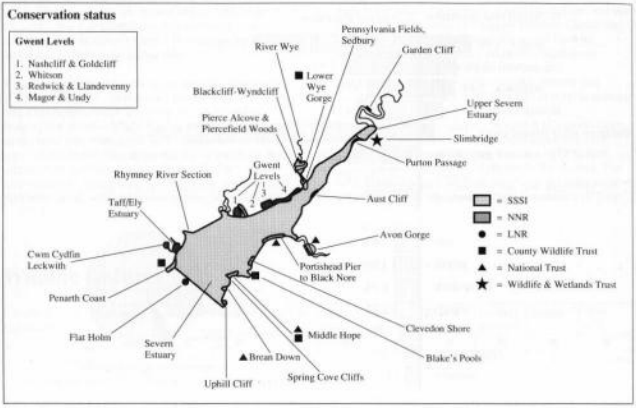
Two nationally rare plants grow within the estuary: the wild leek *Allium ampeloprasum* which is found on rocks, and goldilocks *Aster linosyris* which grows on the cliffs in the south-west of the site. There are also many known populations of nationally scarce species of plant within the estuary. The invertebrate fauna recently recorded on the estuary includes the proposed RDB 3 beetle *Agriotes sordidus* and nine Notable species. In addition the RDB 2 small eggar moth *Eriogaster lanestris*, the RDB 3 beetle *Macronychus quadrituberculatus* and the fly *Haematopota bigoti*, and sixteen Notable species have been recorded from sites adjacent to the estuary.

The Severn supports populations of the nationally rare fish Allis shad *Alosa alosa* and Twaite shad *Alosa fallax*, and there is also a winter migration of sea bass *Dicentrarchus labrax* through the estuary.

Conservation status

● = designated ● = proposed

	NCR	GCR	SSSI (B)	SSSI (G)	SSSI (M)	NNR	LNR	Ramsar	SPA	AONB	CWT	RSPB	ESA	NP	WWT	NT	NSA	HC	Other
	●	●	●	●	●	●	●	●	●	●	●				●	●			●
No.	4	17	11	7	6	1	1	1	1	1	3				1	4			2



Much of the estuary is covered by two Sites of Special Scientific Interest, namely the Upper Severn Estuary biological SSSI (1,437 ha), and the Severn Estuary (15,950 ha) which is an SSSI for its biological, geological and geomorphological interest. There are a further ten biological SSSIs on the estuary: Cwm Cydfin, Leckwith (6 ha); Taff/Ely Estuary (9,165 ha); Nash and Goldcliff (954 ha), Whitson (938 ha), Redwick and Llandevenny (940 ha) and Magor and Undy (587 ha) subsites of the Gwent Levels; River Wye (200 ha); Pierce Alcove and Piercefield Woods (80 ha); Pennsylvania Fields, Sedbury (27 ha); and Uphill Cliff (19 ha). Uphill Cliff is partly managed as a Local Nature Reserve.

SSSIs designated for their biological, geological and geomorphological interest include Penarth Coast (93 ha); Blackcliff-Wyndcliff (119 ha); Lower Wye Gorge (29 ha); Avon Gorge (155 ha) of which part is a National Nature Reserve; Middle Hope (94 ha); and Brean Down (65 ha). Geological SSSIs include Rhymney River Section (2 ha); Garden Cliff (5 ha); Purton Passage (5 ha); Aust Cliff (8 ha); Portishead Pier to Black Nore (72 ha); Clevedon Shore (0.4 ha) and Spring Cove Cliffs (2 ha). There is a proposal to designate an SSSI at Lydney.

Of the SSSIs listed above Uphill Cliff and Brean Down, Avon Gorge, Severn Estuary and Upper Severn Estuary are Nature Conservation Review sites, and there are seventeen Geological Conservation Review sites: Lavernock to Penarth, Lydney, River Wye at Lancaut, Garden Cliff, Tites Point, Aust Cliff which has interest in three GCR blocks, Portishead, Portishead Point, Portishead Pier Section, Clevedon Shore, Middle Hope and Spring Cove which each have interest in two GCR blocks, and Brean Down.

In addition Middle Hope and Blake's Pools are Avon Wildlife Trust reserves, part of the Lower Wye Gorge SSSI is managed as a reserve by the Gloucestershire Trust for Nature Conservation, and the Glamorgan Wildlife Trust have a reserve on the Penarth Coast. The National Trust own land on Brean Down, Avon Gorge, Middle Hope and Portishead Pier to Black Nore, and the Wildfowl and Wetlands Trust have a reserve at Slimbridge.

The Wye Valley is an Area of Outstanding Natural Beauty, and the Upper Severn Estuary has been designated a Special Protection Area and Ramsar site. There are proposals to extend the SPA and Ramsar site to include the whole of the estuary and Bridgwater Bay. Other protected sites include the island of Flat Holm, which is managed as a Local Nature Reserve, Brean Down Sanctuary, which is covered by a Wild Birds Order, and common land on the south side of the River Avon.

Human activities

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
		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

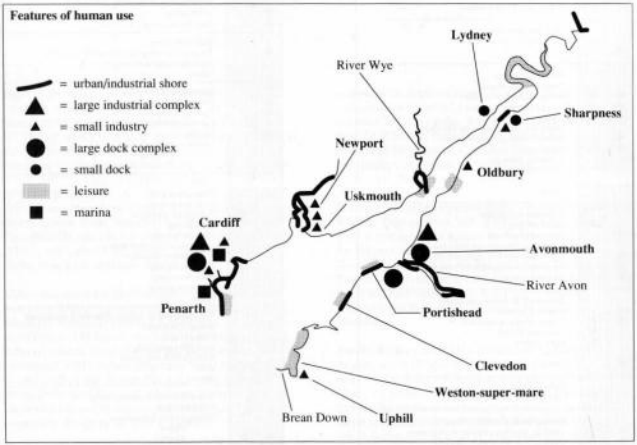
Features of human use

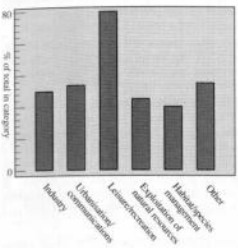
Leisure pursuits are most numerous, and take place within several localities within the estuary. There are several marinas, areas of moorings, sailing clubs and dinghy parks around the site which are the main centres for sailing. Power-boating, water-skiing and canoeing occur at Penarth, along the River Wye and at Beachley on the western side of its mouth. Beach recreation is most intensive at Weston-super-Mare, Penarth, Clevedon and Portishead, and trial-biking, sand-racing and horse-riding are also known to occur at Weston-super-Mare.

The Severn is a highly urbanised and industrialised estuary, with large industrial complexes at Avonmouth and Cardiff which include chemical and metal industries, and a large chemical works at Newport. There are power stations at Oldbury and Uskmouth, and smaller industries at Sharpness, Newport, Cardiff and Uphill. Cardiff, Avonmouth and the Royal Portbury Dock west of the mouth of the Avon are the sites of large dock complexes, and there are smaller docks at Sharpness and Lydney. More recently test drilling in connection with the Second Severn Crossing has taken place.

Exploitation of the natural resources includes commercial shrimp fishing and fishing for salmon using putchers, lave nets, draught nets and bag nets. The Severn also supports an important eel fishery. Many of the saltmarshes around the estuary are grazed, at least in part. Eight wildfowling clubs shoot over the estuary and there are four areas where there is non-club shooting. In total approximately 38 km shoreline and 2,040 ha intertidal area are shot over. Clevedon and District Wildfowlers have a refuge along 2 km of shoreline and a hard weather refuge of 24 ha.

In 1989 there were numerous proposals around the estuary, which included various forms of sea defences, two tidal power barrage schemes, leisure barrages at Newport and Cardiff Bay, three major road schemes, and marinas at Lydney docks, Portishead, Brean Down, Purton and Uskmouth. Many of these proposals would involve some measure of land claim. Since 1989 there have been further proposals which include a major marina and hotel complex on Birnbeck Island, Weston-super-Mare; a power station at Avonmouth; a new sewage treatment works close to Uphill; and a cable-stay bridge to carry a conveyor belt across the River Avon near Avonmouth.





Further reading

Abdullah, M.I., & Royle, L.G. 1974. A study of the dissolved and particulate trace elements in the Bristol Channel. *Journal of the Marine Biological Association of the United Kingdom, 54*: 581-597.

Aprahamian, M.W. 1988. The biology of the twaite shad in the Severn Estuary. *Journal of Fish Biology, 33A*: 141-152.

Bassindale, R. 1941. Studies on the biology of the Bristol Channel. IV. The invertebrate fauna of the southern shores of the Bristol Channel and Severn Estuary. *Proceedings of the Bristol Naturalist's Society, 4* (9): 143-201.

Boyden, C.R., & Little, C. 1973. Faunal distribution in soft sediments of the Severn Estuary. *Estuarine and Coastal Marine Science, 1*: 203-223.

Boyden, C.R., Crothers, J.H., Little, C., & Mettam, C. 1977. The intertidal invertebrate fauna of the Severn Estuary. *Field Studies, 4*: 477-554.

Burd, F. 1986. *Saltmarsh survey of Great Britain. County report, Avon.* Unpublished, Nature Conservancy Council.

Burd, F. 1986. *Saltmarsh survey of Great Britain. County report, Gloucestershire.* Unpublished, Nature Conservancy Council.

Burd, F. 1987. *Saltmarsh survey of Great Britain. County report, Gwent.* Unpublished, Nature Conservancy Council.

Burd, F. 1987. *Saltmarsh survey of Great Britain. County report, Mid and South Glamorgan.* Unpublished, Nature Conservancy Council.

Claridge, P.N., Potter, I.C., & Hardisty, M.W. 1986. Seasonal changes in movements, abundance, size composition and diversity of the fish fauna of the Severn Estuary. *Proceedings of the Bristol Naturalist's Society, 32*: 281-284.

Clark, N.A. 1983. *The ecology of dunlin* Calidris alpina *L. wintering on the Severn estuary.* Ph.D. Thesis, University of Edinburgh.

Clark, N.A. 1989. *Wader migration and distribution in south-west estuaries.* British Trust for Ornithology research report no. 40 and Energy Technology Support Unit contractor report TID 4055, Department of Energy.

Clark, N.A. 1990. *Distribution studies of waders and shelduck in the Severn Estuary.* British Trust for Ornithology research report no. 51.

Clark, N.A., & Prys-Jones, R.P. In press. Low tide distribution of wintering waders and shelduck on the Severn Estuary in relation to the proposed tidal barrage. *Biological Journal of the Linnaean Society.*

Doarks, C., Radley, G.P., & Holder, C. 1990. Sand dune survey of Great Britain. Site report No. 89, Weston Dunes and Sand Bay, Avon. *Nature Conservancy Council, CSD Report*, No. 1,130.

Evans, M.E. 1979. Population composition, and return according to breeding status, of Bewick's swans wintering at Slimbridge, 1963 to 1976. *Wildfowl, 30*: 118-128.

Evans, J., Clark, N.A., & Donald, P.F. 1990. *The effect of the Cardiff Bay barrage on waterfowl populations. I. Distribution and movement studies November 1989 – May 1990.* British Trust for Ornithology research report no. 69.

Ferns, P.N. 1980. Distribution of wading birds and wildfowl in the Severn Estuary and the coastal levels. *In: An environmental appraisal of tidal power stations*, ed. by T.L. Shaw. London, Pitman.

Ferns, P.N. 1983. Sediment mobility in the Severn Estuary and its effects upon the distribution of shorebirds. *Canadian Journal of Fisheries and Aquatic Sciences, 40* Supplement 1: 331-340.

Ferns, P.N., Hastings, M.P., & Shaw, T.L. 1984. Minimizing the possible effects of a tidal power barrage on the shorebirds of a tidal power barrage on the shorebird populations of the Severn Estuary. *Journal of Environmental Management, 18*: 131-143.

Goss-Custard, J.D., *et al*. 1989. *The prediction of post-barrage densities of shorebirds: Volume 4: birds.* Energy Technology Support Unit, Contractor report TID 4,059, Institute of Terrestrial Ecology.

Goss-Custard, J.D., *et al*. In press. Towards predicting wading bird densities from predicted prey densities in a post-barrage Severn Estuary. *Journal of Applied Ecology*.

Hardisty, M.W., & Huggins, R.J. 1975. A survey of the fish population of the middle Severn Estuary based on power station sampling. *International Journal of Environmental Studies, 7*: 227-242.

Hill-Cottingham, M.P. 1973. A preliminary study of the littoral fauna at four sites on the southern shore of the Bristol Channel and Severn Estuary. *Proceedings of the Bristol Naturalist's Society, 32*: 281-284.

Hinsley, S.A. 1984. *The Butetown link and its implications for the shorebirds of the Taff Estuary*. University College of Cardiff Consultants Ltd., report to South Glamorgan County Council.

Hiscock, K. 1979. South-west Britain sublittoral survey. Field survey of sublittoral habitats and species in the Upper Bristol Channel. (Mid Glamorgan, South Glamorgan and north Somerset). (Contractor: Oil Pollution Research Unit, Field Studies Council, Pembroke, Dyfed.) *Nature Conservancy Council, CSD Report*, No. 283.

Little, C., & Smith, L.P. 1980. Vertical zonation on rocky shores in the Severn Estuary. *Estuarine and Coastal Marine Science, 11*: 651-669.

Mudge, G.P. 1979. *The feeding distribution of wintering wading birds (Charadriiformes) in the Severn Estuary in relation to barrage proposals*. University College, Cardiff, report to the Nature Conservancy Council.

Purchon, R.D. 1947. Studies of the biology of the Bristol Channel. XVII. The littoral and sublittoral fauna of the northern shores, near Cardiff. *Proceedings of the Bristol Naturalist's Society, 27*: 285-310.

Purchon, R.D. 1951. Studies of the biology of the Bristol Channel. XVIII. The marine fauna at five stations on the northern shores of the Bristol Channel and Severn Estuary. *Proceedings of the Bristol Naturalist's Society, 29*: 213-226.

Roberts, M. 1976. A list of macroscopic algal species occurring on various beaches on the north shore of the Bristol Channel. *Aquatic Ecology and Pollution Bulletin, 4* (4).

Severn Estuary Conservation Group. 1990. *The Severn Estuary – a heritage of wildlife*. Exeter, Severn Estuary Conservation Group.

Smith, L.P. 1979. A survey of the saltmarshes in the Severn estuary. Vols. 1 & 2. *Nature Conservancy Council, CST Report*, No. 265.

Smith, L.P., & Little, C. 1980. Intertidal communities on rocky shores in the Severn Estuary. *Proceedings of the Bristol Naturalist's Society, 38*: 61-67.

Warwick, R.M., & Davies, J.R. 1977. The distribution of sublittoral macrofauna communities in the Bristol Channel in relation to the substrate. *Estuarine and Coastal Marine Science, 5*: 267-288.

Waters, B. 1987. *Severn tide*. Gloucester, Alan Sutton Publishing.

Worral, D.H. 1981. *The feeding behaviour of Dunlin* Calidris alpina *(L)*. Ph.D. thesis, University College of Cardiff.

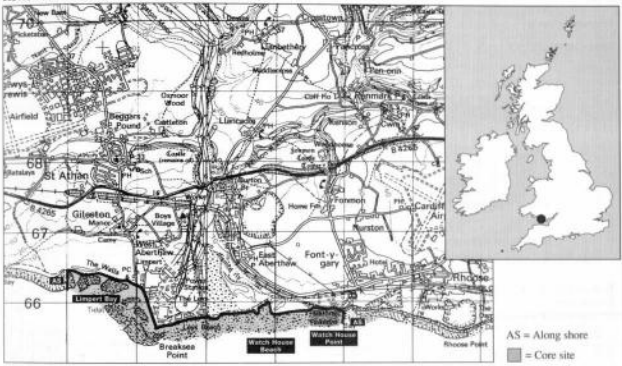
Worral, D.H. 1988. *Distribution and movement of wading birds and wildfowl. Cardiff Bay feasibility study. Creation of alternative feeding ground – stage 2*. Report to the South Glamorgan County Council.

8 Thaw Estuary

Centre grid: STO366
County: South Glamorgan

District: Vale of Glamorgan
CCW region: South Wales

Review site location



Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
160	160	4.7	–	10.5	Coastal plain	< 5,000

Description

This former estuary of the River Thaw has a history of extensive land-claim. Once a small port named Pleasant Harbour, the building of the Aberthaw A and B power stations in the 1960s resulted in the destruction of much of the estuary. Today the river channel is no longer tidal, and with virtually no subtidal habitat this estuarine site is an intertidal flat along the shore. Water quality has been classified as grade A.

The east of the site is dominated by a highly dynamic shingle spit, which is frequently being breached and rebuilt. Parts of the shingle are vegetated with a range of plant communities, that are influenced by sand and the saltmarsh which has been enclosed by the shingle. This small area of saltmarsh on Watch House Beach, which was formerly more extensive prior to the erection of the sea walls, is botanically diverse with low-mid marsh vegetation and a transition to sand dune. The saltmarsh surrounds a lagoon that is known to support a rich invertebrate fauna. There are further relict sand dunes and limestone cliffs towards Watch House Point.

To the west in Limpert Bay, the estuary is dominated by extensive rocky outcrops interspersed with sandflat.

Despite its small size the Thaw Estuary supports a wide range of habitats and is rich in plant and invertebrate species, which include several invertebrates that are of limited distribution within the county. In winter the Thaw is also used by fair numbers of wintering wildfowl, and is known to support small numbers of breeding ringed plover.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other (cliff)
	◉	●	●	◉	◉	●	●		◉	◉
Area (ha)		8	152							

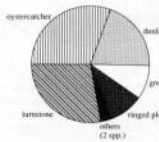
● = major habitat ◉ = minor habitat

Birds

Wintering birds 1984/85 data

Total waterfowl: 190

BoEE	NWC	WSC
		●



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

Breeding birds: a small number of ringed plover are known to breed on the estuary.

Aquatic estuarine communities

Information unavailable.

Additional wildlife features

The invertebrate fauna recently recorded on the estuary includes three notable species. In addition, the green flatworm *Convoluta rofscoffensis* is found on the shingle beach, and is only known from one other locality in the U.K.

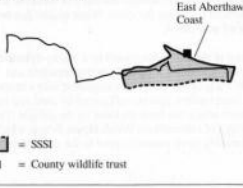
Conservation status

● = designated ◉ = proposed

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

The eastern part of the estuary has been designated as the Aberthaw Coast biological Site of Special Scientific Interest (68 ha), and the Glamorgan Wildlife Trust manages a reserve at Aberthaw.

Conservation status



Human activities

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
		Others
		Extraction & processing of natural gas & oil
		Exploration
		Production
		Rig & platform construction
		Pipeline construction
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●		Overflying by military aircraft
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		Non-commercial aggregates extraction
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		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
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		Hydraulic dredging for worms
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		Molluscs – Hand-gathering
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		Cultivation of living resource
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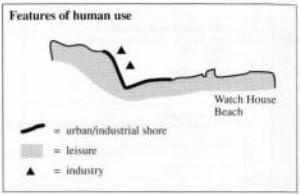
		Reeds for roofing
		Salicornia picking
		Others
		Management & killing of birds & mammals
		Killing of mammals
		Killing of birds
		Adult fish-eating birds
		Adult shellfish-eating birds
		Gulls
		Geese
		Wildlife habitat management
		Spartina control
		Habitat creation & restoration
		Marine
●		Intertidal
		Terrestrial
●		Habitat management
		Others

Features of human use

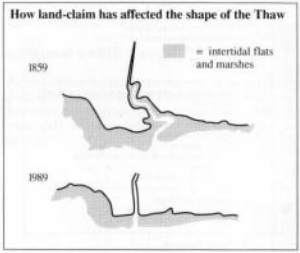
In 1989 there were very few activities occurring on the Thaw Estuary. Historically the estuary was a port used as a centre for exporting agricultural produce and lime, but it is now dominated by Aberthaw A and B coal-fired power stations. The estuary is also used for the tipping of pulverised fuel ash, and there is a cement works to the north of the site.

Recreation and leisure pursuits include walking and bird-watching over the whole estuary, and competition angling occurs in the cooling water effluent from the power stations. In 1989 there was also a habitat creation scheme to develop the lagoon on Watch House Beach.



Land-claim

Once a small port named Pleasant Harbour, the building of the Aberthaw A and B power stations in the 1960s and associated sea wall resulted in the loss of much of the estuary to land-claim. Subsequently areas have been infilled by tipping.



Further reading

Burd, F. 1987. *Saltmarsh survey of Great Britain. County report, Mid and South Glamorgan.* Unpublished, Nature Conservancy Council.

Cryer, M., Whittle, G.N., & Williams, R. 1987. The impact of bait collection by anglers on marine invertebrates. *Biological Conservation, 42*: 83-93.

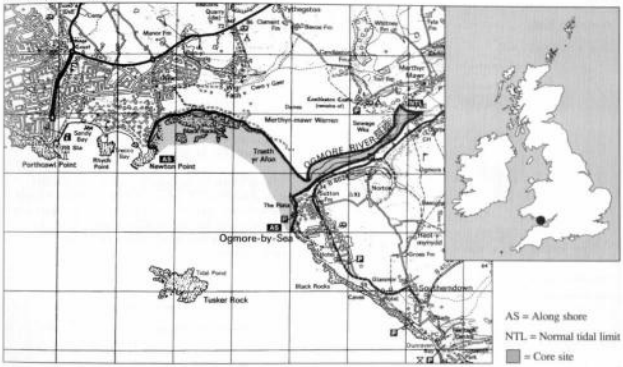
Sneddon, P., & Randall, R.E. In prep. *Shingle survey of Great Britain. Appendix 1. Shingle sites in Wales.* Peterborough, Joint Nature Conservation Committee.

9 Ogmore Estuary

Centre grid: SS8776
County: Mid Glamorgan

District: Ogwr
CCW region: South Wales

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
187	173	8.0	1.6	8.9	Coastal plain	15,000

Description

The Ogmore is a small, shallow estuary that discharges across a sandy beach into the sea. Its mouth is marked by a shingle bank covered by sand, behind which lies the extensive sand dune system of Merthyr Mawr Warren. The review site extends from The Flats at Ogmore-by-Sea to Newton Point on the western shore. Water quality throughout the estuary has been classified as grade A.

The channel of the Ogmore River has narrow intertidal flats along its lower reaches, which are predominantly sandy and flanked by saltmarsh. The greater proportion of saltmarsh lies along the northern shore of the river, and the vegetation has a good range of saltmarsh communities. There is a succession from strandline and pioneer vegetation through low, mid and upper marsh communities, and on the northern edge of the saltmarsh there is a transition to the sand dunes of Merthyr Mawr Warren.

Merthyr Mawr Warren is one of the last remaining extensive sand dune systems on the coast of Mid Glamorgan. The dunes are still accreting, and include steep mobile dunes, fixed dunes and dune slacks, and support a rich flora and invertebrate fauna.

The outer reaches of the estuary consist of the broad sandy beach of Traeth yr Afon, which has extensive areas of intertidal rock in its western parts and terminates in a small patch of intertidal shingle in the shelter of Newton Point.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	●	●	●	●			
Area (ha)	14	15	158							

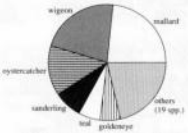
● = major habitat ● = minor habitat

Birds

Wintering birds 1986/87 data

Total waterfowl: 2,420

BoEE	NWC	WSC
●	●	



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

Breeding birds: small numbers of ringed plover are known to breed on the estuary.

Aquatic estuarine communities

Information unavailable.

Additional wildlife features

The nationally rare plant shore dock *Rumex rupestris* has been recorded in the dunes.

The invertebrate fauna recently recorded on Merthyr Mawr adjacent to the estuary includes the RDB 2 beetle *Ceutorhynchus pilosellus*, which has been found on only one other site in Britain, the RDB 3 beetle *Anisoxya fuscula*, one proposed RDB species and eleven Notable species.

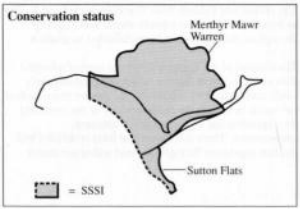
Conservation status

● = designated ● = proposed

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

Much of the estuary is covered by Merthyr Mawr Warren biological Site of Special Scientific Interest (344 ha), and Sutton Flats (32 ha) geological SSSI which is also a Geological Conservation Review site. The Ogmore Estuary lies within the Glamorgan Heritage Coast.

Conservation status



Human activities

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 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

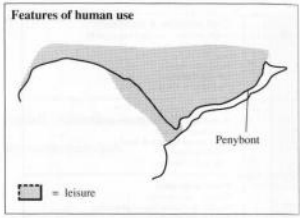
Present	Proposed	
		Tourism & recreation Infrastructure developments
●		Marinas Non-marina moorings Dinghy & boat parks Caravan parks & chalets Leisure centres, complexes & piers
		Aquatic-based recreation Power-boating & water-skiing Jet-skiing Sailing Sailboarding & wind-surfing SCUBA & snorkelling 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

In 1989 there were very few activities on the estuary. Leisure pursuits were widespread, for the dunes are very popular with walkers and are occasionally used for 4WD and trial-biking. Angling is concentrated at the mouth of the estuary.

Exploitation of the natural resources was limited but includes grazing of the saltmarsh, and a field studies centre were using the area for educational studies.

In 1988 parts of the saltmarsh and the dunes were modified by the entrenchment of a new feeder pipe to the Sewage Treatment Works at Penybont. This has since been buried and the sand dunes rebuilt over the top. In addition there was a housing development to the west of the site involving around 6 ha of land-claim within the dunes.



Further reading

Burd, F. 1987. *Saltmarsh survey of Great Britain. County report, Mid and South Glamorgan*. Unpublished, Nature Conservancy Council.

Cooter, J. 1990. Some uncommon beetles captured at Merthyr Mawr Warren, Glamorganshire. *Entomologist's Monthly Magazine*, *126*: 32.

Jones, P.S. 1989. *National sand dune vegetation survey. Site report No. 43: Merthyr Mawr*. Peterborough, Nature Conservancy Council.

Southern, E.J., Randerson, P.F., Williams, A.T., & Dixon, J. 1985. Ecological effects of recreation at Merthyr Mawr dunes, South Wales. *In: Sand dunes and their management*, ed. by P. Doody, 217-238. Peterborough, Nature Conservancy Council. (Focus on nature conservation, No. 13.)

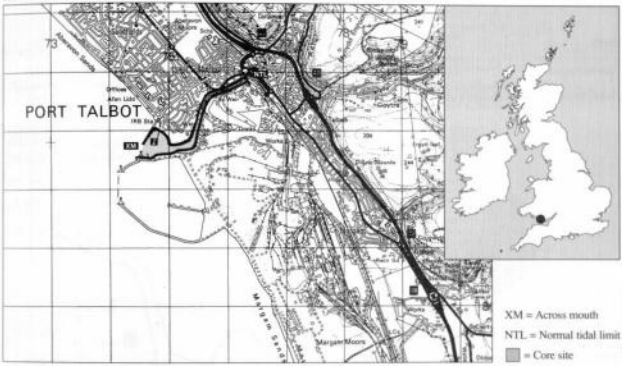
10 Afan Estuary

a.k.a. Port Talbot

Centre grid: SS7588
County: West Glamorgan

District: Port Talbot
CCW region: South Wales

Review site location



Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
38	18	4.9	2.5	8.6	Bar built	40,000

Description

This estuary is a small tidal channel at the lower reaches of the Afan river, which flows past a heavily urbanised and industrial area and through large jetties at the estuary mouth before flowing into Swansea Bay. The coastline is dominated by the Port Talbot dock complex and a large steelworks which was built on what was once extensive sand dunes, effectively isolating the estuary from the Margam Burrows sand dune system to the south. Water quality in the estuary has been classified as grade A.

At low tide the estuary is a narrow channel flanked by narrow sandflats which broaden towards the mouth. The estuary regularly supports a small population of wintering waterfowl.

Wildlife features

Coastal habitats

Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
●		●	●	●					
Area (ha) 20		18							

● = major habitat ● = minor habitat

Aquatic estuarine communities

Information unavailable.

Birds

Wintering birds 1984/85 data

Total waterfowl: 200

BoEE	NWC	WSC
		●

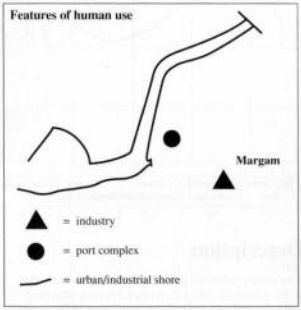
Wintering species assemblage
(Spp. forming >5% assemblage shown separately)

Additional wildlife features

A small population of the nationally rare plant sea stock *Matthiola sinuata* has been recorded in the docks.

Features of human use

There are very few activities on this estuary, which has been highly modified by man and is now 100% bounded by linear defences. The Afan is dominated by the Port Talbot dock complex which has large jetties at the mouth of the estuary, and the Port Talbot steelworks at Margam immediately south of the estuary. Industrial wastes, which include hot water emissions, are discharged into the Afan.



Conservation status

There are no protected sites on this estuary.

Further reading

Jones, P. 1989. *National sand dune vegetation survey. Site report No. 44, Margam Burrows*. Peterborough, Nature Conservancy Council.

Shackley, S.E. 1981. The intertidal soft sediments and their macrofauna in the greater Swansea Bay area (Worm's Head to Nash Point), South Wales. *Estuarine and Coastal Shelf Science, 12*: 535-548.

Human activities

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
		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

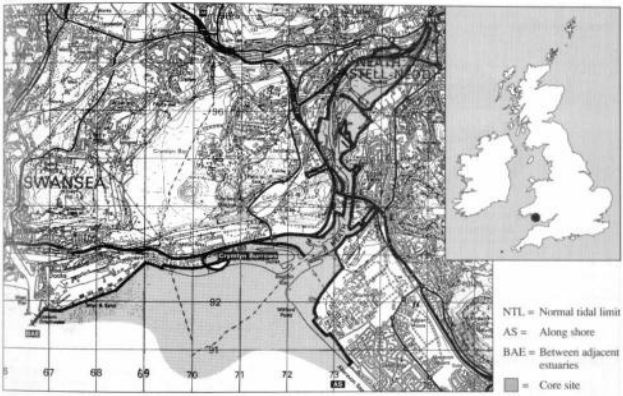
11 Neath Estuary

a.k.a. Nedd Estuary

Centre grid: SS7292
County: West Glamorgan

Districts: Neath, Port Talbot, Swansea
CCW region: South Wales

Review site location



Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
1,129	1,079	26.9	10.6	8.6	Ria	49,000

Description

The River Neath flows across the rocks of the South Wales coalfields and into the north-east of Swansea Bay, where it is separated from the Tawe and Swansea Bay review site by a large breakwater. The Neath Estuary is a drowned river valley which has been filled in with sand and gravel and is one of the remaining undeveloped sections of coastline along this part of Wales. Water quality has been classified as grade B, improving to grade A in the bay.

At low tide the Neath is a narrow, meandering channel flanked on both sides by intertidal mudflats which become more sandy towards the mouth of the estuary. Saltmarsh runs along the length of the channel but the main body of marsh is concentrated along the fringes of channels and creeks at Neath and Crymlyn Burrows.

At Neath the saltmarsh is made up of pioneer vegetation and large areas of mid and upper marsh. At Crymlyn the small area of saltmarsh has a wide range of vegetation communities which grade into the sand dunes of Crymlyn Burrows.

The Crymlyn Burrows sand dunes are the remnants of the more extensive dune systems which once fringed the whole of Swansea Bay. The Crymlyn dunes have formed in the past 150 years and are continuing to accumulate, and have a good range of vegetation communities from extensive foredune to mature dune. The southernmost dunes protect Crymlyn Bog from incursion by the sea.

The Neath Estuary and Crymlyn Burrows are used by a small part of the wader populations which overwinter in the Swansea Bay region.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	●	●			●		
Area (ha)	50	159	920							

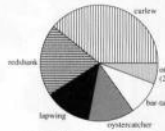
● = major habitat ◉ = minor habitat

Birds

Wintering birds 1986/87 – 1990/91 data

Total waterfowl: 950

BoEE	NWC	WSC
●	●	



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

Breeding birds: small numbers of ringed plover are known to breed on the estuary.

Aquatic estuarine communities

Information unavailable.

Additional wildlife features

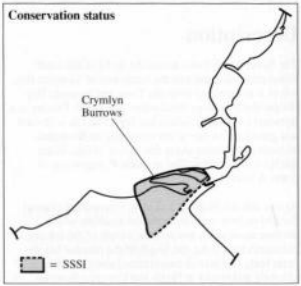
Three nationally rare plants have been recorded from the dunes at Crymlyn Burrows. The sea stock *Matthiola sinuata* is widespread within the foredunes, the fen orchid *Liparis loeselii* has recently been recorded, and there is small introduced population of field wormwood *Artemisia campestris*.

Conservation status

● = designated ◉ = proposed

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

Part of the estuary is covered by Crymlyn Burows biological Site of Special Scientific Interest (244 ha). The Neath Estuary also forms part of the proposed Swansea Bay – Blackpill Special Protection Area, and Crymlyn Bog adjacent to the estuary is proposed as a Ramsar site.



Human activities

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
		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

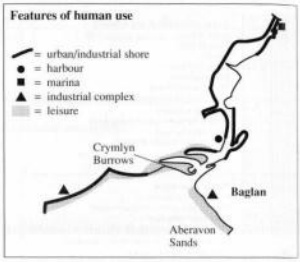
Features of human use

The estuary is dominated by road bridges, a large oil refinery at Baglan and an oil tank storage complex behind the westernmost limits of the estuary. Much of the land around the estuary is devoted to landfill with domestic refuse, and an underground oil pipeline from Crymlyn to Port Talbot is occasionally uncovered; some oil spillages have occurred from here. There are also various docks, including unloading facilities, on the estuary.

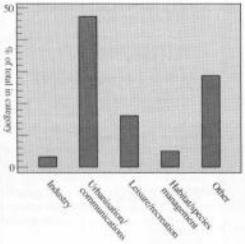
There is little recreational activity on the Neath. There are some moorings in the channel close to the A48 bridge, and a sailing club marina near the upper tidal limit of the site. Bathing occurs on Aberavon sands, and a riding club uses Crymlyn Burrows. There is also very little exploitation of the natural resources, apart from grazing of most of the saltmarsh on the west bank and grazing of some of the sand dunes.

In 1989 there were proposals for sediment extraction from the bay, mining sea-coal deposits at Aberavon sands, and private coal collection at the mouth of the Neath. It is thought that the completion of the M4 to Swansea will have little effect on the estuary.

More recently a barrage has been proposed for the estuary.



Categories of human use



Further reading

Burd, F. 1987. *Saltmarsh survey of Great Britain. County report, West Glamorgan and Llanelli.* Unpublished, Nature Conservancy Council.

Dargie, T.C. 1989. *National sand dune vegetation survey. Site report, No. 46: Crymlyn Burrows.* Peterborough, Nature Conservancy Council.

Gillham, M.E. 1986. *Swansea Bay's green mantle.* Cowbridge and Bridgend, D. Brown & Sons.

Nature Conservancy Council, Neath Borough Council, Swansea City Council, West Glamorgan County Council. 1986. *A management framework for the Crymlyn and Neath estuary areas of West Glamorgan.* Unpublished report.

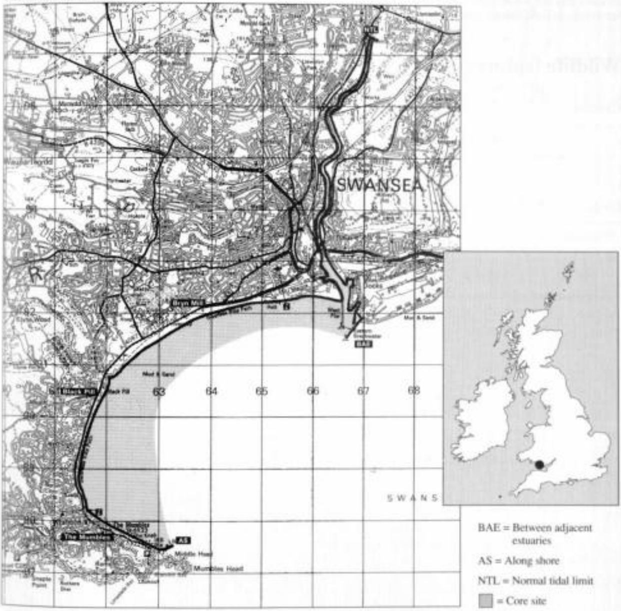
Rees, D.I. 1977. *A nature conservation study of the Neath estuary complex.* Unpublished, Nature Conservancy Council (South Wales Region).

12 Tawe Estuary & Swansea Bay

Centre grid: SS6694
County: West Glamorgan

District: Swansea
CCW region: South Wales

Review site location



BAE = Between adjacent estuaries

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
785	748	22.8	6.5	8.6	Embayment	172,000

Description

The Tawe is a narrow, canalised channel which flows through an industrial valley into a bay dominated by the town of Swansea, and is separated from the Neath Estuary review site by the eastern breakwater at the mouth of the Tawe. The estuary has been greatly modified by man for industrialisation and dock construction, which has led to the loss of intertidal area and subsequent ecological interest. Water quality has been classified as grade A.

The largest proportion of intertidal flats lies within Swansea Bay and is a mixture of mud-and-sand, becoming sand-and-shingle towards the Mumbles in the southernmost parts of the Bay. Behind the flats between Black Pill and Bryn Mill there is a narrow band of relict sand dunes, which are dominated by dune grassland.

Swansea Bay is a site of major importance for overwintering birds and large numbers of waders on passage, and the Black Pill area is a major roost for waders. The estuary regularly supports nationally important populations of sanderling, and forms part of an estuarine complex used by waterbirds which includes the Gwendraeth (Carmarthen Bay), Loughor Estuary and the Severn Estuary review sites.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●		●	●	●		●			
Area (ha)	40		750							

● = major habitat ● = minor habitat

Birds

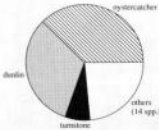
Wintering birds 1986/87 – 1990/91 data

Total waterfowl: 5,630

BoEE	NWC	WSC
●	●	

% National population

sanderling 1.8%



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

Other: Swansea Bay supports nationally important numbers of ringed plover on autumn passage, and is known to be a major wader and gull roost.

Aquatic estuarine communities

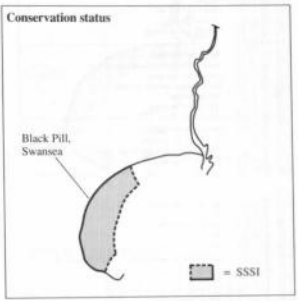
Information unavailable.

Conservation status

● = designated ◍ = proposed

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

The western parts of the Bay are covered by Black Pill, Swansea biological Site of Special Scientific Interest (467 ha), which forms part of a Bird Sanctuary under the Protection of Birds Act 1954. The Tawe Estuary and Swansea Bay forms part of the proposed Swansea Bay – Blackpill Special Protection Area.



Aerial view of the mouth of the Tawe Estuary, showing Swansea docks. (Swansea Bay Coastal Group).

Human activities

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
		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
		Other
		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

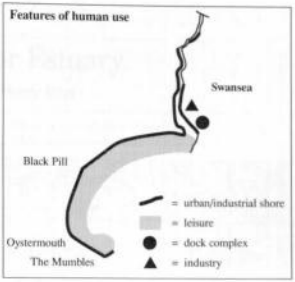
Features of human use

In 1989 the majority of activities were leisure or recreational. Power-boating, sailing, wind-surfing and water-skiing take place between Swansea and Black Pill, while beach recreation is more widespread between Swansea and the Mumbles. Walking takes place over most of the bay, and there is a bike path running through relict sand dunes along the edge of the shore. More recently jet-skiers have been using the estuary.

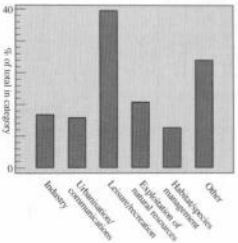
Much of the estuary is dominated by the town of Swansea, and at the mouth of the Tawe there are three major docks which have declined in commercial use; one dock has been infilled, a second is being developed as a marina, and the third dock has some housing development planned but is presently still in commercial use. There is also a shipbuilding/boatbuilding yard in the Tawe.

Exploitation of the natural resources includes bait-digging which occurs in the Black Pill area, and boulder-turning for bait which occurs in the Oystermouth area.

In 1989 consent had been granted for a leisure barrage at the mouth of the Tawe, which was under construction in 1991. More recent proposals include a sewage treatment works and long sea outfall to replace the existing sewage works.



Categories of human use



Further reading

Collins, M.B., Banner, F.T., Tyler, P.A., Wakefield, S.J., & James, A.E. 1980. *Industrialised embayments and their environmental problems. A case study of Swansea Bay*. Oxford, Pergamon Press.

Dargie, T.C. 1989. *National sand dune survey. Site report No. 47, Black Pill to Bryn Mill*. Peterborough, Nature Conservancy Council. (Contract survey, No. 57)

Davies, J. 1991. Benthic marine ecosystems in Great Britain: a review of current knowledge. Western Channel and Bristol Channel and Approaches (MNCR Coastal sectors 8 and 9). *Nature Conservancy Council, CSD Report*, No. 1,173. (Marine Nature Conservation Review Report, No. MNCR/OR/9)

Gillham, M.E. 1986. *Swansea Bay's green mantle*. Cowbridge and Bridgend, D. Brown & Sons.

Naylor, E. 1972. Zoology. *In: Swansea and its region*, ed. by W.G.V. Balchin, 101-118. Swansea, University College of Swansea for the Local Executive Committee of the British Association.

Naylor, E. 1958. The fauna of a warm dock. *In: Proceedings of the 15th International Congress of Zoology*, Section III, Paper 12: 259-262.

Nelson-Smith, A. 1974. The ecology of rocky shores around Swansea Bay. *In: Report on the working party on possible pollution in Swansea Bay. Technical Reports*, 2: 55-70. Cardiff, Welsh Office.

Shackley, S.E. 1981. The intertidal soft sediments and their macrofauna in the Greater Swansea Bay area (Worm's Head to Nash Point), South Wales. *Estuarine Coastal and Shelf Science*, *12*: 535-548.

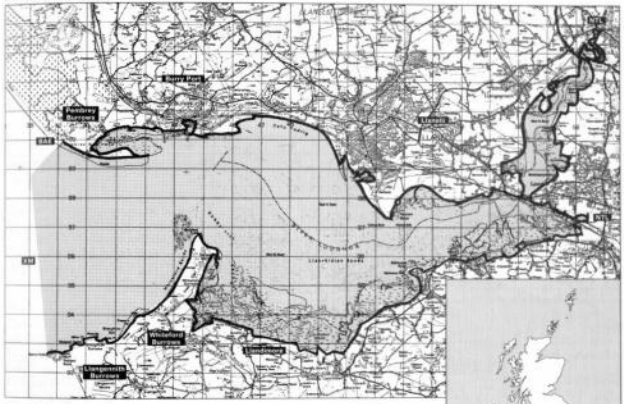
13 Loughor Estuary

a.k.a. Burry Inlet

Centre grid: SS4897
Counties: Dyfed, West Glamorgan

Districts: Llanelli, Lliw Valley, Swansea
CCW region: South Wales

Review site location



NTL = Normal tidal limit
BAE = Between adjacent estuaries
XM = Across mouth
= Core site

Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
9,524	6,553	84.7	30.2	7.1	Coastal plain	60,000

Description

The Loughor is a shallow, sheltered estuary which separates Gower from south-east Dyfed, and is adjacent to the Carmarthen Bay review site to the west. The southern shore of the Loughor is largely undeveloped and natural, while the northern shore from Llanelli to Burry Port is industrial and densely populated. Water quality has been classified as grade A.

The intertidal flats of the estuary are predominantly sandy but grade to silt in its upper reaches, and the sediments are mobile, particularly at the estuary mouth. The estuary is shallow apart from Burry Port and Llanelli docks where dredging occurs. In the late 19th century the construction of a training wall caused major changes in the estuary, when siltation on the southern shore increased and there was a rapid expansion of saltmarsh. Today the Loughor has the most extensive area of saltmarsh in Wales, mostly located on the southern shore of the estuary in the shelter of the Whiteford Burrow spit. The saltmarsh vegetation contains large areas of pioneer, low-mid marsh and middle marsh communities, and *Spartina* has colonised the inner reaches of the estuary following its introduction in the 1930s. Landward of the saltmarsh at Landimore there is a stretch of cliff.

On either side of the estuary mouth there are sand dune systems. On the northern shore is Pembrey Burrows, which extends westwards to the Carmarthen Bay review site, and on the southern shore is Llangennith Burrows. Both systems have large areas of sand dunes and slacks. Further inshore from Llangennith Burrows is the Whiteford Burrows spit, which contains one of the largest and least disturbed systems of dune slacks and dune grassland and is known to support many species of rare plant and a diverse invertebrate fauna. This spit is growing northwards and eastwards, increasing the shelter of the intertidal areas.

The estuary also supports large numbers of wintering waterfowl, which includes internationally important populations of three species and nationally important populations of eight species of waterfowl, for the large expanse of saltmarsh is a focus for feeding, roosting and breeding birds. There is some interchange of waterfowl with the Carmarthen Bay review site.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other (Cliff)
	●	●	●	●	●		●	●		●
Area (ha)	2,971	2,187	4,366							

● = 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

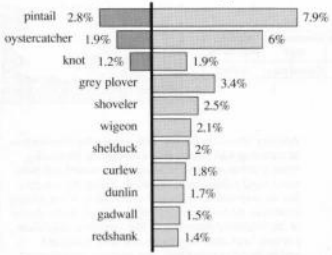
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
	●	●	●													

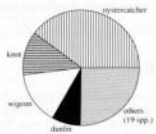
Birds

Wintering birds 1986/87 – 1990/91 data

Total waterfowl: 45,900

BoEE	NWC	WSC
●	●	





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

Breeding birds: low densities of oystercatcher, lapwing and redshank are known to breed on the saltmarshes and low densities of lapwing are known to breed on the grasslands. Small numbers of ringed plover also breed within the estuary.

Additional wildlife features

Three nationally rare plants, the dune gentian *Gentianella uliginosa*, the fen orchid *Liparis loeselii* and the early sand grass *Mibora minima* grow within the dunes. The invertebrate fauna recently recorded on the estuary includes the RDB 1 fly *Dolichopus signifer*, RDB 1 snail *Vertigo angustior*, the RDB 2 flies *Coenosia albatella*, *Platypalpus stabilis* and *Helina pubescens*, the RDB 3 fly *Dexiopsis lacustris*, the RDB 3 bug *Pionosomus varius*, two proposed RDB 3 species and 22 Notable species. Potholes in Torgrro cliffs on the southern shore are used as roosts by horseshoe bats. The Loughor is also a major nursery for sea bass *Dicentrarchus labrax*.

Conservation status

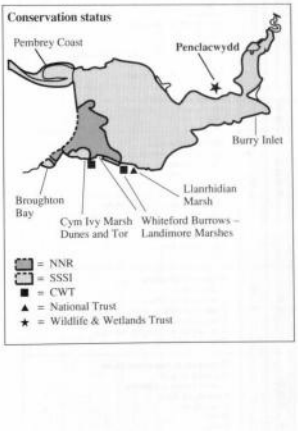
● = designated ● = proposed

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

Much of the estuary is covered by biological Sites of Special Scientific Interest, namely Burry Inlet (5,898 ha), Cwm Ivy Marsh, Dunes and Tor (76 ha), Pembrey Coast (3,180 ha) and Whiteford Burrows-Landimore Marshes (842 ha), most of which is a National Nature Reserve. Broughton Bay is a geological SSSI (10 ha).

The Pembrey Coast and Burry Inlet are Nature Conservation Review sites, and Broughton Bay and Burry Inlet are Geological Conservation Review sites. The National Trust owns land at Whiteford Burrows and Llanrhidian Marsh, and the Glamorgan Wildlife Trust manages two reserves adjacent to the estuary. In addition, the Wildfowl and Wetlands Trust have a reserve at Penclacwydd. The Burry Inlet is subject to a Cockle Fishery Order.

Most of the southern shore lies within the Gower Area of Outstanding Natural Beauty. The Loughor Estuary is proposed as a Ramsar site and Special Protection Area.



Human activities

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
		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
●		Rafting & 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
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●		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

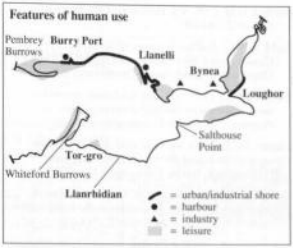
Features of human use

Many of the activities on the Loughor are recreational, with moorings at Loughor, Llanelli and Burry Port, and sailing and wind-surfing occurring most intensively upstream of Loughor. Beach recreation occurs on Pembrey Burrows, Whiteford Burrows and the beach west of Llanelli, and at Tor-gro the cliffs are used for rock-climbing.

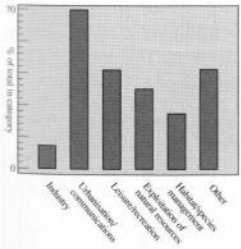
Exploitation of the natural resources includes grazing of most of the saltmarsh and of the dunes at Whiteford. Llanrhidian Sands supports an important cockle fishery which is regulated by the Burry Inlet Fishery Order. The harvesting of cockles is achieved largely by the traditional method of hand-raking. Bait-digging also occurs on Llanrhidian Sands and Whiteford Burrows, and mussels have occasionally been gathered from Whiteford Point. There are also three wildfowling clubs which shoot over the estuary, apart from two refuge areas at Whiteford and Salthouse Point.

Industrial activity within the estuary is limited, and includes two harbours which are no longer used for commercial traffic, but Burry Port is used by fishing boats. There is also a metal industry at Llanelli and a chemical works at Bynea.

In 1989 there were proposals for leisure barrages to create marine lakes at Loughor and Pembrey Harbours, and for marinas at Llanelli North Dock and Burry Port. These marinas may have involved capital dredging and some land-claim for housing and car parks. By 1991 the proposal for a marine lake at Llanelli had been dropped.



Categories of human use



Further reading

Bridges, E.M. 1976. The evolution of the Burry Inlet. *Gower*, 27: 84-89.

Burd, F. 1987. *Saltmarsh survey of Great Britain. County report, West Glamorgan and Llanelli.* Unpublished report, Nature Conservancy Council.

Dargie, T.C.D. 1990. *National sand dune vegetation survey. Site report No. 102, Pembrey Coast.* Peterborough, Nature Conservancy Council.

Dargie, T.C.D. 1990. *National sand dune vegetation survey. Site report No. 51, Whiteford Burrows.* Peterborough, Nature Conservancy Council.

Davidson, P.E. 1967. A study of the oystercatcher in relation to the fishery for cockles in the Burry Inlet. *Fisheries Investigations, Series 2, 25*: 1-28.

Horwood, J.W., & Goss-Custard, J.D. 1977. Predation by the oystercatcher *Haematopus ostralegus* in relation to the cockle, *Cerastoderma edule* fishery in the Burry Inlet, South Wales. *Journal of Applied Ecology, 14*: 139-158.

Moore, J. 1989. Surveys of harbours, rias and estuaries in southern Britain. Loughor estuary, incorporating the Burry Inlet. (Contractor: Field Studies Council Research Unit.) *Nature Conservancy Council, CSD report*, No. 1,004.

Nelson-Smith, A., & Bridges, E.M., *eds.* 1977. *Problems of a small estuary. Proceedings of the symposium on the Burry Inlet (South Wales) held at the University College of Swansea, 13-15 September, 1976.* Swansea, Institute of Marine Studies, University College of Swansea.

Prys-Jones, R.P., Howells, R.J., & Kirby, J.S. 1989. The abundance and distribution of wildfowl and waders on Carmarthen Bay. *Nature Conservancy Council, CSD report*, No. 926.

Poopetch, T. 1980. *Ecology of invertebrates and possible effects of pollution in the Loughor Estuary (Burry Inlet), South Wales.* PhD thesis, University College of Swansea.

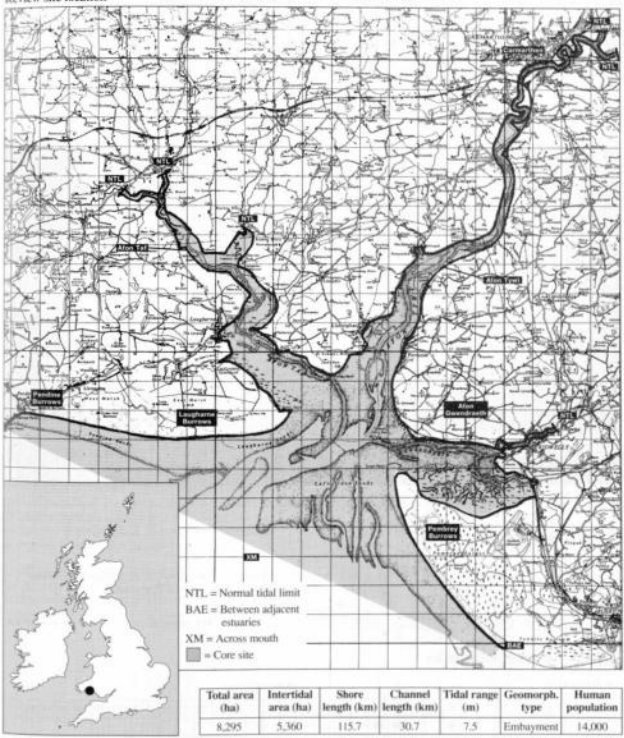
Swarbrick, J. 1984. *Burry Inlet/Three Rivers: a survey of shellfish stocks.* Sea Fish Industry Authority. (Industrial Development Unit, Technical Report, No. 261.)

14 Carmarthen Bay

Centre grid: SN3408
County: Dyfed

Districts: Carmarthen, Llanelli
CCW region: Dyfed-Powys

Review site location



Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
8,295	5,360	115.7	30.7	7.5	Embayment	14,000

Description

Carmarthen Bay is the broad, shallow estuary of the rivers Taf, Tywi and Gwendraeth, which widens into a bay that stretches from Pendine in the west to Pembrey in the east. The estuary is adjacent to the Loughor estuary review site to the east. Water quality within Carmarthen Bay has been classified as grade A, apart from the uppermost tidal section of the Tywi which is grade B.

The intertidal flats of the estuary are predominantly sandy, although the upper reaches of the rivers are muddy, and each of the tributaries has areas of saltmarsh. The most extensive saltmarsh lies on the southern shore of the Gwendraeth, and consists largely of low-mid marsh and shows a good transition to dune vegetation. The saltmarsh of the Taf extends upriver and is dominated by *Spartina*, and there are bands of saltmarsh, mainly narrow but broad in places, along the Tywi.

The outermost shores of the estuary are dominated by extensive sand dune systems. In the west Pendine Burrows grade to a sandy spit which is overlain by the Laugharne Burrows sand dunes, many of which are over 15 metres high and are botanically diverse. Over 300 species of flowering plants have been recorded on Laugharne Burrows. The landward side of the Burrows has undergone extensive land-claim and has been converted to grazing marsh. On the eastern side of the estuary the Pembrey dune system has been largely planted with conifers. The central area of the Pembrey dunes show signs of erosion while the terminal points of the Tywyn spit and Pembrey Nose south-west of the review site are accreting.

The combination of saltmarsh and intertidal flats makes Carmarthen Bay an important feeding ground for wintering waterfowl, of which there is some interchange with the Loughor Estuary review site to the east.

The Tywi Estuary, from Llanstephan. (Rod Jones, Countryside Council for Wales)

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	●	●		◉			
Area (ha)	2,935	910	4,450							

● = 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 1986/87 – 1990/91 data

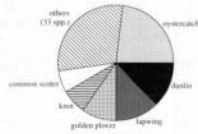
Total waterfowl: 9,820

BoEE	NWC	WSC
●	●	

% National population

common scoter 1.9%

sanderling 1.5%



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

Breeding birds: small numbers of herring gull, fulmar and ringed plover are known to breed on the estuary.
Other: there is a large overwintering population of common scoter in the bay.

Additional wildlife features

Two nationally rare plants are found on this estuary, the long-stalked orache *Atriplex longipes* and the dune gentian *Gentianella uliginosa*. The fen orchid *Liparis loeselii* has also been recently recorded on the dunes.

The invertebrate fauna recently recorded on the estuary includes three Notable species. Carmarthen Bay is a major nursery for sea bass *Dicentrarchus labrax*, and is also known to support good populations of otters.

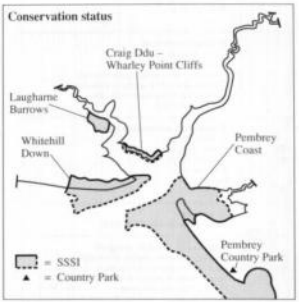
Conservation status

● = designated ◍ = proposed

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

There are several Sites of Special Scientific Interest on the estuary. Craig Ddu-Wharley Point Cliffs (43 ha), Whitehill Down (46 ha) and Pembrey Coast (3,180 ha) are biological SSSIs, and Pembrey Coast is part of the Tywyn Gwendraeth Nature Conservation Review site. Laugharne Burrows (1,086 ha) is an SSSI for its biological and geomorphological interest, and is also a Geological Conservation Review site.

To the east of the estuary is Pembrey Country Park. There are also two areas of Ministry of Defence land at MOD Pendine and RAF Pembrey.



Human activities

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
		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

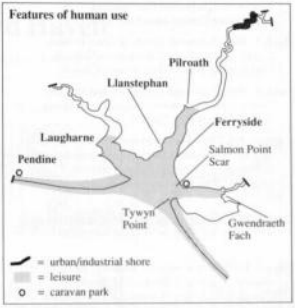
Present	Proposed	
		Tourism & recreation
		Infrastructure developments
		Marinas
●		Non-marina moorings
●		Dinghy & boat parks
●		Caravan parks & chalets
		Leisure centres, complexes & piers
		Aquatic-based recreation
●		Power-boating & water-skiing
		Jet-skiing
●		Sailing
		Sailboarding & wind-surfing
		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

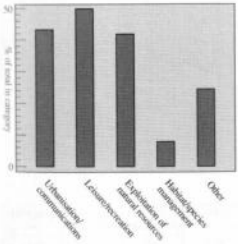
A large number of activities are recreational. Sailing is widespread, with moorings at Laugharne, Pilroath and Gwendraeth Fach and a yacht club and dinghy park at Ferryside. Power-boating and water-skiing are known to occur only rarely. Beach recreation is most intensive at Llanstephan, Salmon Point Scar and Pendine, although there are some MOD restrictions on use of the beach at Pendine and Tywyn.

Exploitation of the natural resources includes grazing of most of the saltmarsh and the sand dunes at Laugharne Burrows. Mussel-collecting and cockling occur within the estuary and bait-digging is widespread. A wildfowling club shoots over the mid and upper reaches of the Taf where there is also a refuge area. Otherwise wildfowling in the estuary is unregulated. More recently there has been a proposal for a shooting lease at Tywyn which would allow for a refuge at Tywyn Point.

In 1989 there was a proposal for trial cultivation of mussels within the estuary.



Categories of human use



Further reading

Ashell, J., Duckworth, J., Smart, S., & Holder, C. In prep. *National sand dune vegetation survey. Site report, Pendine to Laugharne*. Peterborough, Joint Nature Conservation Committee.

Burd, F. 1987. *Saltmarsh survey of Great Britain. County report, West Glamorgan and Llanelli*. Unpublished, Nature Conservancy Council.

Burd, F. 1986. *Saltmarsh survey of Great Britain. County report, Carmarthenshire*. Unpublished, Nature Conservancy Council.

Cadman, P.S. 1989. Environmental impact of lugworm digging. (Contractor: Marine, Environmental and Evolutionary Research Group, University College Swansea.) *Nature Conservancy Council, CSD Report*, No. 901.

Dargie, T.C. 1990. *National sand dune vegetation survey. Site report No. 52, Pembrey Coast*. Peterborough, Nature Conservancy Council.

Mercer, T.M. 1989. Surveys of harbours, rias and estuaries in southern Britain: Taf, Tywi and Gwendraeth Estuary. (Contractor: Oil Pollution Research Unit, Field Studies Council, Pembroke, Dyfed.) *Nature Conservancy Council, CSD Report*, No. 1,113.

Morgan, I.K. 1986. A naturalist's guide – some notes of sites of interest in the Llanelli area, No. 17: Pembrey Forest. *Llanelli Naturalist's Newsletter*: 10-15.

Morgan, I.K. 1986. Field meeting: Tywyn Burrows, (22/361053) VC44, 7 June 1986. *Dyfed Invertebrate Group Newsletter*, No. 2: 11-12.

Morgan, I.K. 1988. Field meeting: Pembrey Forest (22/37-03) VC44, 6 August 1988. *Dyfed Invertebrate Group Newsletter*, No. 10: 15-16.

Morgan, I.K. 1991. Dyfed site report (9): Tywyn-Pembrey (22/30,22/40,21/49) Carms, VC44. *Dyfed Invertebrate Group Newsletter*, No. 22: 4-13.

Powell, H.T., Holme, N.A., Knight, S.J.T., Harvey, R., Bishop, G., & Bartrop, J. 1979. Survey of the littoral zone of the coast of Great Britain. 4. Report on the shores of South West Wales. (Contractor: The Scottish Marine Biological Association/Marine Biological Association Intertidal Survey Unit.) *Nature Conservancy Council, CSD report*, No. 269.

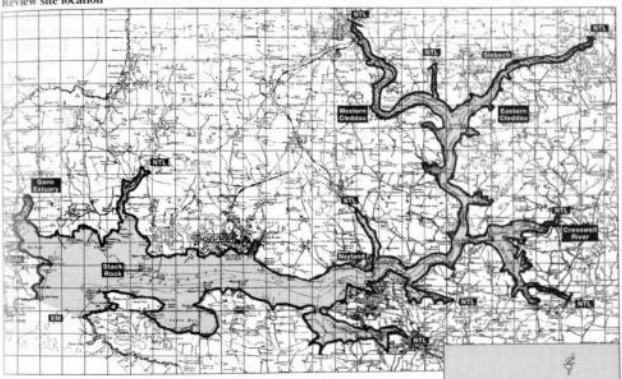
Prys-Jones, R.P., & Davis, P.E. 1990. The abundance and distribution of wildfowl and waders on Carmarthen Bay (Taf/Tywi/Gwendraeth). *Nature Conservancy Council, CSD Report*, No. 1,053.

15 Milford Haven

a.k.a. Cleddau Estuary

Centre grid: SM9403 Districts: Preseli, South Pembrokeshire
County: Dyfed CCW region: Dyfed-Powys

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
5,448	1,710	170.7	35.4	6.3	Ria	36,000

Description

Milford Haven is a large, drowned river valley which is very deep in places, reaching depths greater than 10 metres for 20 km upstream of the mouth. Freshwater inflow to the estuary is low, mainly from the arms of the East and West Cleddau Rivers which meet high up the estuary, and the waters of Milford Haven are fully saline for 16 km east of the entrance. Water quality has been classified as grade A.

The deep waters and rocky and sandy substrates provide a diverse aquatic estuarine flora and fauna which extends far up the estuary, and many communities present are considered to be of interest. The variable salinity rock community and sheltered rock community are regarded as of national importance, and other communities of note include a bed of living maerl near Stack Rock, patches of muddy sand colonised by eelgrass *Zostera*, and an artificial substrata community. The lower reaches of the estuary are dominated by rocky shores.

Upstream of Neyland the channel narrows and the shores become more muddy with earth banks and fringing saltmarsh. On the Cresswell River, saltmarsh has developed in the man-made creeks and loading docks and there is an exceptional diversity of plants and invertebrates here. Far upstream the freshwater inflow from the two Cleddau rivers is dominant, and at Slebech on the Eastern Cleddau there is a large reed-bed only periodically flooded with brackish water. Many of the valley sides of the upper estuary are covered with ancient sessile oak woods, relicts of the extensive woodlands that once lined the shores of the ria system.

Also of note is the Gann estuary, which flows into Milford Haven to the north of Dale. Here a shingle bank behind the tidal sandflat dams a brackish lagoon, which lies beside an area of saltmarsh which supports a range of plant species.

As Milford Haven becomes increasingly sheltered further inland, the Cleddau is an important refuge for waterfowl avoiding freezing weather elsewhere. The estuary regularly supports large numbers of wintering waterfowl, which include an internationally important population of redshank and nationally important populations of four species of waterfowl.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	●		●	◉	●	●	
Area (ha)	3,738	385	1,325							

● = 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
●	●	●	●	●				●	●	●	●	●	●			

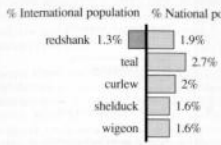
Birds

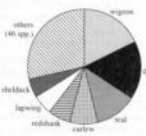
Wintering birds

Total waterfowl: 20,600

1986/87 – 1990/91 data

BoEE	NWC	WSC
●	●	





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

Additional wildlife features

The invertebrate fauna recently recorded on the estuary includes one Notable species. Milford Haven is a major nursery for sea bass *Dicentrarchus labrax*, and otters are regularly recorded on parts of the estuary.

Conservation status

● = designated ◍ = proposed

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

There are several biological Sites of Special Scientific Interest covering small areas of the estuary: Dale Point (13 ha), Gann Estuary (97 ha), Hook Wood (13 ha), Slebech Reed-bed and Carr (16 ha), Minwear Wood (14 ha), Lawrenny Wood (36 ha), and West Williamston Quarries (19 ha). Adjacent to the estuary is Slebech Stableyard, Loft Cellars and Tunnels (0.1 ha).

West Angle Bay (20 ha) is an SSSI for its biological and geological interest, and the estuary has interest in three Geological Conservation Review blocks.

Part of West Williamston Quarries is managed as a reserve by Dyfed Wildlife Trust and the National Trust own land at Williamston Park, Lawrenny and Little Milford Woods. There is also a private reserve at Pembroke Power Station.

Parts of the estuary lie within the Pembrokeshire Coast National Park and the Pembrokeshire Heritage Coast. Milford Haven is a potential Special Protection Area/Ramsar site.

Conservation status

Human activities

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
●		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
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		Thermal discharges (power stations)
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●		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
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		Horse-riding
		Rock-climbing
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		Clay-pigeon shooting
		Others
		Airborne recreation
●		Overflying by light aircraft
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		Others
		Wildfowling & hunting
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●		Other hunting-related activities
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●		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**

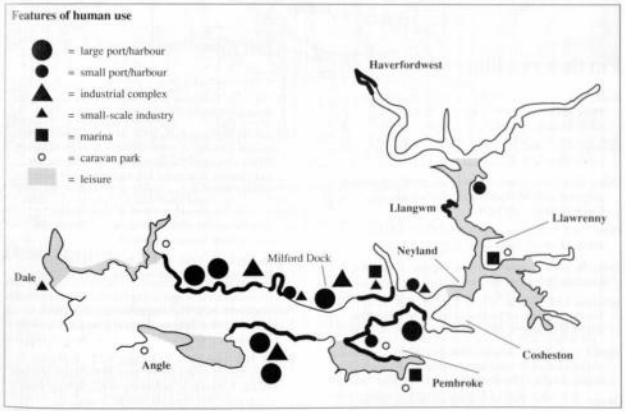
Features of human use

Human uses of Milford Haven are dominated by industry and urbanisation/communications activities. Milford Haven has a large number of port and harbour facilities taking advantage of its deep waters, and many of the large dock complexes are in association with one of the three oil refineries around the estuary. Other industrial activities on Milford Haven include an oil-fired power station, several boat-building/repair yards, and capital and maintenance dredging.

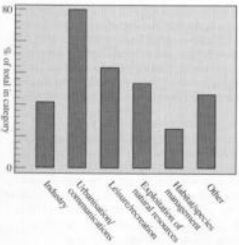
Numerous leisure and recreational activities take place around the estuary. Sailing is concentrated around the marinas and moorings at Dale, Pembroke, Milford Dock, Llangwm, Westfield, Neyland, Lawrenny and Angle, and other aquatic sports are known to occur but are not intensive. Small stretches of shore are used for bathing and beach recreation, and walkers use the Pembrokeshire Coastal Path. More recently jet-skiiers have been using the estuary.

Exploitation of the natural resources is a major feature. Milford Haven is the base for a trawler fleet and herring fishery, and for other smaller fisheries such as salmon fish farms, a ragworm farm and an oyster fishery. Lobster and crab potting and cockle-picking occur around the estuary, and bait-digging is known to be widespread but intensive in localised areas. Wildfowling occurs over some areas of the site.

In 1989 there were proposals for leisure barrages and marinas at Cosheston, Haverfordwest and Pembroke Marina, which at Haverfordwest would involve a major riverside development scheme and at Pembroke would involve some land-claim. There were also proposals for a leisure barrage at Neyland and marinas at Castle Pill and Pennar Park, and for fish farms, chemical industries, rubbish tipping and wildfowling.



Categories of human use



Further reading

Bassindale, R., & Clark, R.B. 1960. The Gann Flat, Dale: studies on the ecology of a muddy beach. *Field Studies, 1*: 1-22.

Crothers, J.H. 1966. *Dale Fort marine fauna.* Pembroke, Field Studies Council.

Dalby, D.H. 1969. Some observations on oil pollution of saltmarshes in Milford Haven. *Biological Conservation, 1*: 295-296.

Dalby, D.H. 1970. The saltmarshes of Milford Haven, Pembrokeshire. *Field Studies, 3*: 297-330.

Dicks, B. 1989. *Ecological impacts of the oil industry.* London, Institute of Petroleum.

Edington, J.M., Morgan, P.J., & Morgan, R.A. 1973. Feeding patterns of wading birds on the Gann Flat, and river estuary at Dale. *Field Studies, 3*: 783-800.

Fridd, C.L.J., Moore, J.J., & Little, D.I. 1989. *Milford Haven beach clean-up guidelines.* Pembroke, Field Studies Research Council.

George, B.J. 1964. Pembrokeshire sea-trading before 1900. *Field Studies, 2*: 1-39.

George, M. 1961. The flowering plants and ferns of Dale, Pembrokeshire. *Field Studies, 1*: 20-44.

Hellawell, T.C., & Phillips, B.N. 1987. *Feeding and roosting patterns of waders and wildfowl in Milford Haven in February and March 1987.* Unpublished report, Nature Conservancy Council, Dyfed-Powys Region.

John, B. 1976. *Pembrokeshire illustrated.* Newton Abbot, David and Charles.

Little, A.E., & Hiscock, K. 1987. Surveys of harbours, rias and estuaries in southern Britain. Milford Haven and the estuary of the River Cleddau. (Contractor: Oil Pollution Research Unit, Field Studies Council.) *Nature Conservancy Council, CSD Report*, No. 735.

Moore, J., & Westwood, S. 1990. *Milford Haven shoreline access and sensitivity maps.* Pembroke, Field Studies Research Council.

Nelson-Smith, A. 1965. Marine biology of Milford Haven: the physical environment. *Field Studies, 2*: 155-188.

Nelson-Smith, A. 1967. Marine biology of Milford Haven: the distribution of littoral plants and animals. *Field Studies, 4*: 435-477.

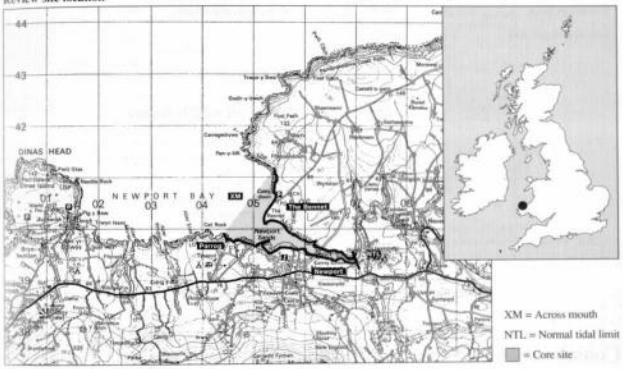
Powell, H.T., Holme, N.A., Knight, S.J.T., & Harvey, R. 1978. Survey of the littoral zone of the coast of Great Britain. 4. Report of the shores of South West Wales. (Contractor: The Scottish Marine Biological Association/Marine Biological Association Intertidal Survey Unit.) *Nature Conservancy Council, CSD Report*, No. 209.

Prys-Jones, R.P. 1989. The abundance and distribution of wildfowl and waders on the Cleddau (Milford Haven). *Nature Conservancy Council, CSD Report*, No. 919.

16 Nyfer Estuary

Centre grid: SN0540 District: Preseli
County: Dyfed CCW region: Dyfed-Powys

Review site location



Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
100	75	6.1	3.1	4.0	Bar built	< 5,000

Description

The Nyfer is a small, shallow estuary, from which the tide withdraws almost completely at low water to leave only a narrow river channel meandering across the curving expanse of Newport Sands. Water quality has been classified as grade A.

The intertidal flat is predominantly sandy, and there is a small area of saltmarsh along the southern shore close to Newport. There is a small range of saltmarsh communities present, with mid-upper marsh vegetation to seaward and a good transition to freshwater marsh north of the bridge and embankment at Newport.

On the northern shore of the estuary there is a small area of sand dunes on the Bennet, and on either side of the mouth there are rocky shores. Just outside the review site lie Newport Cliffs, which range from 5 to 100 metres high and have a diverse vegetation which includes crevice communities, maritime grassland, heath and scrub.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other (cliff)
	●	●	●	◉	●	●				●
Area (ha)	25	10	65							

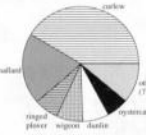
● = major habitat ◉ = minor habitat

Birds

Wintering birds 1986/87 – 1990/91 data

Total waterfowl: 450

BoEE	NWC	WSC
●	●	



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

Aquatic estuarine communities

Information unavailable.

Additional wildlife features

The nationally rare plant perennial centaury *Centaurium scilloides* grows on the sea cliffs just outside the review site.

There is a small breeding colony of grey seals in the caves below Newport Cliffs.

Conservation status

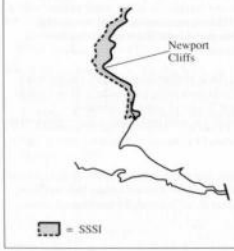
● = designated ◉ = proposed

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

Newport Cliffs (50 ha) is a biological Site of Special Scientific Interest which just overlaps the north-eastern boundary of the estuary mouth. The Nyfer Estuary lies wholly within the Pembrokeshire Coast National Park and the Pembrokeshire Heritage Coast.

In addition the Newport and District Gun Club treat the Nyfer as a wildfowl reserve and refuge.

Conservation status



Human activities

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
		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

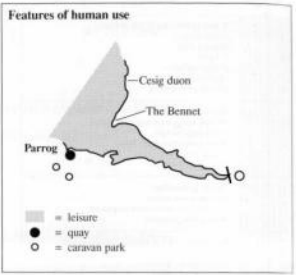
Present	Proposed	
		Tourism & recreation
		Infrastructure developments
		Marinas
•		Non-marina moorings
•		Dinghy & boat parks
•		Caravan parks & chalets
		Leisure centres, complexes & piers
		Aquatic-based recreation
•		Power-boating & water-skiing
		Jet-skiing
•		Sailing
•		Sailboarding & wind-surfing
•		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

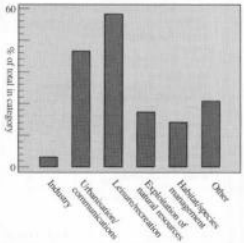
Activities in 1989 were dominated by recreation, with aquatic-based pursuits more intensive around Parrog, at the southern outer limit of the review site. Here there is an old quay now used for leisure. There are also moorings, a dinghy park and a yacht club at Parrog, where sailing and wind-surfing races are held. Power-boating and water-skiing, scuba and snorkelling are more sporadic.

Bathing and beach recreation are centred on the north of the site at Bennet and Cesig duon, and walking and bird-watching occur along paths on both sides of the estuary. Exploitation of the natural resources does occur but on a small-scale, including saltmarsh grazing, *Salicornia* picking and turf cutting.

The National Park Authority undertakes management of parts of the estuary, particularly on the sand dunes, through installation of brushwood fences, netting and control of public access.



Categories of human use



Further reading

Ashell, J., Smart, S., Duckworth, J., & Holder, C. In prep. *The sand dune survey of Great Britain. Site report, The Bennet*. Peterborough, Joint Nature Conservation Committee.

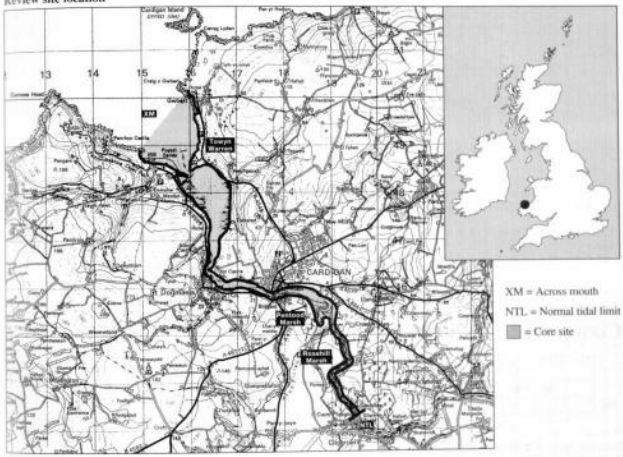
Burd, F. 1989. *The saltmarsh survey of Great Britain. County report, Preseli and South Pembrokeshire*. Unpublished report, Nature Conservancy Council.

Walton, C.L. 1913. The shore fauna of Cardigan Bay. *Journal of the Marine Biological Association of the United Kingdom, 10*: 102-113.

17 Teifi Estuary

Centre grid: SN1648 Districts: Ceredigion, Preseli
County: Dyfed CCW region: Dyfed-Powys

Review site location



Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
301	181	21.0	10.0	4.1	Bar built	< 5,000

Description

The River Teifi flows through a deep, wooded gorge and across a shallow valley floor, to discharge into the southern part of Cardigan Bay. Water quality has been classified as grade A. In the upper reaches of the estuary intertidal flats are predominantly muddy, with an extensive area of estuarine marshes. At Pentood, to the south-east of Cardigan, the marsh has become largely freshwater following its isolation behind a railway embankment. However, the western parts are reverting to saltmarsh, as a result of the incursion of seawater at high tides. Rosehill Marsh to the east is a large reed-bed with developing alder carr. Further downstream are more extensive areas of marsh on either side of the channel, which are dominated by *Spartina* towards the estuary mouth.

In the lower reaches of the estuary there is an expanse of sandflat on both shores, and the mouth is restricted by a small sand-and-shingle spit. To the north of the spit there is a sand dune system at Towyn Warren, where the vegetation shows each stage of dune succession from foredune to mature dune. The seaward dunes are rapidly eroding.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	●	●	●				
Area (ha)	120	46	135							

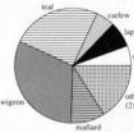
● = major habitat ◍ = minor habitat

Birds

Wintering birds 1986/87 – 1990/91 data

Total waterfowl: 1,290

BoEE	NWC	WSC
●	●	



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

Breeding birds: shelduck are known to breed on the estuary.

Aquatic estuarine communities

Information unavailable.

Additional wildlife features

The invertebrate fauna includes five Notable species, and the proposed RDB 2 cranefly *Gonomyia bradleyi* has been found on the Craig y Gwbert cliffs at the mouth of the estuary.

Conservation status

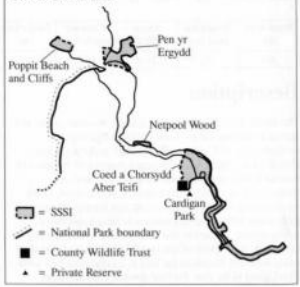
● = designated ◍ = proposed

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

Parts of the estuary are covered by Sites of Special Scientific Interest: these include Pen yr Ergyd (45 ha), Coed a Chorsydd Aber Teifi (108 ha) and Netpool Wood (1 ha) which are biological SSSIs, and Poppit Beach and Cliffs (6 ha) which is a geological SSSI and Geological Conservation Review site. Part of Pentood Marsh is owned by Dyfed Wildlife Trust, who also lease 14 ha of the estuary foreshore.

The Teifi Estuary lies wholly within the Pembrokeshire Coast Heritage Coast, and partly within the Pembrokeshire Coast National Park. Cardigan Park is a private reserve.

Conservation status



Human activities

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
		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**

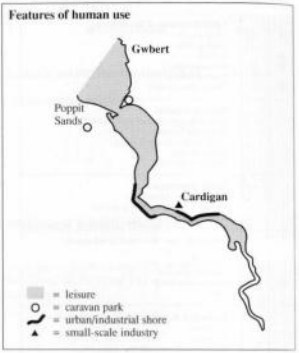
Features of human use

Most activities are leisure pursuits, particularly aquatic sports which focus on the yacht club at Gwbert, on the north-eastern limit of the estuary mouth, and the moorings and dinghy park at Cumbria Quay (west of Cardigan). Bathing and beach recreation occur on a small part of Poppit Sands at the mouth of the estuary.

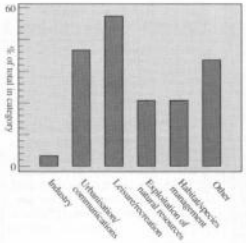
Wildfowling takes place under agreement several times each year on the marshes and northern shore upstream from Cardigan. Other forms of resource exploitation include netting for fish, bait-collecting, lobster and crab potting, *Salicornia* picking and turf-cutting.

Various habitats within the estuary are managed. Scrub is controlled, the beach is fed with shingle to protect the spit, and parts of the sand dunes are protected. Forms of linear defence are also employed to protect the outer estuary and sand dunes. Rabbits and foxes are culled for agricultural control.

In 1989 two proposals for land-claim for agriculture had been abandoned; one scheme was to improve Piliau marsh (20 to 24 ha), and the other to work and improve drainage on what is now the County Wildlife Trust Reserve at Coedydd a Chorsydd Aber Teifi. Since 1989, an area of saltmarsh has been grazed.



Categories of human use



Further reading

Ashell, J., Smart, S., Duckworth, J., & Holder, C. In prep. *The sand dune survey of Great Britain. Site report, Poppit Sands*. Peterborough, Joint Nature Conservation Committee.

Ashell, J., Smart, S., Duckworth, J., & Holder, C. In prep. *The sand dune survey of Great Britain. Site report, Towyn Warren*. Peterborough, Joint Nature Conservation Committee.

Burd, F. 1986. *The saltmarsh survey of Great Britain. County report, Ceredigion & Preseli*. Unpublished, Nature Conservancy Council.

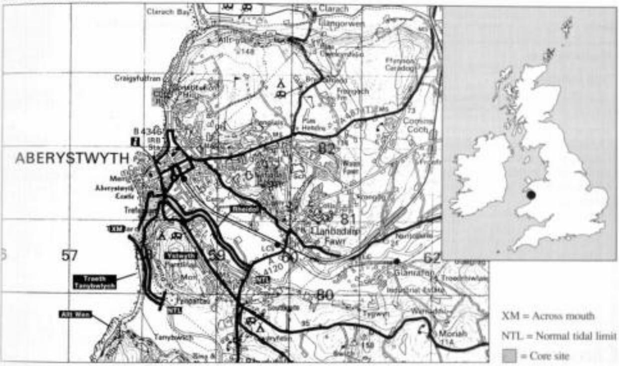
Fowles, A.P. In prep. *Invertebrate conservation in Great Britain*. Peterborough, Joint Nature Conservation Committee.

18 Aberystwyth

Centre grid: SN5980
County: Dyfed

District: Ceredigion
CCW region: Dyfed-Powys

Review site location



Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
18	5	7.1	2.4	4.3	Bar built	10,000

Description

The estuary at Aberystwyth is formed from the confluence of the rivers Ystwyth and Rheidol, and its mouth has long been dominated by the port of Aberystwyth. The estuary is very small, and the Ystwyth is tidal for only 1 km inland while the Rheidol is tidal for 2 km. Water quality has been classified as grade A.

The most prominent feature of the estuary is the shingle spit, Traeth Tanybwylch, that extends northwards from Allt Wen cliffs, deflecting the natural path of the Ystwyth. The northern end of the spit has been undercut by the estuary, and here pioneer shingle vegetation has developed. Southwards the spit becomes more sandy, and where the river turns inland the vegetation communities reflect the transition from shingle to sand, with the development of foredunes.

The remainder of the estuary is composed of fragments of sand dunes, sea cliff and saltmarsh. There are two small areas of saltmarsh within the mouths of the rivers, dominated by mid-upper marsh vegetation communities.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	◍	●		◍		●			
Area (ha)	13	1	4							

● = major habitat ◍ = minor habitat

Birds

Wintering birds 1984/85 data

Total waterfowl: < 20

BoEE	NWC	WSC
		●

Very small numbers of birds winter on the Ystwyth. The total number recorded by the Winter Shorebird Count was less than 20, and included chiefly oystercatcher, purple sandpiper and turnstone. Higher numbers of birds are known to use the estuary during passage.

Aquatic estuarine communities

Information unavailable.

Additional wildlife features

The invertebrate fauna of the shingle spit includes five Notable species. Otters are also present on the estuary.

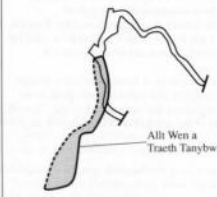
Conservation status

● = designated ◍ = proposed

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

A small part of the estuary is covered by a Site of Special Scientific Interest; Allt Wen a Traeth Tanybwlch (36 ha) is an SSSI for its biological and geomorphological interest. The estuary also forms part of the Ceredigion Heritage Coast.

Conservation status



Human activities

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
		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

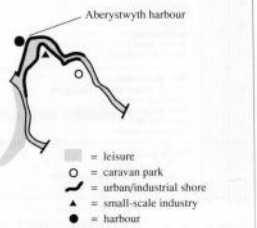
Present	Proposed	
		Tourism & recreation
	●	Infrastructure developments
		Marinas
●		Non-marina moorings
●		Dinghy & boat parks
●		Caravan parks & chalets
		Leisure centres, complexes & piers
		Aquatic-based recreation
●		Power-boating & water-skiing
●		Jet-skiing
		Sailing
●		Sailboarding & wind-surfing
		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

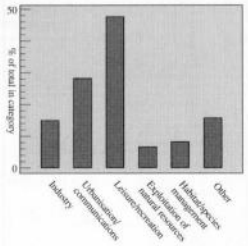
Most activities are recreational, based close to the estuary mouth. Aberystwyth harbour is used by fishing boats and pleasure craft, and there are 100 moorings and a boat park nearby. Most aquatic sports are based around the harbour, except canoeing which also occurs throughout the rivers. Bathing and beach recreation, trial-biking and horse-riding take place from the estuary mouth southwards along the spit.

In 1989 there was a proposal to convert Aberystwyth harbour to a marina, with dredging to provide deep water from which the spoil would be dumped on Allt Wen and out to sea. The estuary was also under consideration as a possible site for an on-shore facility for the Celtic oil fields.

Features of human use



Categories of human use



Further reading

Burd, F. 1986. *The saltmarsh survey of Great Britain. County report, Ceredigion*. Unpublished, Nature Conservancy Council.

Evans, R.G. 1947. The intertidal ecology of Cardigan Bay. *Journal of Ecology, 34*: 273-309.

Fowles, A.P. 1989. The Coleoptera of shingle banks on the River Ystwyth, Dyfed. *Entomologist's Record and Journal of Variation, 101*: 209-221.

Fowles, A.P. In prep. *Invertebrates of Wales*. Peterborough, Joint Nature Conservation Committee.

Ireland, M.P. 1973. Result of fluvial zinc pollution on the zinc content of littoral and sub-littoral organisms in Cardigan Bay, Wales. *Environmental Pollution, 4*: 27-35.

Jones, A.S.G. 1973. The concentrations of copper, lead, zinc and cadmium in shallow marine sediments. *Marine Geologist, 14*: M1-M9.

Sneddon, P., & Randall, R.E. In prep. *The shingle survey of Great Britain. Appendix 1. Report on shingle sites in Wales*. Peterborough, Joint Nature Conservation Committee.

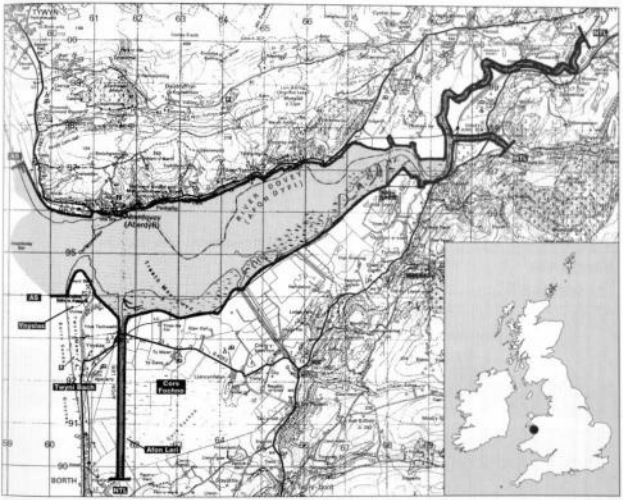
Walton, C.L. 1913. The shore fauna of Cardigan Bay. *Journal of the Marine Biological Association of the United Kingdom, 10*: 102-113.

19 Dyfi Estuary

Centre grid: SN6495
Counties: Dyfed, Gwynedd, Powys

Districts: Ceredigion, Meirionnydd, Montgomeryshire
CCW regions: North Wales, Dyfed-Powys

Review site location



Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
1,954	1,524	52.2	19.6	4.3	Bar built	< 5,000

AS = Along shore
NTL = Normal tidal limit
= Core site

Description

The Dyfi is the largest estuary flowing into Cardigan Bay, with freshwater sources from the Afon Dyfi and the canalised Afon Leri. It is a broad, shallow estuary, dominated by the tide. Water quality has been classified as grade A.

The river channel hugs the steep northern shore, and so it is on the southern shore that most of the intertidal flats have developed. This large area of sandflat has a fringe of saltmarsh along its whole length which, in the early 1900s, was diverse with a pronounced zonation to brackish marsh. Since the introduction of *Spartina* in the 1920s much of the original low saltmarsh has been overtaken by *Spartina*. It has spread to such an extent that the cockle and mussel beds had disappeared by the 1970s, and is considered to have caused a decline in the number

of wintering waders on the estuary. On the northern shore the saltmarsh vegetation is dominated by mid-upper marsh communities with small areas of *Spartina*; further upstream saltmarsh which is only periodically inundated shows transition to brackish marsh.

The mouth of the estuary has been constricted by the northward growth of the Twyni Bach shingle spit, which has become covered with sand. Here the Ynyslas sand dunes have formed. These are of national importance and exhibit all stages of dune formation and growth. On the foreshore west of the Ynyslas dunes lie the remains of a submerged forest.

Large areas of the estuary have undergone land-claim. The embankment of the Afon Leri led to the development of associated brackish saltwater marsh, and other marshes on the south shore which are periodically inundated by brackish water are typical of the former Dyfi floodplain. The Cors Fochno (or Borth Bog, just outside the review site) has developed on former estuarine sediments in the shelter of the developing Ynyslas. This extensive raised bog shows gradation from saltmarsh to raised marsh, and is a nationally important site for the conservation of dragonflies, damselflies, butterflies and moths.

The Dyfi has a number of different habitats and a wide range of vegetation communities, which support a varied invertebrate fauna with many unusual species and also large numbers of wintering waterfowl. The Dyfi regularly supports nationally important populations of wigeon and Greenland white-fronted geese.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	●	●			●		
Area (ha)	430	546	978							

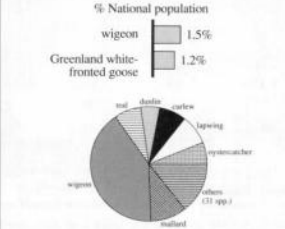
● = major habitat ◉ = minor habitat

Birds

Wintering birds 1986/87 – 1990/91 data

Total waterfowl: 9,930

BoEE	NWC	WSC
●	●	



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

Breeding birds: small numbers of ringed plover and moderate densities of oystercatcher and redshank are known to breed on the estuary.

Other: the estuary is known to be used regularly by ringed plover, sanderling and dunlin during spring and autumn migration.

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 recently recorded on the estuary includes the RDB 3 bug *Pachybrachius luridus*, the RDB 2 high brown fritillary *Argynnis adippe vulgoadippe*, two proposed RDB 3 species and twenty eight Notable species. In addition, Cors Fochno adjacent to the review site supports the RDB 1 rosy marsh moth *Eugraphe subrosea*, the RDB 3 damselfly *Coenagrion mercuriale* and fourteen Notable species. Other species of note include an isolated population of Roesel's bush cricket *Metrioptera roeselii* and a species of spider new to Britain, *Heliophanus dampfi*, which was recorded on Cors Fochno in 1990.

Otters are known to be present on the estuary.

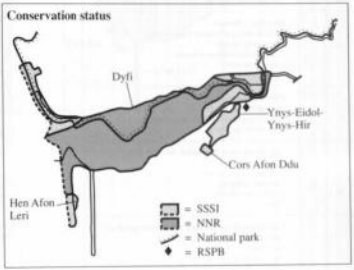
Conservation status

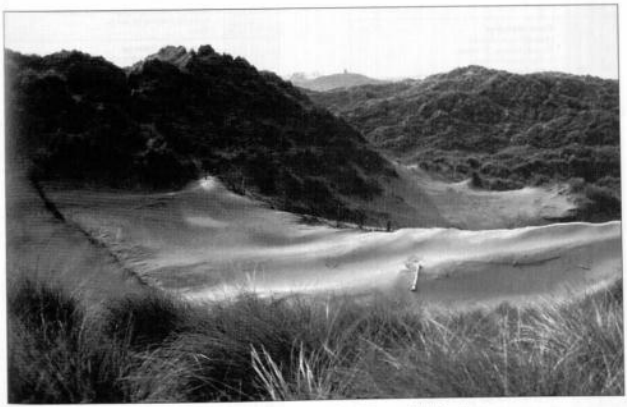
● = designated ◉ = proposed

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

Most of the estuary is covered by Sites of Special Scientific Interest. The Dyfi is an SSSI (2,785 ha) notified for its biological and geomorphological interest, of which part is a National Nature Reserve and a Nature Conservation Review Site. The biological SSSIs include Cors Afon Ddu (2 ha), Hen Afon Leri (7 ha) and Ynys-Eidol-Ynys-Hir (93 ha), which is also an RSPB reserve. Ynyslas and Borth are Geological Conservation Review sites.

The northern shore of the Dyfi lies within Snowdonia National Park. In addition, the Dyfi is a Ramsar site, and has also been designated as a Biosphere Reserve.





Ynyslas sand dunes, a National Nature Reserve at the mouth of the Dyfi Estuary. (Nick Davidson)

Human activities

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
		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
		Pyke-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

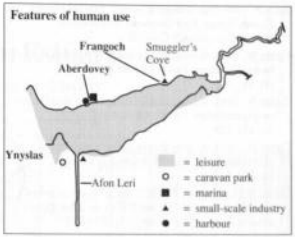
Most activities are recreational. The majority of aquatic-based recreation occurs in the mouth and lower reaches of the estuary, apart from canoeing which occurs throughout. There is a marina and harbour at Aberdovey for pleasure and fishing craft, and moorings at Leri's boatyard and Smuggler's Cove. Other foci for watersports include the water-skiing and power-boating club at Leri outfall and the Outward Bound centres on the north shore.

Bathing and beach recreation are particularly intensive around the sea-front at Ynyslas and south of the spit. 4WD, trial-biking and sand-racing are not permitted on the dunes here but are known to occur. There are also two golf courses. The dunes on the golf course to the north of the estuary mouth are being reinforced and restored by means of brushwood fences and planting marram.

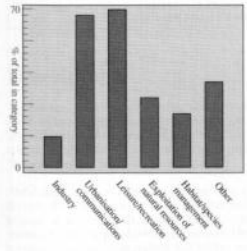
Exploitation of the natural resources is also a major feature, with fish-netting across the river mouth, winkle-gathering, bait-digging and low-intensity cockling. At least 90% of the Leri saltmarsh is grazed, and four wildfowling clubs shoot over the estuary.

There is very little industrial activity on the estuary; there are boat-building yards at Leri and Frangoch on the northern shore, and the channels are occasionally dredged.

There have been attempts to control *Spartina* by spraying, and in 1989 there was a proposal to continue this.



Categories of human use



Further reading

Burd, F. 1986. *The saltmarsh survey of Great Britain. County report, East Gwynedd.* Unpublished, Nature Conservancy Council.

Carter, N. 1933. A comparative study of the alga flora of two saltmarshes. Part I. *Journal of Ecology, 20*: 341-370.

Carter, N. 1933. A comparative study of the alga flora of two saltmarshes. Part II. *Journal of Ecology, 21*: 128-208.

Carter, N. 1933. A comparative study of the alga flora of two saltmarshes. Part III. *Journal of Ecology, 21*: 285-403.

Chater, E.H., & Jones, H. 1957. Some observations of *Spartina townsendii* H. and J. Groves in the Dovey estuary. *Journal of Ecology, 45*: 157-67.

Condry, W.M. 1953. Bird-life on the Dovey estuary. *Report of the West Wales Field Society, 15*: 21-24.

Davis, P., & Moss, D. 1984. *Spartina* and waders - the Dyfi estuary. *In*: Spartina anglica *in Great Britain*, ed. by P. Doody, 37-40. Peterborough, Nature Conservancy Council. (Focus on nature conservation, No. 5).

Durlacher, F.W. 1914. On the drift of sewage in the Dovey estuary in relation to mussel beds. *Transactions of the Biological Society of Liverpool, 28*: 335-352.

Elliott, J.S.B. 1930. The soil fungi of the Dovey saltmarshes. *Annals of Applied Biology, 17*: 284-305.

Godwin, H., & Newton, L. 1938. The submerged forest at Borth and Ynyslas, Cardiganshire. *New Phytologist, 37*: 333-344.

Haynes, J., & Dobson, M. 1969. Physiography, Foraminifera and sedimentation in the Dovey estuary (Wales). *Geological Journal, 6*(2): 217-256.

Hughes, G. 1971. *Plant associations on the Dovey saltmarshes*. B.Sc. Thesis, University College of Wales, Aberystwyth.

Jarvis, J. 1970. *A physical investigation of tidal phenomena in the Dovey estuary with particular reference to channel development and sediment movement*. Ph.D. Thesis, University College of Wales, Aberystwyth.

Jones, A.D. 1969. Photointerpretation in the Dyfi estuary. *Photogrammetric Record, 6*: 29.

Lambert, J.M., & Davies, M.R. 1940. A sandy area in the Dovey estuary. *Journal of Ecology, 28*: 453-464.

Skrine, P.M. 1928. The occurrence of *Fucus vesiculosus muscoides* on the Dovey saltmarshes. *Journal of Botany, 66*: 152-153.

Watkin, E.E., *ed*. 1973. *A handbook for Ynyslas*. Aberystwyth, Nature Conservancy Council South Wales Regional Office & School of Biological Sciences, University College of Wales.

Yapp, R.H., Johns, D., & Jones, O.T. 1916. The saltmarshes of the Dovey estuary. Part I. Introductory. *Journal of Ecology, 4*: 27-42.

Yapp, R.H., Johns, D., & Jones, O.T. 1917. The saltmarshes of the Dovey estuary. Part II. The saltmarshes. *Journal of Ecology, 5*: 65-103.

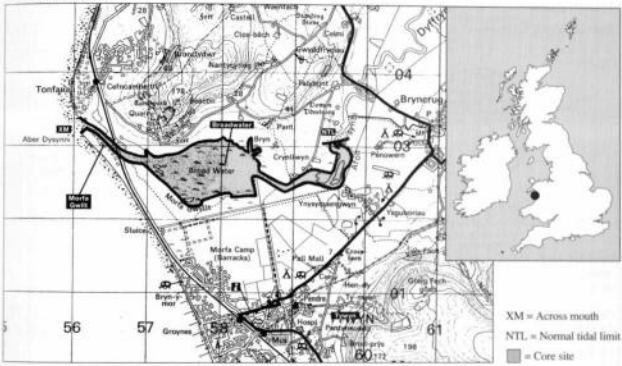
20 Dysynni Estuary

a.k.a. Tywyn Broadwater

Centre grid: SH5802
County: Gwynedd

District: Meirionnydd
CCW region: North Wales

Review site location



Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
117	69	9.9	4.4	4.3	Bar built	< 5,000

Description

The estuary of the Afon Dysynni is small and shallow, enclosed by a shingle spit at its mouth. The spit has severely narrowed the mouth of the estuary and this has markedly reduced the tidal range within the estuary. Water quality has been classified as grade A.

The estuary is widest across the shallow basin of Broadwater, where an expanse of intertidal mudflat is exposed at low tide. In the western half of the basin saltmarsh has developed, which is dominated by lawns of a low-mid saltmarsh community and fringed with mid-upper marsh. A number of small islands in this area have stands of common reed.

The shingle spit that extends north from Tywyn is largely capped with sand, and the vegetation is dominated by grassland but there are some areas of bare shingle and pioneer shingle vegetation to seaward. Towards the north of the spit at Morfa Gwilt a very small lagoon has developed in a natural basin within the shingle. The lagoon receives saltwater inflow via percolation through the shingle and supports a limited macrofauna.

The Dysynni is a small but unusual estuary, with a variety of habitats and a number of unusual species, and regularly supports several thousand wintering waterfowl.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	◉	●			●		◉	
Area (ha)	48	22	47							

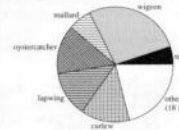
● = major habitat ◉ = minor habitat

Birds

Wintering birds 1986/87 – 1990/91 data

Total waterfowl: 1,720

BoEE	NWC	WSC
●	●	



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

Breeding birds: the shingle spit has been known to support a small colony of breeding terns, which has declined in recent years.

Other: during winter the estuary is a known gull roost for herring, common and black-headed gulls.

Aquatic estuarine communities

Information unavailable.

Additional wildlife features

Two nationally rare species of plant grow on the lower saltmarshes, mudflats and creeks; the Welsh mudwort *Limosella australis* and the round-headed club-rush *Scirpus holoschoenus*.

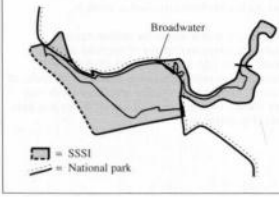
Conservation status

● = designated ◉ = proposed

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

All of the estuary is covered by Broadwater biological Site of Special Scientific Interest (263 ha). The upper reaches and the northern shore of the estuary lie within Snowdonia National Park.

Conservation status



Human activities

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 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

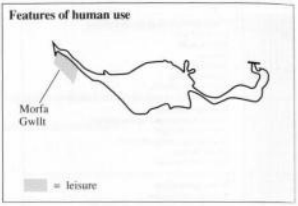
Present	Proposed	
		Tourism & recreation Infrastructure developments Marinas Non-marina moorings Dinghy & boat parks Caravan parks & chalets Leisure centres, complexes & piers Aquatic-based recreation Power-boating & water-skiing Jet-skiing Sailing Sailboarding & wind-surfing SCUBA & snorkelling Canoeing
●		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 & trail-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

In 1989 there were few human activities present on the estuary. Bathing and beach recreation is concentrated on the south side of the mouth, and walking and bird-watching both occur but are not intensive, for access is poor. Canoeing also takes place.

Exploitation of the natural resources is also very limited, with some wildfowling, and 20 ha of the saltmarsh at Morfa Gwllt is grazed.

In 1989 a proposal to clear vegetation on the spit at the south of the estuary mouth, to encourage breeding by little terns, had recently been rejected.



Further reading

Barnes, R.S.K. 1989. The coastal lagoons of Britain: an overview and conservation appraisal. *Biological Conservation*, *49*: 295-313.

Barnes, R.S.K. 1991. Report to the Nature Conservancy Council on a survey of the coastal lagoons of north Wales. *Nature Conservancy Council, CSD report*, No. 1,123.

Burd, F. 1986. *The saltmarsh survey of Great Britain. County report, East Gwynedd*. Unpublished, Nature Conservancy Council.

Sneddon, P., & Randall, R.E. In prep. *Vegetated shingle structures of Great Britain. Appendix 1. Report on shingle sites in Wales*. Peterborough, Joint Nature Conservation Committee.

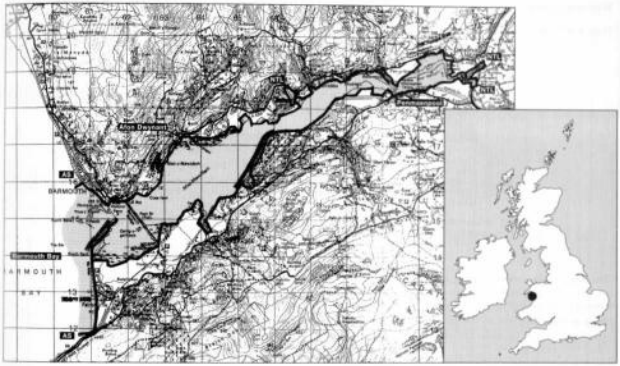
Walton, C. 1913. The shore fauna of Cardigan Bay. *Journal of the Marine Biological Association of the United Kingdom*, *10*: 102-113.

21 Mawddach Estuary

Centre grid: SH6416
County: Gwynedd

District: Meirionnydd
CCW region: North Wales

Review site location



Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
1,159	976	37.7	13.8	4.3	Bar built	< 5,000

NTL = Normal tidal limit
AS = Along shore
= Core site

Description

The Mawddach is a large, shallow estuary which flows through a steeply-sided valley. The mouth of the estuary is narrowed by a pebble and sand spit extending from the south, beyond which the estuary stretches out into Barmouth Bay. Water quality has been classified as grade A, but contains high levels of copper, zinc and iron from the natural outcrops and abandoned mines further upstream within the river catchment.

The intertidal flats are predominantly sandy, very shallow and highly mobile. Some saltmarsh has developed on the northern shore where the Afon Dwynant flows into the Mawddach, and on the southern shore behind the shelter of the spit. *Spartina* is abundant and spreading rapidly, notably within the Afon Dwynant bay. In the mid and upper reaches of the estuary the saltmarsh vegetation is a mosaic of mid-upper communities.

Further upstream at Penmaenpool on the south bank there is a reed-bed, with a large stand of common reed *Phragmites australis*. In this area a full range of successional vegetation types remain intact, from reed-bed and marsh through to sedge meadow and pasture. There is a history of land-claim for agriculture in the upper parts of the estuary, and the resulting grasslands and the reed-bed are a feeding and breeding ground for birds.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	●	●	◉	◉	●		
Area (ha)	183	204	772							

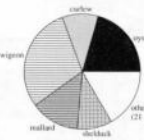
● = major habitat ◉ = minor habitat

Birds

Wintering birds 1986/87 – 1990/91 data

Total waterfowl: 2,000

BoEE	NWC	WSC
●	●	



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

Breeding birds: there is a small colony of breeding herring gulls, and small numbers of lapwing, curlew, redshank and ringed plover are known to breed within the grasslands.

Aquatic estuarine communities

Information unavailable.

Additional wildlife features

The channel is a major nursery for sea bass *Dicentrarchus labrax*. Otters are known to use the reed-bed at Penmaenpool.

Conservation status

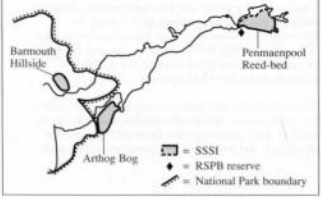
● = designated ◉ = proposed

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

Only a small proportion of the estuary is covered by Sites of Special Scientific Interest: Penmaenpool Reed-bed (93 ha) is a biological SSSI. Adjacent to the estuary is Arthog Bog biological SSSI (64 ha), and Barmouth Hillside (66 ha) which is an SSSI for its biological and geological interest. Barmouth Hillside is also Geological Conservation Review site.

In addition there is an RSPB reserve at Penmaenpool, and much of the estuary lies within Snowdonia National Park.

Conservation status



Human activities

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
		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 & trail-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

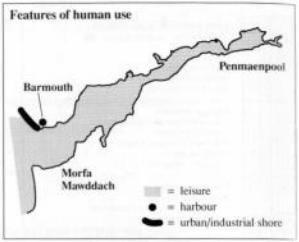
Features of human use

Most activities are recreation and leisure pursuits. Sailing, wind-surfing and canoeing take place throughout the estuary, while water-skiing, power-boating and surfing are based mainly in the bay. At Barmouth, close to the estuary mouth, there are moorings and a small harbour. There is also a footpath running along almost the entire length of the southern shore of the estuary from Morfa Mawddach to Penmaenpool, where there is a visitor centre. Penmaenpool is the area where bird-watching is most intensive.

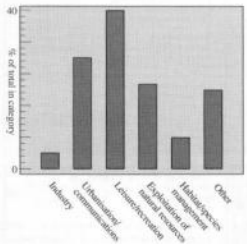
Exploitation of the natural resources is also a feature, with seine-netting for salmon and trout, small-scale gathering of cockles and mussels, and saltmarsh grazing.

Habitat management techniques include *Spartina* control by spraying, which was undertaken in 1989.

In 1989 there was a proposal for land-claim at Penmaenpool, for agricultural purposes. A proposal for a marina behind the south bank spit, which would have involved land-claim, had recently been rejected.



Categories of human use



Further reading

Ashell, J., Smart, S., Duckworth, J., & Holder, C. In prep. The sand dune survey of Great Britain. Site report, Fairbourne. *Joint Nature Conservation Committee Report*, No. 82.

Burd, F. 1986. *The saltmarsh survey of Great Britain. County report, East Gwynedd.* Unpublished, Nature Conservancy Council.

Howells, E.J., Howells, M.E., & Alabaster, J.S. 1983. A field investigation of water quality, fish and invertebrates in the Mawddach river system, Wales. *Journal of Fish Biology*, 22: 447-469.

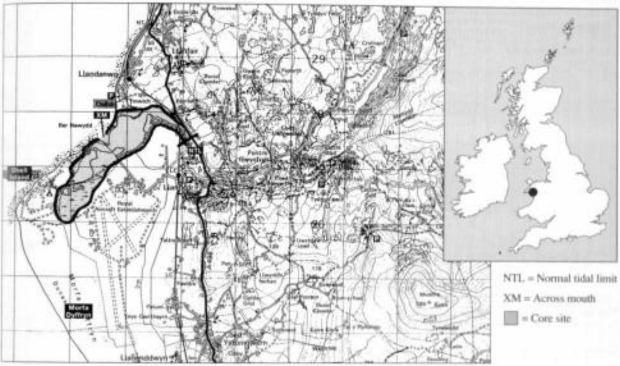
Walton, C. 1913. The shore fauna of Cardigan Bay. *Journal of the Marine Biological Association of the United Kingdom*, 10: 102-113.

22 Artro Estuary

Centre grid: SH5725
County: Gwynedd

District: Meirionnydd
CCW region: North Wales

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
120	114	7.4	1.7	4.4	Bar built	< 5,000

Description

The Artro estuary is a small, very shallow, sandy estuary, sheltered by Shell Island or Mochras. Water quality in the estuary has been classified as grade A. At the southern end of the bay there is a small area of saltmarsh, which has a wide range of saltmarsh vegetation communities, from pioneer communities through to mid-upper marsh, and includes a patch of the rare *Limonium/Armeria* vegetation community. *Spartina* is invading the sandflats, and is extending the area of saltmarsh and stabilizing the range of vegetation types. In scattered areas, upper marsh swamps grade into wet dune slacks.

To the south of the estuary are the Morfa Dyffryn dunes, an extensive area of calcareous mobile and fixed dunes. The dunes are both high and wide, and contain fine examples of dune migration, and are of great botanical interest with a rich flora that includes several locally uncommon species.

Historically, the estuary of the Artro river has been radically modified by man. The river channel once flowed out to sea south of Shell Island, until a land-claim scheme in 1819 diverted the flow of the river northwards through marshy ground. For the next twenty years Shell Island was a true island, isolated from the mainland, but the southern end of the island gradually silted-up, joining it to the land once more, and the sand dunes now present began to form.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●		●		●	◍		
Area (ha)	6	10	104							

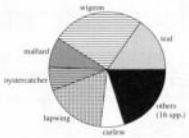
● = major habitat ◍ = minor habitat

Birds

Wintering birds 1986/87 – 1990/91 data

Total waterfowl: 680

BoEE	NWC	WSC
●	●	



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

Breeding birds: small numbers of ringed plover are known to breed on the estuary.

Aquatic estuarine communities

Information unavailable.

Additional wildlife features

The invertebrate fauna recorded on the estuary includes two RDB 3 species, the tiger beetle *Cicindela hybrida* and the bug *Monosynamma bohemani* and 36 Notable species, which have been found on Morfa Dyffryn.

Great crested newts occur in pools on the neighbouring airfield.

The Artro is a major nursery for sea bass *Dicentrarchus labrax*.

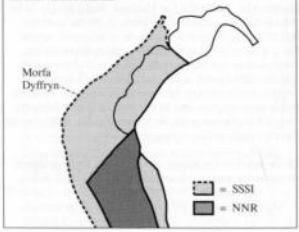
Conservation status

● = designated ◍ = proposed

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

The southern half of the estuary lies within the Morfa Dyffryn Site of Special Scientific Interest (506 ha), of which 202 ha is a National Nature Reserve. The Artro also forms part of the Morfa Dyffryn Geological Conservation Review site, and the Glannau Harlech Nature Conservation Review site.

Conservation status



Human activities

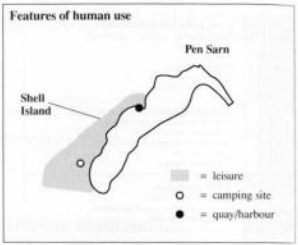
Present	Proposed	
●		**Coast protection & sea defences** Linear defences Training walls Groynes Brushwood fences *Spartina* planting Marram grass planting
		Barrage schemes Weirs & barrages for river management Storm surge barrages Water storage barrages & bunds Leisure barrages Tidal power barrages
		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 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

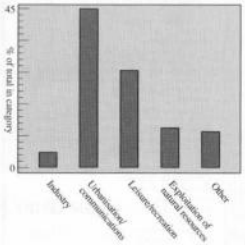
Features of human use

Most human activities are connected with tourism, based around the leisure centre on Shell Island and the sailing club at Pen Sarn. A small quay at the tip of the island has non-marina moorings, but most aquatic-based activities (sailing, wind-surfing) are confined to the seaward side of the sand bar.

Exploitation of the natural resources includes bait-digging, and grazing of the saltmarsh in the south of the site. There is also a military airfield on the southern shore of the review site.



Categories of human use



Further reading

Ashell, J., Smart, S., Duckworth, J., & Holder, C. In prep. The sand dune survey of Great Britain. Site report, Morfa Dyffryn. *Joint Nature Conservation Committee Report*, No. 90.

Burd, F. 1986. *The saltmarsh survey of Great Britain. County report, East Gwynedd*. Unpublished, Nature Conservancy Council.

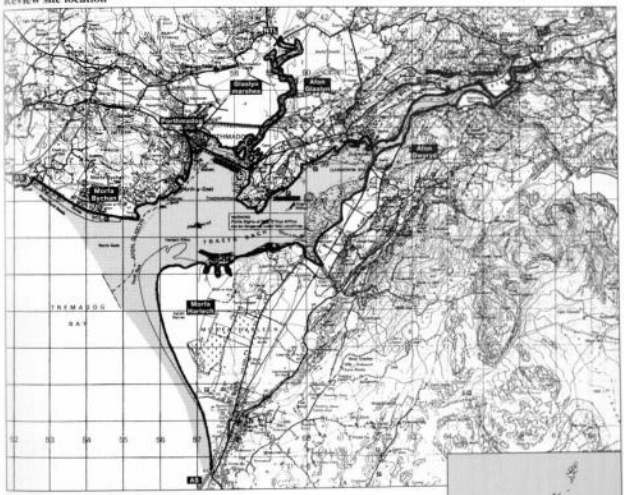
Walton, C.L. 1913. The shore fauna of Cardigan Bay. *Journal of the Marine Biological Association of the United Kingdom, 10*: 102-113.

23 Traeth Bach

a.k.a. Glaslyn/Dwyryd Estuary

Centre grid: SH5736 District: Dwyfor, Meirionnydd
County: Gwynedd CCW region: North Wales

Review site location



NTL = Normal tidal limit

AS = Along shore

= Core site

Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
2,050	1,750	54.0	15.7	4.4	Bar built	< 5,000

Description

Traeth Bach is the broad, shallow estuary of the Afon Glaslyn and the Afon Dwyryd. Historically the estuary has been much modified by man. The construction of the railway along the south bank of the Dwyryd brought about some land-claim, and the building of the cob at Porthmadog reduced the area of the Glaslyn by 50%. Water quality in the estuary has been classified as grade A, except for a small section near Porthmadog, which was grade B.

Traeth Bach is dominated by sandy intertidal sediments, with some sand and silt in the south. Saltmarsh fringes the shores of the Dwyryd, which has low-mid saltmarsh vegetation communities, and grazed mid-upper marsh on the southern shore. Towards the mouth, *Spartina* is present and landwards the saltmarsh grades through to dune grassland. The main area of saltmarsh along the Afon Glaslyn lies seaward of the road and railway at Porthmadog, and is dominated by ungrazed low-mid marsh vegetation with *Spartina*. The Glaslyn marshes that remain behind the road and railway are now only partly tidal, and the vegetation here is grassland that grades from brackish to freshwater. The flora here includes several uncommon plant species.

To the south of the estuary mouth is the sand spit of Morfa Harlech, which has extended across the mouth of the Glaslyn by the northwards movement of sand. However, changes in the position of the river channel have affected the growth and erosion of the spit. The large, moderately lime-rich sand dune system on Morfa Harlech has large populations of many locally uncommon species of plant, and the slacks are rich in invertebrates and support a variety of mosses and liverworts. On the northern shore the sand dunes of Morfa Bychan are a reflection of Morfa Harlech, with pioneer dunes, actively building dunes, areas of mature fixed dunes, and wet slacks. In addition, on the westernmost point of the estuary there is a small patch of rocky shore.

Traeth Bach has a wide range of habitats with a variety of vegetation communities and an interesting invertebrate fauna. In addition it is the second most important site for estuary birds in Cardigan Bay, and wintering populations are dominated by wildfowl.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	●	●	◍		●		
Area (ha)	300	348	1,402							

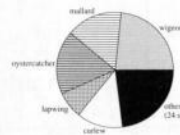
● = major habitat ◍ = minor habitat

Birds

Wintering birds 1986/87 – 1990/91 data

Total waterfowl: 3,390

BoEE	NWC	WSC
●	●	



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

Breeding birds: there is a small breeding colony of black-headed gulls and small numbers of lapwing, curlew, redshank, oystercatcher and ringed plover are known to breed on 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

Two nationally rare plants grow on Glaslyn marshes, the dwarf spike-rush *Eleocharis parvula* and Welsh mudwort *Limosella australis*. This is one of only two sites where Welsh mudwort has been found recently in Britain.
The invertebrate fauna recently recorded on the estuary includes the RDB 2 fly *Pteromicra glabricula*, the RDB 2 beetle *Hypocaccus rugiceps*, the RDB 3 flies *Pherbellia griseola*, *P. grisescens* and *Eumerus sabulonum*, two proposed RDB species and 43 Notable species.
The channel is an important nursery ground for sea bass *Dicentrarchus labrax*.

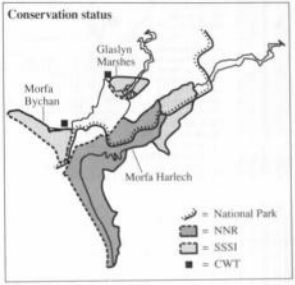
Conservation status

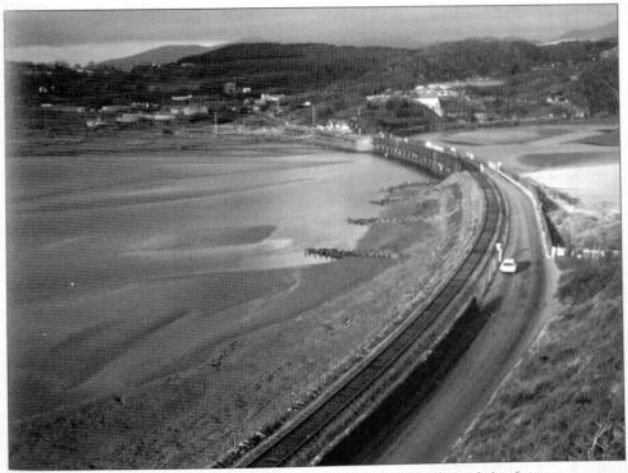
● = designated ◉ = proposed

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

Much of the estuary is covered by Sites of Special Scientific Interest. Glaslyn Marshes (176 ha) and Morfa Bychan (346 ha) are biological SSSIs, parts of which are managed as reserves by the North Wales Wildlife Trust. Morfa Harlech (1,536 ha) is an SSSI of both biological and geomorphological interest, of which 873 ha are established as a National Nature Reserve. It also forms part of Glannau Harlech Nature Conservation Review site.

The northern half of the estuary lies within Snowdonia National Park. Part of the western shore of Traeth Bach falls within the Lleyn Peninsula Environmentally Sensitive Area.





Briwet Bridge across the Afon Dwyryd, Traeth Bach: road and rail communications and an explosives factory. (Peter Wakely, English Nature)

Human activities

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
		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

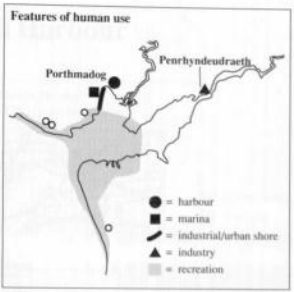
Features of human use

Most activities are connected with leisure and recreation. Water sports such as power-boating, water-skiing, canoeing and surfing taking place in the main channel. Land-based pursuits such as 4WD, trial-biking, car sand-racing, and beach recreation are concentrated on the sand dunes and beaches.

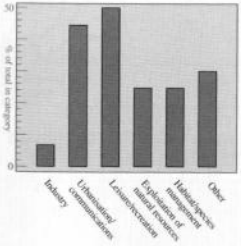
There is very little industrial activity on the estuary, with only a small port at Porthmadog and an explosives works at Penrhyndeudraeth. Exploitation of the natural resources includes grazing of the saltmarsh and the dunes at the estuary mouth; turf-cutting; hand-gathering of molluscs; bait-digging, and wildfowling under agreement.

Habitat and species management includes the culling of mammals, *Spartina* control, and management of sand dunes. In 1989 there were proposals for *Spartina* control and the protection of the dunes on Morfa Bychan.

More recently sailboarding and jet-skiing have occurred on the estuary, and seismic studies have been carried out by the University College of Wales.



Categories of human use



Further reading

Ashell, J., Smart, S., Duckworth, J., & Holder, C. In prep. *The sand dune survey of Great Britain. Site report, Morfa Bychan and Llandanwg*. Peterborough, Joint Nature Conservation Committee.

Ashell, J., Smart, S., Duckworth, J., & Holder, C. In prep. *The sand dune survey of Great Britain. Site report, Morfa Harlech*. Peterborough, Joint Nature Conservation Committee.

Burd, F. 1986. *The saltmarsh survey of Great Britain. County report, East Gwynedd*. Unpublished, Nature Conservancy Council.

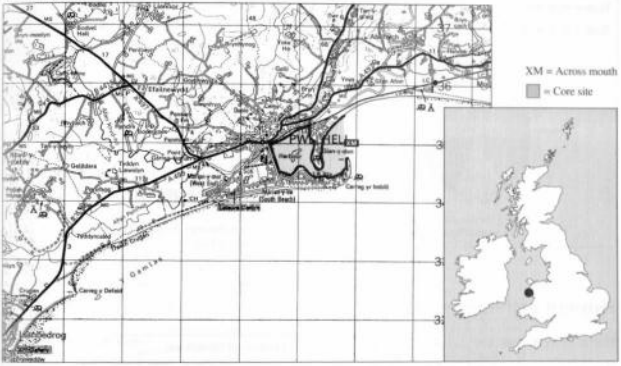
Cook, W., & Rees, E.I.S. 1978. Survey of the macroinvertebrate population in the Glaslyn/Dwyryd estuary. (Contractor: Marine Science Laboratories, University College of North Wales, Menai Bridge). *Nature Conservancy Council, CSD report*, No. 222.

Walton, C.L. 1913. The shore fauna of Cardigan Bay. *Journal of the Marine Biological Association of the United Kingdom, 10*: 102-113.

24 Pwllheli Harbour

Centre grid: SH3835
County: Gwynedd
District: Dwyfor
CCW region: North Wales

Review site location



Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
85	60	4.6	2.4	4.5	Bar built	< 5,000

Description

Pwllheli Harbour is the estuary of the Afon Erch and the Afon Rhyd-hir. The site is dominated by the harbour which, along with the development of the town of Pwllheli, has led to extensive land-claim. Almost 83% of the shore is protected by linear defences. The estuary has only a small area of intertidal sandflat, and a small area of saltmarsh in the outer harbour. The saltmarsh is composed of low-mid vegetation communities, with some *Spartina* to the south.

The intertidal flats support a variety of wintering waterfowl.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●							
Area (ha)	30	3	57							

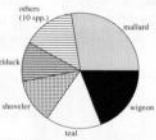
● = major habitat ● = minor habitat

Birds

Wintering birds 1986/87 – 1990/91 data

Total waterfowl: 420

BoEE	NWC	WSC
	●	



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

Aquatic estuarine communities

Information unavailable.

Conservation status

There are no statutory designations or conservation areas on Pwllheli Harbour.

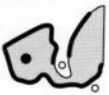
Human activities

Features of human use

There are few activities on Pwllheli. The estuary is dominated by the harbour and a boat-building/repair yard. There are two caravan parks close to the site, and leisure pursuits include angling, walking, bird-watching and sailing.

In 1989 the construction of a marina had been consented, which included the infilling of 6 ha of the inner harbour to create a leisure marina. Also in 1989 there was a proposal for a training wall at the harbour mouth for channel management, which would provide an extra 150-200 moorings.

Features of human use



= urban/industrial shore
● = harbour
○ = caravan site
= leisure/recreation

Further reading

Ashell, J., Smart, S., Duckworth, J., & Holder, C. In prep. The sand dune vegetation survey of Great Britain. Site report, Pwllheli-Penychain. *Joint Nature Conservation Committee Report*, No. 84.

Ashell, J., Smart, S., Duckworth, J., & Holder, C. In prep. *The sand dune vegetation survey of Great Britain. Site report, Traeth Crugan (Pwllheli)*. Peterborough, Joint Nature Conservation Committee.

Burd, F. 1986. *The saltmarsh survey of Great Britain. County report, West Gwynedd*. Unpublished, Nature Conservancy Council.

Human activities

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
		Others
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		Exploration
		Production
		Rig & platform construction
		Pipeline construction
		Pipeline installation
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		Oil refineries
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		Overflying by military aircraft
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		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
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		Wildfowling
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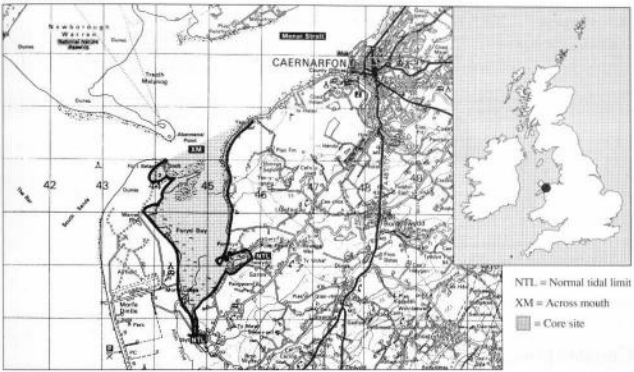
		Crustacea farming
		Reeds for roofing
		Salicornia picking
		Others
		Management & killing of birds & mammals
		Killing of mammals
		Killing of birds
		Adult fish-eating birds
		Adult shellfish-eating birds
		Gulls
		Geese
		Wildlife habitat management
		Spartina control
		Habitat creation & restoration
		Marine
		Intertidal
		Terrestrial
		Habitat management
		Others

25 Foryd Bay

Centre grid: SH4559 District: Arfon
County: Gwynedd CCW region: North Wales

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
343	285	9.4	4.5	4.7	Bar built	< 5,000

Description

Foryd Bay is a very shallow estuary at the southern end of the Menai Strait, and is bounded on its western side by a dune-covered shingle spit which constricts the entrance to the bay. Major flood defences run along the west bank which historically were associated with large-scale land-claim. Water quality in the estuary has been classified as grade A.

The intertidal area within the bay is extensively sandflat, on which there is a patch of the eelgrass *Zostera* near the mouth of the estuary. The largest area of saltmarsh stretches along the western shore. The vegetation is largely *Spartina*, with some fringes of an upper saltmarsh community, and on the eastern shore there are some narrow, broken areas of saltmarsh. *Spartina* is spreading throughout the saltmarsh.

Foryd Bay is part of the network of estuaries at the southern end of the Menai Strait that are used by wintering wildfowl and waders, and there is considerable interchange of waterfowl between the Foryd Bay, Cefni Estuary and Traeth Melynog review sites.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	◍	●		●			
Area (ha)	58	123	162							

● = major habitat ◍ = minor habitat

Birds

Wintering birds 1986/87 – 1990/91 data

Total waterfowl: 3,280

BoEE	NWC	WSC
●	●	

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

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 in Foryd Bay.

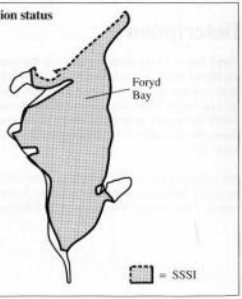
Conservation status

● = designated ◍ = proposed

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

Almost all of the estuary is covered by Foryd Bay biological Site of Special Scientific Interest (283 ha). The estuary is also a proposed Local Nature Reserve, and is included in the proposed Menai Strait Marine Nature Reserve.

Conservation status



Human activities

Present	Proposed	
		Coast protection & sea defences
●		Linear defences
		Training walls
		Groynes
		Brushwood fences
		Spartina planting
		Marram grass planting
		Barrage schemes
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		Exploration
		Production
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		Military activities
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●		Domestic waste disposal
		Sewage discharge & outfalls
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		Accidental discharges
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		Waste incinerators
		Others
		Sediment extraction
	●	Capital dredging
		Maintenance dredging
		Commercial estuarine aggregates extraction
		Commercial terrestrial aggregates extraction
		Non-commercial aggregates extraction
		Hand-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
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		Jet-skiing
		Sailing
		Sailboarding & wind-surfing
		SCUBA & snorkelling
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		Rowing
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●		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
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		Wildfowling & hunting
●		Wildfowling
		Other hunting-related activities
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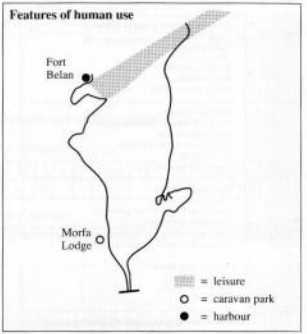
		Spartina control
		Habitat creation & restoration
		Marine
		Intertidal
		Terrestrial
		Habitat management
		Others

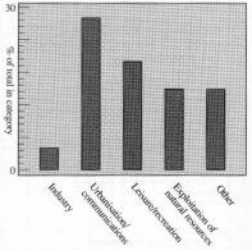
Features of human use

There is no industry within the site, for the single harbour at Fort Belan is tourist-based with organised trips to Caernarfon. Most activities are recreational or exploit the natural resources: there is one caravan park at Morfa Lodge and bird-watching, angling and wind-surfing are known to occur. Small numbers of boats are licensed to bag-net for fish, and low-level bait-digging occurs in the middle of the flats. An agreement exists between wildfowlers that the Cefni and Foryd Bay estuaries are shot over, while Traeth Melynog is a refuge.

In 1989 there was a proposal for a marina at Fort Belan, which would have involved capital dredging to cut out 6 ha for the basin, and associated land-claim for accommodation and hotels. Two golf courses were also proposed on the dunes and peninsula. In 1991 this proposal had been withdrawn.



Categories of human use



Further reading

Allen, P.L., Moore, J.J., Walker, A.J.M., & Rees, E.I.S. 1983. *Estimation of the temporal stability of beach sediments from biological evidence*. Swindon, Science and Engineering Research Council. (SERC marine technology report RDX 38).

Ashell, J., Smart, S., Duckworth, J., & Holder, C. In prep. The sand dune survey of Great Britain. Site report, Morfa Dinlle. *Joint Nature Conservation Committee Report*, No. 87.

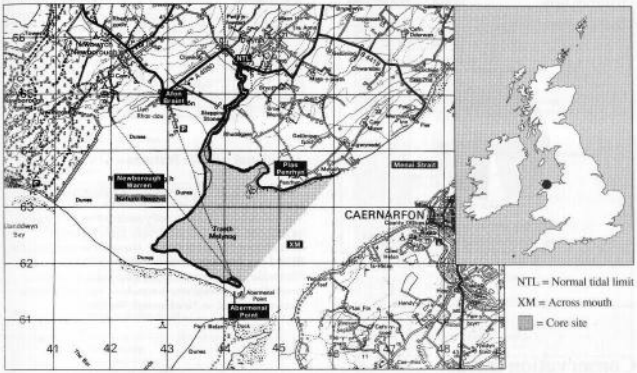
Burd, F. 1986. *The saltmarsh survey of Great Britain. County report, West Gwynedd*. Unpublished, Nature Conservancy Council.

26 Traeth Melynog

a.k.a. Braint Estuary, Traeth Abermenai

Centre grid: SH4364 District: Ynys Mon
County: Gwynedd CCW region: North Wales

Review site location



Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
365	314	10.9	5.4	4.7	Bar built	< 5,000

Description

This very shallow estuary is situated at the south-west of the Menai Straits, where the narrow channel of the Afon Braint opens out onto a large area of intertidal sandflats. Water quality has been classified as grade A. The estuary is bounded on the west by the sand dunes of Newborough Warren and lies in the shelter of the shingle ridge of Abermenai Point, which is accreting. There is a further area of shingle along the east shore at Plas Penrhyn.

A band of saltmarsh runs along the shores of the bay, and extends upstream into the Braint. This saltmarsh has a wide range of vegetation communities, with younger, low-mid marsh in the south, and mid-upper marsh and freshwater transitions in the north. *Spartina* has recently appeared. To the west, Newborough Warren is a major sand dune system with both active and fixed dunes; sand is transported predominantly from west to east, towards the spit at Abermenai Point. The dunes show a full range of vegetation types from strandline flora, dune ridges, and wet and dry slacks through to heath and scrub.

Traeth Melynog has a range of habitats and an outstanding assemblage of flowering plants. Invertebrate populations are varied, including several uncommon species, and in winter the estuary supports a varied waterfowl population. There is considerable interchange of waders and wildfowl with the Foryd Bay review site to the south, and the Cefni Estuary to the north.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	◍	●		●			
Area (ha)	51	66	248							

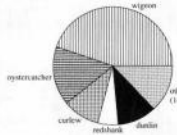
● = major habitat ◍ = minor habitat

Birds

Wintering birds 1986/87 – 1990/91 data

Total waterfowl: 2,840

BoEE	NWC	WSC
●	●	



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

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 nationally rare dune helleborine *Epipactis dunensis* is found on the dunes and the dune slacks.
The invertebrate fauna recently recorded on the estuary includes the RDB 2 sandhill rustic moth *Luperina nickerlii gueneei* and the beetle *Hypocaccus rugiceps;* the RDB 3 bug *Monosynamma bohemani*, and flies *Pherbellia griscescens, Zophomyia temula, Dexiopsis minutalis* and *Limnophora scrupulosa;* and 160 Notable species, recorded on Newborough Warren.

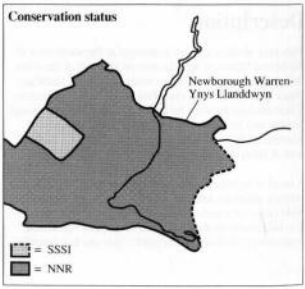
Conservation status

● = designated ◍ = proposed

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

Around half the estuary is covered by Newborough Warren-Ynys Llanddwyn Site of Special Scientific Interest (1,552 ha), notified for its biological, geological and geomorphological interest. Most of the SSSI is a National Nature Reserve. Newborough Warren is also a Nature Conservation Review Site.

The estuary lies within the proposed Menai Straits Marine Nature Reserve.



Human activities

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 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

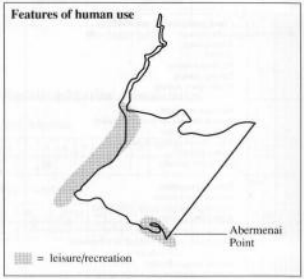
Present	Proposed	
		Tourism & recreation Infrastructure developments Marinas Non-marina moorings Dinghy & boat parks Caravan parks & chalets Leisure centres, complexes & piers Aquatic-based recreation Power-boating & water-skiing Jet-skiing
●	●	Sailing
		Sailboarding & wind-surfing SCUBA & snorkelling 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 & trail-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

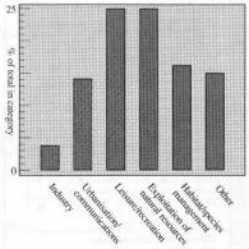
Most activities are leisure pursuits or exploitation of the natural resources, and are of limited extent. The estuary is too shallow for widespread sailing, although some sailing does take place off Abermenai Point. Walking, bird-watching and beach-based recreation are centred on the north of the estuary or Abermenai Point. Occasionally trial-biking occurs in the dunes.

Exploitation of the natural resources includes commercial digging and hand-gathering of mussels and cockles, and there have been attempts to control this. Wildfowling is also restricted, for there is a general agreement that Traeth Melynog is a wildfowl refuge, while Foryd Bay and the Cefni are shot over. In addition, the saltmarsh and sand dunes are grazed.

In 1989 there was a proposal for a marina at Fort Belan on Foryd Bay, which would have had an impact on the Abermenai Point area, with an increase in sailing. This proposal was later withdrawn.



Categories of human use



Further reading

Blackstock, T.H. 1985. Nature conservation within a conifer plantation on a coastal sand dune system, Newborough Warren, Anglesey, North Wales. *In: Sand dunes and their management*, ed. by P. Doody, 145-150. (Focus on nature conservation, No. 13.) Peterborough, Nature Conservancy Council.

Burd, F. 1986. *The saltmarsh survey of Great Britain. County report, West Gwynedd*. Unpublished, Nature Conservancy Council.

Mills, D.J.L. 1991. Benthic marine ecosystems in Great Britain: a review of current knowledge. Cardigan Bay, North Wales, Liverpool Bay and the Solway (MNCR Coastal sectors 10 and 11). *Nature Conservancy Council, CSD Report*, No. 1,174. (Marine Nature Conservation Review Report, No. MNCR/OR/12)

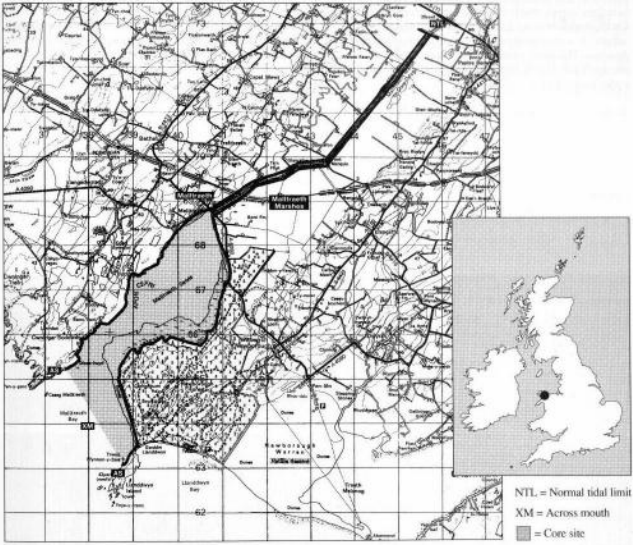
Rees, E.I.S., & Walker, A.J.M. 1976. Survey of the macroinvertebrate populations of Traeth Melynog, Gwynedd. (Contractor: Marine Science Laboratories, University College of North Wales, Menai Bridge). *Nature Conservancy Council, CSD report*, No. 70.

27 Cefni Estuary

a.k.a. Malltraeth Estuary

Centre grid: SH4067 District: Ynys Mon
County: Gwynedd CCW region: North Wales

Review site location



Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
744	614	26.1	12.7	4.7	Bar built	< 5,000

Description

The Cefni is a shallow, sandy estuary on the southern shores of Anglesey, and is in close proximity to the Traeth Melynog review site. The size of the estuary was greatly reduced when the Cob was built at Malltraeth in 1819; above Malltraeth the flood prevention embankments have entirely canalised the channel. Water quality of the estuary has been classified as grade B, apart from the outer reaches of the estuary which were grade A.

The construction of the Cob caused the accretion of sediments and development of extensive intertidal sandflats, across which the Cefni meanders at low tide. On the northern shore there is a narrow fringe of saltmarsh, with mid-upper vegetation communities and *Spartina*. The most extensive area of saltmarsh lies along the south and eastern shore, which has a well-established upper marsh with a wooded fringe.

To the east of the estuary there is an extensive system of sand dunes which continue eastwards to the Traeth Melynog estuary. A large area of dunes adjacent to the Cefni were planted with conifers in the late 1940s, which halted the dunes' ecological development. Some damp slacks in this forest still retain sand dune vegetation.

The tidal gates and embankments in the upper reaches of the site prevent the intrusion of saline water, and the Malltraeth Marshes outside the embankments have subsequently become freshwater marsh and agricultural land. These marshes retain a remnant wetland flora and are a major feeding area for birds, and a small pool east of Malltraeth is known to attract small numbers of migrating waders. The Cefni regularly supports nationally important populations of wintering pintail.

In addition there is a small area of rocky shore to the north-west of the estuary mouth.

Sea holly *Eryngium maritimum* on Newborough Warren, the extensive sand dune system lying between the Cefni Estuary and Traeth Melynog. (Pat Doody)

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	◉	●	◉		●		
Area (ha)	130	111	503							

● = major habitat ◉ = minor habitat

Birds

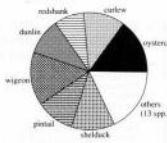
Wintering birds 1986/87 – 1990/91 data

Total waterfowl: 3,380

BoEE	NWC	WSC
●	●	

% National population

pintail 1.2%



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

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 nationally rare shore dock *Rumex rupestris* is found within Newborough Forest. The invertebrate fauna recently recorded on the estuary includes the RDB 3 fly *Eumerus sabulonum* and 57 Notable species.

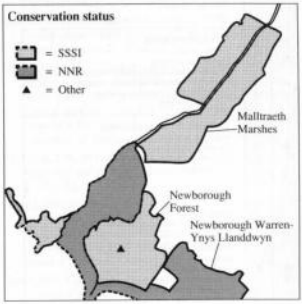
Conservation status

● = designated ◉ = proposed

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

Almost all of the estuary is covered by Sites of Special Scientific Interest. Malltraeth Marshes (184 ha) and Penrhynoedd Llangadwaladr (1,248 ha – previously known as Bodorgan Head) are biological SSSIs. Newborough Warren – Ynys Llanddwyn is an SSSI for its biological and geomorphological interest and for the most part is a National Nature Reserve. Newborough Forest (702 ha) is also an SSSI for its biological and geomorphological interest, and lies within the Newborough Warren Nature Conservation Review site.

Part of the estuary lies within Anglesey Area of Outstanding Natural Beauty, and the forest areas are considered as "Conservation Areas and Working Forest" by the Forestry Commission. The proposed Menai Straits Marine Nature Reserve encompasses the Cefni.



Human activities

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
		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

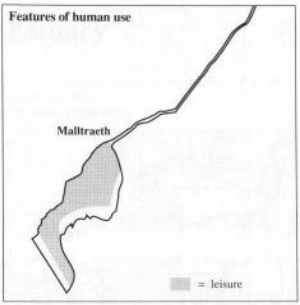
Present	Proposed	
		Tourism & recreation
		Infrastructure developments
		Marinas
●		Non-marina moorings
		Dinghy & boat parks
		Caravan parks & chalets
		Leisure centres, complexes & piers
		Aquatic-based recreation
●		Power-boating & water-skiing
		Jet-skiing
●		Sailing
●		Sailboarding & wind-surfing
		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

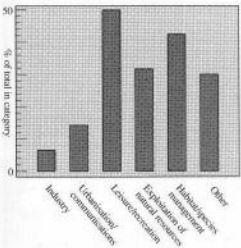
Most activities are of a recreational nature or involve exploiting the natural resources of the estuary. Power-boating, sailing, wind-surfing and water-skiing all take place in the main estuary below Malltraeth, while land-based pursuits are concentrated around the dunes and sea-front to the south. Sand-yachting, 4WD and trial-biking occur on the sandflats, and at present there is a scheme to licence horse-riding.

Cockling, and mussel- and winkle-gathering are not intensive, and mussel-collecting and digging for bait are also limited. Wildfowling occurs over the central section of the estuary, and is subject to an agreement that the Cefni and Foryd Bay are shot, while the Traeth Melynog estuary is a refuge. Habitat and species management include culling of mammals, creation of lakes within the Forestry Commission land, and *Spartina* control.

Proposals in 1989 included the renewal of the tidal gates on Malltraeth Cob, and the development of a visitor centre by the Forestry Commission.



Categories of human use



Further reading

Ashell, J., Duckworth, J., Smart, S., & Holder, C. In prep. *Sand dune survey of Great Britain. Site report, Newborough Warren.* Peterborough, Joint Nature Conservation Committee.

Atwell, C.A.M. 1972. *Some aspects of the ecology of shorebirds at Newborough Warren National Nature Reserve with some associated management problems.* London, University College of London. Dissertation for Conservation Course.

Blackstock, T.H. 1985. Nature conservation within a conifer plantation on a coastal sand dune system, Newborough Warren, Anglesey, North Wales. *In: Sand dunes and their management*, ed. by P. Doody, 145-150. Peterborough, Nature Conservancy Council. (Focus on nature conservation, No. 13.)

Burd, F. 1986. *The saltmarsh survey of Great Britain. County report, West Gwynedd.* Unpublished, Nature Conservancy Council.

Mills, D.J.L. 1991. Benthic marine ecosystems in Great Britain: a review of current knowledge. Cardigan Bay, North Wales, Liverpool Bay and the Solway (MNCR Coastal sectors 10 and 11). *Nature Conservancy Council, CSD report*, No. 1,174. (Marine Nature Conservation Review Report, No. MNCR/OR/10)

Packham, J.R., & Liddle, M.J. 1970. The Cefni saltmarsh, Anglesey, and its recent development. *Field Studies, 3*: 331-356.

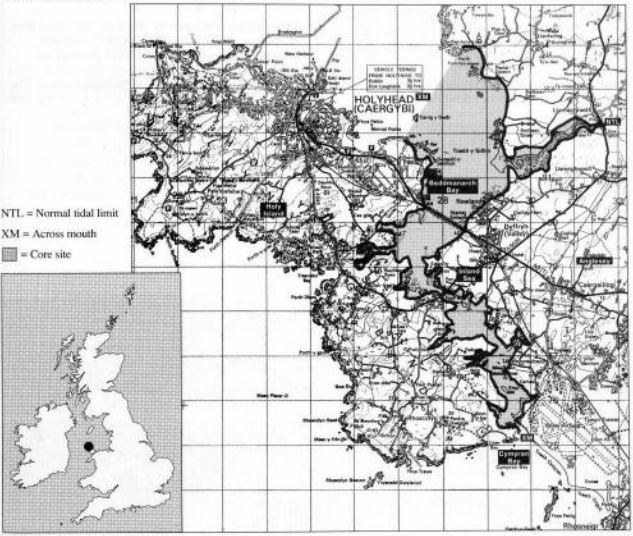
Rees, E.I.S., & Walker, A.J.M. 1976. Survey of macroinvertebrate populations in the Cefni estuary, Gwynedd. (Contractor: Marine Science Laboratories, University College of North Wales, Menai Bridge.) *Nature Conservancy Council, CSD report*, No. 69.

Tunnicliffe, C.F. 1952. *Shorelands summer diary.* London, Collins.

28 Alaw Estuary

Centre grid: SH3081 District: Ynys Mon
County: Gwynedd CCW region: North Wales

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
1,085	721	38.2	10.4	5.0	Fjard	13,000

Description

The Alaw Estuary review site includes the channel of the Afon Alaw and the strait into which it discharges, which separates Holy Island from mainland Anglesey. The town of Holyhead lies in close proximity to the site. The tide varies along the length of the site, for when the Alaw channel is submerged, the area known as the Inland Sea (between the two road bridges) is usually exposed. Water quality in the estuary has been classified as grade A.

The estuary has a variety of habitats. The section north of the Stanley embankment is particularly varied with extensive sandflats and a small mudflat in Beddmanarch Bay, patches of bare shingle, and rocky outcrops. The intertidal channel of the Alaw is a mixture of mud and shingle, with fringes of saltmarsh on both shores that is dominated by *Spartina*, with some mid-upper saltmarsh communities. The Inland Sea is largely subtidal with some mudflats and fringes of saltmarsh along the sheltered indentations of the shore. The vegetation consists largely of patches of low marsh, with transitions to freshwater marsh where seepages occur. South of the Four Mile Bridge the estuary forms a small, sandy creek, which connects with the sea at Cymyran Bay. In the sheltered bays of the southernmost parts of the estuary there are patches of intertidal mud, with low-mid saltmarsh communities and invading *Spartina*.

The aquatic estuarine habitat of the Alaw is dominated by soft substrate communities, which include muddy gravel and muddy sand communities, and *Zostera* beds where all three species of eelgrass have been recorded. A sheltered rocky shore community is also present.

There are also small areas of sand dune and coastal dune heath at the mouth of the Alaw and at Cymyran. In addition there is a mass of small rocky outcrops and grassy islands along the shores of the Alaw, which attract a variety of waterfowl during passage and in winter. The Alaw is an important feeding area for overwintering birds, for the unusual tidal conditions allow birds to feed on the Inland Sea when the Alaw section is submerged.

Saltmarsh fringes the sheltered tidal flats of the Alaw Estuary. (Nick Davidson)

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	●	●	●	●	●		
Area (ha)	364	63	658							

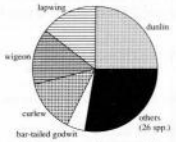
● = major habitat ◍ = minor habitat

Birds

Wintering birds 1986/87 – 1990/91 data

Total waterfowl: 4,690

BoEE	NWC	WSC
●	●	



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

Breeding birds: a small colony of breeding terns has returned in recent years, following a collapse in the late 1970s.

Aquatic estuarine communities

Soft Substrate

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

Hard Substrate

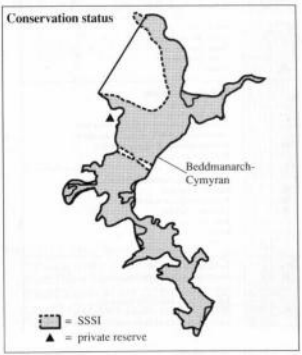
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
		●														

Conservation status

● = designated ◍ = proposed

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

Most of the estuary is covered by Beddmanarch-Cymyran Site of Special Scientific Interest (911 ha), which is an SSSI notified for its biological interest. There is also a private reserve to the west of the estuary, owned by Anglesey Aluminium plc.



Human activities

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
		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**

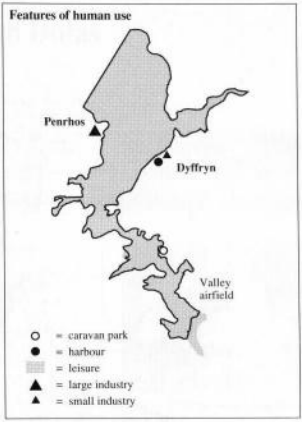
Features of human use

Most activities are of a recreational nature. Water-based activities take place over all of the estuary, but most (wind-surfing, canoeing, water-skiing) are concentrated on the channel south of the Stanley embankment. Sailing occurs mainly in the north, where there are boat moorings and a small harbour near Dyffryn. 4WD and trial-biking take place west of the airfield.

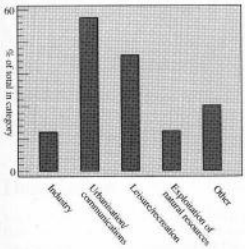
There is little industry within the review site. Most industrial activities occur at Holyhead which is outside the estuary. There is a small boatyard near Dyffryn, and on the west coast at Penrhos there is a large aluminium smelting works which discharges effluent into the estuary.

The Valley airfield on the south-east coast is the site of intense use by military aircraft. The estuary is also used for Coastguard rescue exercises, particularly the headlands and islands in the mouth of the site.

Proposals in 1989 included *Spartina* control and cultivation of oysters. By 1991 there were two oyster farms located within the Inland Sea, with a third near Cymyran. In addition consent had been granted for improvements to the A5.



Categories of human use



Further reading

Ashell, J., Duckworth, J., Smart, S., & Holder, C. In prep. *Sand dune vegetation survey of Great Britain. Site report, Valley Airfield and Links*. Peterborough, Joint Nature Conservation Committee.

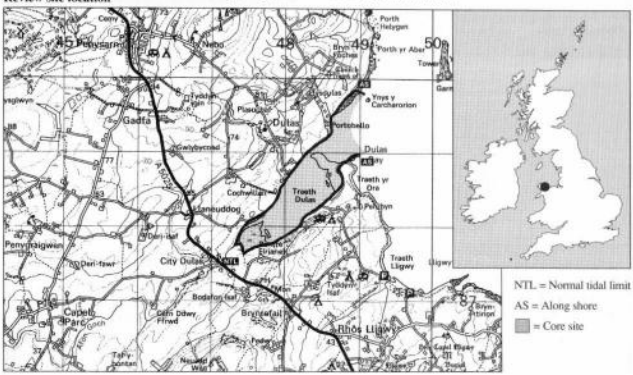
Burd, F. 1986. *The saltmarsh survey of Great Britain. County report, West Gwynedd*. Unpublished, Nature Conservancy Council.

Mills, D.J.L. 1991. Benthic marine ecosystems in Great Britain: a review of current knowledge. Cardigan Bay, North Wales, Liverpool Bay and the Solway (MNCR Coastal sectors 10 and 11). *Nature Conservancy Council, CSD Report*, No. 1,174. (Marine Nature Conservation Review Report, No. MNCR/OR/12)

29 Traeth Dulas

Centre grid: SH4888 District: Ynys Mon
County: Gwynedd CCW region: North Wales

Review site location



Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
103	103	5.2	2.9	6.4	Bar built	< 5,000

Description

Traeth Dulas is the small, sandy estuary of the Afon Goch, which flows into the sea on the north-east coast of Anglesey. The Afon Goch originates from Parys mountain, where it is polluted by heavy metals from the old mineworkings.

The estuary is sheltered behind a sand and shingle spit, Morfa Dulas, which severely constricts the estuary mouth and markedly reduces the influence of the tide. Inside the spit the estuary is very shallow and drains almost completely at spring tides. The intertidal area is predominantly sandy with an area of saltmarsh at the mouth of the river and on the inner shore of the spit.

Despite the relatively small size of the estuary, there is a wide variety of saltmarsh vegetation communities, which reflect the varied physical conditions. In the upper reaches pioneer and mid-upper marsh communities are present, and a narrow strip of saltmarsh along the southern shore has interesting freshwater transitions where seepages occur. Behind the spit, an area of saltmarsh grades into dune grassland communities.

Wintering bird populations are dominated by waders, particularly curlew, which use the pastures adjacent to the site as well as the estuary itself.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	●	●	●	●			
Area (ha)	21		82							

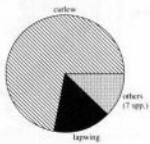
● = major habitat ● = minor habitat

Birds

Wintering birds 1987/88 & 1990/91 data

Total waterfowl: 740

BoEE	NWC	WSC
●		



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

Breeding birds: a small colony of little terns formerly bred on the sand and shingle spit.

Aquatic estuarine communities

Information unavailable.

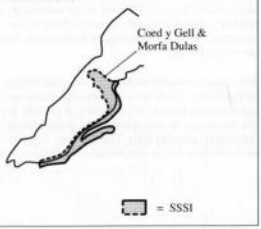
Conservation status

● = designated ● = proposed

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

A small part of the estuary lies within Coed y Gell and Morfa Dulas biological Site of Special Scientific Interest (19 ha).

Conservation status



Human activities

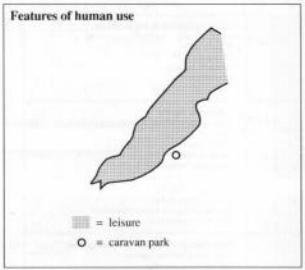
Present	Proposed	
		Coast protection & sea defences
		Linear defences
		Training walls
		Groynes
		Brushwood fences
		Spartina planting
		Marram grass planting
		Barrage schemes
		Weirs & barrages for river management
		Storm surge barrages
		Water storage barrages & bunds
		Leisure barrages
		Tidal 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
		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

There are very few activities on Traeth Dulas. Recreational uses include a single caravan park, walking, bird-watching, beach recreation and some 4WD. Wildfowling does occur but is not intensive.

In 1989 there were proposals for *Spartina* control, and for the re-opening of the mine on Parys mountain, which would involve discharges of waste into the Afon Goch. By 1991 the mine had been re-opened, with waste water treatment expected to improve the water quality of the river. In 1991 there was also a proposal for sewage discharge into the estuary.



Further reading

Ashell, J., Duckworth, J., Smart, S., & Holder, C. In prep. *Sand dune survey of Great Britain. Site report, Traeth Dulas.* Peterborough, Joint Nature Conservation Committee.

Burd, F. 1986. *The saltmarsh survey of Great Britain. County report, West Gwynedd.* Unpublished, Nature Conservancy Council.

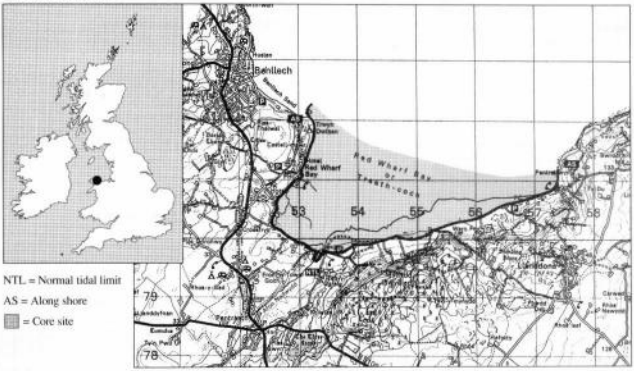
Sneddon, P., & Randall, R.E. In prep. *The shingle survey of Great Britain. Appendix 1. Report on shingle sites in Wales.* Peterborough, Joint Nature Conservation Committee.

30 Traeth Coch

a.k.a. Red Wharf Bay, Nodwydd Estuary

Centre grid: SH5380 District: Ynys Mon
County: Gwynedd CCW region: North Wales

Review site location



NTL = Normal tidal limit
AS = Along shore
= Core site

Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
583	583	10.0	4.4	6.4	Linear shore	< 5,000

Description

The Afon Nodwydd flows into the large, open, shallow bay known as Traeth Coch, or Red Wharf Bay. This site is made up almost entirely of an extensive intertidal sandflat, across which the river meanders at low water. Along the lower banks of the river there is a small area of saltmarsh, which has mid-upper marsh vegetation communities and stands of *Phragmites* reed which extend upstream into the Afon Nodwydd. *Spartina* is found in the muddier parts to the west.

On the western shore of the bay there is also a very small, highly sandy, calcareous shingle spit. This is largely covered with grassland vegetation, but around the seaward edge there is also a strip of pioneer shingle vegetation.

Traeth Coch supports relatively small numbers of wintering waterfowl, which are predominantly waders.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	●	●		●			
Area (ha)		31	552							

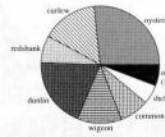
● = major habitat ● = minor habitat

Birds

Wintering birds 1986/87 – 1990/91 data

Total waterfowl: 2,640

BoEE	NWC	WSC
●	●	



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

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 RDB 3 fly *Spilogona biseriata* has been recorded on the estuary in the past.

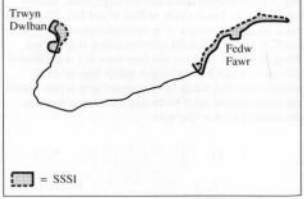
Conservation status

● = designated ● = proposed

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

Only a very small area of the estuary is covered by Sites of Special Scientific Interest. To the west is Trwyn Dwlban, a geological SSSI of 16 ha, which is also a Geological Conservation Review site. Just overlapping the eastern limit of the estuary is Fedw Fawr SSSI (119 ha), which is of geological and biological interest.

Conservation status



Human activities

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
		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
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		Dredge spoil
		Accidental discharges
		Aerial crop spraying
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		Others
		Sediment extraction
		Capital dredging
		Maintenance dredging
		Commercial estuarine aggregates extraction
		Commercial terrestrial aggregates extraction
		Non-commercial aggregates extraction
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		Transport & communications
		Airports & helipads
		Tunnels, bridges & aqueducts
●		Causeways & fords
		Road schemes
		Ferries
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		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

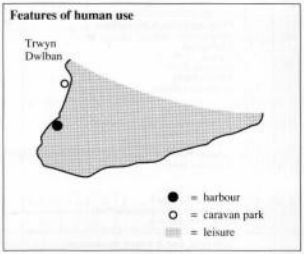
Present	Proposed	
		Tourism & recreation
		Infrastructure developments
		Marinas
●		Non-marina moorings
		Dinghy & boat parks
●		Caravan parks & chalets
		Leisure centres, complexes & piers
		Aquatic-based recreation
		Power-boating & water-skiing
		Jet-skiing
●		Sailing
		Sailboarding & wind-surfing
		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 & mud-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

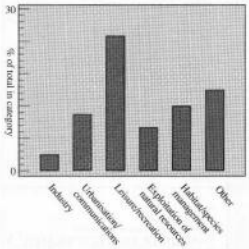
Few activities occur on Traeth Coch, and those that are present are generally on a small scale. Leisure and recreation are most numerous, with beach recreation, bird-watching, angling, 4WD and trial-biking occurring over the bay but with relatively little impact, and very occasionally rock-climbing occurs at Trwyn Dwlban. To the west of the bay there is one small harbour and a single caravan park.

Exploitation of the natural resources includes small numbers of cocklers and bait-diggers, and wildfowling, which is not intensive.

In 1989 a proposal for *Spartina* control was under consideration.



Categories of human use



Further reading

Ashell, J., Duckworth, J., Smart, S., & Holder, C. In prep. *Sand dune vegetation survey of Great Britain. Site report, Red Wharf Bay.* Peterborough, Joint Nature Conservation Committee.

Burd, F. 1986. *The saltmarsh survey of Great Britain. County report, East Gwynedd.* Unpublished, Nature Conservancy Council.

Mills, D.J.L. 1991. Benthic marine ecosystems in Great Britain: a review of current knowledge. Cardigan Bay, North Wales, Liverpool Bay and the Solway (MNCR Coastal sectors 10 and 11). *Nature Conservancy Council, CSD Report*, No. 1,174.

Rees, E.I.S., Nicolaidou, A., & Laskaridou, P. 1977. The effects of storms on the dynamics of shallow water benthic associations. *In*: *Biology of benthic organisms*, ed. by B.F. Keegan, P.O. Ceidigh & P.J.S. Boaden, 465-474. Oxford, Pergamon.

Rees, E.I.S., & Walker, A.J.M. 1983. Annual and spatial variation in the *Abra* community in Liverpool Bay. *Proceedings of the Oceanological Acta*, 165-169. 17 European Marine Biological Symposium, Brest, France, 27 September – 1 Oct 1982.

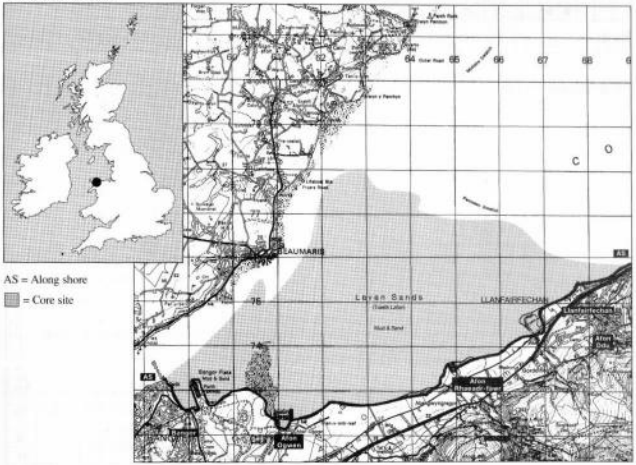
Sneddon, P., & Randall, R.E. In prep. *The shingle survey of Great Britain. Appendix 1. Shingle sites in Wales.* Peterborough, Joint Nature Conservation Committee.

31 Traeth Lafan

a.k.a. Lavan Sands, Afon Ogwen

Centre grid: SH6375 Districts: Aberconwy, Arfon, Ynys Mon
County: Gwynedd CCW region: North Wales

Review site location



AS = Along shore

= Core site

Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
3,040	2,932	16.1	2.9	6.9	Embayment	< 12,000

Description

Traeth Lafan is a shallow, estuarine system at the northern end of the Menai Strait, where at low water the freshwater of the Rivers Ogwen, Ddu and Rhaeadr-sawr flows out across the intertidal flats into the sea. Water quality has been classified as grade A.

The estuary is an extensive intertidal flat with a range of habitats, from sands exposed to waves and tidal currents at the seaward edge through to sheltered sand and mudflats, and there is an area of shingle and mussel beds near Bangor. Relatively small areas of saltmarsh have formed along the shore. At the mouth of the Rhaeadr-fawr there is a patch of mature mid-upper marsh with several large clumps of *Spartina*, and further east, an area of saltmarsh with mid-upper vegetation communities is partially enclosed by the small shingle spit south-west of Llanfairfechan.

The intertidal flats have an abundant invertebrate fauna which attract large numbers of waterfowl. Traeth Lafan is known to support several thousands of wintering waterfowl, which include nationally important populations of curlew, oystercatcher and dunlin.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	●			●			
Area (ha)	108	14	2,938							

● = 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 1986/87 – 1990/91 data

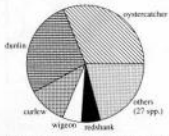
Total waterfowl: 11,100

BoEE	NWC	WSC
●	●	

Nationally important species

curlew 1.5%

oystercatcher 1.4%



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

Breeding birds: small numbers of ringed plover are known to breed on the estuary.
Other: Traeth Lafan is known to be an important moulting site for red-breasted mergansers and for up to 500 great crested grebes.

Conservation status

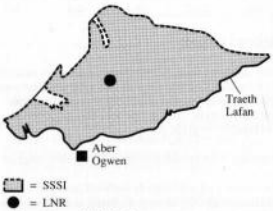
● = designated ● = proposed

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

Most of the review site is covered by the Traeth Lafan biological Site of Special Scientific Interest (2,700 ha), of which the most part is a Local Nature Reserve (2,240 ha). There is also a North Wales Wildlife Trust reserve at Aber Ogwen.

Traeth Lafan was designated a Special Protection Area in 1992. The estuary lies within the Menai Strait proposed Marine Nature Reserve.

Conservation status



Human activities

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
		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

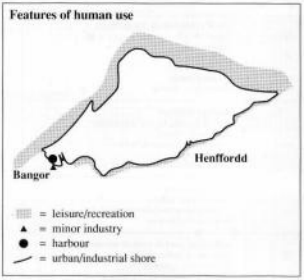
Present	Proposed	
		Tourism & recreation
	●	Infrastructure developments
		Marinas
●		Non-marina moorings
		Dinghy & boat parks
		Caravan parks & chalets
●		Leisure centres, complexes & piers
		Aquatic-based recreation
●		Power-boating & water-skiing
		Jet-skiing
●		Sailing
●		Sailboarding & wind-surfing
●		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

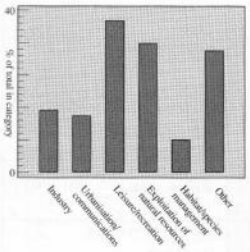
Most activities are of a recreational nature. Water-based pursuits such as sailing, sailboarding, snorkelling and canoeing are limited to the channel and Menai Strait rather than the sands. Walking and bird-watching occur over the beach. Exploitation of the natural resource is also a major feature and Traeth Lafan is a shellfish water designated under EC directive. Cockles, mussels, oysters and carpet shells are dredged, gathered and cultivated, and bait-digging also occurs. A wildfowling club shoots over part of the estuary, with areas shot on alternate days only.

In 1989 there were proposals for a marina, residential holiday and commercial development at Bangor, which would involve some land-claim. There was also a proposal for visitor facilities, bird hides and lagoons on the sea-front near Hennfordd.

By 1991 the proposal for the developments at Bangor had been dropped.



Categories of human use



Further reading

Ashell, J., Duckworth, S., Smart, S., & Holder, C. In prep. *Sand dune vegetation survey of Great Britain. Site report, Red Wharf Bay*. Peterborough, Joint Nature Conservation Committee.

Burd, F. 1986. *Saltmarsh survey of Great Britain. County report, East Gwynedd*. Unpublished, Nature Conservancy Council.

Cook, W. 1990. *Studies on the effects of hydraulic suction dredging on cockle and macroinvertebrate populations at Traeth Lafan*. First summary report, North Western and North Wales Sea Fisheries Committee, Lancaster.

Dare, P.J., & Schofield, P. *Ecological survey of the Lavan sands: ornithological survey*, 1969-74. Unpublished, Cambrian Ornithological Society.

Eagle, R.A., Hartley, J.P., Rees, E.I.S., & Walker, A.J.M. 1974. *Ecological survey of the Lavan Sands: invertebrate macrofauna*. (Contractor: Marine Science Laboratories, University College of North Wales, Menai Bridge). Peterborough, Nature Conservancy Council.

Hughes, R.N. 1970. An energy budget for a tidal flat population of the bivalve *Scrobicularia plana* (da Costa) on an intertidal mudflat in north Wales. *Journal of Animal Ecology, 39*: 357-381.

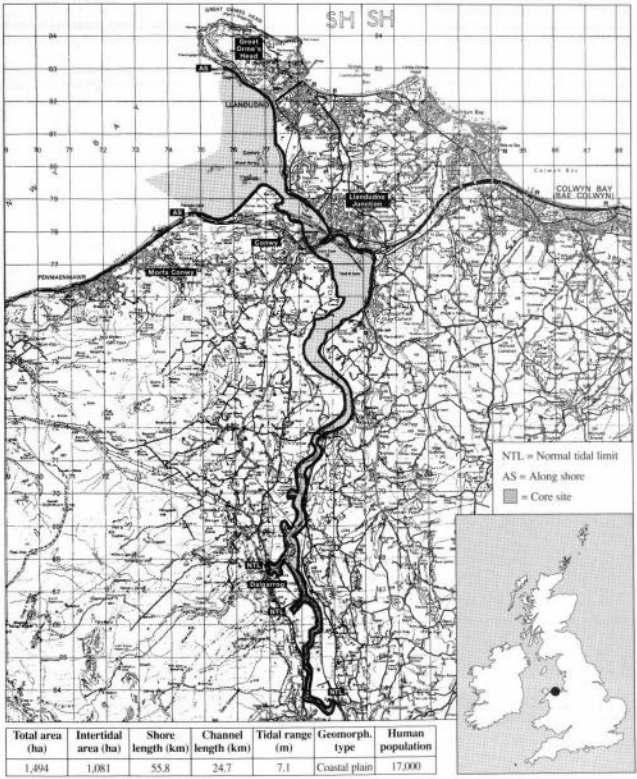
Hughes, R.N. 1970. Population dynamics of the bivalve *Scrobicularia plana* (da Costa) on an intertidal mudflat in north Wales. *Journal of Animal Ecology, 39*: 333-356.

Moore, J. 1990. Experimental studies of the impact of hydraulic cockle dredging on intertidal sediment flat communities. (Contractor: Field Studies Council Research Centre, Pembroke.) *Nature Conservancy Council, CSD Report*, No. 1,121.

32 Conwy Estuary

Centre grid: SH7976 District: Aberconwy
County: Gwynedd CCW region: North Wales

Review site location



Total area (ha)	Intertidal area (ha)	Shore length (km)	Channel length (km)	Tidal range (m)	Geomorph. type	Human population
1,494	1,081	55.8	24.7	7.1	Coastal plain	17,000

Description

The Conwy is a long and narrow estuary that is tidal for almost 25 km inland, and at low water the tide withdraws from all but its outermost parts. Water quality has been classified as grade A along most of its length, apart from a short section between Conwy and the estuary mouth which is grade B. The Conwy has a legacy of heavy metal pollution from old mine workings upstream of the estuary.

The aquatic estuarine communities of the Conwy are varied, with communities of exposed, current-swept and sheltered habitats. These include extensive growths of the eelgrass *Zostera* and mussel beds which are known to have existed since Roman times, although they have declined in size due to encroachment of mobile sand. Much of the estuary is intertidal flats, which are predominantly mud-and-sand along the main channel but become sandy toward the bay, where there are small areas of shingle.

Small areas of saltmarsh fringe most of the estuary and include a tidal reed-bed at Dalgarrog. In the upper reaches of the estuary the saltmarsh is largely mid-upper marsh vegetation, but further downstream substantial areas of low-mid marsh are backed by upper marsh communities. In the sheltered bays near the estuary mouth the saltmarsh is dominated by *Spartina*, which is increasing on the eastern shore and threatening to dominate the saltmarsh here. In addition the shore adjacent to Great Orme's Head is backed by cliffs, and there are small patches of sand dunes at Morfa Conwy and Llandudno.

The recent development of the Conwy tunnel has had a great impact on the estuary. The area of saltmarsh has declined, and construction work at Llandudno Junction has affected sedimentation in the lower estuary, and has lead to further loss of mudflats and saltmarsh.

Wildlife features

Coastal habitats

	Subtidal	Saltmarsh	Sandflats	Mudflats	Sand dunes	Rocky shores	Shingle	Lowland grassland	Lagoon	Other
	●	●	●	●	●		●	●		●
Area (ha)	413	105	976							

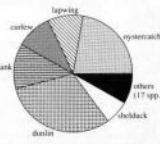
● = major habitat ● = minor habitat

Birds

Wintering birds 1986/87 – 1990/91 data

Total waterfowl: 4,230

BoEE	NWC	WSC
●	●	



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

Breeding birds: small numbers of herring gull, lesser black-backed gull and ringed plover are known to breed on 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 nationally rare plant Goldilocks *Aster linosyris* grows on the coastal grassland adjacent to the estuary. The invertebrate fauna recorded on Morfa Conwy includes the RDB 2 sandhill rustic moth *Luperina nickerlii gueneei* and the RDB 3 belted beauty moth *Lycia zonaria*.

The estuary is a known major nursery for sea bass *Dicentrarchus labrax*, and the upper limits of the tidal channel are a spawning ground for smelt *Osmerus eperlanus*.

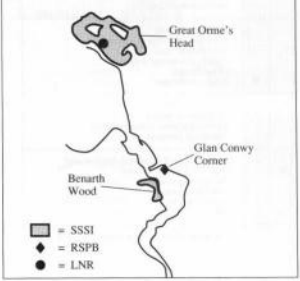
Conservation status

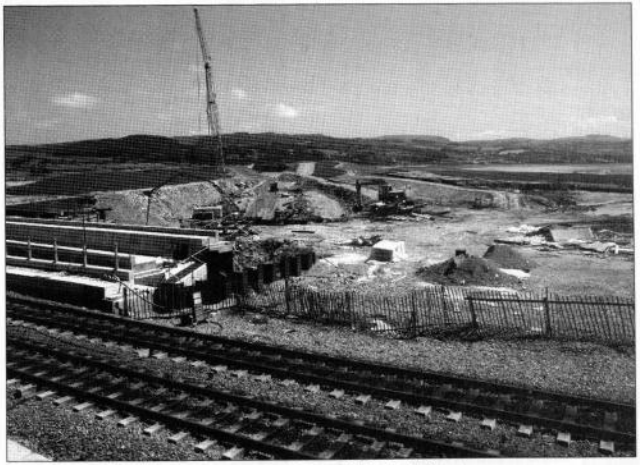
● = designated ● = proposed

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

There are no Sites of Special Scientific Interest within the review site, but two are closely associated with the estuary. Benarth Wood (22 ha) is a biological SSSI on the western shore, and on the headland Great Orme's Head (321 ha) is an SSSI for its biological and geological interest. Great Orme's Head is also a Local Nature Reserve, Country Park, Geological Conservation Review site and Nature Conservation Review Site. Dolgarrog Reedbeds and the upper reaches of the river are proposed SSSIs. In addition the RSPB are developing a reserve at Glan Conwy corner.

Conservation status





Land-claim and the construction of the road tunnel in 1989. (Peter Wakely, English Nature)

Human activities

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
		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
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		Dredging
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		Cultivation of living resource
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		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

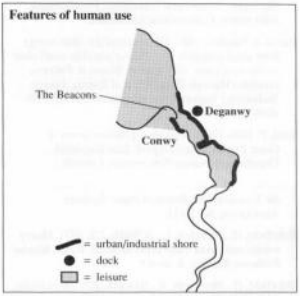
Features of human use

Most activities are of a recreational nature, and are confined to the lower reaches of the estuary. Sailing and beach recreation are centred on the bay, and canoeing and water-skiing are limited to the main river channel. Exploitation of the natural resources includes fishing, cockle- and mussel-gathering, and mussel-raking. There is also a wildfowling club which shoots over 124 ha of the estuary.

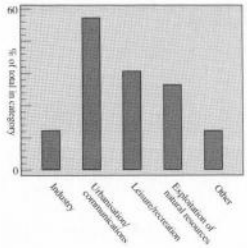
The major industrial activities on the estuary are part of the construction of the road tunnel at Conwy, which involves capital dredging, sediment extraction and geological studies/drilling. The construction of the crossing will eventually cause 100 ha of land-claim, and it is thought to have had a catastrophic effect on the numbers of waders on the estuary, particularly dunlin and lapwing. A single dock at Deganwy is used mainly for recreation and fishing.

In 1989 there was a proposal for the building of a tidal power barrage from The Beacons to Deganwy, which would affect most of the estuary. A marina had also been proposed on the site of the reclaimed casting basin for the tunnel (18 ha), with a nature reserve to be managed by the RSPB at Glan Conwy Corner.

By 1991 planning permission for the development of the marina had been granted.

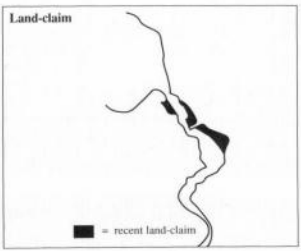


Categories of human use



Land-claim

Historically, large areas of the upper reaches of the estuary have been lost to land-claim, by drainage and embanking for agriculture. Additionally, with the recent construction of the Conwy crossing, approximately 100 ha of intertidal flats and saltmarsh have been lost.



Further reading

Ashell, J., Duckworth, S., Smart, S., & Holder, C. In prep. *Sand dune vegetation survey of Great Britain. Site report, Conwy and Llandudno.* Peterborough, Joint Nature Conservation Committee.

Binnie & Partners. 1987. *UK potential for tidal energy from small estuaries. A survey of possible small sites on the west coast.* (Contractor: Binnie & Partners, London.) Harwell, Department of Energy, Energy Technology Support Unit. (Report no. ESTU-STP-4048-P1.)

Burd, F. 1986. *The saltmarsh vegetation survey of Great Britain. County report, East Gwynedd.* Unpublished, Nature Conservancy Council.

Cook, W. 1988. The Conwy mussel fishery. *Bulletin of the Estuarine and Brackish Water Sciences Association, 50*: 20-21.

Elderfield, H., Thornton, L., & Webb, J.S. 1971. Heavy metals and oyster cultivation in North Wales. *Marine Pollution Bulletin, 2*: 44-47.

Elderfield, H., Hepworth, A., Edwards, P.N., & Holliday, P.M. 1979. Zinc in the Conwy river and estuary. *Estuarine and Marine Coastal Science, 9*: 403-422.

Fitch, J.R. 1988. A55 North Wales coast road Conwy crossing. *Bulletin of the Estuarine and Brackish Water Sciences Association, 50*: 17-18.

Hewett, D.G. 1988. The history and development of *Spartina* marsh. *Bulletin of the Estuarine and Brackish Water Sciences Association, 50*: 24.

Howells, G. 1988. The Conwy crossing: conservation strategies. *Bulletin of the Estuarine and Brackish Water Sciences Association, 50*: 24-28.

Scharer, A.J. 1988. The Conwy and its catchment. *Bulletin of the Estuarine and Brackish Water Sciences Association, 50*: 16-17.

Simpson, J.H. 1988. Convergent fronts in the Conwy estuary. *Bulletin of the Estuarine and Brackish Water Sciences Association, 50*: 18-19.

Thorburn, I.W., & Rees, E.I.S. 1976. An ecological survey of the Conway estuary. (Contractor: Marine Science Laboratories, University College of North Wales, Menai Bridge.) *Nature Conservancy Council, CSD report*, No. 233.

Utting, S.D. 1988. Oyster research and the Conwy estuary. *Bulletin of the Estuarine and Brackish Water Sciences Association, 50*: 21-23.

West, J.R., & Sangodoyin, A.Y.A. 1988. Sediment transport in the upper Conwy estuary. *Bulletin of the Estuarine and Brackish Water Sciences Association, 50*: 19.