

Inlets in the Bristol Channel and approaches

Area summaries

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1998

Series editor: David Connor

Location

<i>Position (centre)</i>	ST 325 865	51°33'N 03°59'W
<i>Administrative area</i>	Newport	
<i>Conservation agency/area</i>	Countryside Council for Wales	South

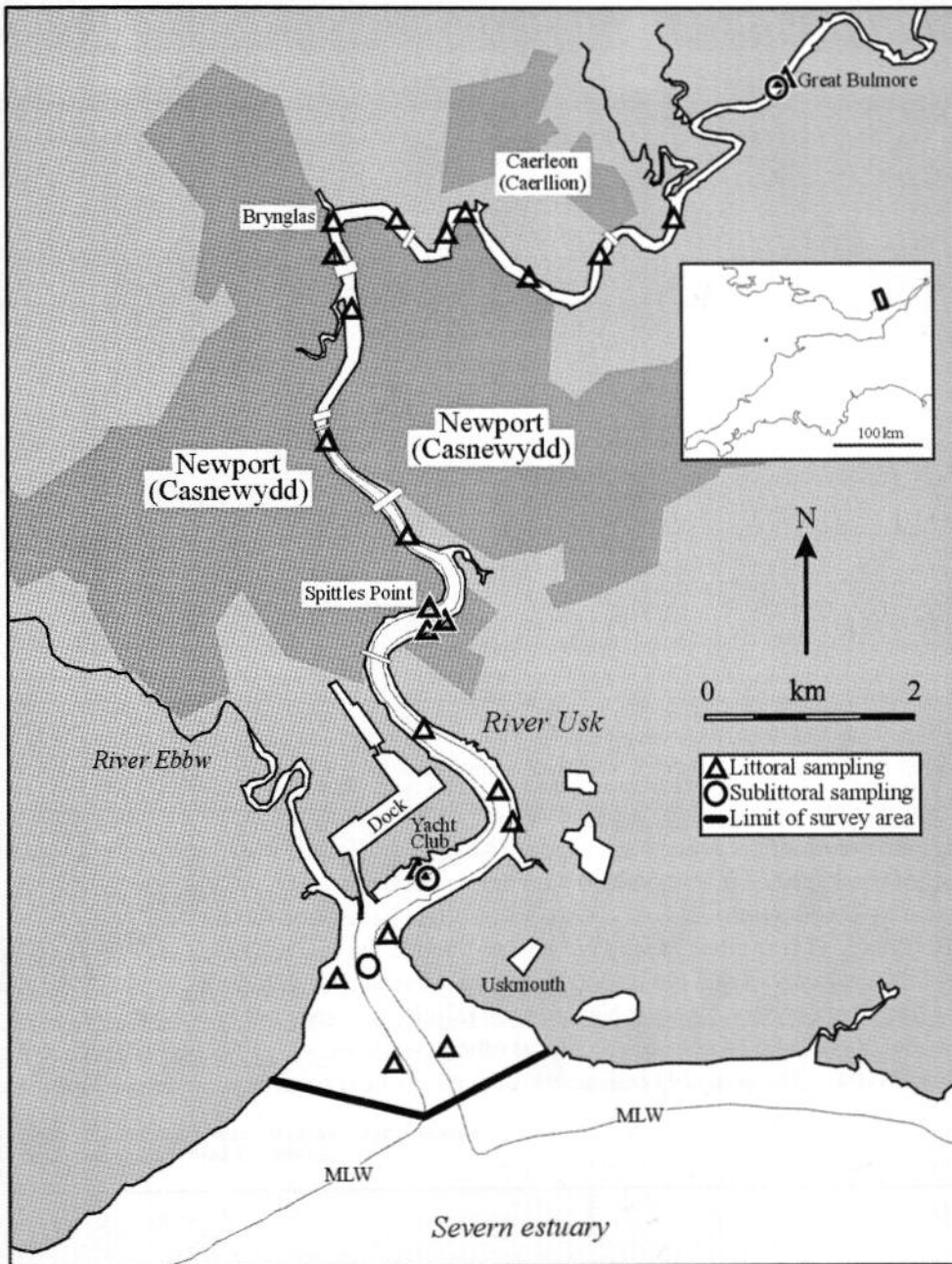


Figure 9.1 Main features of the area and sites surveyed.

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Marine biological surveys			
	Survey method	Date of survey	Source
<i>Littoral</i>	Infaunal sampling (Eckman grab)	July 1984	Davies & Wade (1985)
	Infaunal sampling (Hunter grab)	Nov. 1977-June 1978	Wharfe <i>et al.</i> (1979)
<i>Sublittoral</i>	Infaunal sampling (Van Veen grab)	August 1987	Morrisey & Sait (1988)

Introduction

The River Usk is tidal for almost 30 km while its tributary the River Ebbw is tidal for only 3 km. The estuary is dominated by fine, muddy sediments and its waters are characterised by high turbidity and low salinity. Large areas of intertidal mudflats are present at the mouth of the Usk along with some saltmarsh and the mudflats are important feeding grounds for waders. The river catchment is heavily populated and there is a good deal of industry; the effluent discharged into the estuary has resulted in a reduction in water quality.

Physical features	
<i>Physiographic type</i>	Coastal plain estuary
<i>Length of coast</i>	60 km
<i>Area of inlet</i>	5 km ²
<i>Length of inlet</i>	30 km
<i>Bathymetry</i>	Lower estuary narrow channel 0.5-1.5 m deep, bounded by intertidal mudflats
<i>Wave exposure range</i>	Very sheltered
<i>Tidal stream range</i>	Not known
<i>Tidal range</i>	12 m MHWS (Newport)
<i>Salinity range</i>	Reduced to upper estuarine

Marine biology

The whole estuary is dominated by soft, muddy sediments which are influenced by low salinities and strong tidal currents. The inlet is flanked by steep sides and is reduced to a very narrow channel on low spring tides. Subtidal biotopes are therefore confined to the centre of the channel and have not been represented in any grab sampling surveys. Littoral hard substrata (sea walls) also have not been described.

The muds at the mouth of the estuary are exposed to higher salinities which support a relatively greater diversity of infaunal species in comparison with the rest of the estuary. Within the estuary the muds are dominated by the ragworm *Hediste diversicolor*, oligochaetes and the Baltic tellin *Macoma balthica* (HedMac). A few other species are able to tolerate the low salinities, such as the polychaete worm *Streblospio shrubsolii* and the isopod *Cyathura carinata*. Grab samples typically contained a total of just five or six species. Above Newport the salinity becomes too low for Baltic tellin *M. balthica*, the polychaete *Streblospio* and most other species except oligochaetes and low numbers of ragworms *Hediste*. These muddy sediments are typical of the riverine oligochaete biotope (HedOI).

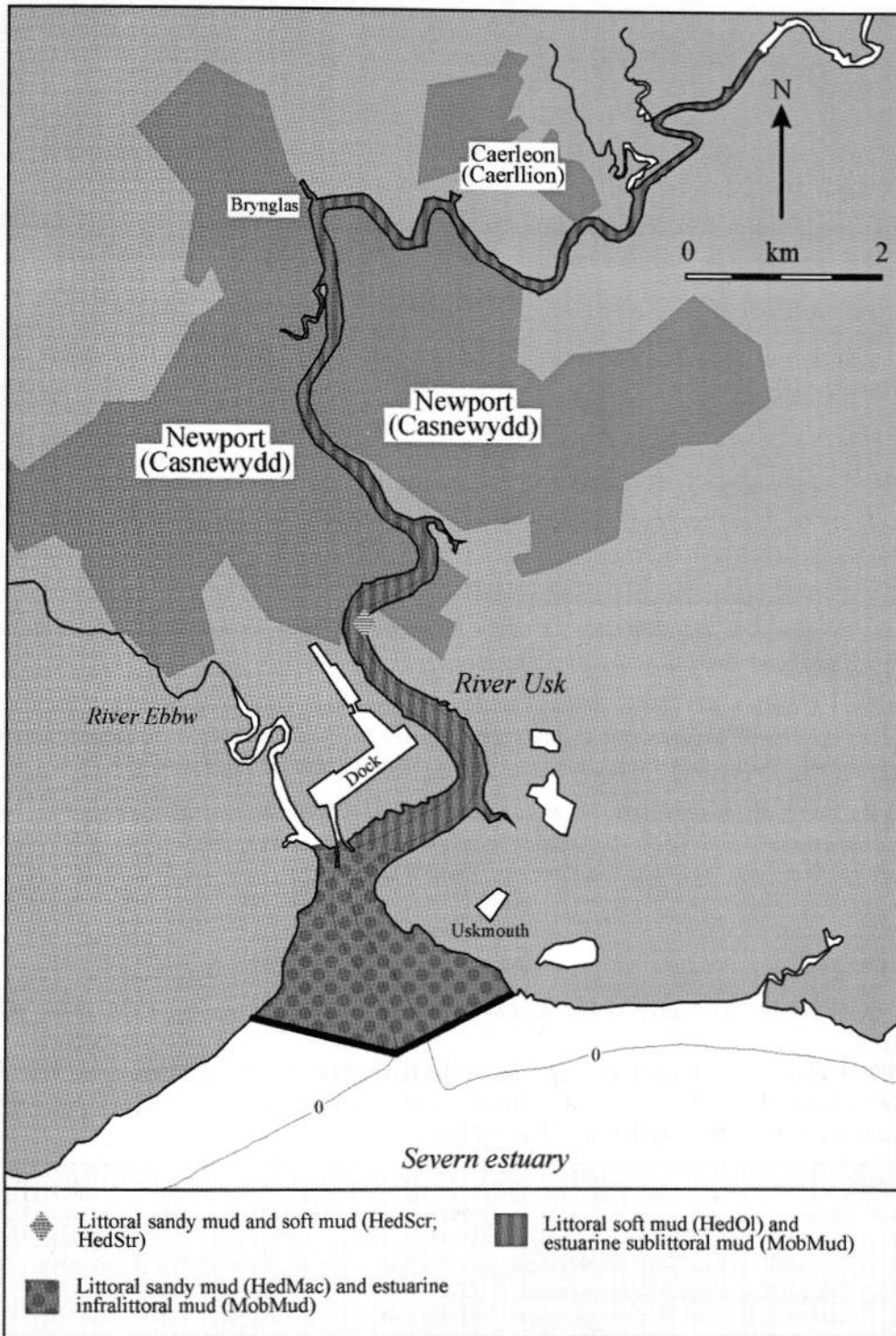


Figure 9.2 Indicative distribution of the main biotopes in the area (based on data from survey sites shown in Figure 9.1, cited literature and additional field observations).

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Nature conservation

Conservation sites			
Site name	Designation	Grid ref.	Main features
River Usk/Afon Wysg	possible SAC	SN 834 285- ST 317 837	Allis shad <i>Alosa alosa</i> , twaite shad <i>Alosa fallax</i> , river lamprey <i>Lampetra fluviatilis</i> , bullhead <i>Cottus gobio</i> , brook lamprey <i>Lampetra planeri</i>
River Usk (Lower Usk; Upper Usk)	SSSI	SN 239 239- ST 317 837	River habitats and flora, invertebrates, fish, birds, otters

Human influences

There are a number of docks and associated shipping and dredging. Industrial effluents are discharged into the estuary.

References and further reading

- Davies, G.L., & Wade, K.R. 1985. *Studies of the intertidal benthic fauna of the Usk estuary in relation to BSC ORB Works No. 1 outfall*. Unpublished, Welsh Water Authority. (South Eastern District Laboratory, Biology Department Report, No. SE/14/85/18.)
- Mettam, C., Conneely, M.A., & White, S.J. 1994. Benthic macrofauna and sediments in the Severn estuary. *Biological Journal of the Linnean Society*, 51: 71-81.
- Morrisey, D.J., & Sait, S.M. 1988. *Ecology of the sub-estuaries of the River Severn*. (Contractor: University of Bristol, Department of Zoology, Bristol.) Unpublished report to Department of Energy, Energy Technology Support Unit. (ETSU Report, No. ETSU-TID-4057.)
- Wharfe, J.R., Flynn, E., Richardson, A., & Li Shing Tat, B. 1979. *Ecological studies of the benthic invertebrate macrofauna of the Usk and Wye estuaries, south Wales*. Unpublished, Welsh Water Authority, Directorate of Scientific Services, Marine Laboratory.

Sites surveyed

- Survey 486. Welsh Water Authority Usk and Wye estuaries sublittoral survey, 1977-1978; Wharfe *et al.* (1979).
- Survey 489. University of Bristol sub-estuaries of the River Severn survey; Morrisey & Sait (1988).
- Survey 493. Welsh Water Authority: An industrial waste discharge pipe in the River Usk, Severn estuary littoral survey, 1984; Davies and Wade (1985).

Littoral sites					
Survey	Site	Place	Grid reference	Latitude/longitude	Biotopes present
486	1	Usk site A, Usk and Wye sub-estuaries.	ST 320 810	51°31.4'N 02°58.8'W	HedMac; HedOl
486	2	Usk site B, Usk and Wye sub-estuaries.	ST 320 810	51°31.4'N 02°58.8'W	HedMac
486	3	Usk site C, Usk and Wye sub-estuaries.	ST 310 830	51°32.4'N 02°59.7'W	HedMac
486	4	Usk site 4, Usk and Wye sub-estuaries.	ST 320 840	51°33.0'N 02°58.8'W	HedMac
486	5	Usk site 5, Usk and Wye sub-estuaries.	ST 330 840	51°33.0'N 02°57.9'W	HedOl
486	6	Usk site 6, Usk and Wye sub-estuaries.	ST 320 850	51°33.5'N 02°58.8'W	HedOl
486	7	Usk site 7, Usk and Wye sub-estuaries.	ST 320 860	51°34.1'N 02°58.8'W	HedOl
486	8	Usk site 8, Usk and Wye sub-estuaries.	ST 320 870	51°34.6'N 02°58.8'W	HedMac
486	9	Usk site 9, Usk and Wye sub-estuaries.	ST 310 880	51°35.1'N 02°59.7'W	HedOl
486	10	Usk site 10, Usk and Wye sub-estuaries.	ST 310 890	51°35.7'N 02°59.7'W	HedMac
486	11	Usk site 11, Usk and Wye sub-estuaries.	ST 310 900	51°36.2'N 02°59.7'W	HedOl
486	12	Usk site 12, Usk and Wye sub-estuaries.	ST 320 900	51°36.2'N 02°58.9'W	HedOl
486	13	Usk site 13, Usk and Wye sub-estuaries.	ST 320 900	51°36.2'N 02°58.9'W	HedOl
486	14	Usk site 14, Usk and Wye sub-estuaries.	ST 330 890	51°35.7'N 02°58.0'W	HedOl
486	15	Usk site 15, Usk and Wye sub-estuaries.	ST 340 900	51°36.2'N 02°57.1'W	HedOl

Littoral sites - continued

<i>Survey</i>	<i>Site</i>	<i>Place</i>	<i>Grid reference</i>	<i>Latitude/longitude</i>	<i>Biotopes present</i>
486	16	Usk site 16, Usk and Wye sub-estuaries.	ST 340 900	51°36.2'N 02°57.1'W	HedOI
489	13	Uskmouth, sub-estuaries of the River Severn.	ST 313 833	51°32.6'N 02°59.4'W	HedMac
489	14	Yacht Club, sub-estuaries of the River Severn.	ST 322 842	51°33.1'N 02°58.6'W	HedOI
489	15	Spittles Point, sub-estuaries of the River Severn.	ST 324 866	51°34.4'N 02°58.5'W	HedOI
489	16	Brynglas, sub-estuaries of the River Severn.	ST 314 902	51°36.3'N 02°59.4'W	HedOI
489	17	Great Bulmore, sub-estuaries of the River Severn.	ST 357 916	51°37.1'N 02°55.7'W	HedOI
493	1	Usk Survey, Usk estuary.	ST 320 860	51°34.1'N 02°58.8'W	HedMac; HedScr; HedStr

Sublittoral sites

<i>Survey</i>	<i>Site</i>	<i>Place</i>	<i>Grid reference</i>	<i>Latitude/longitude</i>	<i>Biotopes present</i>
489	13	Uskmouth, sub-estuaries of the River Severn.	ST 313 833	51°32.6'N 02°59.4'W	MobMud
489	14	Yacht Club, sub-estuaries of the River Severn.	ST 322 842	51°33.1'N 02°58.6'W	MobMud
489	17	Great Bulmore, sub-estuaries of the River Severn.	ST 357 916	51°37.1'N 02°55.7'W	MobMud

Compiled by:

Mike Little and Jon Moore

10

River Neath

Location

<i>Position (centre)</i>	SS 723 930	51°38'N 03°50'W
<i>Administrative area</i>	Neath	Port Talbot
<i>Conservation agency/area</i>	Countryside Council for Wales	South

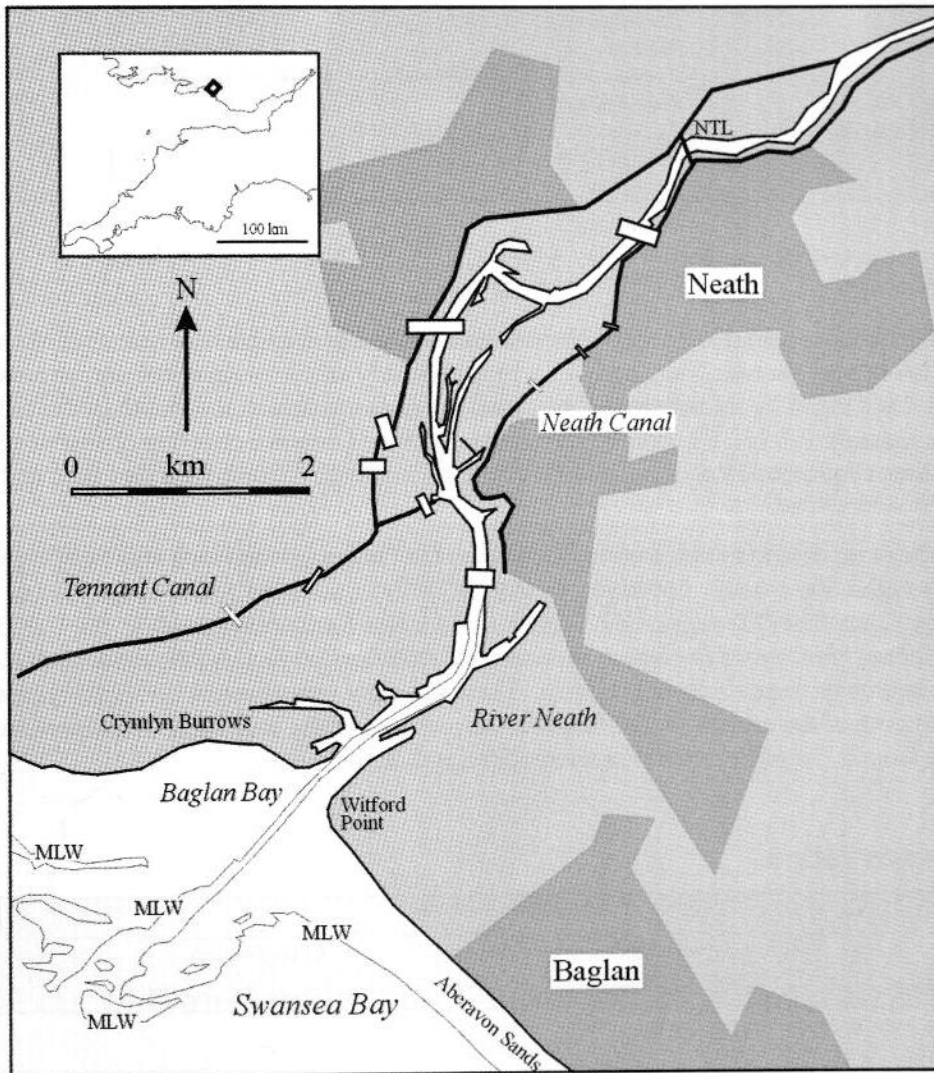


Figure 10.1 Main features of the area and sites surveyed.

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Marine biological surveys

	<i>Survey method</i>	<i>Date of survey</i>	<i>Source</i>
<i>Littoral</i>	Sampling (methods not described)	1977	Nature Conservancy Council (1977)

Introduction

This narrow inlet, at the northern end of Swansea Bay, has been greatly affected by man including the construction of a retaining wall to help safeguard the main channel. At low tide the River Neath is a narrow, meandering channel flanked on both sides by intertidal mudflats which become more sandy towards the mouth of the inlet.

Physical features

<i>Physiographic type</i>	Ria
<i>Length of coast</i>	26.9 km
<i>Area of inlet</i>	500 ha (approx.)
<i>Length of inlet</i>	10.6 km
<i>Bathymetry</i>	Main entrance channel dries at low water, 0.5-1.8 m ACD
<i>Wave exposure range</i>	Very sheltered
<i>Tidal stream range</i>	Not known
<i>Tidal range</i>	8.6 m MHWS
<i>Salinity range</i>	Not known

Marine biology

The River Neath lacks shingle or rocky substrata and is dominated by muds within the inlet and by sands near the estuary mouth. The intertidal area is relatively small owing to the narrowness of the estuary and it is fringed by saltmarsh; the saltmarsh is most extensive at the mouth of the estuary and totals approximately 160 ha. On man-made structures there is a sparse covering of fucoid algae including channelled wrack *Pelvetia canaliculata*, knotted wrack *Ascophyllum nodosum* and bladder wrack *Fucus vesiculosus*.

There have been no detailed marine biological surveys in the estuary and data are insufficient to map the biotopes within the estuary. However, the empty shells of molluscs found by the Nature Conservancy Council (1977) suggest the presence of cockles *Cerastoderma edule*, the Baltic tellin *Macoma balthica*, gastropods *Buccinum undatum* and *Polinices catena* and the razor shell *Ensis ensis*, but the true source of these shells is uncertain. There are more extensive data from Aberavon Sands, outside the mouth of the estuary, which indicate the presence of the burrowing amphipod *Bathyporeia* spp. and the isopod *Eurydice pulchra* in the mobile sands at the mouth.

Nature conservation

Conservation sites

<i>Site name</i>	<i>Designation</i>	<i>Gird ref.</i>	<i>Main features</i>
Crymlyn Burrows	SSSI	SS 712 927	Coastal habitats, flora

Human influences

The area surrounding the River Neath is dominated by road bridges, a large oil refinery and an oil tank storage complex. Much of the land around the inlet is devoted to landfill with domestic refuse and there are occasional oil spills. There has been considerable land-claim and construction for industrial development including various docks and unloading facilities. There is some discharge of industrial and domestic effluents into the river. There have been proposals for impounding the inlet.

There is little recreational activity on the River Neath apart from a few moorings and a sailing club marina near the upper tidal limit.

References and further reading

Nature Conservancy Council. 1977. *A nature conservation study of the Neath estuary complex (West Glamorgan)*. Unpublished, Nature Conservancy Council. (South Wales Region Internal Report, No. NC 140 H.)

Sites surveyed

None known.

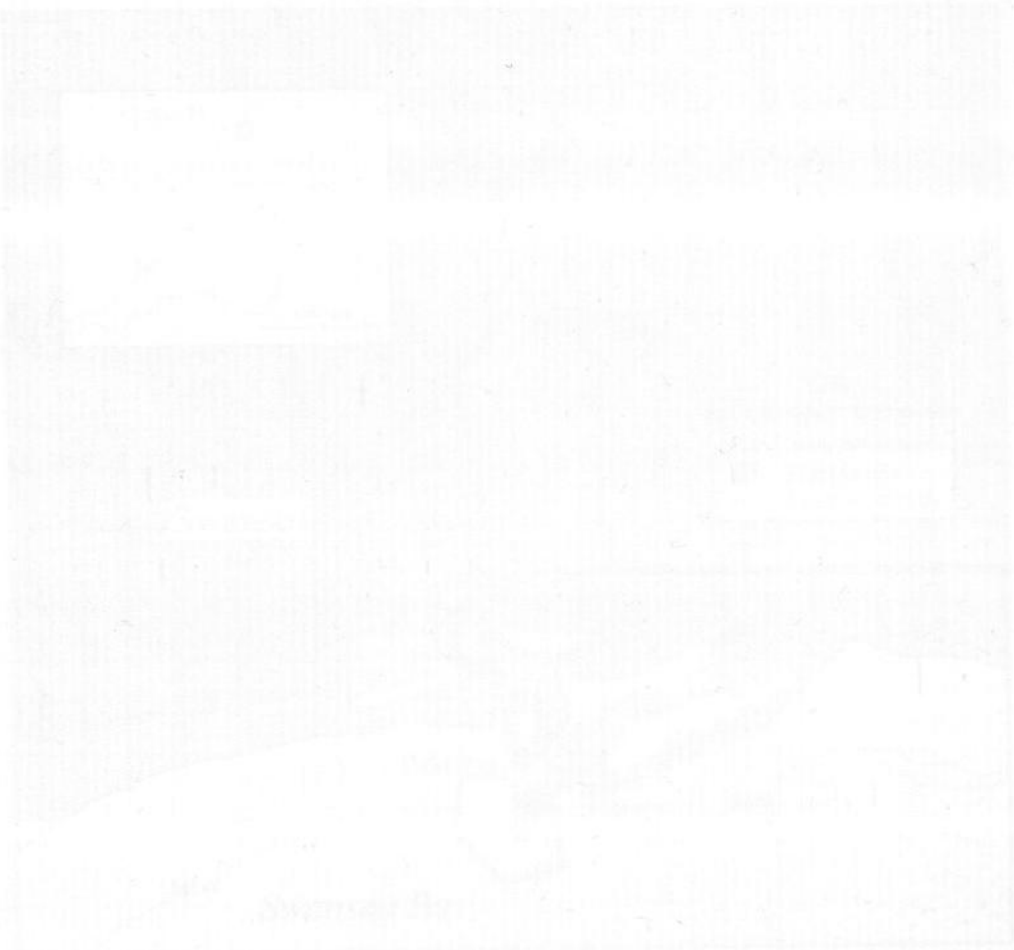


Figure 10.1 Map of the Neath estuary complex showing the location of the sites surveyed in this study.

Location

<i>Position (centre)</i>	SS 663 940	51°37'N 03°56'W
<i>Administrative area</i>	Swansea	Swansea
<i>Conservation agency/area</i>	Countryside Council for Wales	South

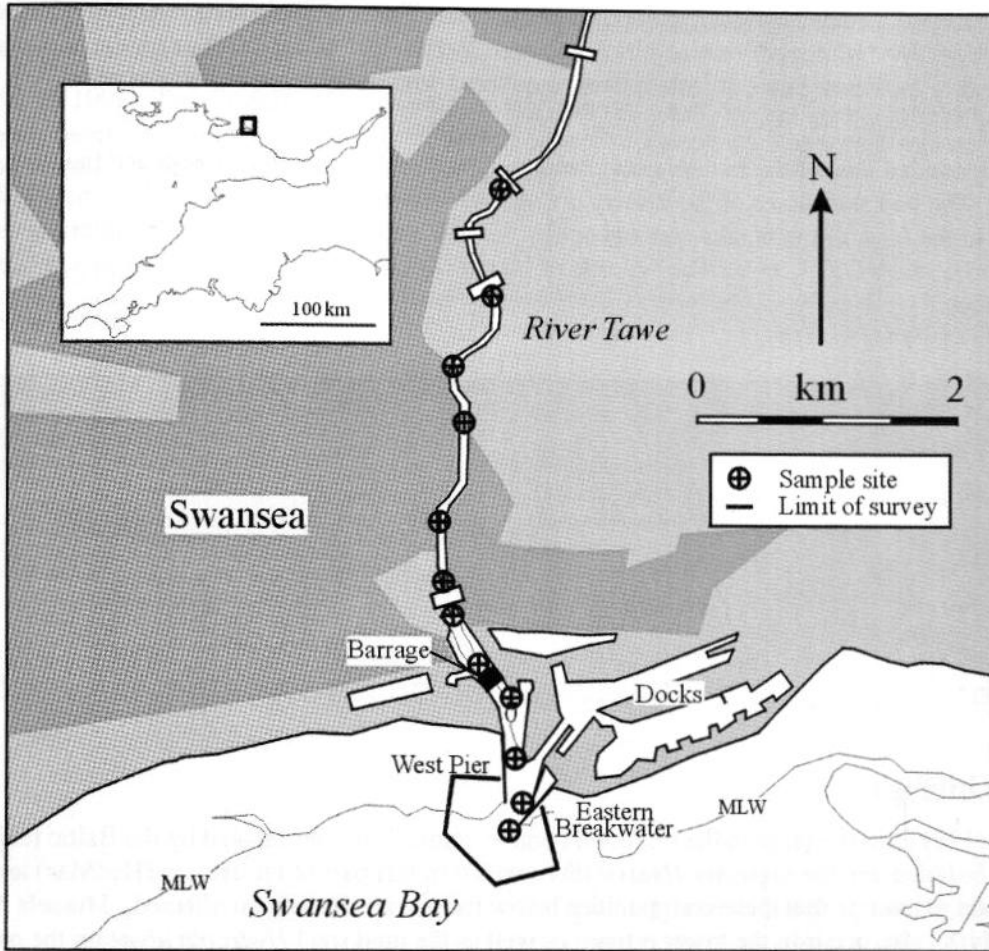


Figure 11.1 Main features of the area (Note: sites were surveyed prior to construction of the tidal barrage).

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Marine biological surveys

<i>Survey method</i>	<i>Date of survey</i>	<i>Source</i>
<i>Sublittoral Dredge and grab sampling</i>	January 1990	Dyrynda (1991)

Introduction

The lower estuary of the River Tawe has been drastically modified with the construction of an amenity barrage, completed in July 1992, a short distance upstream of the mouth. The impounded area now experiences a much reduced tidal regime and a greatly reduced salinity; it no longer receives seawater on most neap tides. The partial exclusion design of the barrage allows seawater to spill over the top of the weir at high spring tides, thus maintaining some saline input. This is in contrast to the barrage at Cardiff Bay which, when completed in 1998, will exclude the tide completely and will create a freshwater impoundment.

The remaining area of the Tawe estuary, downstream of the barrage, has been greatly affected by industrial and urban development, particularly the construction of docks, marinas and breakwaters. The very high level of disturbance within this system and the loss of the small intertidal area that once existed makes the River Tawe of little interest compared with many other Welsh estuaries (Countryside Council for Wales 1993).

The unimpounded area of the estuary now consists of the breakwater at the mouth and the dock complex. The bed and shores of the estuary are of mud, though there is extensive artificial hard substrata in the form of the breakwater and docks. Considerable quantities of refuse litter the estuary, derived from storm drains, as well as deposits of leaves which may restrict the development of benthic communities.

Physical features	
<i>Physiographic type</i>	Artificial embayment with highly modified estuary upstream of barrage (previously a coastal plain estuary)
<i>Length of coast</i>	23 km (pre-barrage)
<i>Area of inlet</i>	785 ha (pre-barrage)
<i>Length of inlet</i>	6.5 km (pre-barrage)
<i>Bathymetry</i>	4.6 m maximum depth at the mouth, with the main entrance channel dredged to 3 m
<i>Wave exposure range</i>	Very sheltered
<i>Tidal stream range</i>	Not known
<i>Tidal range</i>	8.6 m MHWS
<i>Salinity range</i>	Full salinity; reduced behind barrage

Marine biology

Dyrynda (1991), before impoundment, found benthic communities dominated by the Baltic tellin *Macoma balthica* and the ragworm *Hediste diversicolor* in this part of the estuary (HedMac) and there is no reason to assume that these communities below the barrage have been affected. Mussels *Mytilus edulis* (MytX) also occur in the lower estuary as well as the mud snail *Hydrobia ulvae* on the narrow intertidal mudbanks. Artificial hard substrata support typical algal communities with spiral wrack *Fucus spiralis*, bladder wrack *Fucus vesiculosus*, the red alga *Porphyra umbilicalis*, and the green alga *Ulva lactuca* and *Enteromorpha intestinalis* (Fspi; FvesX).

Upstream of the barrage there are no details on the nature of the estuary bed or its biota, now that the barrage has been constructed.

Nature conservation

There are no conservation sites covering the estuary.

Human influences

Construction of the barrage as part of a new marina development has effectively replaced the original estuary with a low salinity impoundment. The development of the disused dock in Swansea and the construction of a marina associated with the barrage has provided a large number of moorings for pleasure craft. Little other recreational activity takes place within the estuary, as the focus of such activity is Swansea Bay.

References and further reading

- Buck, A.L. 1993. *An inventory of UK estuaries. Volume 2. South-west Britain*. Peterborough, Joint Nature Conservation Committee.
- Dyrynda, P. 1991. *Tawe estuary barrage monitoring: assessment of the existing environment prior to impoundment*. (Contractor: University of Wales, School of Biological Sciences, Swansea.) Unpublished report to World Wide Fund for Nature.

Sites surveyed

No relevant sites.

12

Burry Inlet (River Loughor)

Location

Position (centre)	SS 480 970	
Administrative area	Carmarthenshire	Swansea
Conservation agency/area	Countryside Council for Wales	South; West

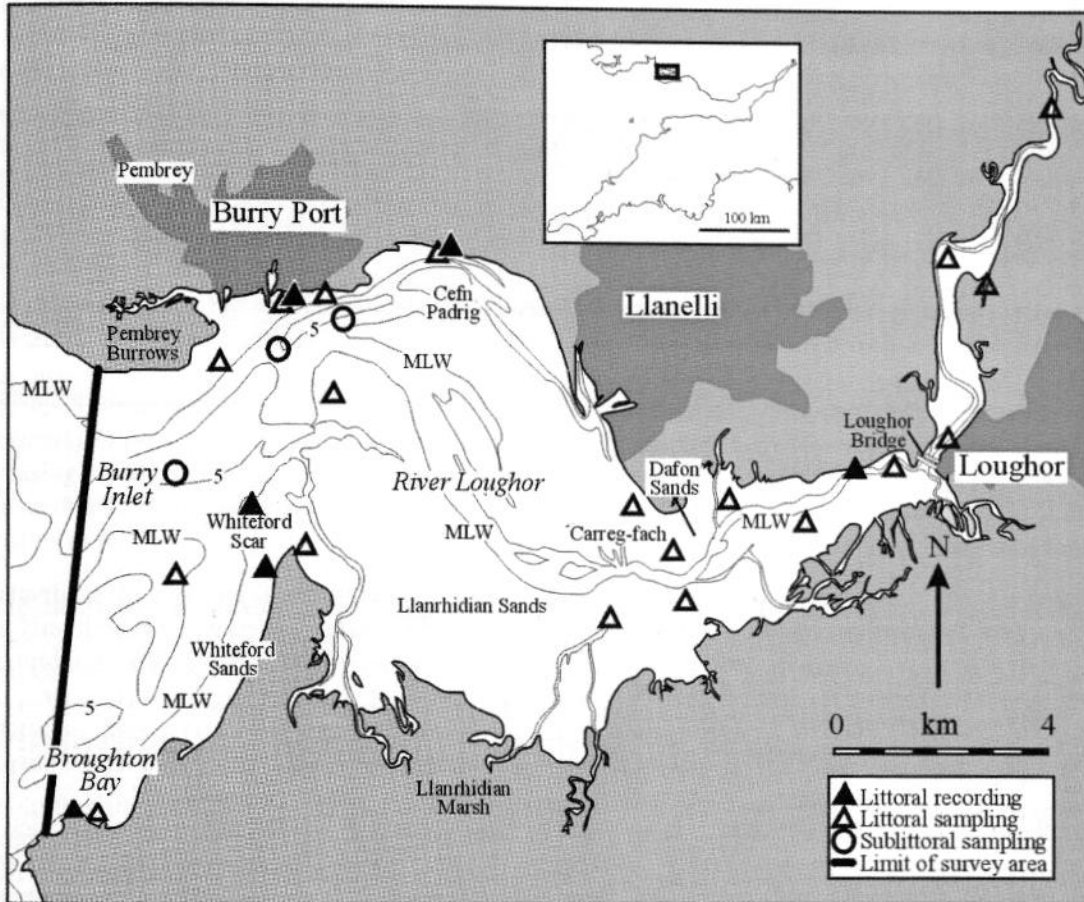


Figure 12.1 Main features of the area and sites surveyed.

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Marine biological surveys

	Survey method	Date of survey	Source
Littoral	Recording and infaunal sampling (cores)	April 1988	Moore (1989)
Sublittoral	Infaunal sampling (pipe dredge)	April 1988	Moore (1989)

Introduction

The Burry Inlet, which forms the lower part of the River Loughor estuary, lies on the south coast of Wales and opens into Carmarthen Bay. It is a very shallow and sheltered estuary, dominated by large

expanses of intertidal sediment flats and fringing saltmarsh. Below mid-tide level, the sediments are highly mobile; above mid-tide level they are more stable. The upper shore and upper estuary are often very muddy. Natural hard substrata are rare, being restricted to occasional boulder and mussel scars, most extensively at Whiteford Point. In contrast to the southern shore, the northern side of the estuary is considerably affected by man and has extensive stretches of artificial hard substratum (sea defences, harbour and dock walls). Extensive sand dune systems are present each side of the estuary mouth.

The southern shore is rural in nature and generally undeveloped while the northern side is densely populated and industrialised. Llanelli is the largest town in Carmarthenshire with a population of 24,000. Large volumes of industrial waste water and sewage are discharged to the estuary from the Llanelli area in particular. The water of the Burry Inlet is classified as grade A (highest quality).

The estuary is a major nursery area for bass *Dicentrarchus labrax*.

Physical features

<i>Physiographic type</i>	Coastal plain estuary
<i>Length of coast</i>	84.7 km
<i>Area of inlet</i>	9,524 ha
<i>Length of inlet</i>	30.2 km
<i>Bathymetry</i>	Very shallow; maximum depth 10 m in channel
<i>Wave exposure range</i>	Exposed to extremely sheltered
<i>Tidal stream range</i>	Max. 4.0 knots
<i>Tidal range</i>	7.1 m
<i>Salinity range</i>	Fully marine to upper estuarine

Marine biology

Littoral biotopes

The lower estuary and entrance to the inlet is an extremely high energy area dominated by sandbanks of mobile fine and medium sands. The fauna associated with these sands is very sparse, with only a few species able to withstand the sediment mobility. The polychaete *Nephtys cirrosa*, the amphipod *Bathyporeia pelagica* and the isopod *Eurydice pulchra* are the most abundant species with other species (polychaetes including *Scoloplos armiger* and the thin tellin *Angulus tenuis*) present in much smaller numbers (AEur; AP.P). The species richness and biomass increases with sediment stability.

The southern shore of the lower estuary is bounded by Broughton Bay and Whiteford Sands, which are beaches of wave-exposed fine sand (AP.P; Lan) backed by sand dunes. The infauna consists of a wide variety of small polychaetes and crustaceans. Dominant species include the thin tellin *Angulus tenuis*, the polychaetes *Nephtys cirrosa*, *Owenia fusiformis* and sand mason worm *Lanice conchilega* and the amphipods *Bathyporeia pelagica*, *B. pilosa* and *Urothoe poseidonis*. Lugworms *Arenicola marina* and the amphipod *Haustorius arenarius* are also present.

At the southern end of Broughton Bay is an area of steep, exposed limestone (Foxhole Point) which is the only intertidal bedrock within the estuary. The splash zone is dominated by lichens (YG; Ver.Ver) with frequent rough periwinkles *Littorina saxatilis*. Below this zone the upper shore is dominated by the barnacle *Chthamalus montagui* and the rough periwinkle *Littorina saxatilis* var. *rudis* (BPat.Cht). The mid-shore area is dominated by the mussel *Mytilus edulis*, the barnacle *Semibalanus balanoides* and the limpet *Patella vulgata* (MytB). Large rockpools contain algae including *Polysiphonia fucoides*, encrusting coralline algae and kelp *Laminaria digitata* (Cor). The dogwhelk *Nucella lapillus* is abundant on overhangs and the beadlet anemone *Actinia equina* is frequent. A variety of other mobile and encrusting species are also present. The lower shore is subject to sand scour with the result that much of the bedrock is bare or covered with ectocarpoid algae (EntPor). Algae *Porphyra* spp. and *Enteromorpha* sp., mussels *Mytilus edulis* and the barnacle *Balanus crenatus* are also found in this lower shore zone, mostly on the tops of rocks.

Whiteford Scar lies at the northern end of Whiteford Sands and is an extensive area of intertidal boulders and cobbles, with finer sediments infilling many areas. The fauna is dominated by an extensive bed of mussels *Mytilus edulis* encrusted with barnacles *Semibalanus balanoides* and *Elminius modestus* (MytX). Sand mason worms *Lanice conchilega* are found between the mussels and, apart from the green algae *Enteromorpha* spp., little else is present. The lower shore and shallow sublittoral fringe of the Scar are richer areas with large areas of shallow pools containing the hydroid *Obelia longissima* and the barnacle *Balanus crenatus* (H). Several species of brown and green algae are also present. Boulders and cobbles to the west of the Scar are colonised by rich communities of animals and algae. Encrusting sponges, hydroids, ascidians, barnacles and bryozoans are abundant with various crustaceans, molluscs and starfish between and under boulders. Thirty-nine species of algae have been recorded which is considered to be very rich for this biotope (Fser.Fser.Bo). Lower down the shore, at the south end of the scar, cobbles support serrated wrack *Fucus serratus*, encrusting sponges and red algae (FserX.T).

In the lower and middle estuary, the wide expanses of Llanrhidian Sands, Cefn Padrig and Dafon Sands form the most extensive habitat of the inlet. The sediments are moderately stable fine and very fine sands (MacAre; PCer). This habitat has made the Burry Inlet famous for its cockle fishery and the cockle *Cerastoderma edule* is one of the most characteristic species (PCer). They prefer higher, more stable areas and there are dense beds above mid-tide level throughout the estuary. More ubiquitous is the Baltic tellin *Macoma baltica* which is found in all sediments except the most mobile sands. Other characteristic species found throughout this habitat include the amphipod *Bathyporeia pilosa* and the polychaetes *Arenicola marina*, *Pygospio elegans*, *Capitella capitata* and *Nephtys hombergii*. In the more stable areas with a higher mud content, the sand gaper *Mya arenaria*, peppery furrow shell *Scrobicularia plana*, the mud snail *Hydrobia ulvae* and amphipods *Corophium* spp. are found in increasing numbers (HedScr). A population of the rare polychaete *Ophelia bicornis* has been observed on a sandbank on the western side of Llanrhidian Sands. This species has been recorded from only a few sites in the UK.

Along the lower and middle estuary, there are lower shore areas of stable muddy sand which contain similar communities to the upper shore areas of moderately stable sands described above. Cockles *Cerastoderma edule*, sand gaper *Mya arenaria* and peppery furrow shell *Scrobicularia plana* are present in larger numbers in these muddier sediments and also characteristic are ragworm *Hediste diversicolor*, the mud snail *Hydrobia ulvae*, the amphipod *Corophium volutator* and tubificid worms.

The old training wall in the middle of the estuary and the area of cobbles and boulders at Carreg-fach are dominated by the barnacles *Semibalanus balanoides* and *Elminius modestus* with mussels *Mytilus edulis* dominant in areas of strong current flow (MytX). Lower shore boulders are colonised by the hydroid *Obelia longissima* and, where the scour is not great on the lower and mid-shore, the upper surfaces of the boulders are colonised by bladder wrack *Fucus vesiculosus* (Fves). Periwinkles *Littorina littorea* and *L. saxatilis* are abundant on the upper mid-shore at Carreg-fach. Numerous shore crabs *Carcinus maenas* are present throughout and large numbers of the isopod *Sphaeroma rugicauda* are found under boulders.

Along the northern side of the inlet at Cefn Padrig, there are areas of stable, hard substrata colonised by similar middle and lower shore communities, dominated by furoid algae, with knotted wrack *Ascophyllum nodosum* (Asc.Asc). Barnacles dominate under the algae and on horizontal surfaces. In crevices and overhangs, mussels *Mytilus edulis* are common and the beadlet anemone *Actinia equina* and common periwinkle *Littorina littorea* are frequent. Dogwhelks and barnacles are also found here. The channelled wrack *Pelvetia canaliculata* (Pel) is present on the upper shore.

On the shore of the lower estuary at Burry Port is an area of mid-shore boulders and cobbles. Mussels *Mytilus edulis* dominate most of the hard surfaces, with barnacles *Semibalanus balanoides* and *Elminius modestus* also present (MytX). In those areas sheltered from scouring, bladder wrack *Fucus vesiculosus* is abundant with common periwinkles *Littorina littorea* among the algae and boulders

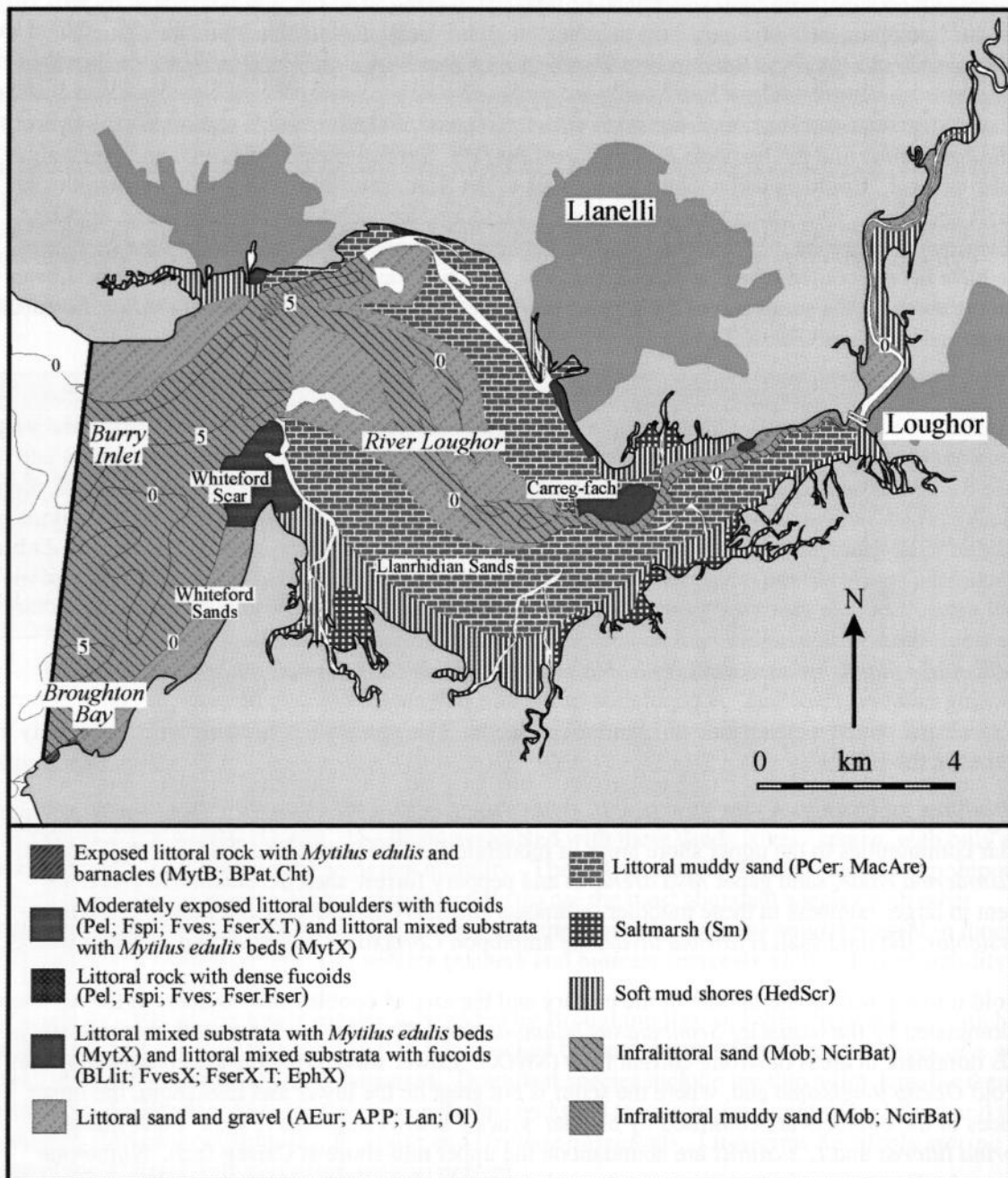


Figure 12.2 Indicative distribution of the main biotopes in the area (based on data from survey sites shown in Figure 12.1, cited literature and additional field observations).

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(Fves). In small pools at Burry Port the red algae *Dumontia contorta* and *Chondrus crispus* are found along with the beadlet anemone *Actinia equina*.

Upstream of the Loughor Bridge the sediments range from slightly muddy sands to muds with an anaerobic layer close to the surface. The infauna is typical of upper estuarine sediments, being dominated by the ragworm *Hediste diversicolor* and the peppery furrow shell *Scrobicularia plana* (HedScr). Oligochaetes dominate numerically in these sediments (Ol). At the Loughor Bridge itself, a

small area of cobbles and boulders with a fine muddy sand infill is present. Bladder wrack *Fucus vesiculosus* is abundant on the upper surfaces with barnacles present especially on the lower and mid-shore (FvesX). Amphipods and gastropods are found among the algae and underboulders while the shore crab *Carcinus maenas* is common throughout.

Sublittoral biotopes

The subtidal area of the Burry Inlet is confined to the narrow channels which are dredged in places and subject to very strong tidal currents. The sediments of the main channel in the lower estuary are very mobile medium fine sands and contain an infauna similar to that of the mobile sandbanks on the shore. The polychaete *Nephtys cirrosa* and the amphipod *Bathyporeia pelagica* are the most common species (Mob; NcirBat).

At the entrance to Burry Port harbour the muddy sediments of the dredged channel support only low numbers of species and biomass. Species present include the polychaete *Anaitides mucosa* and the amphipods *Corophium volutator* and *Gammarus tigrinus* (FaMS).

Nature conservation

Conservation sites			
Site name	Designation	Grid ref.	Main features
Burry Inlet: saltmarsh and estuary/Cilfach Burry: cors heli ac aber	possible SAC	SS 500 970	Estuaries, saltmarsh habitats
Cwm Ivy Marsh, Dunes and Tor	SSSI, WT	SS 442 941	Dunes, grassland
Whiteford Burrows and Landimore Marshes	NNR, SSSI, part NT	SS 450 955	Dune habitats and flora
Burry Inlet	Ramsar, SPA, SSSI	SS 500 970	Ornithology, saltmarsh, flora, geomorphology
Burry estuary	AoSP	SS 449 947	Ornithology
Pembrey Coast	SSSI, part LNR	SS 316 054- SS 438 996	Intertidal habitats, saltmarsh and dune vegetation, flora, ornithology
Llanrhidian Marsh	NT	SS 490 932	Saltmarsh
Llanelli, Dyfed	WWT	SS 530 984	Ornithology
Gower	AONB, HC	SS 410 900	Landscape, scenery

Human influences

There is only limited industrial activity within the inlet. The harbours at Burry Port and Llanelli support a small fishing fleet and a few other commercial boats. To the north the hinterland is urban with some light industry at Llanelli. The southern coast is predominantly rural and undeveloped.

The Burry Inlet supports an important regulated cockle *Cerastoderma edule* fishery. Harvesting is undertaken largely by the traditional method of hand-raking, on Llanrhidian Sands and off Llanelli. There is a smaller mussel *Mytilus edulis* fishery based on Whiteford Point. Bait-digging is carried out primarily at Llanrhidian Sands and Whiteford Burrows. Most of the saltmarsh and Whiteford sand dunes are grazed and wildfowling clubs shoot over the estuary except in recognised refuge areas.

Sailing and windsurfing are most intensive upstream of Loughor with moorings present at Loughor, Llanelli and Burry Port. Beach recreation is concentrated at Whiteford Burrows and the beach west of Llanelli. Some climbing takes place at Tor gro cliffs on the southern side of the inlet. Bird-watching is very popular.

References and further reading

Moore, J. 1989. Surveys of harbours, rias and estuaries in southern Britain: Loughor Estuary incorporating the Burry Inlet. (Contractor: Field Studies Council Oil Pollution Research Unit, Pembroke.) *Nature Conservancy Council, CSD Report, No. 1,004.* (FSC Report, No. FSC/OPRU/7/88.)

Sites surveyed

Survey 256: HRE survey of the Loughor estuary incorporating the Burry Inlet 1988 (Moore 1989).

Littoral sites					
Survey	Site	Place	Grid reference	Latitude/longitude	Biotopes present
256	1	Burry Port harbour entrance, Burry Inlet.	SN 446 001	51°40.6'N 04°14.8'W	YG; Pel; Fspi; Fves; MytX; AP.P; MacAre
256	2	Cefn Padrig, Burry Inlet.	SN 475 008	51°41.0'N 04°12.3'W	Pel; Fspi; Fves; Asc.Asc; AP.P; HedScr
256	3	Loughor Bridge, Loughor estuary.	SS 564 982	51°39.8'N 04°04.5'W	FvesX; BarSnd
256	4	Pontardulais Bridge, Loughor estuary.	SN 580 020	51°41.9'N 04°03.3'W	Ol
256	5	Machynys Point, Burry Inlet.	SS 509 978	51°39.5'N 04°09.3'W	MacAre
256	6	The Nose, Burry Inlet.	SS 436 990	51°40.0'N 04°15.7'W	AEur
256	7	Whiteford Scar, Burry Inlet.	SS 440 970	51°38.9'N 04°15.3'W	Fser.Fser.Bo; FserX.T; MytX; H
256	8	Hooper Sands, Burry Inlet.	SS 430 970	51°38.9'N 04°16.1'W	AEur
256	9	Middle Sand, Burry Inlet.	SS 450 990	51°40.0'N 04°14.4'W	Lan
256	10	E of Power Station, Burry Inlet.	SN 453 000	51°40.6'N 04°14.2'W	MytX; Lan
256	11	W of Loughor Bridge, Loughor estuary.	SS 555 979	51°39.6'N 04°05.3'W	Ol
256	12	Morfa Bacas, Loughor estuary.	SS 549 979	51°39.6'N 04°05.8'W	LMU
256	13	N of Pen-clawdd, Loughor estuary.	SS 541 973	51°39.3'N 04°06.5'W	MacAre
256	14	Dafon Sands, Burry Inlet.	SS 525 971	51°39.1'N 04°07.9'W	PCer; MacAre; HedScr
256	15	Old Training Wall, Burry Inlet.	SS 513 964	51°38.7'N 04°08.9'W	Fves; MytX; PCer
256	16	Careg-fach, Burry Inlet.	SS 512 969	51°39.0'N 04°09.0'W	BLlit; EphX; MytX; HedScr
256	17	Llanrhidian Sands, Burry Inlet.	SS 502 962	51°38.6'N 04°09.9'W	PCer
256	18	Cwrt-y-carne, Loughor estuary.	SN 571 004	51°41.0'N 04°04.0'W	HedScr
256	19	W of Cwrt-y-carne, Loughor estuary.	SN 565 006	51°41.1'N 04°04.5'W	HedOl
256	20	Foxhole Point, Burry Inlet.	SS 412 932	51°36.8'N 04°17.6'W	YG; Ver.Ver; BPat.Cht; BPat.Sem; MytB; EntPor; Cor; SR
256	21	Broughton Bay, Burry Inlet.	SS 415 932	51°36.8'N 04°17.3'W	AP.P
256	22	E of Whiteford Point, Burry Inlet.	SS 451 966	51°38.7'N 04°14.3'W	HedScr
256	23	Whiteford Sands, Burry Inlet.	SS 440 960	51°38.4'N 04°15.2'W	AP.P

Sublittoral sites

Survey	Site	Place	Grid reference	Latitude/longitude	Biotopes present
256	D1	Off Windy Point.	SS 461 999	51°40.5'N 04°13.5'W	NcirBat
256	D2	Burry Port harbour entrance.	SS 445 995	51°40.3'N 04°14.9'W	FaMS
256	D3	Off The Nose.	SS 430 980	51°39.5'N 04°16.2'W	Mob

Compiled by: Jan Smith and Jon Moore

13

Rivers Taf, Tywi & Gwendraeth

Location

Position (centre)	SN 350 090	51°45'N 04°25'W
Administrative area	Carmarthenshire	
Conservation agency/area	Countryside Council for Wales	South

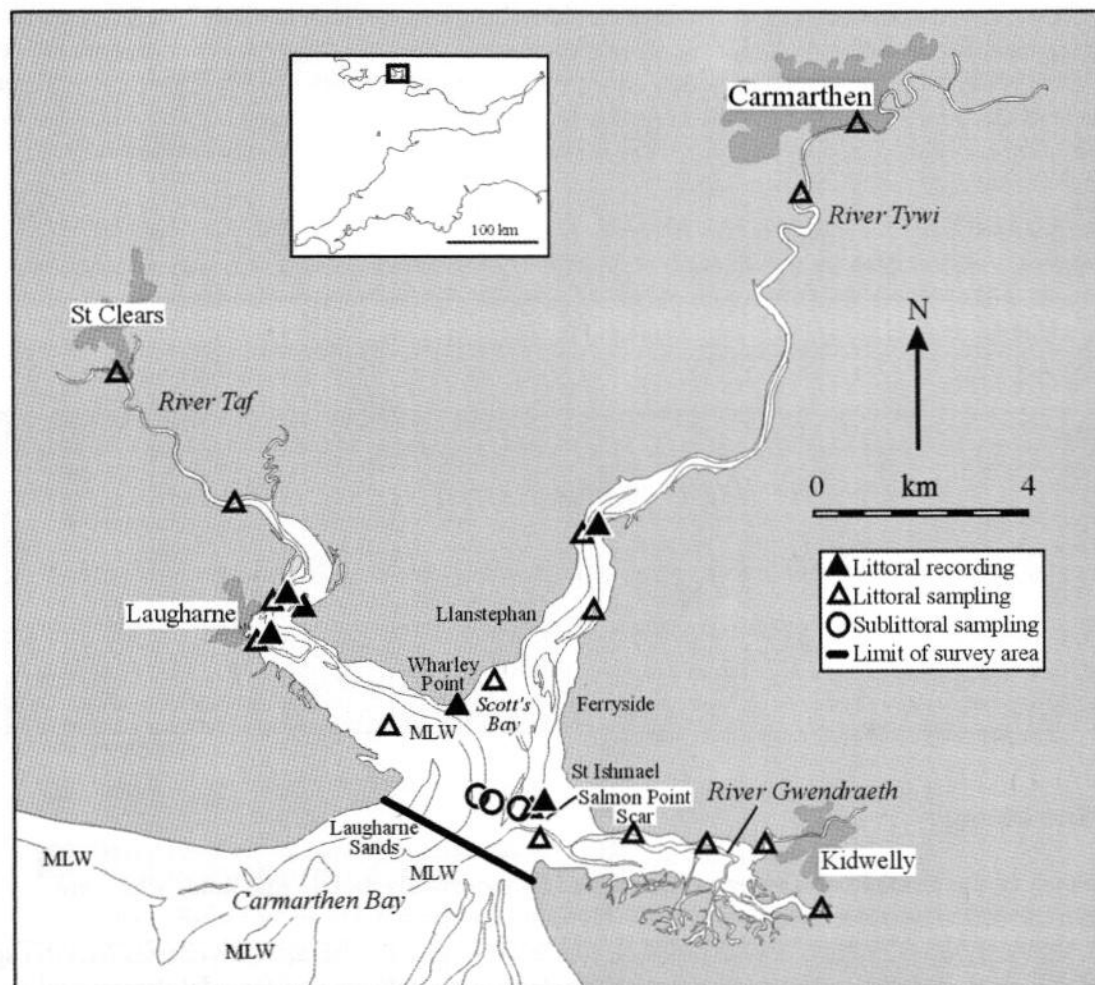


Figure 13.1 Main features of the area and sites surveyed.

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Marine biological surveys

	Survey method	Date of survey	Source
Littoral	Recording and infaunal sampling (cores)	August 1988	Mercer (1989)
Sublittoral	Pipe dredge sampling	August 1988	Mercer (1989)

Introduction

The estuaries of the Taf, Tywi and Gwendraeth are known locally as the 'Three Rivers' which converge and enter Carmarthen Bay, south-west Wales, through a common mouth. The Rivers Taf and Tywi are typical coastal plain estuaries and the River Gwendraeth is a bar-built estuary formed by movement of sand from the Pembrey coast dune system to the east. All three estuaries are undergoing substantial infilling by marine sediments derived from Carmarthen Bay. As a result they are shallow and drain almost completely at low tide. Tidal currents are generally of considerable strength, especially in the Taf and Tywi.

Hard substrata are very limited within the estuaries and, where they are present, they are sand-scoured with impoverished communities. Sediment habitats dominate the system, grading from sandflats at the mouth to mudflats in the upper estuaries. Lower shore areas are generally unstable with more stable sediments being found on the upper middle shore where communities are considerably richer. Three mussel *Mytilus edulis* scars present are subject to scouring losses. Both mussels and cockles *Cerastoderma edule* are harvested commercially on a small scale. The area is also an important nursery ground for bass *Dicentrarchus labrax*.

The hinterland is predominantly rural and beach recreational activities are intensive especially during the summer months when the populations of surrounding towns and villages increase considerably. The water quality of the Three Rivers is classified as grade A, apart from the uppermost section of the Tywi which is grade B.

Physical features

<i>Physiographic type</i>	Taf and Tywi - coastal plain estuaries Gwendraeth - bar-built estuary
<i>Length of coast</i>	115.7 km
<i>Area of inlet</i>	8,295 ha
<i>Length of inlet</i>	30.7 km (Tywi - longest tidal channel)
<i>Bathymetry</i>	Very shallow; maximum depth 5 m in channel
<i>Wave exposure range</i>	Exposed to extremely sheltered
<i>Tidal stream range</i>	Strong (4.0 knots) to negligible
<i>Tidal range</i>	7.5 m
<i>Salinity range</i>	Fully marine to upper estuarine

Marine biology

The mouth of the Three Rivers system is dominated by moderately mobile fine sands which are continually shifted by waves and tidal action. The communities present are of low diversity, characterised by Baltic tellin *Macoma balthica*, thin tellin *Angulus tenuis* and polychaetes *Nephtys* spp. (AP.P; AP.Pon). Species richness increases up the shore as the influence of the tidal streams and fluctuating salinity decreases. The cockle *Cerastoderma edule* may be present in more stable sediments further up the shore.

Stable sandflats are present in the lower estuaries, generally on the upper middle shores. Here tidal streams and salinity fluctuations are reduced, resulting in a greater species richness than the lower shore areas mentioned above. The communities support typical bivalve/polychaete and amphipod assemblages including the cockles *Cerastoderma edule*, Baltic tellin *Macoma balthica*, ragworms *Hediste diversicolor* and polychaetes *Nephtys* spp. (MacAre). The amphipod *Bathyporeia sarsi* and the mud snail *Hydrobia ulvae* are also present.

Moderately stable sandflats are present on the upper and mid-shore of all three estuaries. At Laugharne Sands these contain a fairly diverse infauna including dense beds of cockles *Cerastoderma edule* (PCer). The sand gaper *Mya arenaria*, mud snail *Hydrobia ulvae*, mud shrimp *Corophium arenarium*, peppery furrow shell *Scrobicularia plana* and the spionid worm *Pygospio elegans* are also

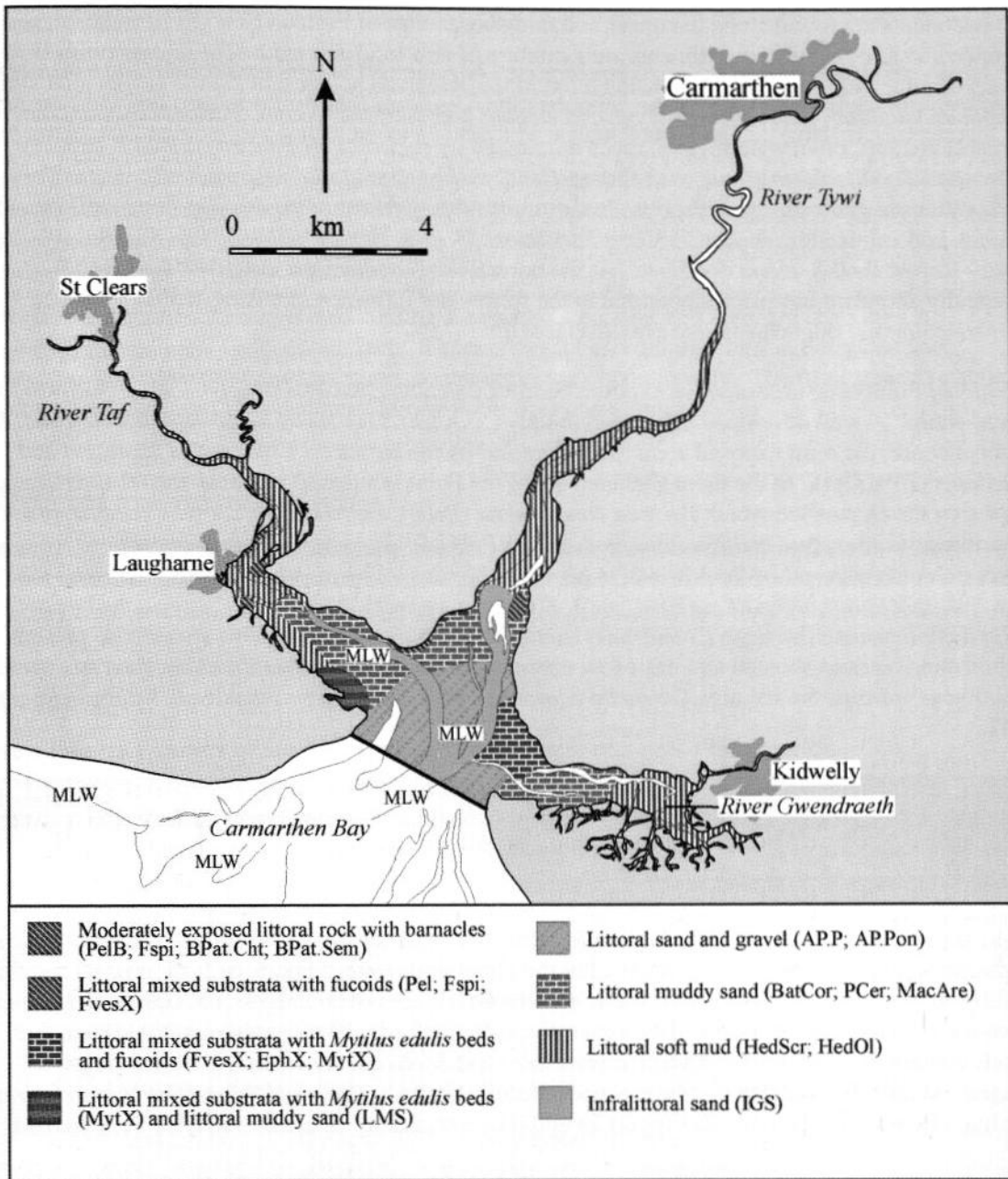


Figure 13.2 Indicative distribution of the main biotopes in the area (based on data from survey sites shown in Figure 13.1, cited literature and additional field observations).

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present. At Salmon Point Scar, the spionid worms *P. elegans*, *Spio martinensis* and *Spiophanes bombyx* are common. The infauna here is dominated by the thin tellin *Angulus tenuis*, the sand mason worm *Lanice conchilega* and the amphipod *Bathyporeia sarsi*. At Scott's Bay the community is less species rich, dominated by Baltic tellin *Macoma balthica*, polychaete *Nephtys hombergii* and spionid worm *P. elegans*.

Finer sediments are found along the upper and mid-shore. East of Pastoun Scar (St Ishmael) at Ferryside and Laugharne, the sediments are a mixture of fine sand and mud. The communities here are very similar, being composed of Baltic tellin *M. balthica*, the polychaete *Eteone longa*, mud shrimp *Corophium volutator*, spionid worm *Pygospio elegans* and tubificid worms. Further upstream the sediments are soft, often waterlogged, muds dominated by ragworm *Hediste diversicolor*, peppery furrow shell *Scrobicularia plana*, mud shrimp *C. volutator* and oligochaete worms (HedScr). The communities are generally species poor. In the upper estuary there are organically rich mudflats and the fauna is dominated by deposit feeders. Ragworms *H. diversicolor*, mud shrimps *C. volutator* and peppery furrow shell *S. plana* dominate. At the normal tidal limits of the estuaries, the fauna is numerically abundant but species poor due to the freshwater influence. Only ragworms *H. diversicolor* and oligochaetes are present (HedOl).

At Wharley Point is an area of wave exposed bedrock extending across a steeply sloping platform to the mid-shore. A well developed lichen community (YG; Ver.Ver) exists in the supralittoral zone. On the upper shore, the most exposed areas are dominated by the barnacles *Chthamalus montagui* and *C. stellatus* (BPat.Cht). In the more sheltered lee of the Point is a mixed barnacle-furoid assemblage comprising the channelled wrack *Pelvetia canaliculata* (PelB), the red alga *Catenella caespitosa* and the barnacles *C. montagui* and *Elminius modestus* (BPat.Cat). Rockpools on the upper shore are more species rich than adjacent bedrock which is generally dominated by mussels *Mytilus edulis* and the barnacle *Semibalanus balanoides* (BPat.Sem). Common periwinkles *Littorina littorea*, the hydroid *Obelia dichotoma* and the algae *Chondrus crispus*, *Gelidium pusillum* and *Ulva* sp. are also present. The mid-shore is sand-scoured and has a low diversity, dominated by algae *Enteromorpha* sp., spiral wrack *Fucus spiralis*, the red alga *Catenella caespitosa* with common periwinkles *L. littorea* present (Fspi).

Boulders, cobbles and pebbles resting on muddy sands are found in a variety of exposure grades throughout the estuaries. These habitats are generally moderately scoured and unstable and resistant species are predominant. The mid-shore is dominated by bladder wrack *Fucus vesiculosus* with barnacles and mussels present (FvesX).

There are three beds of mussels *Mytilus edulis* within the estuaries, lying on muddy sand or stones. At Laugharne Sands the lower shore is mobile but the upper mid-shore supports beds of mussels and this has aided mud accretion (MytX). The shells provide attachment sites for hydroids *Obelia dichotoma*, sea lettuce *Ulva* sp. and (rarely) bladder wrack *Fucus vesiculosus*. The muddy matrix between the mussels contain the polychaetes *Hediste diversicolor* and *Scolecopsis squamata*, brown shrimps *Crangon crangon* and cockles *C. edule*, peppery furrow shells *S. plana* and thin tellins *Mya arenaria*. At Salmon Point Scar, the mussels support an epibiotic community of bladder wrack *F. vesiculosus* and barnacles *Semibalanus balanoides* (MytX). Grazing gastropods (periwinkles *Littorina littorea* and *L. saxatilis* agg.) are also present. The mussels at Scott's Bay support a less diverse barnacle/furoid epibiotic community.

Nature conservation

Conservation sites			
Site name	Designation	Grid ref.	Main features
Pembrey Coast	SSSI, LNR	SS 316 054- SS 438 996	Intertidal habitats, saltmarsh and dune vegetation, flora, ornithology
Craig Ddu to Wharley Point Cliffs	SSSI	SN 320 102	Cliff habitats, flora, invertebrates
Whitehill Down	SSSI	SN 290 135	Grassland, flora
Laugharne and Pendine Burrows	SSSI	SN 290 070	Dune habitats, flora, ornithology
Wharley Point	NT	SN 340 093	Cliff

Human influences

The Ministry of Defence own land at Pendine and Pembrey and there are restrictions on the use of nearby beaches and coastal waters as a result. The hinterland is almost entirely rural and undeveloped. There are a small number of caravan parks and the area is very popular with tourists in summer.

There is grazing of the saltmarsh and sand dunes at Laugharne Burrows. Mussel *Mytilus edulis* and cockle populations *Cerastoderma edule* fisheries are exploited and bait-digging is widespread. Periwinkles are also collected on a small scale. A wildfowling club shoots over the upper and middle reaches of the River Taf apart from the refuge area.

Recreational activities are numerous. Sailing is especially popular and there are moorings at Laugharne, Pilloath and Gwendraeth Fach. There are yacht and dinghy clubs at Ferryside and Llanstephan and power-boating and water-skiing occur very occasionally. The most intensive activity occurs on the beaches at Llanstephan, Salmon Point Scar and Pendine.

References and further reading

Mercer, T.M. 1989. Surveys of harbours, rias and estuaries in southern Britain: Taf, Tywi and Gwendraeth estuaries. (Contractor: Field Studies Council Oil Pollution Research Unit, Pembroke.) *Nature Conservancy Council, CSD Report*, No. 1,113. (FSC Report, No. FSC/OPRU/20/88.)

Sites surveyed

Survey 258: HRE survey of the Taf, Tywi and Gwendraeth estuaries 1988 (Mercer 1989).

Littoral sites					
Survey	Site	Place	Grid reference	Latitude/longitude	Biotores present
258	1	Laugharne Sands, River Taf.	SN 320 080	51°44.7'N 04°26.0'W	MytX; PCer; HedScr
258	2	Wharley Point, River Taf.	SN 337 096	51°45.5'N 04°24.5'W	YG; Ver.Ver; PelB; Fspi; BPat.Cht; BPat.Sem; BPat.Cat; Ent; MytX; Rkp
258	3	Kidwelly Quay, River Gwendraeth.	SN 397 064	51°43.9'N 04°19.2'W	HedScr
258	4	SW of Penallt Farm (Gwendraeth), River Gwendraeth.	SN 386 065	51°44.0'N 04°20.2'W	FvesX; AP.P; BatCor
258	5	A484 Bridge, Kidwelly, River Gwendraeth.	SN 411 056	51°43.5'N 04°18.0'W	HedOI
258	6	E of Pastoun Scar, River Gwendraeth.	SN 372 069	51°44.2'N 04°21.4'W	HedScr
258	7	Salmon Point Scar, River Gwendraeth.	SN 350 070	51°44.2'N 04°23.3'W	Pel; Fspi; BPat.Sem; FvesX; EphX; MytX; SwSed; MacAre; HedOI
258	8	Cefn Sidan (north), River Gwendraeth.	SN 350 060	51°43.6'N 04°23.3'W	AP.Pon
258	9	SE of Johnstown, River Tywi.	SN 404 186	51°50.5'N 04°19.0'W	HedOI
258	10	Tywi Sailing Club, River Tywi.	SN 365 127	51°47.3'N 04°22.2'W	Fspi; FvesX; HedScr
258	11	Scott's Bay, River Tywi.	SN 349 099	51°45.7'N 04°23.5'W	MytX; MacAre
258	12	Ferryside, River Tywi.	SN 360 100	51°45.8'N 04°22.6'W	Fspi; FvesX; G; HedScr
258	13	A48 Bridge, Carmarthen, River Tywi.	SN 406 197	51°51.1'N 04°18.8'W	LR (Barren)
258	14	St Clears, River Taf.	SN 228 215	51°51.8'N 04°34.4'W	HedOI
258	15	Laugharne (north), River Taf.	SN 307 110	51°46.2'N 04°27.2'W	Pel; Fspi; FvesX; HedMac
258	16	Laugharne (south), River Taf.	SN 305 103	51°45.9'N 04°27.3'W	Pel; Fspi; HedScr
258	17	N of Brixtarw, River Taf.	SN 299 128	51°47.2'N 04°27.9'W	FvesX; HedOI
258	18	Black Scar, River Taf.	SN 309 107	51°46.1'N 04°27.0'W	Fspi; FvesX

Sublittoral sites					
<i>Survey</i>	<i>Site</i>	<i>Place</i>	<i>Grid reference</i>	<i>Latitude/longitude</i>	<i>Biotopes present</i>
258	19	Tywi channel 1	SN 354 074	51°44.4'N 04°23.0'W	AP.P
258	20	Tywi channel 2	SN 345 074	51°44.4'N 04°23.8'W	AP.Pon
258	21	Tywi channel 3	SN 348 074	51°44.4'N 04°23.5'W	AP.Pon

Location

Position (centre)	SM 945 035	51°42'N 05°05'W
Administrative area	Pembrokeshire	
Conservation agency/area	Countryside Council for Wales	West

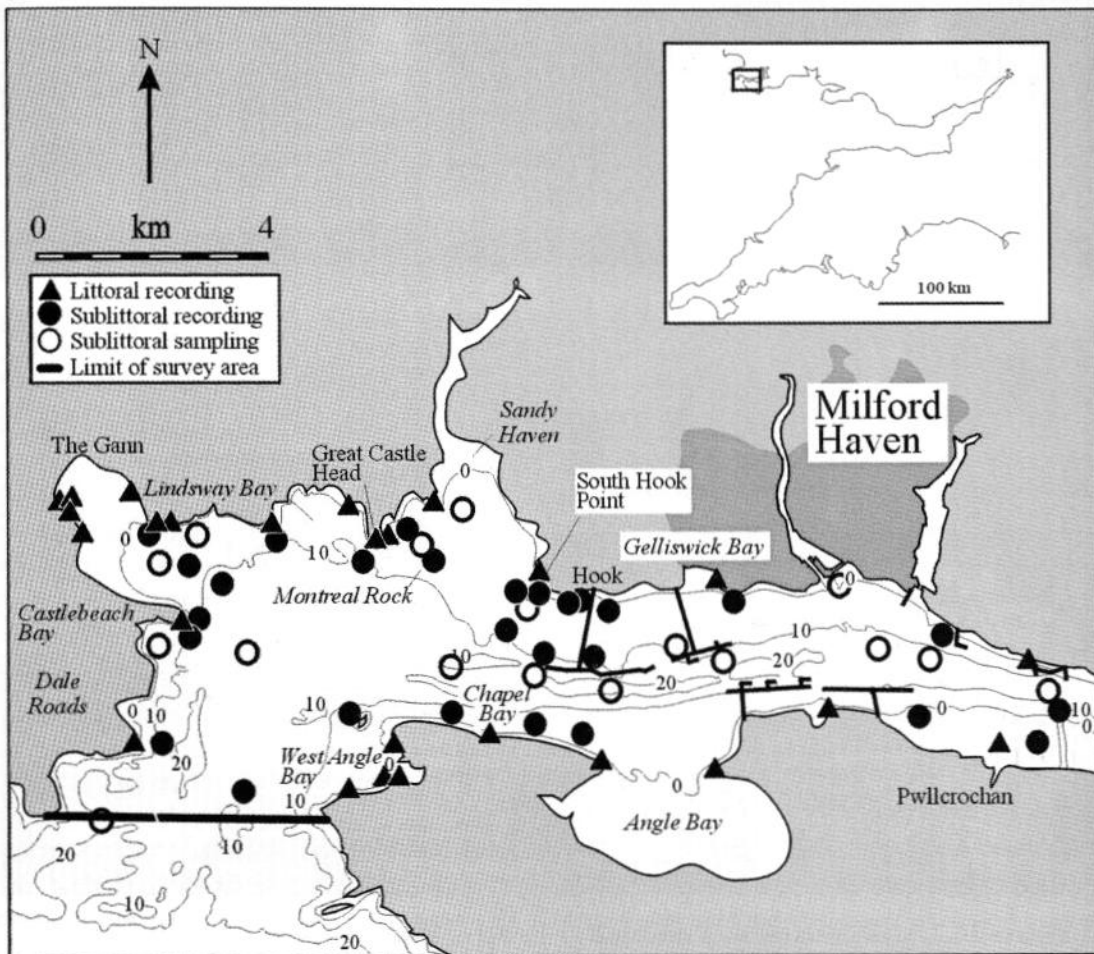


Figure 14.1 Main features and sites surveyed in the lower inlet.

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Marine biological surveys

	Survey method	Date of survey	Source
Littoral	Infaunal sampling (cores)	April 1989	Hern (1989)
	Recording	Oct. 1995	Moore (1996)
	Recording	Oct. 1985	Little & Hiscock (1987)
	Recording	May 1976-Sept. 1978	Powell <i>et al.</i> (1979)
Sublittoral	Recording	May 1996	Posford Duvivier
	Recording	May 1988	Little <i>et al.</i> (1988)
	Recording	July 1978-Sept. 1979	Hiscock (1981)
	Recording	July 1985	Little & Hiscock (1987)
	Infaunal sampling (Day grab)	Oct. 1993	Levell <i>et al.</i> (1994)
	Infaunal sampling (pipe dredge)	July 1985	Little & Hiscock (1987)

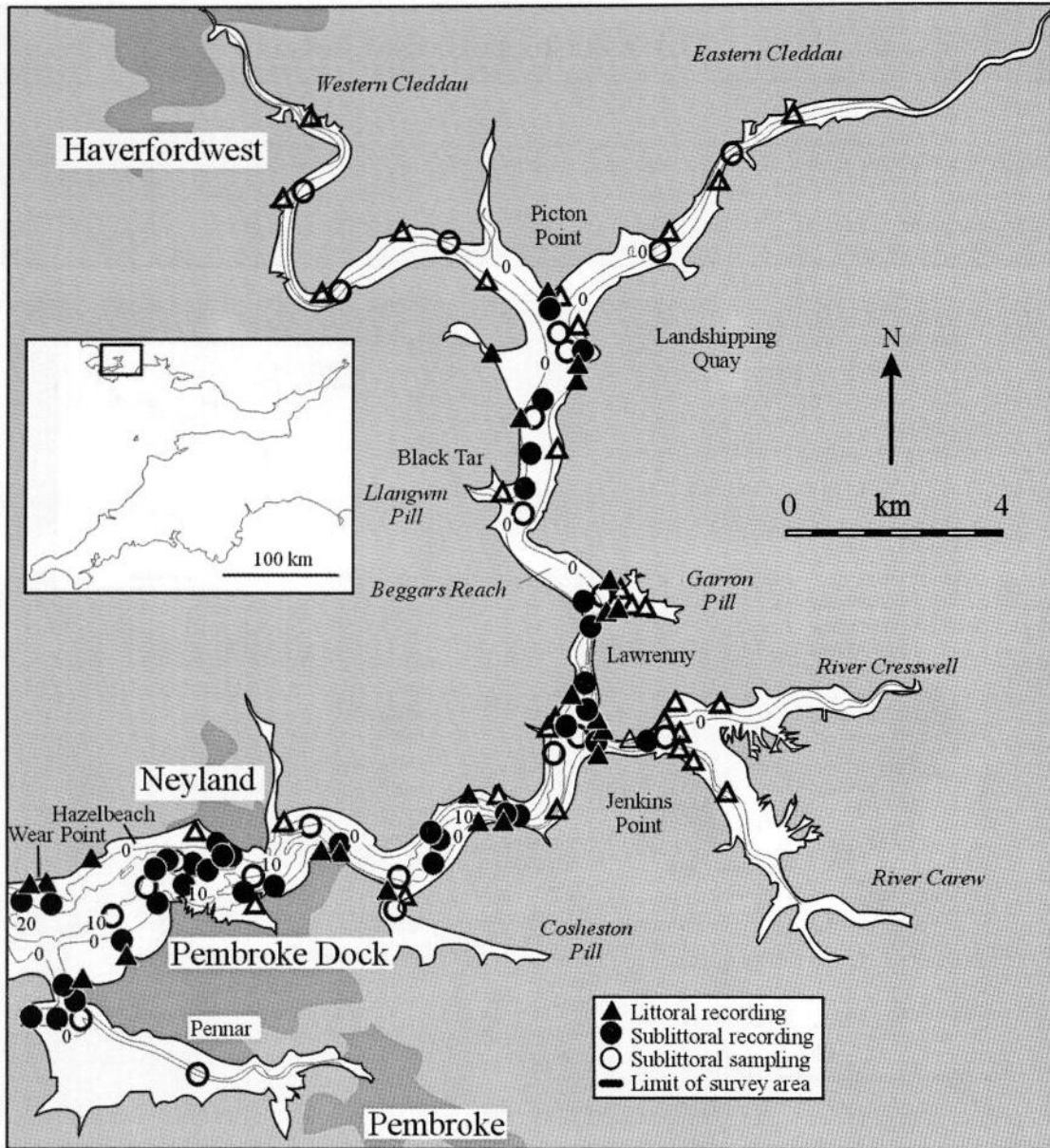


Figure 14.2 Main features sites surveyed in the upper inlet.

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Introduction

Milford Haven and the estuaries of the Western and Eastern Cleddau rivers are situated at the south-west tip of Wales. This drowned river valley is a superb natural harbour which has a long history of human activity. In addition to the main channel, there are several large embayments and numerous side creeks or pills. The steep-sided valley east of the Cleddau Bridge continues into the subtidal; mudflats are present in the wider parts of the estuary and the pills; sandy beaches occur near to the mouth; the lower reaches of the ria are dominated by rocky shores; and the sea bed consists predominantly of sediment. Areas of maerl (a calcareous red alga) occur in the lower estuary and patches of muddy sand are colonised by seagrass, both in the subtidal and in the intertidal. The ria is a major nursery for the bass *Dicentrarchus labrax*.

Much of the coastline between Sandyhaven and Neyland on the northern shore and from Angle Bay to the Cleddau Bridge on the southern shore is urbanised or industrialised. Two oil refineries remain along these shores but the oil-fired power station has been closed down. The rest of the coast and the majority of the catchment area are rural in nature. A wide variety of domestic, agricultural and industrial effluents enter the waterway; however, the water quality has been classified as grade A (highest quality).

Physical features

<i>Physiographic type</i>	Ria
<i>Length of coast</i>	174 km
<i>Area of inlet</i>	Total 5,700 ha; intertidal 1,750 ha
<i>Length of inlet</i>	36.5 km
<i>Bathymetry</i>	Steep sided; depths greater than 10 m for 20 km inland
<i>Wave exposure range</i>	Exposed to extremely sheltered
<i>Tidal stream range</i>	Up to 4 knots above Cleddau Bridge
<i>Tidal range</i>	6.3 m
<i>Salinity range</i>	Fully marine to low salinity

Marine biology

Littoral rock

Around the entrance to Milford Haven on the western side, as far along the northern shore as South Hook, there are wave exposed shores of bedrock and stable boulders. These shores have extensive splash and maritime lichen zones supporting a rich flora (YG; Ver.Ver). The upper and mid-shore is dominated by barnacles and limpets with little or no macroalgal cover (BPat). Mosaics of red algae with limpets, barnacles and a wide variety of other invertebrate fauna are found on the lower shore (XR; Fser.R). The sublittoral fringe is dominated by pink encrusting algae with kelps *Laminaria digitata* and *Alaria esculenta* at West Blockhouse (Ala.Ldig). The communities on these shores are similar to those of the open coast.

On the eastern side of the entrance, as far along the south shore as Chapel Bay, the shores are of exposed bedrock and stable boulders. The lichen zone is variable in extent. On open bedrock the shores are steep and, where local topography allows for more shelter, some areas are dominated by fucoid algae and the red alga *Osmundea pinnatifida* (FvesB; Fser.R). These shores have a rich and varied lower shore biota particularly in crevices, overhangs (SR) and beneath boulders. Rockpools (Cor; FK) at West Angle Bay are particularly rich and are the type locality for the cushion star *Asterina phylactica*.

Sheltered bedrock and stable boulder shores fringe the coast from Gelliswick Bay to Hazelbeach and are also found on the lower shore at the Gann Flats. The most interesting and rich shores are those at Hazelbeach, Bullwell Bay, Pennar Point and Wear Spit. The latter shore supports an especially rich attached flora and fauna with several notable algal species including *Solieria chordalis*, *Chondracanthus acicularis* and *C. teedei* (FserX.T). The sponge fauna is also varied and well developed.

From Pembroke Ferry upstream to the mouth of Garron Pill the bedrock and mixed stony shores are colonised by typical sheltered rocky shore fucoid communities (Pel; Fspi; Asc.Asc; Fser; AscX; FvesX; FserX), although the extensive areas of very steep bedrock are dominated by barnacles and limpets (BPat). Bedrock and boulder shales on the lower shore are dominated by the gooseberry sea squirt *Dendrodoa grossularia*. The sublittoral fringe is rich with a gradually diminishing diversity from Cosheston Folly to south of Garron Pill (Lsac.Ldig). Several species common on rocky shores reach their upstream limits within this stretch, including the top shells *Gibbula umbilicalis* and *Osilinus lineatus*, the whelks *Nucella lapillus* and *Buccinum undatum* and the red algae *Gracilaria sp.* and *Osmundea hybrida*. Epiphytic algae decrease in variety but not abundance upstream, the most

common being the red algae *Polysiphonia* sp., *Callithamnion* sp. and *Antithamnion* sp. Large eels *Anguilla anguilla* are common under boulders upstream from Jenkins Point.

At Landshipping, Picton Point and East Wood Farm, there are very sheltered bedrock or stable boulder shores. Each of these sites is fairly isolated with mud nearby. The upper shores have patches of saltmarsh vegetation between hard outcrops. The communities are impoverished; mid-shore rocks and boulders are dominated by furoid algae (Asc.VS). No limpets, top shells or dogwhelks are found upstream of Beggars Reach. Only the red seaweed *Polysiphonia lanosa* is found as far upstream as East Wood Farm. At this site barnacles *Elminius modestus* and *Balanus crenatus* are confined to lower shore boulders. The only molluscs are common periwinkles *Littorina littorea*, mussels *Mytilus edulis* on the lower shore and the rough periwinkle *Littorina saxatilis* under stones on the upper shore. Many species reach their upstream limit in this area including the barnacle *Semibalanus balanoides*, the mud snails *Littorina obtusata* and *L. mariae* and the breadcrumb sponge *Halichondria panicea*.

Littoral sediments

Between the rocky areas of the entrance to Milford Haven there are sandy beaches of exposed or moderately exposed clean sand. At West Angle and Lindsway Bays, the sediment supports a crustacean-polychaete community (Lan). Mun Sands (Sandyhaven) supports a good representative community of tellins *Angulus* (AP.Pon; pers. obs.). At Gann Flats, Dale Beach, Angle Bay, Sandyhaven and Pwllcrochan there are areas of muddy sand which are rich in species. At Dale and Gann, the substrata are very heterogeneous and of great scientific interest and hold representative communities of the sandy common heart urchin *Echinocardium cordatum* and muddy sand Baltic tellin *Macoma balthica* (MacAre) biotopes; the muddy gravel pullet carpet shell *Venerupis senegalensis* (VsenMtru) biotope at the Gann was considered to be the richest in south-west Wales by Powell *et al.* (1979).

In the central area of Milford Haven are lower shore mud banks with high levels of organic matter and an infauna dominated by the ampharetid worm *Melinna palmata* and the polychaete *Nephtys hombergii*. Mudflat communities in Pembroke River comprise the polychaetes *Pygospio elegans* and *Manayunkia aestuarina*, the molluscs *Abra* sp., *Cerastoderma edule* and *Hydrobia ulvae* and nematodes. The phoronid worm *Phoronis muelleri* has been noted as abundant close to the south shore. The lugworm *Arenicola* community at Angle Bay is particularly rich and the peppery furrow shell *Scrobicularia* community (HedStr) at Pwllcrochan is probably one of the richest in west Wales.

Estuarine muddy sediments along the banks of the mid-estuary and the Carew and Cresswell Rivers are dominated by ragworms *Hediste diversicolor*, peppery furrow shell *S. plana* and a variety of other polychaetes and amphipods typical of the reduced salinity mud habitats (HedStr).

Creeks and mud banks dominate the shores north of Williamston Pill and they support an increasingly impoverished fauna upstream of Llangwm (HedStr; HedOl). Species that are successful in low salinity conditions are restricted to the uppermost areas of Pembroke River, Williamston Pill, Garron Pill and the north side of the Carew/Cresswell Rivers. The sediment macrofauna of these areas includes high densities of the polychaetes *Manayunkia aestuarina* and *Streblospio shrubsolii*, oligochaetes and nematodes.

Sublittoral rock

A wide range of subtidal habitats is present in Milford Haven, ranging from bedrock and boulder surfaces, which occur over large areas, to muddy sands and maerl (calcified free-living red algae).

Extensive areas of wave exposed subtidal bedrock occur in the mouth of the Haven, including the headlands of the Dale and Angle peninsulas. Communities present are very similar to those of the open coast and include a dense kelp *Laminaria hyperborea* forest (Lhyp.Ft; Lhyp.Pk). Rock below the kelp is encrusted with coralline algae and colonised by a large variety of foliose algae. Infralittoral animal communities include rich populations of erect bryozoans together with sponges and ascidians. Sublittoral fringe communities are dominated by crustose coralline algae and an assemblage of typical open coast species. In less exposed areas, the algal cover extends to shallower depths. Animal communities of overhangs are colonised by dense erect bryozoans and ascidians (SCAs.ByH).

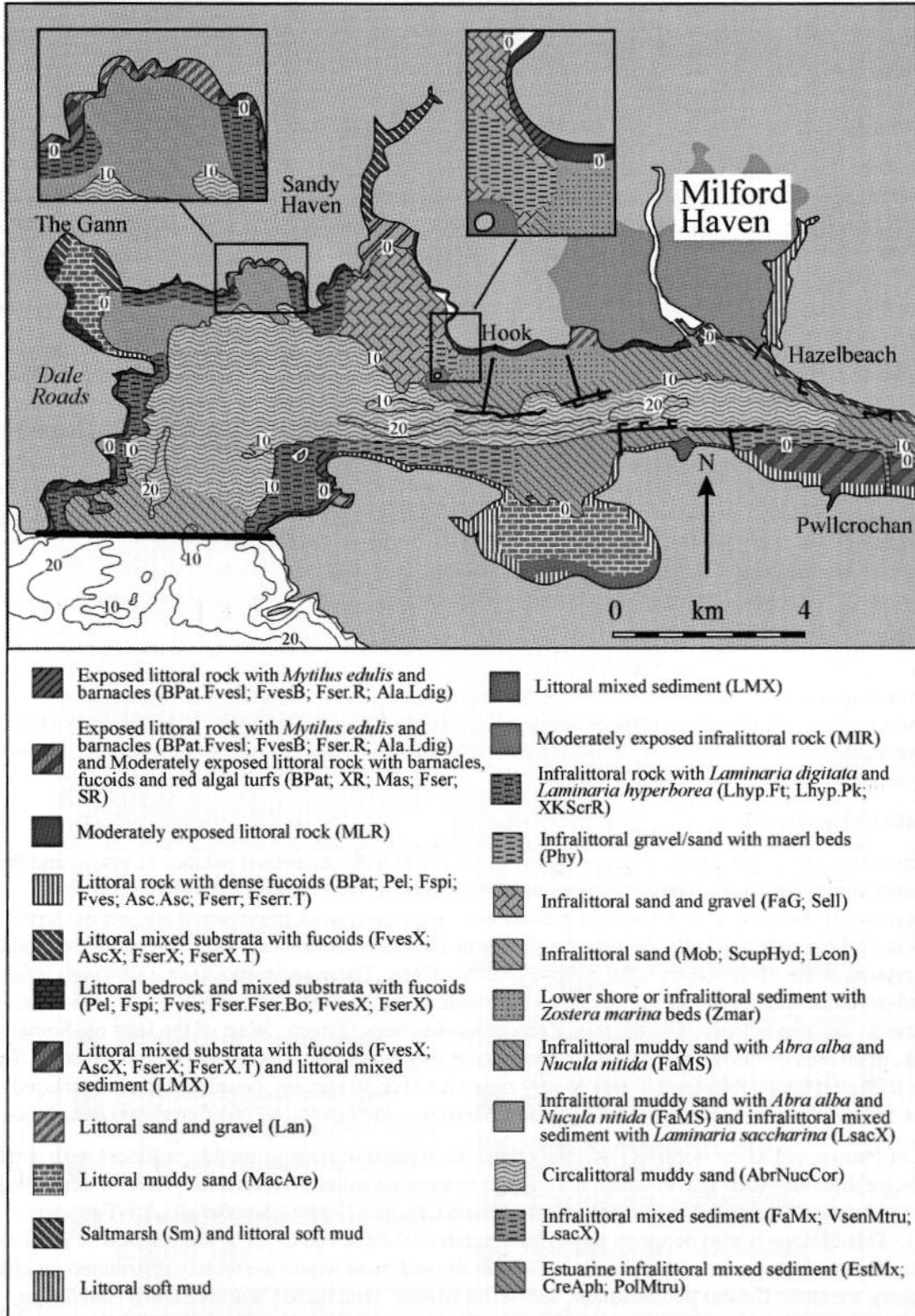


Figure 14.3 Indicative distribution of the main biotopes in the lower inlet (based on data from survey sites shown in Figure 14.1, cited literature and additional field observations). © Crown copyright. Licence number GD27254X/06/98.

Communities characteristic of fully saline but moderately sheltered and turbid conditions are found west of Chapel Bay, in Dale Roads, at Castle Beach Bay and Montreal Rocks (east of Great Castle Head). Shallow rocks are dominated by a kelp forest (LsacX). A wide variety of foliose and crustose red algae are present, especially *Calliblepharis ciliata* and *Cryptopleura ramosa*. Unusual red algal species include *Cordylecladia erecta* and *Schmitzia hiscockiana*. Fauna present are typical of a reduced open coast community and include abundant erect bryozoans and ascidians.

Also in the outer Haven, between Dale Roads and the town of Milford Haven, there are substrata which comprise wave sheltered small boulders, cobbles and shells exposed to moderate tidal currents. The communities are generally impoverished although an interesting algal community is present in shallow water (LsacX). In deeper water the community is dominated by barnacles *Balanus crenatus* (ByH) and shells are bored by the sponge *Cliona* sp. The artificial substrata of the jetties, slipways and the bay at Target Trot support communities that are characterised by sponges, the plumose anemone *Metridium senile*, the featherstar *Antedon bifida* and ascidian species (SCAs).

Upstream of Wear Point (off Milford Haven town) are wave-sheltered areas of bedrock and boulders or cobbles exposed to moderate and strong tidal streams. The community spans a wide range of sites and environmental conditions from almost fully marine (Wear Point and Dockyard Bank) to the variable salinity and high turbidity conditions of Black Tar. There is a progressive impoverishment upstream, although the communities are basically similar. In the shallow sublittoral is a fringe of kelp *Laminaria digitata* with dulce *Palmaria palmata* and an undergrowth of foliose and filamentous algae (Ldig.Ldig). The gooseberry sea squirt *Dendrodoa grossularia* is abundant in most areas with other ascidians, anemones and hydroids also present. Dense sponge growths occur throughout. The estuarine goby *Gobius niger* and the goldsinny *Ctenolabrus rupestris* are also present among boulders.

Also between Pwllcrochan and Landshipping are areas of wave sheltered cobbles, pebbles and shells which are exposed to moderate tidal streams. Fine filamentous algae are present including *Griffithsia devoniensis* (LsacRS.FiR). Hard substrata are colonised by the barnacles *Balanus crenatus* and *Elminius modestus*, the tubeworm *Pomatoceros* sp., bryozoans and ascidians. In sediment pockets between cobbles, the polychaetes *Myxicola infundibulum* and *Lanice conchilega*, crabs and anemones are present.

Sublittoral sediments

Sediments at the mouth of the inlet are mostly clean sands with occasional patches of gravel and their infaunal communities are typical of open coast sands with a wide variety of bivalves (*Goodallia triangular*, *Spisula elliptica*, *Chamelea gallina* and *Timoclea ovata*), polychaetes and echinoderms such as *Ophiura albida* (Sell). Within the shelter of the lower Haven, however, the sands are muddier and typical of the bivalve *Abra alba* biotope (AbrNucCor). These sediments have a very rich infauna of polychaetes, amphipods and bivalves, and in shallow depths along the coast of Littlewick these sediments are also colonised by eelgrass *Zostera marina* beds (Zmar). West of the jetty off South Hook, in an area of fairly strong tidal streams, maerl *Phymatolithon calcareum* (Phy) is present. The flora living on the pebbles in this area is very rich with over 50 species recorded, including the red algae *Spermothamnion* sp., *Gracilaria gracilis*, *Stenogramme interrupta* and *Ceramium nodulosum*.

East of Pennar and as far north as Lawrenny there are extensive areas of muddy sediment with small shells, pebbles and shell gravel which are subject to variable salinity conditions. These muds have a reduced infauna dominated by the polychaetes *Tharyx* sp. and *Nephtys hombergii* (AphTub; pers. obs.). This biotope is also common throughout much of the sea bed of the lower reaches of Pembroke River. Burrowing species or species living within the sediment which are widely distributed include the daisy anemone *Cereus pedunculatus*, terebellid worms, sand mason worms *Lanice conchilega*, shore crabs *Carcinus maenas* and pagurid crabs. Species which are found only in Milford Haven, being absent from the Daucleddau, include the crabs *Goneplax rhomboides* and *Liocarcinus depurator* and the brittlestar *Ophiura albida*.

Much of the channel bed of the Daucleddau estuary is characterised by strong tidal currents and very coarse mixed sediments. These sediments are colonised by a high diversity of infauna and epifauna with a particular abundance of errant polychaetes (CreAph). However, as one moves further up the

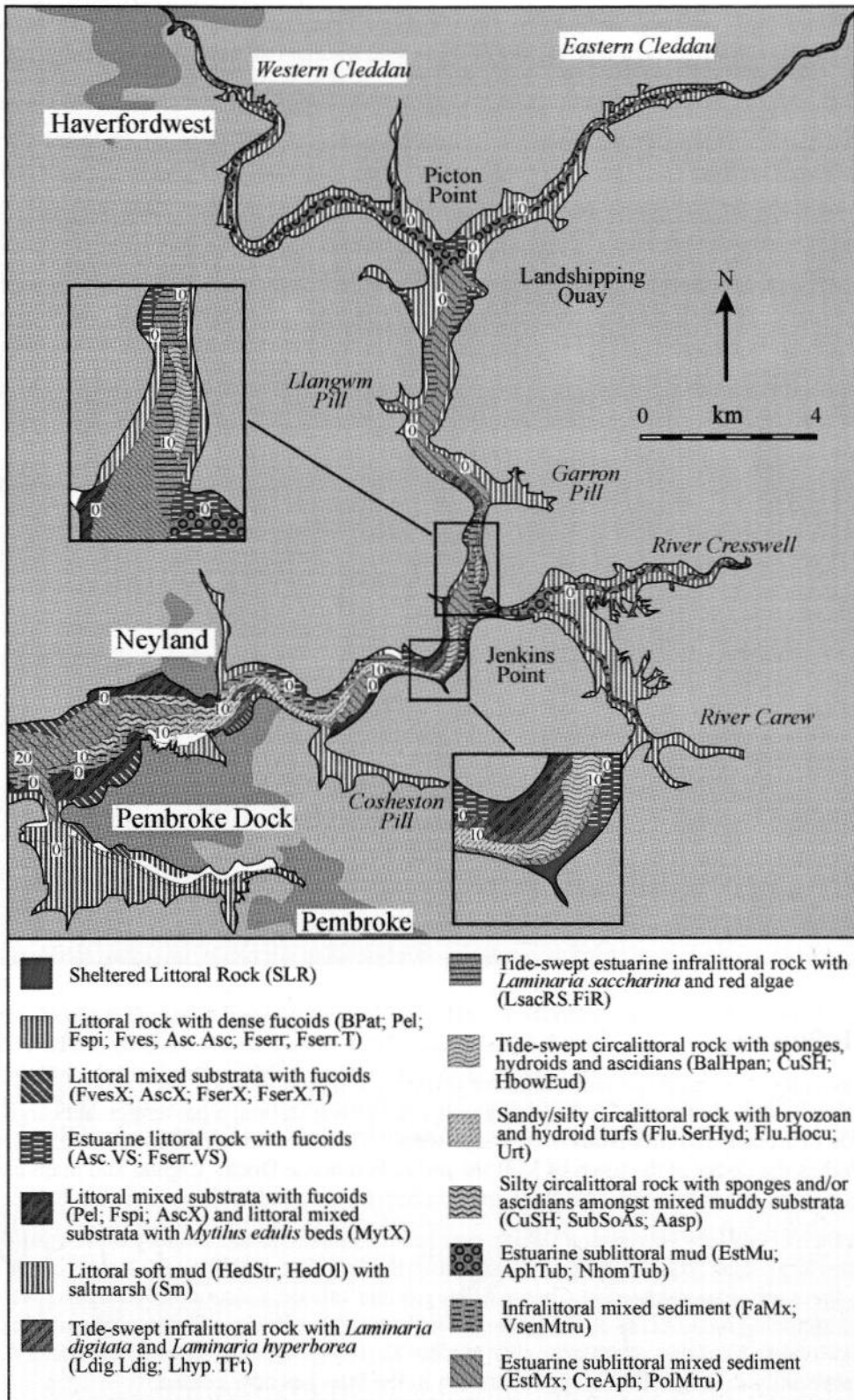


Figure 14.4 Indicative distribution of the main biotopes in the upper inlet (based on data from survey sites shown in Figure 14.2, cited literature and additional field observations).

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estuary to Picton Point and into the Eastern and Western Cleddau the bottom muds are increasingly dominated by oligochaetes and a low variety of other species that can cope with low salinities (HedOI).

Nature conservation

Conservation sites			
Site name	Designation	Grid ref.	Main features
Pembrokeshire Islands/Ynysydd Sir Benfro	candidate SAC	SM 740 130	Large shallow inlets and bays, reefs, estuaries, grey seal <i>Halichoerus grypus</i>
West Angle Bay	SSSI	SM 851 034	Geology, marine habitats and fauna
Angle Bay	SSSI	SM 883 025	Marine habitats and species, ornithology
Pembroke River and Pwllcrochan Flats	SSSI	SM 940 025	Marine habitats and fauna, saltmarsh, ornithology
Cosheston Pill	SSSI	SM 990 036	Marine habitats, marine flora and fauna, saltmarsh, ornithology
Carew/Cresswell Rivers	SSSI	SN 05 055	Marine habitats, saltmarsh, marine flora and fauna, ornithology
West Williamston Quarries	SSSI, NT, WT	SN 026 060	Flora
Lawrenny Wood	SSSI, NT	SN 010 069	Woodland, flora
Dauceddau	SSSI	SN 003 116	Saltmarsh, marine flora and fauna, ornithology
Hook Wood	SSSI	SM 973 114	Woodland, flora
Minwear Wood	SSSI	SN 042 138	Woodland, flora
Slebech Reedbed and Carr	SSSI	SN 053 142	Reedbed, carr habitat
Little Castle Head	SSSI	SM 855 065	Geology
Gann Estuary	SSSI	SM 812 070	Marine habitats and fauna, saltmarsh flora, invertebrates
Dale Point	SSSI	SM 818 053	Cliff vegetation
Cleddau	AoSP	SN 005 115	Ornithology
Sam's Wood	WT	SN 004 093	Woodland
Pembrokeshire Coast	NP	SR 940 940	Landscape, recreation
South Pembrokeshire	HC	SS 125 983- SM 871 029	Scenery, landscape
Marloes and Dale	HC	SM 815 055- SM 852 128	Scenery, landscape

Human influences

Milford Haven has been an important centre for shipping and light industry for hundreds of years. Current activities include three oil refineries, an oil-fired power station, a passenger and cargo ferry to the Republic of Ireland and numerous other cargo ships. There are several boat building and repair yards as well as the docks at the town of Milford and at Pembroke Dock. Capital and maintenance dredging is carried out within the waterway, off Pembroke Dock and in the approaches to the jetties.

The importance of Milford Haven as a fishing port has declined over this century but it is still home to a fleet of trawlers which work both locally and within the Irish Sea and Western Approaches. Within the Haven, there are seasonal herring *Clupea harengus* and salmon *Salmo salar* fisheries. Netting for several fish including bass occurs as far upstream as the Cleddau Bridge. Potting for crab *Cancer pagurus* and lobster *Homarus gammarus* also occurs. Bait-digging and collecting are locally intensive, especially in Angle Bay. Oyster farming in the inlet has now ceased.

Leisure activities are widespread and numerous throughout Milford Haven. Sailing is particularly popular and there are moorings and marinas at Angle, Dale, Lawrenny, Llangwm, Milford, Neyland and Pembroke. Windsurfing is concentrated at Dale where there is an instructional centre. Water-skiers use the central reaches of the Haven where there are specifically designated zones for this pursuit. Scuba diving occurs in the lower reaches of the Haven. Beach recreation is most intensive at West Angle Bay with other sections of the shore being popular with walkers, bird-watchers and anglers.

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Sites surveyed

- Survey 78: South-west Britain sublittoral survey of Milford Haven 1978-79 (Hiscock 1981).
- Survey 246: HRE survey of Milford Haven and the Cleddau 1985 (Little & Hiscock 1987).
- Survey 265: 1970-1980 SMBA/MBA Great Britain intertidal survey (Powell *et al.* 1979).
- Survey 656: Posford Duvivier Environment Milford Haven sublittoral survey 1996 (unpublished data).
- Survey 657: OPRU Milford Haven survey 1993 (unpublished data).
- Survey 659: Daucleddau estuary, Milford Haven, littoral survey 1989 (Hern 1989).
- Survey 669: OPRU Milford Haven rocky shore littoral monitoring survey 1995 (unpublished data).
- Survey 671: OPRU Cosheston Trot, Milford Haven, sublittoral survey 1988 (unpublished data).

Littoral sites					
Survey	Site	Place	Grid reference	Latitude/longitude	Biotopes present
78	6	N side of Cosheston Trot, River Cleddau.	SN 000 050	51°42.4'N 04°53.7'W	BalHpan
246	L1	W Blockhouse, Milford Haven.	SM 818 035	51°41.2'N 05°09.4'W	BPat; BPat.Sem; Cor; FK; Ala.Ldig
246	L2	E Blockhouse, Milford Haven.	SM 843 030	51°41.0'N 05°07.2'W	BPat.Cht; BPat.Sem; XR; Mas; Fser.R; Fser.Fser.Bo; Cor; Ov; SR; Ldig.Ldig
246	L3	Musselwick East, Milford Haven.	SM 817 065	51°42.8'N 05°09.6'W	FvesB; Fser.Fser.Bo; FK; SR; Ov; Ldig.Ldig.Bo
246	L4	W of Musselwick, Milford Haven.	SM 824 062	51°42.7'N 05°09.0'W	FserX; Lan

Littoral sites - continued

Survey	Site	Place	Grid reference	Latitude/longitude	Biotores present
246	L5	Wear Spit, Milford Haven.	SM 940 043	51°41.9'N 04°58.8'W	FserX.T; Fser.Fser.Bo; G; Ldig.Ldig.Bo
246	L6	Pwllcrochan, Milford Haven.	SM 921 038	51°41.6'N 05°00.5'W	Pel; Fspi; Asc.Asc; AscX; FserX.T; MytX; Cor; Lsac.Ldig; Sac
246	L7	Pennar Gut, Milford Haven.	SM 944 031	51°41.3'N 04°58.4'W	Asc.Asc; BLlit; FserX.T; Ldig.T
246	L8	S of Garron Pill, Cleddau estuary.	SN 009 075	51°43.8'N 04°53.0'W	YG; Ver.Ver; BPat.Sem; Pel; Asc.Asc; Fserr.T; Rkp; Ldig.T
246	L9	Coshaston Folly, Cleddau estuary.	SM 993 050	51°42.4'N 04°54.3'W	Pel; FserX.T; MytX; Asc.VS; Fserr.VS
246	L10	E of Jenkins Point, Cleddau estuary.	SN 009 060	51°43.0'N 04°52.9'W	Fser.Fser.Bo; FserX.T; Lsac.Ldig
246	L11	Mouth of Garron Pill, Cleddau estuary.	SN 009 079	51°44.0'N 04°53.0'W	Fser.Fser.Bo
246	L12	Eastwood Farm, Cleddau estuary.	SM 991 102	51°45.2'N 04°54.6'W	FvesX; Asc.VS; HedOl
246	L13	Woodhouse Landshipping, Cleddau estuary.	SN 004 104	51°45.3'N 04°53.5'W	Pel; Fspi; Asc.VS; Fserr.VS
246	L14	Picton Point, Cleddau estuary.	SN 003 117	51°46.0'N 04°53.6'W	Pel; Fspi; Asc.VS; Fserr.VS
265	364	Gann Flat Rocks.	SM 809 065	51°42.8'N 05°10.3'W	BPat.Sem; Pel; Asc.Asc; Fser
265	365	Gann Stone Bed.	SM 811 065	51°42.8'N 05°10.1'W	FvesX; FserX; MacAre
265	374	Lawrenny, Dauceddau.	SN 008 063	51°43.1'N 04°53.0'W	BPat.Sem; Ver.Ver; Pel; Asc.Asc; Fserr
265	377	Llanion Camp, Milford Haven.	SM 982 043	51°42.0'N 04°55.2'W	Pel; Fspi; Asc.VS; Fserr.VS
265	378	Longoar Bay.	SM 849 060	51°42.6'N 05°06.8'W	Ver.Ver; BPat; Fser.R; Pel; Asc.Asc
265	387	Pembroke Ferry, Milford Haven.	SM 975 046	51°42.1'N 04°55.8'W	Fspi; Fves; Fserr.VS
265	421	W Angle, North.	SM 850 034	51°41.2'N 05°06.6'W	BF; R
265	422	W Angle, South.	SM 850 032	51°41.1'N 05°06.6'W	BF; R
657	2	SW of Hook Reach, Western Cleddau.	SM 975 118	51°46.0'N 04°56.0'W	HedStr
657	6	E of Castle Lake Camp, Eastern Cleddau.	SN 023 132	51°46.9'N 04°51.9'W	HedStr
657	16	Beneath Cleddau road bridge, Cleddau estuary.	SM 972 052	51°42.5'N 04°56.1'W	HedStr
659	1	SW of Hanton Farm, Western Cleddau.	SM 973 137	51°47.0'N 04°56.3'W	HedOl
659	2	SE of Black Hill, Western Cleddau.	SM 970 126	51°46.4'N 04°56.5'W	HedOl
659	3	W of Hook, Western Cleddau.	SM 976 116	51°45.9'N 04°56.0'W	HedStr
659	4	Hook Reach, Western Cleddau.	SM 983 123	51°46.3'N 04°55.4'W	HedStr
659	5	E Hook, Western Cleddau.	SM 996 117	51°46.0'N 04°54.2'W	HedStr
659	6	Off Picton Point, Dauceddau estuary.	SN 004 116	51°46.0'N 04°53.5'W	HedStr
659	7	SW of Castle Lake Camp, Eastern Cleddau.	SN 017 123	51°46.4'N 04°52.4'W	HedStr
659	8	E of Castle Lake Camp, Eastern Cleddau.	SN 024 129	51°46.7'N 04°51.8'W	HedStr
659	9	S of Slebech Park, Eastern Cleddau.	SN 034 137	51°47.2'N 04°51.0'W	HedStr
659	10	Landshipping Quay, Dauceddau estuary.	SN 007 109	51°45.6'N 04°53.3'W	HedStr
659	11	NE of Blacktar Point, Dauceddau estuary.	SN 003 094	51°44.8'N 04°53.5'W	HedStr
659	12	S of Blacktar Point, Dauceddau estuary.	SM 997 088	51°44.4'N 04°54.0'W	HedStr
659	13	Mouth of Garron Pill, Dauceddau estuary.	SN 010 079	51°44.0'N 04°52.9'W	HedStr
659	14	S side of Garron Pill, Dauceddau estuary.	SN 012 077	51°43.9'N 04°52.7'W	HedStr
659	15	SW of Garron, Dauceddau estuary.	SN 014 076	51°43.8'N 04°52.5'W	HedStr
659	16	N of Williamston Pill, Dauceddau estuary.	SN 004 063	51°43.1'N 04°53.4'W	HedStr
659	17	Off Lawrenny Quay, Dauceddau estuary.	SN 013 061	51°43.0'N 04°52.6'W	HedStr
659	18	0.25 km NW of Black Mixen, Dauceddau estuary.	SN 017 062	51°43.1'N 04°52.2'W	HedStr
659	19	Nr mouth of Cresswell River.	SN 018 064	51°43.2'N 04°52.1'W	HedStr
659	20	NE of Black Mixen, Cresswell River.	SN 024 064	51°43.2'N 04°51.6'W	HedStr
659	21	Black Mixen, Dauceddau estuary.	SN 019 061	51°43.0'N 04°52.0'W	HedStr

Littoral sites - continued

Survey	Site	Place	Grid reference	Latitude/longitude	Biotores present
659	22	S of Black Mixen, Carew River.	SN 020 059	51°42.9'N 04°52.0'W	HedStr
659	23	SE of Black Mixen, Carew River.	SN 022 058	51°42.9'N 04°51.8'W	HedStr
659	24	1 km NW of Shipping Point, Carew River.	SN 025 053	51°42.6'N 04°51.5'W	HedStr
659	25	Williamston Pill, Daucleddau estuary.	SN 003 062	51°43.1'N 04°53.4'W	HedStr
659	26	NE of Mill Bay, Daucleddau estuary.	SN 004 051	51°42.5'N 04°53.3'W	HedStr
659	27	E of Burton, Daucleddau estuary.	SM 993 053	51°42.6'N 04°54.3'W	HedStr
659	28	N of Coshleston Point, Daucleddau estuary.	SM 984 042	51°41.9'N 04°55.0'W	HedStr
659	29	Pembroke Docks, Daucleddau estuary.	SM 965 039	51°41.7'N 04°56.7'W	HedStr
659	30	Hazelbeach, Daucleddau estuary.	SM 957 048	51°42.2'N 04°57.4'W	HedStr
659	31	E of Neyland, Daucleddau estuary.	SM 970 050	51°42.3'N 04°56.3'W	HedStr
669	1	Dale Point, Milford Haven.	SM 824 050	51°42.0'N 05°08.9'W	YG; Ver.B; BPat.Cht; BPat.Fvesl; XR
669	2	S Hook Point, Milford Haven.	SM 867 055	51°42.4'N 05°05.2'W	YG; Ver.Ver; BPat.Cht; Ver.B; BPat.Fvesl; XR
669	3	Watchhouse Point, Milford Haven.	SM 836 062	51°42.7'N 05°07.9'W	YG; Ver.B; BPat; BPat.Cht; BPat.Fvesl; XR
669	4	Rook's Nest Point, Milford Haven.	SM 844 063	51°42.8'N 05°07.2'W	Ver.B; BPat.Cht; BPat.Fvesl; BPat.Sem
669	5	Musselwick East, Milford Haven.	SM 823 062	51°42.7'N 05°09.0'W	YG; Ver.B; Ver.Ver; BPat; XR; Pel; Fser.Fser; SR
669	6	Little Castle Head, Milford Haven.	SM 855 064	51°42.8'N 05°06.3'W	YG; Ver.B; Ver.Ver; BPat; BPat.Lic; Fser.R; Pel
669	7	W Angle Bay, Milford Haven.	SM 848 031	51°41.0'N 05°06.8'W	YG; Ver.B; Ver.Ver; BPat; BPat.Cht; Fser.R; XR
669	8	Point Wood Beach, Milford Haven.	SM 821 053	51°42.2'N 05°09.2'W	YG; Ver.Ver; BPat; FvesB; Pel; FserX.T
669	9	Black Rock, Milford Haven.	SM 813 061	51°42.6'N 05°09.9'W	YG; Ver.B; BPat; Pel; Fser.Fser.Bo
669	10	Gelliswick, Milford Haven.	SM 889 054	51°42.4'N 05°03.3'W	YG; BPat; Pel; Fser.Fser.Bo
669	11	Angle Point, Milford Haven.	SM 875 033	51°41.2'N 05°04.4'W	YG; Ver.Ver; BPat; Fves; Fser.Fser
669	12	Bullwell, Milford Haven.	SM 902 039	51°41.6'N 05°02.1'W	YG; Ver.Ver; BPat.Sem; Pel; Fspi; Fser.Fser
669	13	The Horseshoe, Milford Haven.	SM 924 046	51°42.0'N 05°00.2'W	YG; Ver.Ver; Pel; Fves; FvesX; FserX
669	14	Wear Point, Milford Haven.	SM 938 043	51°41.9'N 04°59.0'W	YG; Ver.Ver; FvesX; FserX
669	15	Hazelbeach, Milford Haven.	SM 945 045	51°42.0'N 04°58.4'W	YG; BPat; Pel; FserX
669	16	Cliff Cottages, Milford Haven.	SM 811 064	51°42.7'N 05°10.1'W	YG; BPat.Sem; Pel; Fspi; Fves
669	17	Llanreath, Milford Haven.	SM 950 033	51°41.4'N 04°57.9'W	YG; Ver.Ver; BPat; Pel; Fspi; Fves; MytX
669	18	Pembroke Ferry, Milford Haven.	SM 976 046	51°42.1'N 04°55.7'W	YG; BPat; Ent; Pel; Fspi; Asc.VS; Fser.VS
669	19	Burton Hawn, Milford Haven.	SM 991 053	51°42.5'N 04°54.4'W	YG; Ver; Pel; Fspi; Fves; FserX
669	20	Coshleston Folly, Milford Haven.	SM 996 050	51°42.4'N 04°54.0'W	YG; Ver.Ver; BPat; Pel; Fves; Asc.VS; Fser.VS
669	21	Lawrenny Ferry, Milford Haven.	SN 008 062	51°43.1'N 04°53.0'W	Ver; Pel; FvesX; AscX; Asc.VS
669	24	Great Castle Head (inner), Milford Haven.	SM 850 060	51°42.6'N 05°06.7'W	YG; Ver.B; Ver.Ver; BPat; BPat.Lic; Fser.R; Pel

Littoral sites - continued					
Survey	Site	Place	Grid reference	Latitude/longitude	Biotores present
669	25	Sawdern Point, Milford Haven.	SM 888 031	51°41.1'N 05°03.3'W	YG; BPat; AscX
669	26	Chapel Bay, Milford Haven.	SM 861 036	51°41.3'N 05°05.7'W	YG; Ver.Ver; Fser.R; Pel; Fspi; Fves
669	27	Garron Pill, Milford Haven.	SN 010 076	51°43.8'N 04°52.9'W	YG; Ver.Ver; BPat; Pel; Fves; Fserr.VS
669	28	Landshipping (south), Milford Haven.	SN 004 103	51°45.3'N 04°53.5'W	YG; Ver.Ver; Pel; Fserr.VS; Asc.VS
669	30	Black Tar (north), Milford Haven.	SM 999 098	51°45.0'N 04°53.9'W	Ent; Pel; Fves; Asc.VS; Fserr.VS
669	31	Benton Castle, Milford Haven.	SN 006 068	51°43.4'N 04°53.2'W	YG; Ver.Ver; BPat; Pel; Fspi; Asc.VS

Sublittoral sites					
Survey	Site	Place	Grid reference	Latitude/longitude	Biotores present
78	1	Picton Point, River Cleddau.	SN 003 115	51°45.9'N 04°53.6'W	EstMx
78	2	Opposite Sprinkle Pill, River Cleddau.	SN 006 107	51°45.5'N 04°53.3'W	LsacRS.FiR
78	3	Black Tar, River Cleddau.	SM 999 095	51°44.8'N 04°53.9'W	LsacRS.FiR
78	4A	Beacon NW of Benton Wood, River Cleddau.	SN 007 078	51°43.9'N 04°53.1'W	Lhyp.TFt; Lsac.Ldig
78	4B	S of Garron Pill, River Cleddau.	SN 009 075	51°43.8'N 04°53.0'W	CuSH; LsacRS.FiR
78	5	Castle Reach, River Cleddau.	SN 008 069	51°43.4'N 04°53.0'W	CuSH; LsacRS.FiR
78	6	N side of Coshoston Trot, River Cleddau.	SN 000 050	51°42.4'N 04°53.7'W	BalHpan
78	6A	Coshoston Trot, S side, Milford Haven.	SM 999 052	51°42.5'N 04°53.7'W	CuSH; SubSoAs; ByH; Lhyp.TFt; LsacRS.FiR
78	7	Burton Cliff, River Cleddau.	SM 988 051	51°42.4'N 04°54.7'W	Urt; LsacRS.FiR
78	8	Pembroke Ferry, River Cleddau.	SM 977 047	51°42.2'N 04°55.6'W	Flu.Hocu
78	8A	Hobbs Point, Milford Haven.	SM 967 043	51°42.0'N 04°56.5'W	Flu.Hocu; Ldig.T
78	9	Carr Spit, Milford Haven.	SM 955 044	51°42.0'N 04°57.5'W	SubSoAs; LsacX
78	10	Pennar Pool, Milford Haven.	SM 942 026	51°41.0'N 04°58.6'W	MarMu
78	11	Power Station Channel, Milford Haven.	SM 938 025	51°40.9'N 04°58.9'W	MarMu
78	12	E to W Pennar Points, Milford Haven.	SM 942 030	51°41.2'N 04°58.6'W	FserX.T; ByH; Lsac.T
78	13	W of Wear Point, Milford Haven.	SM 937 042	51°41.8'N 04°59.1'W	ByH
78	14	Pwllcrochan Flats, Milford Haven.	SM 916 038	51°41.6'N 05°00.9'W	LsacX
78	15	Milford Conservancy Jetty, Milford Haven.	SM 892 052	51°42.3'N 05°03.0'W	SCAs.ByH; LsacX
78	16	E of Esso Jetty, Milford Haven.	SM 875 053	51°42.3'N 05°04.5'W	Zmar
78	16A	W of Esso Jetty, Milford Haven.	SM 868 053	51°42.3'N 05°05.1'W	Phy
78	17	Angle Lifeboat Slip, Milford Haven.	SM 872 035	51°41.3'N 05°04.7'W	SCAs.ByH
78	18	E of Chapel Bay, Milford Haven.	SM 865 036	51°41.4'N 05°05.3'W	LsacX
78	19	S of Stack Rocks, Milford Haven.	SM 864 049	51°42.1'N 05°05.4'W	Lhyp.Pk
78	20	W of Chapel Bay, Milford Haven.	SM 856 038	51°41.4'N 05°06.1'W	Lhyp.Ft; FaMx; LsacX
78	21	Great Castle Head, Milford Haven.	SM 847 058	51°42.5'N 05°07.0'W	Lhyp.Ft; SCAs.ByH; Lhyp.Pk; AlcMaS
78	22	Dale Roads N, Milford Haven.	SM 820 062	51°42.7'N 05°09.3'W	LsacX
78	23	Watch House Point, Milford Haven.	SM 836 061	51°42.6'N 05°07.9'W	Lhyp.Ft; FaMx; LsacX
78	24	W of Thorn Island, Milford Haven.	SM 845 038	51°41.4'N 05°07.1'W	SCAs.DenCla
78	25	W Blockhouse, Milford Haven.	SM 820 035	51°41.2'N 05°09.2'W	SCAs.ByH; Lhyp.Ft; Lhyp.Pk
78	26	N of Sheep Island, Milford Haven.	SM 842 017	51°40.3'N 05°07.2'W	Lhyp.Ft; Lhyp.Pk; Mob
78	27	Chapel Rocks, Milford Haven.	SM 830 029	51°40.9'N 05°08.3'W	AlcMaS
78	28	Dale Point, Milford Haven.	SM 825 052	51°42.1'N 05°08.8'W	AlcMaS
78	A	Pennar Mouth, Milford Haven.	SM 943 028	51°41.1'N 04°58.5'W	FserX.T; Ldig.Ldig; LhypLsac.Ft; CMX; LsacX
78	C	Wards Pier, Milford Haven.	SM 920 048	51°42.1'N 05°00.6'W	LsacX
78	D	Between Amoco and Esso Jetties, Milford Haven.	SM 879 053	51°42.3'N 05°04.2'W	Zmar; LsacX
78	E	Jetty 4, Esso Jetty, Milford Haven.	SM 875 044	51°41.8'N 05°04.5'W	Ldig.Ldig
78	F	Littlewick Bay, Milford Haven.	SM 873 053	51°42.3'N 05°04.7'W	Zmar; LsacX

Sublittoral sites - continued

Survey	Site	Place	Grid reference	Latitude/longitude	Biotores present
78	G	W Dolphin, Esso Jetty, Milford Haven.	SM 869 046	51°41.9'N 05°05.0'W	SCAs.ByH; LhypLsac.Ft; Lsac.Ldig; AlcMaS
78	H	Montreal Rocks, Milford Haven.	SM 855 058	51°42.5'N 05°06.3'W	AlcMaS
78	I	Longoar Bay, Milford Haven.	SM 850 062	51°42.7'N 05°06.7'W	Zmar; FaMx
246	D1	S of Monk Haven, Milford Haven.	SM 827 061	51°42.6'N 05°08.7'W	FaMx
246	D2	SW of Watch House Point, Dale.	SM 832 059	51°42.5'N 05°08.3'W	FaMS
246	D3	E of Great Castle Head, Milford Haven.	SM 853 060	51°42.6'N 05°06.4'W	SIR; FaG
246	D4	Nr. mouth of Sandyhaven Pill, Milford Haven.	SM 859 064	51°42.8'N 05°05.9'W	Lcon
246	D5	NE of Stack Rock, Milford Haven.	SM 867 051	51°42.2'N 05°05.2'W	FaG
246	D6	NW of S Hook Point, Milford Haven.	SM 867 051	51°42.2'N 05°05.2'W	FaG
246	D7	Kilroom, N of S Hook Point, Milford Haven.	SM 865 059	51°42.6'N 05°05.4'W	FaG
246	S1	Dockyard Bank Deep, Milford Haven/Cleddau estuary.	SM 963 042	51°41.9'N 04°56.8'W	Flu.Hocu; Urt; SubSoAs
246	S2	Dockyard Bank West, Cleddau estuary.	SM 956 043	51°41.9'N 04°57.4'W	CMX; LsacX
246	S3	W of Carr Spit, Cleddau estuary.	SM 954 041	51°41.8'N 04°57.6'W	LsacRS.FiR
246	S4	Lawrenny Park, Cleddau estuary.	SN 009 066	51°43.3'N 04°52.9'W	Flu.Hocu; LsacRS.FiR; CMU
246	S5	Off Williamston Pill, Cleddau estuary.	SN 006 062	51°43.1'N 04°53.2'W	EstMx; HbowEud; ByH
246	S6	E Lawrenny Creek, Cleddau estuary.	SN 016 061	51°43.0'N 04°52.3'W	MCR; LsacRS.FiR
246	S7	W of Lawrenny Creek, Cleddau estuary.	SN 010 061	51°43.0'N 04°52.8'W	Lsac.Ldig; LsacRS.FiR
246	S8	Burton Cliff, Cleddau estuary.	SM 989 050	51°42.4'N 04°54.6'W	Flu.Hocu; Lsac.Ldig; ByH; LsacRS.FiR;
246	S9	Knapp Farm, Cleddau estuary.	SM 999 099	51°45.0'N 04°53.9'W	LsacRS.FiR; XFa
246	S10	Target Trot, Cleddau estuary.	SM 990 047	51°42.2'N 04°54.5'W	SCAs; Ldig.Ldig; LsacRS.FiR
246	S11	Dale Shelf 1, Milford Haven.	SM 824 058	51°42.4'N 05°08.9'W	Phy.R; LsacX
246	S12	Dale Shelf 2, Milford Haven.	SM 828 056	51°42.3'N 05°08.6'W	FaMx; AlcMaS; LsacX
246	S13	Castlebeach Bay, Milford Haven.	SM 823 050	51°42.0'N 05°09.0'W	Lhyp.Ft; LsacX
246	S14	NE of Stack Rock, Milford Haven.	SM 866 053	51°42.3'N 05°05.3'W	Phy.R; LsacX;
246	S15	E of Wear Point, Milford Haven.	SM 941 042	51°41.8'N 04°58.7'W	CMX; ScupHyd; Lsac.T; LsacX
246	S16	NW of Martello Tower (Llanreath), Milford Haven.	SM 949 035	51°41.5'N 04°58.0'W	Aasp; MarMu
246	S17	Power Station Outfall, Milford Haven.	SM 930 038	51°41.6'N 04°59.7'W	CreAph
246	S18	N Pennar Gut, Milford Haven.	SM 926 030	51°41.2'N 05°00.0'W	ByH; LsacX
656	1	Area 2. Dockyard buoy no. 3 towards Dry Dock, Milford Haven.	SM 959 045	51°42.1'N 04°57.1'W	EstMx
656	2	Carr Spit, Milford Haven.	SM 952 044	51°42.0'N 04°57.8'W	Ost
656	3	Carr Spit, Milford Haven.	SM 952 045	51°42.0'N 04°57.8'W	CMX
656	4	S of Neyland small craft moorings, Milford Haven.	SM 959 046	51°42.2'N 04°57.2'W	Flu.Hocu
656	5	E of Dockyard buoy no. 3, Milford Haven.	SM 960 045	51°42.1'N 04°57.1'W	CMX
656	6	W slope of Hobbs Point Hole, Milford Haven.	SM 962 042	51°41.9'N 04°56.9'W	ErSPbolSH
656	8	Carr Spit Bury - W bank, Milford Haven.	SM 951 044	51°42.0'N 04°57.8'W	CMX
656	9	No. 1 Buoy S of Carr Spit, Milford Haven.	SM 951 043	51°42.0'N 04°57.8'W	CMX
657	1	E of Black Hill, Western Cleddau.	SM 969 129	51°46.6'N 04°56.6'W	MarMu
657	3	N of Underwood, Western Cleddau.	SM 989 122	51°46.3'N 04°54.8'W	PolMtru
657	4	S of Picton Point, Cleddau estuary.	SN 002 113	51°45.8'N 04°53.6'W	PolMtru
657	5	SE of Church Hoe, Eastern Cleddau.	SN 017 122	51°46.4'N 04°52.4'W	AphTub
657	7	Landshipping Quay, Cleddau estuary.	SN 004 109	51°45.6'N 04°53.5'W	AphTub
657	8	E of Knave Farm, Cleddau estuary.	SM 999 100	51°45.1'N 04°53.9'W	CreAph
657	9	S of Blacktar Point, Cleddau estuary.	SM 999 091	51°44.6'N 04°53.8'W	CreAph
657	10	Mouth of Garron Pill, Cleddau estuary.	SN 009 078	51°44.0'N 04°52.9'W	CreAph
657	11	N of Jenkins Point, Cleddau estuary.	SN 007 061	51°43.0'N 04°53.0'W	CreAph
657	12	Black Mixen, Carew River.	SN 019 062	51°43.1'N 04°52.0'W	AphTub

Sublittoral sites - continued

<i>Survey</i>	<i>Site</i>	<i>Place</i>	<i>Grid reference</i>	<i>Latitude/longitude</i>	<i>Biotopes present</i>
657	13	S of Williamston Pill, Cleddau estuary.	SN 002 059	51°42.9'N 04°53.5'W	CreAph
657	14	Mouth of Cosheston Pill, Cleddau estuary.	SM 983 043	51°42.0'N 04°55.0'W	AphTub
657	15	S of Cosheston Point, Cleddau estuary.	SM 982 039	51°41.8'N 04°55.1'W	NhomTub
657	17	Neyland Point, Cleddau Estuary.	SM 964 043	51°42.0'N 04°56.7'W	FaMx
657	18	NW of Carr Rock, Cleddau estuary.	SM 953 044	51°42.0'N 04°57.6'W	VsenMtru
657	19	S of Hazelbeach, Milford Haven.	SM 950 041	51°41.8'N 04°57.9'W	VsenMtru; FaMx
657	20	N of E Pennar Point, Milford Haven.	SM 947 039	51°41.7'N 04°58.2'W	FaMx; VsenMtru
657	21	S of Pennar Park, Pembroke River.	SM 943 026	51°41.0'N 04°58.4'W	AphTub
657	22	NW of Bentlass, Pembroke River.	SM 958 020	51°40.7'N 04°57.1'W	NhomTub
657	23	NE of Martins Haven, Milford Haven.	SM 929 039	51°41.7'N 04°59.7'W	VsenMtru
657	24	S of Newton Noyes Pier, Milford Haven.	SM 917 045	51°42.0'N 05°00.8'W	AbrNucCor
657	25	N of Texaco terminal, Milford Haven.	SM 908 046	51°42.0'N 05°01.6'W	AbrNucCor
657	26	N of Bullwell Bay, Milford Haven.	SM 901 051	51°42.3'N 05°02.2'W	AbrNucCor
657	27	N of Popton Point, Milford Haven.	SM 891 044	51°41.9'N 05°03.0'W	AphTub
657	28	NE of Angle Point, Milford Haven.	SM 879 040	51°41.6'N 05°04.1'W	AbrNucCor
657	29	S of Sawdern Point, Milford Haven.	SM 884 045	51°41.9'N 05°03.6'W	AbrNucCor
657	30	Below west end of Esso terminal jetty, Milford Haven.	SM 867 043	51°41.8'N 05°05.1'W	AbrNucCor
657	31	NE of Thorn Point, Milford Haven.	SM 857 044	51°41.8'N 05°06.0'W	AbrNucCor
657	32	SE of Musselwick Point, Milford Haven.	SM 820 058	51°42.4'N 05°09.2'W	AbrNucCor
657	33	SE of Dale Fort, Milford Haven.	SM 831 045	51°41.8'N 05°08.3'W	AbrNucCor
657	34	Castlebeach Bay, Milford Haven.	SM 821 048	51°41.9'N 05°09.1'W	AbrNucCor
657	35	SE of St Ann's Head, Milford Haven.	SM 813 024	51°40.6'N 05°09.8'W	Sell; Ven.Bra
671	1	Under Aqua Norse Fish Farm, Cosheston Trot, Milford Haven.	SM 998 052	51°42.5'N 04°53.8'W	CuSH; Flu.SerHyd

Compiled by:

Jan Smith and Jon Moore

Appendix A

Biotopes classification

A hierarchical classification of the biotopes recorded in MNCR Sector 9 (Bristol Channel and approaches) during the surveys given in Table 1, together with their higher types, is given below. Records of biotopes noted in the text but not shown here come from additional published sources noted in the individual area summaries. The biotopes listed are derived from the MNCR national biotope classification (Connor *et al.* 1997a, b), except IMX.SalvMx, for which a description is given here.

Higher code	Biotope code	Biotope
LR		LITTORAL ROCK (and other hard substrata)
LR.L		Lichens or algal crusts
LR.L	YG	Yellow and grey lichens on supralittoral rock
LR.L	Ver	<i>Verrucaria maura</i> on littoral fringe rock
LR.L	Ver.B	<i>Verrucaria maura</i> and sparse barnacles on exposed littoral fringe rock
LR.L	Ver.Ver	<i>Verrucaria maura</i> on moderately exposed to very sheltered upper littoral fringe rock
ELR		Exposed littoral rock (mussel/barnacle shores)
ELR.MB		<i>Mytilus</i> (mussels) and barnacles
ELR.MB	MytB	<i>Mytilus edulis</i> and barnacles on very exposed eulittoral rock
ELR.MB	BPat	Barnacles and <i>Patella</i> spp. on exposed or moderately exposed, or vertical sheltered, eulittoral rock
ELR.MB	BPat.Cht	<i>Chthamalus</i> spp. on exposed upper eulittoral rock
ELR.MB	BPat.Lic	Barnacles and <i>Lichina pygmaea</i> on steep exposed upper eulittoral rock
ELR.MB	BPat.Cat	<i>Catenella caespitosa</i> on overhanging, or shaded vertical, upper eulittoral rock
ELR.MB	BPat.Fvesl	Barnacles, <i>Patella</i> spp. and <i>Fucus vesiculosus</i> f. <i>linearis</i> on exposed eulittoral rock
ELR.MB	BPat.Sem	<i>Semibalanus balanoides</i> on exposed or moderately exposed, or vertical sheltered, eulittoral rock
ELR.FR		Robust fucoids or red seaweeds
ELR.FR	Him	<i>Himanthalia elongata</i> and red seaweeds on exposed lower eulittoral rock
MLR		Moderately exposed littoral rock (barnacle/fucoid shores)
MLR.BF		Barnacles and fucoids (moderately exposed shores)
MLR.BF	PelB	<i>Pelvetia canaliculata</i> and barnacles on moderately exposed littoral fringe rock
MLR.BF	FvesB	<i>Fucus vesiculosus</i> and barnacle mosaics on moderately exposed mid eulittoral rock

Higher code	Biotope code	Biotope
MLR.BF	Fser	<i>Fucus serratus</i> on moderately exposed lower eulittoral rock
MLR.BF	Fser.R	<i>Fucus serratus</i> and red seaweeds on moderately exposed lower eulittoral rock
MLR.BF	Fser.Fser	Dense <i>Fucus serratus</i> on moderately exposed to very sheltered lower eulittoral rock
MLR.BF	Fser.Fser.Bo	<i>Fucus serratus</i> and under-boulder fauna on lower eulittoral boulders
MLR.R		Red seaweeds (moderately exposed shores)
MLR.R	XR	Mixed red seaweeds on moderately exposed lower eulittoral rock
MLR.R	Mas	<i>Mastocarpus stellatus</i> and <i>Chondrus crispus</i> on very to moderately exposed lower eulittoral rock
MLR.Eph		Ephemeral green or red seaweeds (freshwater or sand-influenced)
MLR.Eph	Ent	<i>Enteromorpha</i> spp. on freshwater-influenced or unstable upper eulittoral rock
MLR.Eph	EntPor	<i>Porphyra purpurea</i> or <i>Enteromorpha</i> spp. on sand-scoured mid or lower eulittoral rock
MLR.Eph	Rho	<i>Rhodothamniella floridula</i> on sand-scoured lower eulittoral rock
MLR.MF		Mytilus (mussels) and furoids (moderately exposed shores)
MLR.MF	MytFR	<i>Mytilus edulis</i> , <i>Fucus serratus</i> and red seaweeds on moderately exposed lower eulittoral rock
MLR.Sab		Littoral Sabellaria (honeycomb worm) reefs
MLR.Sab	Salv	<i>Sabellaria alveolata</i> reefs on sand-abraded eulittoral rock
SLR		Sheltered littoral rock (fucoid shores)
SLR.F		Dense furoids (stable rock)
SLR.F	Pel	<i>Pelvetia canaliculata</i> on sheltered littoral fringe rock
SLR.F	Fspi	<i>Fucus spiralis</i> on moderately exposed to very sheltered upper eulittoral rock
SLR.F	Fves	<i>Fucus vesiculosus</i> on sheltered mid eulittoral rock
SLR.F	Asc	<i>Ascophyllum nodosum</i> on very sheltered mid eulittoral rock
SLR.F	Asc.Asc	<i>Ascophyllum nodosum</i> on full salinity mid eulittoral rock
SLR.F	Asc.VS	<i>Ascophyllum nodosum</i> and <i>Fucus vesiculosus</i> on variable salinity mid eulittoral rock
SLR.F	Fserr	<i>Fucus serratus</i> on sheltered lower eulittoral rock
SLR.F	Fserr.T	<i>Fucus serratus</i> , sponges and ascidians on tide-swept lower eulittoral rock

Higher code	Biotope code	Biotope
SLR.F	Fserr.VS	<i>Fucus serratus</i> and large <i>Mytilus edulis</i> on variable salinity lower eulittoral rock
SLR.F	Fcer	<i>Fucus ceranoides</i> on reduced salinity eulittoral rock
SLR.FX		Fucoids, barnacles or ephemeral seaweeds (mixed substrata)
SLR.FX	BLlit	Barnacles and <i>Littorina littorea</i> on unstable eulittoral mixed substrata
SLR.FX	FvesX	<i>Fucus vesiculosus</i> on mid eulittoral mixed substrata
SLR.FX	AscX	<i>Ascophyllum nodosum</i> on mid eulittoral mixed substrata
SLR.FX	FserX	<i>Fucus serratus</i> on lower eulittoral mixed substrata
SLR.FX	FserX.T	<i>Fucus serratus</i> with sponges, ascidians and red seaweeds on tide-swept lower eulittoral mixed substrata
SLR.FX	EphX	Ephemeral green and red seaweeds on variable salinity or disturbed eulittoral mixed substrata
SLR.FX	FcerX	<i>Fucus ceranoides</i> on reduced salinity eulittoral mixed substrata
SLR.MX		Mytilus (mussel) beds (mixed substrata)
SLR.MX	MytX	<i>Mytilus edulis</i> beds on eulittoral mixed substrata
		Littoral rock (other)
		Rockpools
LR.Rkp		
LR.Rkp	G	Green seaweeds (<i>Enteromorpha</i> spp. and <i>Cladophora</i> spp.) in upper shore rockpools
LR.Rkp	Cor	<i>Corallina officinalis</i> and coralline crusts in shallow eulittoral rockpools
LR.Rkp	Cor.Bif	<i>Bifurcaria bifurcata</i> in shallow eulittoral rockpools
LR.Rkp	FK	Fucoids and kelps in deep eulittoral rockpools
LR.Rkp	FK.Sar	<i>Sargassum muticum</i> in eulittoral rockpools
LR.Rkp	SwSed	Seaweeds in sediment (sand or gravel)-floored eulittoral rockpools
LR.Rkp	H	Hydroids, ephemeral seaweeds and <i>Littorina littorea</i> in shallow eulittoral mixed substrata pools
LR.Ov		Overhangs and caves
LR.Ov	SR	Sponges and shade-tolerant red seaweeds on overhanging lower eulittoral bedrock
LS		LITTORAL SEDIMENTS
LGS		Littoral gravels and sands
LGS.S		Sand shores
LGS.S	BarSnd	Barren coarse sand shores

Higher code	Biotope code	Biotope
LGS.S	AEur	Burrowing amphipods and <i>Eurydice pulchra</i> in well-drained clean sand shores
LGS.S	AP	Burrowing amphipods and polychaetes in clean sand shores
LGS.S	AP.P	Burrowing amphipods and polychaetes (often with <i>Arenicola marina</i>) in clean sand shores
LGS.S	AP.Pon	Burrowing amphipods <i>Pontocrates</i> spp. and <i>Bathyporeia</i> spp. in lower shore clean sand
LGS.S	Lan	Dense <i>Lanice conchilega</i> in tide-swept lower shore sand
LGS.Est		Estuarine coarse sediment shores
LGS.Est	OI	Oligochaetes in reduced or low salinity gravel or coarse sand shores
LMS		Littoral muddy sands
LMS.MS		Muddy sand shores
LMS.MS	BatCor	<i>Bathyporeia</i> spp. and <i>Corophium</i> spp. in upper shore slightly muddy fine sands
LMS.MS	PCer	Polychaetes and <i>Cerastoderma edule</i> in fine sand and muddy sand shores
LMS.MS	MacAre	<i>Macoma balthica</i> and <i>Arenicola marina</i> in muddy sand shores
LMU		Littoral muds
LMU.Sm		Saltmarsh
LMU.Sm		Saltmarsh (pioneer)
LMU.Sm	NVC SM8	<i>Salicornia</i> spp.
LMU.SMu		Sandy mud shores
LMU.SMu	HedMac	<i>Hediste diversicolor</i> and <i>Macoma balthica</i> in sandy mud shores
LMU.SMu	HedMac.Are	<i>Hediste diversicolor</i> , <i>Macoma balthica</i> and <i>Arenicola marina</i> in muddy sand or sandy mud shores
LMU.SMu	HedMac.Pyg	<i>Hediste diversicolor</i> , <i>Macoma balthica</i> and <i>Pygospio elegans</i> in sandy mud shores
LMU.Mu		Soft mud shores
LMU.Mu	HedScr	<i>Hediste diversicolor</i> and <i>Scrobicularia plana</i> in reduced salinity mud shores
LMU.Mu	HedStr	<i>Hediste diversicolor</i> and <i>Streblospio shrubsolii</i> in sandy mud or soft mud shores
LMU.Mu	HedOl	<i>Hediste diversicolor</i> and oligochaetes in low salinity mud shores
LMX		Littoral mixed sediments

Higher code	Biotope code	Biotope
IR		INFRALITTORAL ROCK (and other hard substrata)
EIR		Exposed infralittoral rock
EIR.KFaR		Kelp with cushion fauna, foliose red seaweeds or coralline crusts (exposed rock)
EIR.KFaR	Ala	<i>Alaria esculenta</i> on sublittoral fringe bedrock
EIR.KFaR	Ala.Ldig	<i>Alaria esculenta</i> and <i>Laminaria digitata</i> on exposed sublittoral fringe bedrock
EIR.KFaR	LhypR	<i>Laminaria hyperborea</i> with dense foliose red seaweeds on exposed infralittoral rock
EIR.KFaR	LhypR.Ft	<i>Laminaria hyperborea</i> forest with dense foliose red seaweeds on exposed upper infralittoral rock
EIR.SG		Robust faunal cushions and crusts (surge gullies & caves)
EIR.SG	FoSwCC	Foliose seaweeds and coralline crusts in surge gully entrances
EIR.SG	SCAs	Sponge crusts and colonial ascidians on wave-surged vertical infralittoral rock
EIR.SG	SCAs.DenCla	<i>Dendrodoa grossularia</i> and <i>Clathrina coriacea</i> on wave-surged vertical infralittoral rock
EIR.SG	SCAs.ByH	Sponge crusts, colonial (polyclinid) ascidians and a bryozoan/hyroid turf on wave-surged vertical or overhanging infralittoral rock
MIR		Moderately exposed infralittoral rock
MIR.KR		Kelp with red seaweeds (moderately exposed rock)
MIR.KR	Ldig	<i>Laminaria digitata</i> on moderately exposed or tide-swept sublittoral fringe rock
MIR.KR	Ldig.Ldig	<i>Laminaria digitata</i> on moderately exposed sublittoral fringe rock
MIR.KR	Ldig.Ldig.Bo	<i>Laminaria digitata</i> and under-boulder fauna on sublittoral fringe boulders
MIR.KR	Ldig.T	<i>Laminaria digitata</i> , ascidians and bryozoans on tide-swept sublittoral fringe rock
MIR.KR	Lhyp	<i>Laminaria hyperborea</i> and foliose red seaweeds on moderately exposed infralittoral rock
MIR.KR	Lhyp.Ft	<i>Laminaria hyperborea</i> forest and foliose red seaweeds on moderately exposed upper infralittoral rock
MIR.KR	Lhyp.Pk	<i>Laminaria hyperborea</i> park and foliose red seaweeds on moderately exposed lower infralittoral rock
MIR.KR	Lhyp.TFt	<i>Laminaria hyperborea</i> forest, foliose red seaweeds and a diverse fauna on tide-swept upper infralittoral rock
MIR.SedK		Sand or gravel-affected or disturbed kelp and seaweed communities
MIR.SedK	Sac	<i>Saccorhiza polyschides</i> and other opportunistic kelps on disturbed upper infralittoral rock

Higher code	Biotope code	Biotope
MIR.SedK	XKScrR	Mixed kelps with scour-tolerant and opportunistic foliose red seaweeds on scoured or sand-covered infralittoral rock
SIR		Sheltered infralittoral rock
SIR.K		Silted kelp (stable rock)
SIR.K	LhypLsac	Mixed <i>Laminaria hyperborea</i> and <i>Laminaria saccharina</i> on sheltered infralittoral rock
SIR.K	LhypLsac.Ft	Mixed <i>Laminaria hyperborea</i> and <i>Laminaria saccharina</i> forest on sheltered upper infralittoral rock
SIR.K	Lsac	<i>Laminaria saccharina</i> on very sheltered infralittoral rock
SIR.K	Lsac.Ldig	<i>Laminaria saccharina</i> and <i>Laminaria digitata</i> on sheltered sublittoral fringe rock
SIR.K	Lsac.T	<i>Laminaria saccharina</i> , foliose red seaweeds, sponges & ascidians on tide-swept infralittoral rock
SIR.K	LsacRS.FiR	Sparse <i>Laminaria saccharina</i> with dense filamentous red seaweeds, sponges and <i>Balanus crenatus</i> on tide-swept variable salinity infralittoral rock
CR		CIRCALITTORAL ROCK (and other hard substrata)
ECR		Exposed circalittoral rock
ECR.Alc		<i>Alcyonium</i>-dominated communities (tide-swept/vertical)
ECR.Alc	AlcMaS	<i>Alcyonium digitatum</i> with massive sponges (<i>Cliona celata</i> and <i>Pachymatisma johnstonia</i>) and <i>Nemertesia antennina</i> on moderately tide-swept exposed circalittoral rock
ECR.BS		Barnacle, cushion sponge and <i>Tubularia</i> communities (very tide-swept/wave-sheltered)
ECR.BS	BalHpan	<i>Balanus crenatus</i> , <i>Halichondria panicea</i> and <i>Alcyonidium diaphanum</i> on extremely tide-swept sheltered circalittoral rock
ECR.BS	CuSH	Cushion sponges, hydroids and ascidians on very tide-swept sheltered circalittoral rock
ECR.BS	HbowEud	<i>Halichondria bowerbanki</i> , <i>Eudendrium arbusculum</i> and <i>Eucratea loricata</i> on reduced salinity tide-swept circalittoral mixed substrata
MCR		Moderately exposed circalittoral rock
MCR.XFa		Mixed faunal turfs (moderately exposed rock)
MCR.XFa	ErSPbolSH	Cushion sponges (<i>Polymastia boletiformis</i> , <i>Tethya</i>), stalked sponges, <i>Nemertesia</i> spp. and <i>Pentapora foliacea</i> on moderately exposed circalittoral rock
MCR.ByH		Bryozoan/hydroid turfs (sand-influenced)

Higher code	Biotope code	Biotope
MCR.ByH	Flu	<i>Flustra foliacea</i> and other hydroid/bryozoan turf species on slightly scoured circalittoral rock or mixed substrata
MCR.ByH	Flu.SerHyd	<i>Sertularia argentea</i> , <i>S. cupressina</i> and <i>Hydrallmania falcata</i> on tide-swept circalittoral cobbles and pebbles
MCR.ByH	Flu.Hocu	<i>Haliclona oculata</i> and <i>Flustra foliacea</i> with a rich faunal turf on tide-swept sheltered circalittoral boulders or cobbles
MCR.ByH	Urt	<i>Urticina felina</i> on sand-affected circalittoral rock
SCR		Sheltered circalittoral rock
SCR.BrAs		Brachiopod and solitary ascidian communities (sheltered rock)
SCR.BrAs	SubSoAs	<i>Suberites</i> spp. and other sponges with solitary ascidians on very sheltered circalittoral rock
SCR.BrAs	Aasp	<i>Asciidiella aspersa</i> on sheltered circalittoral rocks on muddy sediment
SS		SUBLITTORAL SEDIMENTS
IGS		Infralittoral gravels and sands
IGS.Mrl		Maerl beds (open coast/clean sediments)
IGS.Mrl	Phy	<i>Phymatolithon calcareum</i> maerl beds in infralittoral clean gravel or coarse sand
IGS.Mrl	Phy.R	<i>Phymatolithon calcareum</i> maerl beds with red seaweeds in shallow infralittoral clean gravel or coarse sand
IGS.FaG		Shallow gravel faunal communities
IGS.FaG	Sell	<i>Spisula elliptica</i> and venerid bivalves in infralittoral clean sand or shell gravel
IGS.FaS		Shallow sand faunal communities
IGS.FaS	Mob	Sparse fauna in marine infralittoral mobile clean sand
IGS.FaS	NcirBat	<i>Nephtys cirrosa</i> and <i>Bathyporeia</i> spp. in infralittoral sand
IGS.FaS	ScupHyd	<i>Sertularia cupressina</i> and <i>Hydrallmania falcata</i> on tide-swept sublittoral cobbles or pebbles in coarse sand
IGS.FaS	Lcon	Dense <i>Lanice conchilega</i> and other polychaetes in tide-swept infralittoral sand
IGS.EstGS		Estuarine sublittoral gravels and sands
IGS.EstGS	MobRS	Sparse fauna in reduced salinity infralittoral mobile sand
IGS.EstGS	Ncir	<i>Nephtys cirrosa</i> and fluctuating salinity-tolerant fauna in reduced salinity infralittoral mobile sand
CGS		Circalittoral gravels and sands

Higher code	Biotope code	Biotope
CGS	Ven	Venerid bivalves in circalittoral coarse sand or gravel
CGS	Ven.Bra	Venerid bivalves and <i>Branchiostoma lanceolatum</i> in circalittoral coarse sand with shell gravel
IMS		Infralittoral muddy sands
IMS.Sgr		Seagrass beds (sublittoral/lower shore)
IMS.Sgr	Zmar	<i>Zostera marinalangustifolia</i> beds in lower shore or infralittoral clean or muddy sand
IMS.FaMS		Shallow muddy sand faunal communities
CMS		Circalittoral muddy sands
CMS	AbrNucCor	<i>Abra alba</i> , <i>Nucula nitida</i> and <i>Corbula gibba</i> in circalittoral muddy sand or slightly mixed sediment
IMU		Infralittoral muds
IMU.MarMu		Shallow marine mud communities
IMU.EstMu		Estuarine sublittoral muds
IMU.EstMu	PolVS	<i>Polydora ciliata</i> in variable salinity infralittoral firm mud or clay
IMU.EstMu	AphTub	<i>Aphelochaeta marioni</i> and <i>Tubificoides</i> spp. in variable salinity infralittoral mud
IMU.EstMu	NhomTub	<i>Nephtys hombergii</i> and <i>Tubificoides</i> spp. in variable salinity infralittoral soft mud
IMU.EstMu	MobMud	Infralittoral fluid mobile mud
IMU.EstMu	Tub	<i>Tubificoides</i> spp. in reduced salinity infralittoral muddy sediment
IMU.EstMu	LimTub	<i>Limnodrilus hoffmeisteri</i> , <i>Tubifex tubifex</i> and <i>Gammarus</i> spp. in low salinity infralittoral muddy sediment
CMU		Circalittoral muds
IMX		Infralittoral mixed sediments
IMX.KSw		<i>Laminaria saccharina</i> (sugar kelp) and filamentous seaweeds (mixed sediment)
IMX.KSw	LsacX	<i>Laminaria saccharina</i> , <i>Chorda filum</i> and filamentous red seaweeds on sheltered infralittoral sediment
IMX.Oy		Oyster beds
IMX.Oy	Ost	<i>Ostrea edulis</i> beds on shallow sublittoral muddy sediment
IMX.FaMx		Shallow mixed sediment faunal communities

Higher code	Biotope code	Biotope
IMX.FaMx	VsenMtru	<i>Venerupis senegalensis</i> and <i>Mya truncata</i> in lower shore or infralittoral muddy gravel
IMX.EstMx		Estuarine sublittoral mixed sediments
IMX.EstMx	CreAph	<i>Crepidula fornicata</i> and <i>Aphelochoaeta marioni</i> in variable salinity infralittoral mixed sediment
IMX.EstMx	PolMtru	<i>Polydora ciliata</i> , <i>Mya truncata</i> and solitary ascidians in variable salinity infralittoral mixed sediment
IMX.EstMx	SalvMx	<i>Sabellaria alveolata</i> in variable salinity sublittoral mixed sediment. Tide-swept sandy mixed sediments often characterised by surface accumulations of the reef-building polychaete <i>Sabellaria alveolata</i> . The presence of <i>Sabellaria</i> sp. has a strong influence on the associated infauna as the tubes bind the surface sediments together and provide increased stability. Other associated species include the polychaete <i>Melinna cristata</i> , itself often in dense aggregations, and also mobile surface-feeding polychaetes including <i>Typosyllis armillaris</i> and <i>Eulalia tripunctata</i> . Reduced species richness in comparison with CMX.SspiMx.
CMX		Circalittoral mixed sediments

References

- Connor, D.W., Brazier, D.P., Hill, T.O., & Northen, K.O. 1997a. Marine Nature Conservation Review: marine biotope classification for Britain and Ireland. Volume 1. Littoral biotopes. Version 97.06. *JNCC Report*, No. 229.
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Appendix B

Biotopes present in each area

The biotopes recorded in each area, using the data listed in Table 1, are summarised below. Biotope codes are given according to MNCR classification version 97.06 (Connor *et al.* 1997a, b), except SalvMx (see Appendix A).

Numbers refer to the area summaries as follows:

- | | |
|----------------------------|-------------------------------------|
| 1. River Hayle | 8. River Wye |
| 2. The Gannel | 9. River Usk |
| 3. River Camel | 10. River Neath |
| 4. Rivers Taw and Torridge | 11. River Tawe |
| 5. River Parrett | 12. Burry Inlet (River Loughor) |
| 6. River Avon (Bristol) | 13. Rivers Taf, Tywi and Gwendraeth |
| 7. Severn estuary | 14. Milford Haven and the Cleddau |

	Area	1	2	3	4	5	6	7	8	9	10	11	12	13	14
<i>Littoral rock</i>															
LR															.
YG	
Ver					.										.
Ver.B															.
Ver.Ver	
MytB													.		
BPat			
BPat.Cht			
BPat.Lic															.
BPat.Cat					.									.	
BPat.Fvesl				.											.
BPat.Sem													.	.	.
Him				.											
BF															.
PelB				.										.	
FvesB				.	.										.
Fser					.										.
Fser.R				.											.
Fser.Fser	
Fser.Fser.Bo			
R															.
XR															.
Mas															.
Eph								.							
Ent			
EntPor													.		
Rho				.	.										
MytFR				.	.										
Salv								.							
Pel	
Fspi	
Fves			
Asc					.										
Asc.Asc	
Asc.VS	

	Area	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Fserr																.
Fserr.T																.
Fserr.VS					.			.								.
Fcer					.											.
BLlit													.			.
FvesX	
AscX	
FserX					.											.
FserX.T													.			.
EphX			
FcerX								.								.
MytX				
Rkp				
G				
Cor					.								.			.
Cor.Bif				.												.
FK				.	.											.
SwSed			
H					.								.			.
Ov																.
SR				.									.			.
<i>Littoral sediment</i>																
LGS				.				.								.
S								.								.
BarSnd			
AEur	
AP			
AP.P			
AP.Pon				.										.		.
Lan			
Ol				
MS								.								.
BatCor				
PCer													.	.		.
MacAre			
LMU													.			.
Sm					.			.								.
NVC SM8	
HedMac				
HedMac.Are	
HedMac.Pyg		.						.								.
Mu						.		.								.
HedScr	
HedStr		
HedOl	
LMX		.			.											.
<i>Sublittoral rock</i>																
Ala.Ldig																.
LhypR.Ft				.												.
FoSwCC				.												.
SCAs																.
SCAs.DenCla																.
SCAs.ByH				.												.
Ldig.Ldig																.

	Area	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Ldig.Ldig.Bo															•
Ldig.T															•
Lhyp.Ft				•											•
Lhyp.Pk				•											•
Lhyp.TFt															•
Sac															•
XKScrR				•											
SIR															•
LhypLsac.Ft															•
Lsac.Ldig															•
Lsac.T															•
LsacRS.FiR															•
AlcMaS															•
BalHpan															•
CuSH					•										•
HbowEud															•
MCR															•
XFa															•
ErSPbolSH															•
ByH															•
Flu.SerHyd					•										•
Flu.Hocu															•
Urt															•
SubSoAs															•
Aasp															•
<i>Sublittoral sediment</i>															
SS									•						
Phy															•
Phy.R															•
FaG									•						•
Sell															•
FaS									•						
Mob									•				•		•
NcirBat				•	•				•				•		
ScupHyd					•				•						•
Lcon															•
MobRS						•									
Ncir						•									
Ven.Bra															•
Zmar					•										•
FaMS									•				•		•
AbrNucCor															•
IMU									•						
MarMu															•
EstMu						•			•						
PolVS									•						
AphTub									•						•
NhomTub									•						•
MobMud						•	•	•	•	•					
Tub									•						
LimTub									•	•					
CMU															•
LsacX															•
Ost															•

	Area	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
FaMx								•								•
VsenMtru																•
EstMx																•
CreAph																•
PolMtru																•
SalvMx								•								
CMX																•

References

- Connor, D.W., Brazier, D.P., Hill, T.O., & Northen, K.O. 1997a. Marine Nature Conservation Review: marine biotope classification for Britain and Ireland. Volume 1. Littoral biotopes. Version 97.06. *JNCC Report*, No. 229.
- Connor, D.W., Dalkin, M.J., Hill, T.O., Holt, R.H.F., & Sanderson, W.G. 1997b. Marine Nature Conservation Review: marine biotope classification for Britain and Ireland. Volume 2. Sublittoral biotopes. Version 97.06. *JNCC Report*, No. 230.

Appendix C

Species recorded

All taxa recorded during the surveys given in Table 1 are listed below; records of species noted in the text but not shown here come from additional published sources noted in the individual area summaries. Species nomenclature follows Howson & Picton (1996); that for higher plants follows Stace (1991) and that for lichens follows Purvis *et al.* (1992).

Numbers refer to the *area summaries* as follows:

- | | |
|----------------------------|-------------------------------------|
| 1. River Hayle | 8. River Wye |
| 2. The Gannel | 9. River Usk |
| 3. River Camel | 10. River Neath |
| 4. Rivers Taw and Torridge | 11. River Tawe |
| 5. River Parrett | 12. Burry Inlet (River Loughor) |
| 6. River Avon (Bristol) | 13. Rivers Taf, Tywi and Gwendraeth |
| 7. Severn estuary | 14. Milford Haven and the Cleddau |

PROTOZOA

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<i>Lysianassa</i> sp.	14	<i>Gnathia oxyuraea</i>	14
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<i>Bathyporeia nana</i>	3	<i>Jaera prae-hirsuta</i>	14
<i>Bathyporeia pelagica</i>	1, 2, 3, 4, 7, 12, 13	<i>Janira maculosa</i>	7, 14
<i>Bathyporeia pilosa</i>	2, 3, 5, 7, 12, 13	<i>Pleurogonium spinosissimum</i>	14
<i>Bathyporeia sarsi</i>	4, 13	<i>Idotea</i> sp.	3, 7, 12
<i>Hauistorius arenarius</i>	2, 3, 4, 5, 7, 12, 13	<i>Idotea baltica</i>	12
Gammaridae indet.	3, 4, 7, 12, 13	<i>Idotea granulosa</i>	7, 12, 14
<i>Echinogammarus marinus</i>	4, 12	<i>Arcturella</i> sp.	14
<i>Echinogammarus stoerensis</i>	1	<i>Astacilla longicornis</i>	14
<i>Gammarus</i> sp.	3, 6, 7	<i>Ligia oceanica</i>	1, 4, 7, 14
<i>Gammarus chevreuxi</i>	4, 7	<i>Philoscia muscorum</i>	7
<i>Gammarus crinicornis</i>	12	<i>Oniscus asellus</i>	7
<i>Gammarus finmarchicus</i>	1	<i>Porcellio scaber</i>	7
<i>Gammarus insensibilis</i>	7	Tanaidae indet.	8
<i>Gammarus locusta</i>	1, 14	Anarthruridae indet.	14
<i>Gammarus salinus</i>	5, 6, 7	<i>Apseudes talpa</i>	14
<i>Gammarus tigrinus</i>	12, 14	<i>Cumopsis fagei</i>	3
<i>Gammarus zaddachi</i>	7	<i>Cumopsis goodsiri</i>	3, 7
Melitidae indet.	14	<i>Bodotria pulchella</i>	12, 14
<i>Cheirocratus</i> sp.	14	<i>Bodotria scorpioides</i>	3, 14
<i>Cheirocratus intermedius</i>	14	<i>Iphinoe trispinosa</i>	3, 14
<i>Cheirocratus sundevallii</i>	14	<i>Eudorella truncatula</i>	14
<i>Maera othonis</i>	14	<i>Pseudocuma longicornis</i>	7
<i>Melita palmata</i>	4, 7, 14	<i>Diastylis bradyi</i>	3
<i>Ampithoe rubricata</i>	14		

<i>Diastylis rathkei typica</i>	5, 7	<i>Gibbula tumida</i>	14
<i>Diastylis rugosa</i>	14	<i>Gibbula cineraria</i>	3, 4, 14
<i>Diastylis tumida</i>	7, 14	<i>Gibbula umbilicalis</i>	3, 4, 14
Decapoda indet.	3, 7	<i>Calliostoma</i> sp.	14
<i>Leander tenuicornis</i>	14	<i>Calliostoma zizyphinum</i>	3, 14
<i>Palaemon</i> sp.	4	<i>Tricolia pullus</i>	7, 14
<i>Palaemon elegans</i>	4, 7	<i>Lacuna pallidula</i>	3
<i>Palaemon serratus</i>	14	<i>Littorina</i> sp.	9
<i>Athanas nitescens</i>	14	<i>Littorina littorea</i>	1, 3, 4, 7, 12, 13, 14
Hippolytidae indet.	14	<i>Littorina mariaae</i>	1, 3, 4, 14
<i>Hippolyte</i> sp.	14	<i>Littorina obtusata</i>	1, 3, 4, 7, 14
<i>Thoralus cranchii</i>	14	<i>Littorina neglecta</i>	1, 3, 4, 7, 12, 14
<i>Crangon</i> sp.	4, 14	<i>Littorina nigrolineata</i>	13, 14
<i>Crangon crangon</i>	1, 3, 4, 7, 13, 14	<i>Littorina saxatilis</i>	1, 3, 4, 7, 12, 13, 14
<i>Homarus gammarus</i>	14	<i>Littorina saxatilis</i> var. <i>rudis</i>	4, 12, 13
Paguridae indet.	14	<i>Littorina obtusata/mariaae</i>	7, 14
<i>Pagurus</i> sp.	14	<i>Melarhappe neritoides</i>	3, 4, 12, 14
<i>Pagurus bernhardus</i>	3, 4, 7, 14	<i>Hydrobia</i> sp.	12
<i>Pagurus cuanensis</i>	14	<i>Hydrobia ulvae</i>	3, 4, 6, 7, 8, 9, 12, 13, 14
<i>Galathea</i> sp.	3, 14	<i>Potamopyrgus jenkinsi</i>	7, 8, 9, 13
<i>Galathea squamifera</i>	3, 14	<i>Rissoa</i> sp.	7, 14
<i>Galathea strigosa</i>	14	<i>Rissoa interrupta</i>	14
<i>Pisidia longicornis</i>	12, 14	<i>Onoba semicostata</i>	7, 14
<i>Porcellana platycheles</i>	3, 12, 14	<i>Hyalia vitrea</i>	14
<i>Maja squinado</i>	3, 14	<i>Turritella communis</i>	14
<i>Hyas araneus</i>	14	<i>Ondina diaphana</i>	14
<i>Inachus</i> sp.	14	<i>Turbonilla lactea</i>	14
<i>Inachus phalangium</i>	3, 14	<i>Calyptrea chinensis</i>	14
<i>Macropodia</i> sp.	14	<i>Crepidula fornicata</i>	14
<i>Macropodia linaresi</i>	4, 14	<i>Trivia arctica</i>	3, 14
<i>Macropodia rostrata</i>	14	<i>Trivia monacha</i>	3, 14
<i>Corystes cassivelaunus</i>	3	<i>Polinices pulchellus</i>	14
<i>Cancer pagurus</i>	3, 4, 12, 14	<i>Nucella lapillus</i>	3, 4, 12, 14
Portunidae indet.	14	<i>Ocenebra erinacea</i>	3, 14
<i>Liocarcinus</i> sp.	3, 14	Buccinidae indet.	7
<i>Liocarcinus arcuatus</i>	14	<i>Buccinum undatum</i>	3, 7, 14
<i>Liocarcinus depurator</i>	14	<i>Hinia incrassata</i>	14
<i>Liocarcinus marmoreus</i>	14	<i>Hinia reticulata</i>	3, 14
<i>Necora puber</i>	3, 14	Opisthobranchia indet.	3, 14
<i>Carcinus maenas</i>	1, 3, 4, 7, 12, 13, 14	<i>Retusa obtusa</i>	7, 9, 14
<i>Goneplax rhomboides</i>	14	<i>Retusa truncatula</i>	14
<i>Pilumnus hirtellus</i>	14	<i>Limapontia depressa</i>	7
<i>Pinnotheres pisum</i>	3	<i>Aplysia punctata</i>	3
INSECTA		<i>Pleurobranchus</i>	14
Insecta indet.	13	<i>Tritonia lineata</i>	14
Chironomida indet.	7, 13, 14	<i>Dendronotus frondosus</i>	14
Diptera larva	6, 7, 8, 9	<i>Doto coronata</i>	4, 12
<i>Anurida maritima</i>	1, 3, 4, 7, 12, 13, 14	<i>Doto fragilis</i>	14
		<i>Okenia</i> sp.	14
MOLLUSCA		Onchidorididae indet.	14
Polyplacophora indet.	4, 7, 12, 14	<i>Limacia clavigera</i>	14
<i>Lepidochitona cinerea</i>	4, 7, 14	<i>Polycera</i> sp.	14
<i>Tonicella rubra</i>	3, 4, 7	<i>Polycera faeroensis</i>	14
<i>Acanthochitona</i> sp.	3, 4	<i>Polycera quadrilineata</i>	3, 12, 14
Gastropoda indet.	3, 14	<i>Thecacera pennigera</i>	3
<i>Emarginula fissura</i>	14	Dorididae indet.	3
<i>Diodora graeca</i>	14	<i>Archidoris pseudoargus</i>	3, 4, 14
<i>Tectura virginea</i>	14	<i>Jorunna tomentosa</i>	14
<i>Patella</i> sp.	1, 3, 4, 7, 12, 13, 14	<i>Janolus cristatus</i>	3, 14
<i>Patella depressa</i>	3, 14	<i>Coryphella verrucosa</i>	14
<i>Patella ulyssiponensis</i>	3, 14	<i>Flabellina pedata</i>	14
<i>Patella vulgata</i>	1, 3, 4, 7, 12, 14	<i>Eubranchus farrani</i>	14
<i>Helcion pellucidum</i>	3, 14	<i>Eubranchus tricolor</i>	14
<i>Osilinus lineatus</i>	3, 4, 14	<i>Facelina</i> sp.	14

<i>Facelina annulicornis</i>	14		
<i>Facelina auriculata</i>	14		
<i>Aeolidia papillosa</i>	3, 14		
<i>Aeolidiella glauca</i>	14		
<i>Ovatella myosotis</i>	7		
<i>Onchidella celtica</i>	3		
Pelecypoda indet.	1, 7, 12, 14		
<i>Nucula</i> sp.	14		
<i>Nucula nitidosa</i>	7		
Mytilacea indet.	14		
<i>Mytilus edulis</i>	1, 3, 4, 7, 12, 13, 14		
<i>Mytilus galloprovincialis</i>	3		
<i>Musculus discors</i>	14		
<i>Modiolus</i> sp.	14		
<i>Modiolus barbatus</i>	4		
<i>Modiolus modiolus</i>	7, 14		
<i>Ostrea edulis</i>	14		
<i>Aequipecten opercularis</i>	14		
<i>Pecten maximus</i>	14		
Anomiidae indet.	1, 14		
<i>Anomia ephippium</i>	1, 3, 14		
<i>Pododesmus patelliformis</i>	14		
<i>Heteranomia squamula</i>	14		
<i>Lucinoma borealis</i>	14		
<i>Thyasira</i> sp.	14		
<i>Thyasira flexuosa</i>	14		
<i>Lasaea adansoni</i>	3, 14		
<i>Kellia suborbicularis</i>	7		
<i>Devonia perrieri</i>	14		
<i>Mysella bidentata</i>	7, 14		
<i>Tellimya ferruginosa</i>	14		
<i>Goodallia triangularis</i>	14		
<i>Parvicardium exiguum</i>	14		
<i>Parvicardium minimum</i>	14		
<i>Parvicardium ovale</i>	4		
<i>Cerastoderma edule</i>	1, 3, 4, 12, 13, 14		
<i>Spisula elliptica</i>	3, 14		
<i>Phaxas pellucidus</i>	14		
<i>Angulus tenuis</i>	3, 4, 12, 13		
<i>Fabulina fabula</i>	14		
<i>Moerella donacina</i>	14		
<i>Macoma balthica</i>	3, 4, 5, 6, 7, 8, 9, 12, 13, 14		
<i>Gari fervensis</i>	14		
<i>Gari tellinella</i>	14		
<i>Scrobicularia plana</i>	1, 2, 4, 7, 9, 12, 13		
<i>Abra</i> sp.	14		
<i>Abra alba</i>	14		
<i>Abra tenuis</i>	4		
<i>Dosinia lupinus</i>	14		
<i>Tapes decussatus</i>	4		
<i>Tapes rhomboides</i>	4, 14		
<i>Venerupis senegalensis</i>	4, 14		
<i>Chamelea gallina</i>	14		
<i>Clausinella fasciata</i>	14		
<i>Timoclea ovata</i>	14		
<i>Mysia undata</i>	14		
<i>Mya truncata</i>	14		
<i>Mya arenaria</i>	12, 13		
<i>Sphenia binghami</i>	7		
<i>Corbula gibba</i>	14		
<i>Hiatella arctica</i>	3, 12, 14		
<i>Pholas dactylus</i>	7		
<i>Lyonsia norwegica</i>	14		
<i>Thracia phaseolina</i>	14		
BRYOZOA			
Bryozoa indet.		3, 4, 12, 14	
Crisiidae indet.		14	
<i>Crisidia cornuta</i>		14	
<i>Crisia denticulata</i>		3, 14	
<i>Crisia eburnea</i>		14	
<i>Tubulipora</i> sp.		14	
<i>Lichenopora</i> sp.		14	
<i>Alcyonidium</i> sp.		14	
<i>Alcyonidium diaphanum</i>		3, 14	
<i>Alcyonidium gelatinosum</i>		1, 3, 4, 7, 12, 14	
<i>Alcyonidium hirsutum</i>		1, 3, 12, 14	
<i>Alcyonidium mamillatum</i>		4	
<i>Alcyonidium mytili</i>		14	
<i>Alcyonidium parasiticum</i>		14	
<i>Flustrellidra hispida</i>		3, 12, 14	
<i>Walkeria uva</i>		14	
<i>Vesicularia spinosa</i>		14	
<i>Amathia lendigera</i>		12	
<i>Bowerbankia</i> sp.		14	
<i>Bowerbankia gracilis</i>		4	
<i>Bowerbankia imbricata</i>		1, 4, 7, 14	
<i>Bowerbankia pustulosa</i>		14	
Ascophorina indet.		3	
<i>Umbonula</i> sp.		4	
<i>Umbonula littoralis</i>		1, 3, 4, 12, 14	
<i>Escharoides coccinea</i>		14	
<i>Cryptosula pallasiana</i>		1, 3, 4, 14	
<i>Pentapora foliacea</i>		14	
<i>Smittoidea reticulata</i>		14	
<i>Parasmittina trispinosa</i>		14	
<i>Escharella immersa</i>		14	
<i>Schizoporella</i> sp.		14	
<i>Schizoporella unicornis</i>		14	
<i>Schizomavella linearis</i>		14	
<i>Schizomavella hastata</i>		14	
<i>Chorizopora brongniartii</i>		14	
<i>Celleporella hyalina</i>		14	
<i>Cellepora pumicosa</i>		3, 14	
<i>Membranipora membranacea</i>		3, 4, 14	
<i>Conopeum</i> sp.		7	
<i>Conopeum reticulum</i>		14	
<i>Electra crustulenta</i>		7	
<i>Electra monostachys</i>		7	
<i>Electra pilosa</i>		1, 3, 4, 12, 14	
<i>Flustra foliacea</i>		14	
<i>Chartella papyracea</i>		14	
<i>Cellaria</i> sp.		14	
<i>Cellaria sinuosa</i>		14	
<i>Scrupocellaria</i> sp.		3, 14	
<i>Scrupocellaria reptans</i>		3, 14	
<i>Scrupocellaria scrupea</i>		14	
<i>Scrupocellaria scruposa</i>		3, 14	
<i>Bicellariella ciliata</i>		3, 14	
<i>Bicellarina alderi</i>		14	
<i>Bugula avicularia</i>		3	
<i>Bugula flabellata</i>		3, 14	
<i>Bugula fulva</i>		14	
<i>Bugula plumosa</i>		3, 14	
<i>Bugula turbinata</i>		3, 14	
Bryozoa indet. (crusts)		4, 7, 14	
PHORONIDA			
<i>Phoronis</i> sp.		3, 12, 14	

<i>Phoronis hippocrepia</i>	14	<i>Botryllus schlosseri</i>	3, 12, 14
ECHINODERMATA		<i>Botrylloides leachi</i>	3, 14
Echinodermata indet.	14	<i>Molgula</i> sp.	14
<i>Antedon bifida</i>	14	<i>Molgula manhattensis</i>	3, 14
<i>Luidia ciliaris</i>	14	CEPHALOCHORDATA	
<i>Asterina gibbosa</i>	3, 14	<i>Branchiostoma</i> sp.	14
<i>Asterina phylactica</i>	14	<i>Branchiostoma lanceolatum</i>	14
<i>Crossaster papposus</i>	14	PISCES	
<i>Henricia oculata</i>	3, 14	Pisces indet.	13
<i>Asterias rubens</i>	3, 4, 12, 14	<i>Scyliorhinus canicula</i>	14
<i>Marthasterias glacialis</i>	3, 14	<i>Raja</i> sp.	14
Ophiuroidea indet.	14	<i>Anguilla anguilla</i>	4, 14
<i>Ophiothrix fragilis</i>	3, 12, 14	<i>Conger conger</i>	4
<i>Amphiura</i> sp.	14	Clupeidae indet.	14
<i>Amphiura brachiata</i>	14	<i>Lepadogaster lepadogaster</i>	3
<i>Amphiura chiajei</i>	14	<i>Pollachius pollachius</i>	3, 14
<i>Amphiura filiformis</i>	14	<i>Pollachius virens</i>	3
<i>Amphipholis squamata</i>	3, 12, 14	<i>Syngnathus</i> sp.	14
<i>Ophiura</i> sp.	14	<i>Syngnathus acus</i>	14
<i>Ophiura affinis</i>	14	<i>Taurulus bubalis</i>	3, 14
<i>Ophiura albida</i>	14	<i>Agonus cataphractus</i>	14
<i>Ophiura ophiura</i>	14	<i>Chelon labrosus</i>	14
<i>Psammechinus miliaris</i>	14	<i>Crenilabrus melops</i>	14
<i>Echinus esculentus</i>	14	<i>Ctenolabrus rupestris</i>	14
Holothurioida indet.	14	<i>Labrus bergylta</i>	3, 14
<i>Leptopentacta elongata</i>	14	<i>Lipophrys pholis</i>	3, 4, 12, 14
<i>Thyone fusus</i>	14	<i>Pholis gunnellus</i>	4, 14
<i>Leptosynapta</i> sp.	14	<i>Ammodytes</i> sp.	4, 12, 13
<i>Leptosynapta inhaerens</i>	14	<i>Ammodytes tobianus</i>	3
TUNICATA		<i>Callionymus lyra</i>	14
Tunicata indet.	3, 14	Gobiidae indet.	1, 3, 4, 12, 14
<i>Clavelina lepadiformis</i>	3, 14	<i>Gobius niger</i>	14
<i>Pycnoclavella aurilucens</i>	3, 14	<i>Gobiusculus flavescens</i>	3, 14
<i>Distaplia rosea</i>	14	<i>Pomatoschistus</i> sp.	7, 14
Polyclinidae indet.	14	<i>Pomatoschistus minutus</i>	4
<i>Polyclinum aurantium</i>	3, 12, 14	<i>Pomatoschistus pictus</i>	1, 4, 14
<i>Morchellium argus</i>	3, 12, 14	<i>Thorogobius ephippiatus</i>	4, 14
<i>Sidnyum</i> sp.	14	<i>Scophthalmus rhombus</i>	4
<i>Sidnyum turbinatum</i>	3, 12, 14	Pleuronectidae indet.	3
<i>Aplidium</i> sp.	14	<i>Platichthys flesus</i>	4
<i>Aplidium densum</i>	3	<i>Pleuronectes platessa</i>	4, 12, 14
<i>Aplidium proliferum</i>	14	<i>Haematopus ostralegus</i>	4
<i>Aplidium punctum</i>	3, 14	CYANOPHYCOTA	
Didemnidae indet.	3, 14	Cyanophycota indet.	3, 4, 14
<i>Didemnum</i> sp.	14	RHODOPHYCOTA	
<i>Didemnum gelatinosum</i>	14	Rhodophycota indet.	1, 3, 4, 12, 14
<i>Didemnum maculosum</i>	3	<i>Porphyropsis coccinea</i>	14
<i>Diplosoma</i> sp.	14	<i>Bangia atropurpurea</i>	14
<i>Diplosoma listerianum</i>	3, 14	<i>Porphyra</i> sp.	1, 3, 4, 12, 14
<i>Lissoclinum perforatum</i>	3	<i>Porphyra purpurea</i>	4
<i>Ciona intestinalis</i>	14	<i>Porphyra umbilicalis</i>	3, 4, 14
<i>Asciidiella</i> sp.	14	<i>Audouinella</i> sp.	1, 3, 4, 14
<i>Asciidiella aspersa</i>	14	<i>Audouinella efflorescens</i>	3
<i>Ascidia mentula</i>	14	<i>Rhodothamniella floridula</i>	3, 14
<i>Pleurogona</i> indet.	14	<i>Audouinella purpurea</i>	14
<i>Styela clava</i>	14	<i>Schmitziella endophloea</i>	14
<i>Styela plicata</i>	14	<i>Scinia</i> sp.	14
<i>Polycarpa</i> sp.	3, 12, 14	<i>Scinia furcellata</i>	14
<i>Polycarpa pomaria</i>	14	<i>Scinia trigona</i>	3, 14
<i>Polycarpa scuba</i>	3, 14	<i>Naccaria wiggii</i>	3
<i>Dendrodoa grossularia</i>	3, 12, 14	<i>Asparagopsis armata</i>	3
<i>Distomus variolosus</i>	3		
<i>Stolonica socialis</i>	3		

<i>Bonnemaisonia asparagoides</i>	3, 14	<i>Rhodymenia delicatula</i>	14
<i>Bonnemaisonia hamifera</i>	3	<i>Rhodymenia holmesii</i>	3, 14
<i>Gelidium</i> sp.	3, 13, 14	<i>Rhodymenia pseudopalmata</i>	3, 14
<i>Gelidium latifolium</i>	14	<i>Chylocladia verticillata</i>	3, 14
<i>Gelidium pusillum</i>	1, 3, 4, 13, 14	<i>Gastroclonium ovatum</i>	3, 14
<i>Pterocladia capillacea</i>	4	<i>Gastroclonium reflexum</i>	3
<i>Palmaria palmata</i>	1, 3, *4, 12, 14	<i>Lomentaria articulata</i>	1, 3, 12, 14
<i>Dilsea carnosa</i>	3, 14	<i>Lomentaria clavellosa</i>	1, 3, 14
<i>Dumontia contorta</i>	1, 3, 4, 12, 14	<i>Lomentaria orcadensis</i>	3, 14
<i>Holmsella pachyderma</i>	12, 14	Ceramiaceae indet.	14
<i>Grateloupa</i> sp.	4	<i>Antithamnion</i> sp.	14
<i>Grateloupa dichotoma</i>	4	<i>Antithamnion cruciatum</i>	14
<i>Grateloupa filicina</i>	3, 4, 14	<i>Antithamnionella spirographidis</i>	14
<i>Callophyllis</i> sp.	14	<i>Aglaothamnion byssoides</i>	1, 14
<i>Callophyllis laciniata</i>	3, 14	<i>Aglaothamnion hookeri</i>	1, 4, 14
<i>Kallymenia reniformis</i>	3, 14	<i>Aglaothamnion pseudobyssoides</i>	3
<i>Meredithia microphylla</i>	3, 14	<i>Aglaothamnion roseum</i>	14
<i>Gloiosiphonia capillaris</i>	7	<i>Aglaothamnion sepositum</i>	12, 14
<i>Peyssonnelia dubyi</i>	14	<i>Callithamnion</i> sp.	1, 3, 12, 14
<i>Hildenbrandia</i> sp.	1, 3, 4, 12, 14	<i>Callithamnion tetragonum</i>	3, 14
<i>Hildenbrandia rubra</i>	7	<i>Callithamnion tetricum</i>	14
Corallinaceae indet.	1, 3, 4, 7, 12, 14	<i>Aglaothamnion tripinnatum</i>	14
<i>Corallina officinalis</i>	3, 4, 12, 14	<i>Ceramium</i> sp.	1, 3, 7, 13, 14
<i>Jania</i> sp.	3	<i>Ceramium pallidum</i>	14
<i>Lithophyllum</i> sp.	4, 14	<i>Ceramium ciliatum</i>	3, 14
<i>Lithophyllum incrustans</i>	3, 14	<i>Ceramium deslongchampii</i>	14
<i>Lithothamnion</i> sp.	4, 14	<i>Ceramium diaphanum</i>	3, 4, 12
<i>Mesophyllum lichenoides</i>	3, 14	<i>Ceramium echionotum</i>	3
<i>Phymatolithon calcareum</i>	14	<i>Ceramium gaditanum</i>	14
<i>Phymatolithon lenormandii</i>	4	<i>Ceramium nodulosum</i>	1, 3, 4, 12, 13, 14
<i>Phymatolithon purpureum</i>	3, 14	<i>Ceramium shuttleworthianum</i>	3, 12, 14
Maerl indet.	14	<i>Ceramium strictum</i>	14
<i>Itonoa marginifera</i>	1	<i>Ceramium botryocarpum</i>	14
<i>Gracilaria</i> sp.	14	<i>Compsothamnion gracillimum</i>	14
<i>Gracilaria gracilis</i>	1, 3, 4, 12, 14	<i>Compsothamnion thuyoides</i>	14
<i>Schmitzia hiscockiana</i>	14	<i>Griffithsia corallinoides</i>	14
<i>Ahnfeltia plicata</i>	3, 4, 14	<i>Griffithsia devoniensis</i>	14
<i>Gymnogongrus</i> sp.	14	<i>Halurus flosculosus</i>	3, 12, 14
<i>Gymnogongrus crenulatus</i>	14	<i>Halurus equisetifolius</i>	3, 14
<i>Gymnogongrus griffithsiae</i>	4, 14	<i>Plumaria plumosa</i>	3, 14
<i>Phyllophora crispa</i>	3, 14	<i>Pterothamnion</i> sp.	1, 14
<i>Phyllophora pseudoceranoides</i>	3, 12, 14	<i>Pterothamnion plumula</i>	14
<i>Erythrodermis traillii</i>	3, 14	<i>Seirospora seirosperma</i>	14
<i>Schottera nicaeensis</i>	3, 14	<i>Spermothamnion</i> sp.	14
<i>Stenogramme interrupta</i>	14	<i>Sphondylothamnion multifidum</i>	3, 14
<i>Mastocarpus stellatus</i>	1, 3, 4, 14	<i>Acrosorium reptans</i>	3, 14
<i>Chondrus crispus</i>	1, 3, 4, 7, 12, 13, 14	<i>Acrosorium venulosum</i>	14
<i>Chondracanthus acicularis</i>	14	<i>Apoglossum ruscifolium</i>	3, 14
<i>Chondracanthus teedei</i>	14	<i>Cryptopleura ramosa</i>	3, 14
<i>Gigartina pistillata</i>	3	<i>Delesseria sanguinea</i>	3, 14
<i>Polyides rotundus</i>	3, 4, 7, 14	<i>Drachiella spectabilis</i>	14
<i>Plocamium cartilagineum</i>	3, 14	<i>Hypoglossum hypoglossoides</i>	1, 3, 12, 14
<i>Furcellaria lumbricalis</i>	3, 14	<i>Membranoptera alata</i>	3, 14
<i>Halarachnion ligulatum</i>	3, 14	<i>Haraldiophyllum bonnemaisonii</i>	3, 14
<i>Solieria chordalis</i>	14	<i>Nitophyllum punctatum</i>	3, 14
<i>Catenella caespitosa</i>	1, 3, 4, 7, 12, 13, 14	<i>Phycodrys rubens</i>	3, 14
<i>Calliblepharis</i> sp.	14	<i>Polyneura</i> sp.	14
<i>Calliblepharis ciliata</i>	3, 4, 14	<i>Polyneura bonnemaisonii</i>	14
<i>Calliblepharis jubata</i>	3, 14	<i>Erythroglossum laciniatum</i>	3, 12, 14
<i>Cystoclonium purpureum</i>	3, 12, 14	<i>Radicilingua thysanorhizans</i>	3, 14
<i>Rhodophyllis</i> sp.	14	<i>Dasya</i> sp.	14
<i>Rhodophyllis divaricata</i>	3, 14	<i>Dasya hutchinsiae</i>	3, 14
<i>Haemescharia hennedyi</i>	14	<i>Heterosiphonia</i> sp.	14
<i>Cordylecladia erecta</i>	3, 4, 14	<i>Heterosiphonia plumosa</i>	3, 14
<i>Rhodymenia</i> sp.	14	<i>Bostrychia scorpioides</i>	3, 4, 14

<i>Brongniartella byssoides</i>	3, 14	<i>Laminaria hyperborea</i>	3, 14
<i>Chondria</i> sp.	14	<i>Laminaria saccharina</i>	3, 12, 14
<i>Chondria coeruleascens</i>	14	<i>Saccorhiza polyschides</i>	3, 14
<i>Chondria dasyphylla</i>	3, 14	<i>Alaria esculenta</i>	3, 14
<i>Osmundea hybrida</i>	3, 4, 14	Fucales indet.	4
<i>Osmundea pinnatifida</i>	3, 4, 14	<i>Ascophyllum nodosum</i>	1, 3, 4, 7, 12, 13, 14
<i>Polysiphonia</i> sp.	3, 13, 14	<i>Fucus</i> sp.	1, 3, 4, 12, 14
<i>Polysiphonia atlantica</i>	14	<i>Fucus ceranoides</i>	4, 7, 14
<i>Polysiphonia brodiei</i>	3	<i>Fucus serratus</i>	1, 3, 4, 7, 12, 14
<i>Polysiphonia elongata</i>	3, 4, 12, 14	<i>Fucus spiralis</i>	1, 3, 4, 7, 12, 13, 14
<i>Polysiphonia foetidissima</i>	14	<i>Fucus vesiculosus</i>	1, 3, 4, 7, 12, 13, 14
<i>Polysiphonia insidiosa</i>	14	<i>Pelvetia canaliculata</i>	1, 3, 4, 7, 12, 13, 14
<i>Polysiphonia lanosa</i>	1, 3, 4, 14	<i>Himanthalia elongata</i>	3, 14
<i>Polysiphonia nigra</i>	3, 4, 12, 14	<i>Bifurcaria bifurcata</i>	3, 14
<i>Polysiphonia fucoidea</i>	1, 3, 4, 12, 14	<i>Cystoseira</i> sp.	3
<i>Polysiphonia stricta</i>	3, 14	<i>Cystoseira baccata</i>	3
<i>Pterosiphonia</i> sp.	14	<i>Cystoseira foeniculaceus</i>	3
<i>Pterosiphonia complanata</i>	3	<i>Cystoseira nodicaulis</i>	3, 14
<i>Pterosiphonia parasitica</i>	3, 14	<i>Cystoseira tamariscifolia</i>	3
<i>Pterosiphonia pennata</i>	3	<i>Halidrys siliquosa</i>	3, 14
<i>Boergesenella thuyoides</i>	3, 14	Filamentous brown algae indet.	14
<i>Rhodomela confervoides</i>	3, 12, 14	Chromophycota indet. (crusts)	14
Foliose red algae indet.	14		
Rhodophycota indet. (non-calcareous crusts)	3, 7, 14		
		CHLOROPHYCOTA	
CHRYSOPHYCOTA		Chlorophycota indet.	1, 3, 4, 12, 13, 14
Chrysophycota indet.	14	<i>Ulothrix</i> sp.	3, 7
Diatoms - colonial	4, 14	<i>Dilabifilum arthropyreniae</i>	3
Diatoms - film	1, 4, 7, 12, 13, 14	<i>Enteromorpha</i> sp.	1, 3, 4, 7, 12, 13, 14
		<i>Enteromorpha clathrata</i>	7, 12
CHROMOPHYCOTA		<i>Enteromorpha compressa</i>	1, 3, 7, 14
Chromophycota indet.	3, 12, 14	<i>Enteromorpha intestinalis</i>	1, 4, 7, 13
Ectocarpaceae indet.	1, 3, 4, 12, 13, 14	<i>Enteromorpha linza</i>	3, 4, 14
<i>Ectocarpus</i> sp.	14	<i>Enteromorpha prolifera</i>	7
<i>Hincksia granulosa</i>	12	<i>Enteromorpha ralfsii</i>	7
<i>Pilayella littoralis</i>	14	<i>Enteromorpha ramulosa</i>	7
<i>Ralfsia</i> sp.	3, 4, 14	<i>Ulva</i> sp.	1, 3, 4, 7, 12, 13, 14
<i>Elachista</i> sp.	3	<i>Ulva lactuca</i>	3, 4, 7, 14
<i>Elachista fucicola</i>	14	<i>Blidingia</i> sp.	7
<i>Leathesia difformis</i>	3	<i>Blidingia marginata</i>	7
<i>Cutleria multifida</i>	3, 14	<i>Blidingia minima</i>	7, 14
<i>Aglaozonia</i> (Asexual <i>Cutleria</i>)	14	<i>Prasiola stipitata</i>	12
<i>Zanardinia prototypus</i>	3, 14	<i>Chaetomorpha</i> sp.	3, 4, 12, 14
<i>Sphacelaria</i> sp.	14	<i>Chaetomorpha capillaris</i>	14
<i>Halopteris</i> sp.	3	<i>Chaetomorpha linum</i>	7, 13
<i>Halopteris filicina</i>	14	<i>Chaetomorpha mediterranea</i>	14
<i>Cladostephus spongiosus</i>	1, 3, 4, 12, 14	<i>Chaetomorpha melagonium</i>	3, 4, 12, 13, 14
<i>Dictyopteris membranacea</i>	3, 14	<i>Cladophora</i> sp.	1, 3, 4, 12, 14
<i>Dictyota dichotoma</i>	3, 4, 12, 14	<i>Cladophora pellucida</i>	1, 12
<i>Taonia atomaria</i>	3, 14	<i>Cladophora retroflexa</i>	14
<i>Desmarestia aculeata</i>	3, 14	<i>Cladophora rupestris</i>	3, 4, 7, 12, 14
<i>Desmarestia ligulata</i>	3, 14	<i>Cladophora sericea</i>	7, 14
<i>Desmarestia viridis</i>	14	<i>Rhizoclonium</i> sp.	14
<i>Arthrocladia villosa</i>	14	<i>Bryopsis</i> sp.	14
<i>Asperococcus</i> sp.	14	<i>Bryopsis hypnoides</i>	12, 14
<i>Asperococcus compressus</i>	3	<i>Bryopsis plumosa</i>	3, 12, 14
<i>Asperococcus fistulosus</i>	3	<i>Derbesia</i> sp.	14
<i>Asperococcus bullosus</i>	3	<i>Codium</i> sp.	3, 14
<i>Punctaria</i> sp.	14	<i>Codium tomentosum</i>	3
<i>Colpomenia peregrina</i>	3	Filamentous green algae indet.	4, 7
<i>Scytosiphon lomentaria</i>	3, 4, 12, 14		
<i>Chorda filum</i>	1, 3, 14	XANTHOPHYTA	
<i>Laminaria</i> sp.	14	Vaucheriaceae indet.	14
<i>Laminaria digitata</i>	1, 3, 12, 14	<i>Vaucheria</i> sp.	4

ANGIOSPERMAE

Angiospermae indet.	13, 14
<i>Zostera</i> sp.	14
<i>Zostera marina</i>	4, 14
<i>Salicornia</i> sp.	4, 7
<i>Armeria maritima</i>	14

LICHENS

Lichens indet.	12, 13, 14
<i>Anaptychia fusca</i>	14
<i>Arthropyrenia halodytes</i>	4, 13
<i>Caloplaca</i> sp.	4, 14
<i>Caloplaca marina</i>	1, 3, 4, 12, 13, 14
<i>Caloplaca thallicola</i>	1, 3, 4, 7, 12, 14

<i>Lecanora</i> sp.	4
<i>Lecanora atra</i>	1, 3, 4, 7, 14
<i>Lichina confinis</i>	3, 4, 12, 14
<i>Lichina pygmaea</i>	3, 7, 12, 13, 14
<i>Ochrolechia parella</i>	3, 4, 13, 14
<i>Opegrapha saxicola</i>	14
<i>Ramalina</i> sp.	3, 13, 14
<i>Verrucaria maura</i>	1, 3, 4, 7, 12, 13, 14
<i>Verrucaria microspora</i>	4
<i>Verrucaria mucosa</i>	3, 4, 7, 13, 14
<i>Verrucaria striatula</i>	14
<i>Xanthoria parietina</i>	1, 3, 4, 7, 12, 13, 14
Grey lichens indet.	1, 3, 4, 14

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