

# **Inlets in the western English Channel**

**Area summaries**

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**1999**

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# Coasts and seas of the United Kingdom

## Marine Nature Conservation Review series

### Area summaries

#### Preface

The *Marine Nature Conservation Review* (MNCR) was initiated by the Nature Conservancy Council in 1987 as the third major resource survey, following the *Nature Conservation Review* and the *Geological Conservation Review*. Since April 1991, the MNCR has been undertaken within the Support Unit of the Joint Nature Conservation Committee. The JNCC is a forum through which the three country agencies, the Countryside Council for Wales, English Nature and Scottish Natural Heritage, deliver their special statutory responsibilities for Great Britain as a whole and internationally. These special responsibilities, known as special functions, contribute to sustaining and enriching biological diversity, enhancing geological features and sustaining natural systems.

The MNCR is drawing together information on marine ecosystems around Great Britain with the objectives of:

- extending our knowledge of benthic marine habitats, communities and species in Great Britain, particularly through description of their characteristics, distribution and extent; and
- identifying sites of nature conservation importance.

The data collected also provide information to support more general measures to minimise adverse effects of development and pollution, particularly on sites and species of nature conservation importance.

The area included in the MNCR is the coastline of England, Scotland and Wales (excluding the Isle of Man and the Channel Isles), extending on the shore from the lower limit of terrestrial flowering plants and within marine inlets from the limit of marine influence out to the limit of British territorial seas. Saline lagoons are also included. The MNCR included a major field survey programme of the shores and near-shore sublittoral zone, undertaken to standard methodology.

MNCR studies have been undertaken within particular coastal sectors around Britain (see map overleaf) or of major physiographic types, such as lagoons and sealochs. These studies are being presented, in the *Coasts and seas of the United Kingdom - MNCR series*, as *area summaries*, each of which provides an account of a discrete stretch of open coast, a marine inlet or a lagoon within the area of study. A list of *area summary* volumes and other major publications from the MNCR is given overleaf.

A full list of MNCR and other JNCC marine reports is available from the Marine Information Officer, JNCC. JNCC publications can be purchased from NHBS Ltd, 2-3 Wills Road, Totnes, Devon, TQ9 5XN (tel. 01803-865 913; fax. 01803-865 280; e-mail [nhbs@nhbs.co.uk](mailto:nhbs@nhbs.co.uk)). JNCC reports are available directly from JNCC (tel. 01733-562 626; fax 01733-555 948).

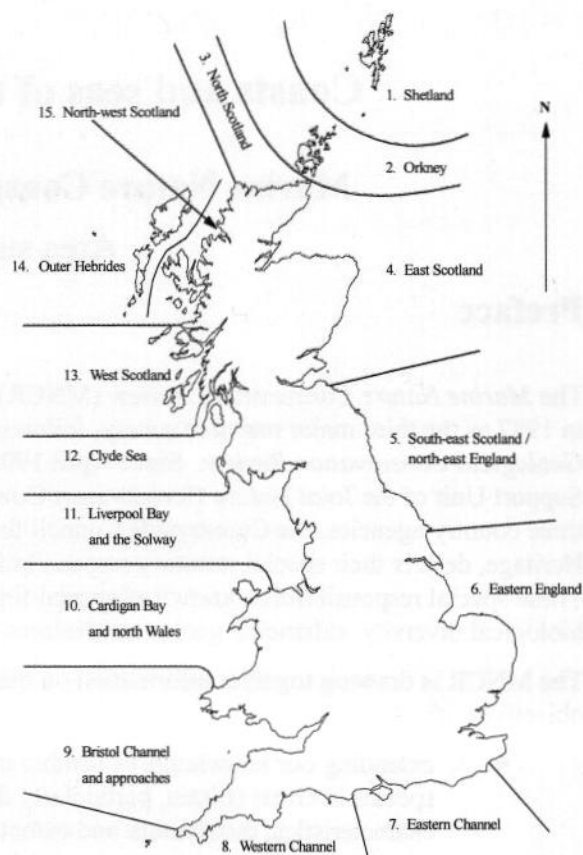
**David Connor**

**Joint Nature Conservation Committee**



## Publications in the MNCR series

MNCR coastal sectors, as used in the *Coasts and seas of the United Kingdom - MNCR series*.



## Volumes published or near publication:

Sector	Title	Authors	Date
<b>Foundation volumes</b>			
1-15	Rationale and methods	Hiscock, <i>ed.</i>	1996
1-15	Benthic marine ecosystems of Great Britain and the north-east Atlantic	Hiscock, <i>ed.</i>	1998
<b>Biotope classification</b>			
1-15	Marine biotope classification for Britain and Ireland. Volume 1. Littoral biotopes ( <i>JNCC Report</i> , No. 229)	Connor, Brazier, Hill & Northen	1997
1-15	Marine biotope classification for Britain and Ireland. Volume 2. Sublittoral biotopes ( <i>JNCC Report</i> , No. 230)	Connor, Dalkin, Hill, Holt & Sanderson	1997
<b>Area summaries</b>			
1	Shetland	Howson	Due 1999
1-2	Lagoons in Shetland and Orkney	Thorpe	1998
2	Orkney	Murray, Dalkin, Fortune & Begg	Due 1999
3, 4, 12, 13, 15	Lagoons in mainland Scotland and the Inner Hebrides	Covey, Fortune, Nichols & Thorpe	1998
5	South-east Scotland and north-east England	Brazier, Davies, Holt & Murray	1998
6	Inlets in eastern England	Hill, Emblow & Northen	1996
8	Inlets in the western English Channel	Moore, Smith & Northen	1999
9	Inlets in the Bristol Channel and approaches	Moore, Smith, Northen & Little	1998
10	Cardigan Bay and north Wales	Brazier, Holt, Murray & Nichols	Due 1999
11	Liverpool Bay and the Solway Firth	Covey	1998
12	Sealochs in the Clyde Sea	Dipper & Beaver	Due 1999
13	Sealochs in west Scotland		Due 1999
14	Lagoons in the Outer Hebrides	Thorpe, Dalkin, Fortune & Nichols	1998
14	Sealochs in the Outer Hebrides		Due 1999
15	Sealochs in north-west Scotland		Due 1999

# Marine Nature Conservation Review

## Sector 8

### Inlets in the western English Channel

#### Area summaries

#### Synopsis

The habitats and communities of the marine inlets of south-west Britain are considered to have many physiographic and ecological similarities and have been the subject of various surveys, the most comprehensive being the Harbours, Rias and Estuaries (HRE) programme commissioned by the Nature Conservancy Council (NCC) in the 1980s. The HRE surveys were carried out by the Field Studies Council Oil Pollution Research Unit (OPRU) between 1985 and 1989 and covered all the major and most of the minor inlets between Portsmouth and Milford Haven.

The HRE studies included field surveys of the shores and sublittoral zone of each inlet to describe their habitats and communities (together referred to as biotopes) and to assess their natural heritage importance. The data from the HRE surveys, together with data from a variety of other sources, have been analysed to classify the marine biotopes present and to describe their distribution within each inlet.

This volume contains a summary of information on the marine inlets between Weymouth Harbour in Dorset and the Helford River in Cornwall. Information on the designated conservation sites and main human influences in each inlet was also compiled. The information is presented here as 16 *area summaries*:

- |   |                                     |
|---|-------------------------------------|
| 1. Weymouth Harbour                         | 9. River Avon                       |
| 2. Portland Harbour                         | 10. River Erme                      |
| 3. River Axe                                | 11. River Yealm                     |
| 4. River Otter                              | 12. Plymouth Sound                  |
| 5. River Exe                                | 13. East and West River Looe        |
| 6. River Teign                              | 14. River Fowey                     |
| 7. River Dart                               | 15. Carrick Roads and the River Fal |
| 8. Salcombe Harbour and Kingsbridge estuary | 16. Helford River                   |

Inlets in the Bristol Channel and its approaches from the River Hayle in Cornwall northwards to Milford Haven in Pembrokeshire are described in Moore *et al.* (1998). Each area is described in a standard format, giving details of its physical and biological character, the biotopes present and their distribution, current nature conservation designations, the main human influences and relevant literature. The areas surveyed and the marine biotope information are also presented in a series of maps. These *area summaries* are supported by a summary of the biotopes defined for the region (from Connor *et al.* 1997a, b) and by a list of species recorded from the surveys.

#### References

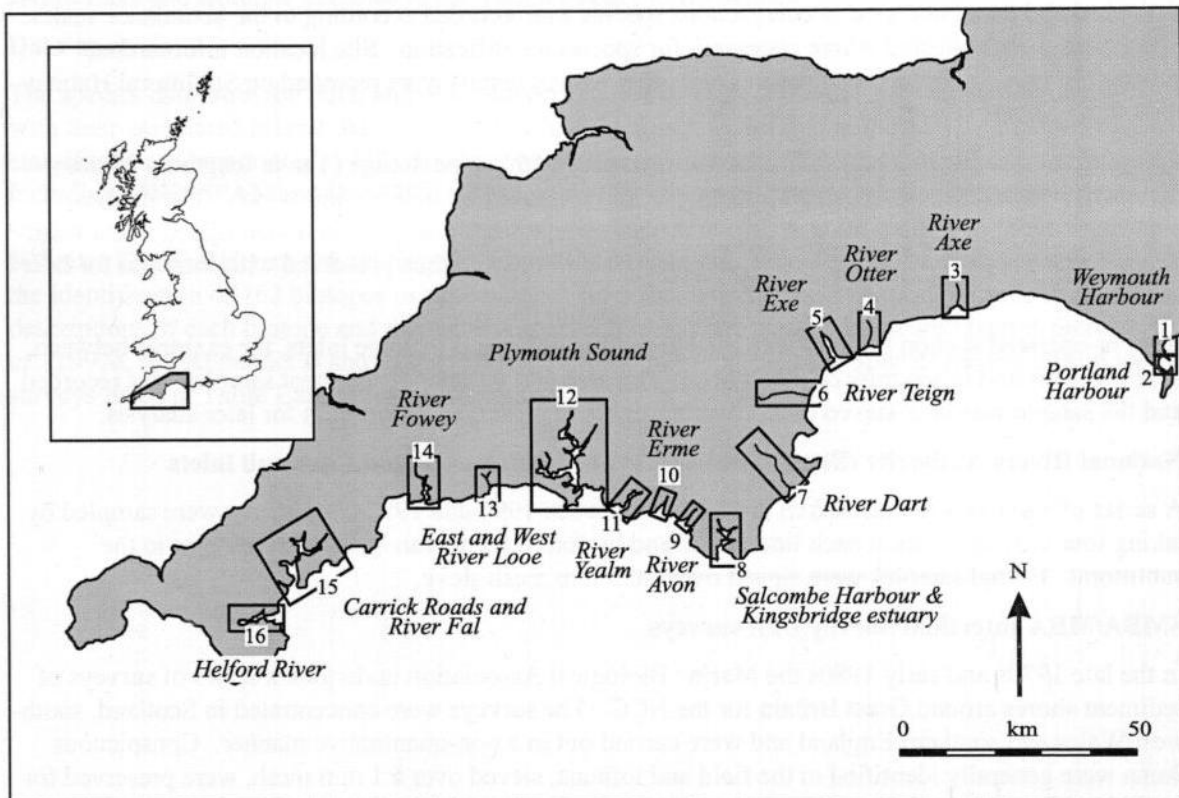
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## Introduction

### Background

MNCR Sector 8 extends from Durlston Head in Dorset to Cape Cornwall. Sixteen marine inlets occur along this stretch of coast (Figure 1) and these have been the subject of various surveys to describe their marine habitats and communities (together referred to as biotopes). The inlets are considered to have many physiographic and ecological similarities and a diverse range of habitats and communities are represented within them. An analysis of the available data from these inlets has been undertaken as part of the Marine Nature Conservation Review (MNCR) programme, to describe the biotopes present and their distribution within each inlet.



**Figure 1** Location of the 16 reporting inlets (area summaries) in MNCR Sector 8. Based upon Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office © Crown copyright. Joint Nature Conservation Committee licence number GD 27254X/01/99.

### Data collection and the classification of biotopes

#### The Harbours, Rias and Estuaries (HRE) surveys

This study, which covered all of the major and most of the minor inlets between Portsmouth and Milford Haven, was carried out between 1985 and 1989. It was commissioned by the Nature Conservancy Council (NCC) and undertaken by the Field Studies Council's Oil Pollution Research Unit (OPRU). A series of 21 reports was produced; each comprised both a review of available information on the marine environment of the inlets and the results of descriptive fieldwork. During the field surveys, information on the nature of each site, together with its habitats and their associated communities, were collected. Sites were selected in order to sample a wide range of substrata and different environmental conditions, such as differing wave exposure and salinity regimes, in the littoral



and sublittoral zones. Photographs were taken of the sites, and their biotopes and species, to provide a visual record of the areas surveyed. Sites were surveyed using a variety of techniques to record the epibiota and sample the infauna, based on techniques that had been developed for use in previous NCC surveys. Most of these techniques were the forerunners of the current MNCR methodology (Connor & Hiscock 1996). Information from each site was recorded on standard field recording forms.

On rocky shores there was a systematic description of the abundance of species in the main habitats/communities present at different heights on the open shore, recording the physical character of each habitat and the conspicuous species present using semi-quantitative abundance scales. Species that could not be identified in situ were collected for later identification in the laboratory. Records were also made from habitats such as overhangs, gullies, rockpools and underboulders.

Littoral sediments were sampled by taking four x 0.01 m<sup>2</sup> cores at each station and sieving over a 1 mm (or occasionally a 0.5 mm) mesh and preserved for later macrofaunal analysis.

Sublittoral areas were surveyed mainly by diving. At each survey station, the habitat type was described and the abundance of conspicuous species was recorded according to the abundance scales. Specimens were collected where necessary for species identification. Site location information, substratum type, topographical features and other habitat details were recorded on Sublittoral Habitat Recording Sheets.

The sublittoral sediments in most inlets were sampled with a pipe dredge (1 m in length by 25 cm diameter) which was towed behind a fishing boat (or similar) on a wire warp winch. The dredge contents were tipped into a 30-litre skip to measure the volume, sampled, and then tipped into a wash box and washed over a 1 mm sieve. Contents of the sieve were then preserved with formalin for later analysis.

A diver-operated suction sampler was used to sample sediments in some inlets, for example between rock outcrops and in seagrass or maerl beds. The area and volume of sediment sampled was recorded and the sample was later sieved over a 1 mm mesh and preserved in formalin for later analysis.

#### **National Rivers Authority (South west) surveys of south Devon and Cornwall inlets**

A series of surveys was undertaken in 12 inlets between 1990 and 1992. Sediments were sampled by taking four 0.01 m<sup>2</sup> cores at each littoral site and by four 0.05 m<sup>2</sup> van Veen grab samples in the sublittoral. Faunal samples were sieved over a 0.5 mm mesh sieve.

#### **SMBA/MBA Intertidal Survey Unit surveys**

In the late 1970s and early 1980s the Marine Biological Association undertook a series of surveys of sediment shores around Great Britain for the NCC. The surveys were concentrated in Scotland, south-west Wales and southern England and were carried out in a non-quantitative manner. Conspicuous fauna were generally identified in the field and infauna, sieved over a 1 mm mesh, were preserved for later identification. A field card was completed for each area, giving various physical details such as dominant sediment type, wave exposure, conspicuous marks (burrows, etc.) and shore morphology.

#### **Marine Conservation Society survey of the Dart estuary**

In August 1986 the Marine Conservation Society undertook a survey of the Dart estuary, partly supported and assisted by the NCC. The aim of the survey was to provide information in order to assess some of the potential impacts of a proposed deep-water port. Both littoral and sublittoral areas were investigated. The former was surveyed using the NCC Coastwatch mapping system and was therefore limited to recording the main habitat types. The sublittoral area was investigated by divers and data, including the abundances of conspicuous species, were recorded on habitat forms and species checklists.

#### **Devon Wildlife Trust**

Between 1991 and 1996 Devon Wildlife Trust surveyed Axmouth, the Rivers Dart and Teign, the Exe estuary, Salcombe estuary and Plymouth Sound. *Seasearch* methodology was followed and the



resultant data incorporated into the MNCR database. The *Seasearch* recording of Salcombe Harbour (Prawle Point area) was conducted by the Totnes branch of the British Sub-Aqua Club for the DWT.

#### **Seasearch survey of Salcombe Harbour**

No specific information or reference is available on the methodology used during this survey, but it is assumed that standard *Seasearch* methodology was used by volunteer divers to describe the seabed habitats. Records on the MNCR database (entered by the DWT) provide qualitative data on species of epibiota found at sites between the Salt Stone and the open coast.

#### **Posford Duvivier Environment survey of Plymouth Sound**

In 1997 Posford Duvivier Environment were commissioned by English Nature to undertake broad-scale biological mapping survey of Plymouth Sound and its estuaries (Posford Duvivier Environment, 1997). The sublittoral mapping was carried out using acoustic techniques, validated by ground-truthing using divers, remote video and grab sampling of sediments. Two littoral areas were also mapped: St. John's Lake and from the entrance to the Yealm estuary to Bovisand.

#### **Data analysis**

The species data from the HRE and other surveys (listed in Table 1) were analysed, in conjunction with their associated habitat data, to identify which biotopes, as defined in the MNCR national biotope classification (Connor *et al.* 1997a, b), were present in the dataset. Multivariate analytical techniques, including TWINSpan and DECORANA, were employed to facilitate the identification of distinct assemblages of species within the dataset, using the procedures given in Mills (1994). Data from 805 sites (2,240 different habitat records) from MNCR Sector 8 were used in the analyses, resulting in the identification of 162 biotopes or sub-biotopes from the national classification (Appendix A). Full descriptions of each biotope and the general approach to biotope classification are given in Connor *et al.* (1997a, b). Appendix B shows the presence of biotopes in each area. Species recorded from the surveys listed in Table 1 are given in Appendix C.

Table 1 Sources of field survey information

MNCR database survey no.	Survey	Source	No. of sites	No. of habitats surveyed
14	1986-89 MNCR general surveys of Sector 8 - Western Channel	MNCR (Unpublished data)	4	4
126	1986 MCS survey of the River Dart	Horsman (1986)	19	46
168	1983 UCW investigation of the subtidal ecology of the Fleet Lagoon (Dorset)	Dyrynda (1984)	2	2
197	1987 OPRU assessment of extent and effects of spoil dumping in the Salcombe and Kingsbridge estuary	Little (1987)	9	24
241	1985 HRE survey of Salcombe Harbour and the Kingsbridge estuary	Hiscock (1986)	56	214
242	1986 HRE survey of Plymouth Harbour and the Yealm estuary	Hiscock & Moore (1986)	137	509
243	1985 HRE survey of the Exe estuary	Dixon (1986)	47	92
244	1985 HRE survey of the Fal estuary	Rostron (1985)	75	290
247	1986-87 HRE survey of the Helford River	Rostron (1987)	52	128
249	1987 HRE survey of Portland and Weymouth Harbour	Howard, Howson & Moore (1988)	11	38
251	1987 HRE survey of the Looe estuary	Little (1988)	4	17
252	1987 HRE survey of the Avon and Erme estuaries	Moore (1988a)	7	25
253	1987 HRE survey of the Dart estuary including The Range	Moore (1988b)	50	138
254	1988 HRE survey of the Teign estuary	Frid (1989)	37	78
260	1986 HRE survey of the Fowey estuary	OPRU (Unpublished data)	48	192
265	1970-1980 SMBA/MBA Great Britain intertidal survey	Holme & Bishop (1980)	9	9
300	1991 DWT Seasearch survey of Salcombe Harbour	DWT (Unpublished data)	21	31
303	1991-93 DWT littoral survey of Salcombe estuary	DWT (Unpublished data)	1	1
306	1992-94 DWT littoral survey of Plymouth	DWT (Unpublished data)	19	56
336	1993-96 DWT Seasearch survey of Plymouth	DWT (Unpublished data)	12	14
431	1990 NRA SW Region littoral survey of the Axe estuary	NRA SW Region (1992)	5	5
432	1990 NRA SW Region littoral survey of the Exe estuary	NRA SW Region (1992)	8	8
433	1990 NRA SW Region littoral and sublittoral survey of the Fal estuary	NRA SW Region (1992)	49	49
435	1990 NRA SW Region littoral survey of the Fowey estuary	NRA SW Region (1992)	16	16
436	1990 NRA SW Region littoral survey of the Helford estuary	NRA SW Region (1992)	10	10
437	1990 NRA SW Region littoral and sublittoral survey of the Kingsbridge estuary	NRA SW Region (1992)	18	18
438	1990 NRA SW Region littoral survey of the Otter estuary	NRA SW Region (1992)	3	3
439	1990 NRA SW Region littoral survey of the Plym estuary	NRA SW Region (1992)	4	4
440	1992 NRA SW Region littoral survey of the Tamar estuary	NRA SW Region (1992)	3	3
451	1992 NRA SW Region littoral and sublittoral survey of the Teign estuary	NRA SW Region (1992)	10	10
452	1991 NRA SW Region littoral survey of the Yealm estuary	NRA SW Region (1992)	10	10
466	1994 MNCR littoral survey of Lizard Peninsula and Falmouth Bay	MNCR (Unpublished data)	19	110
484	1993 MNCR training week - Plymouth	MNCR (Unpublished data)	1	10
603	1992-93 DWT littoral survey of the Exe estuary	DWT (1996)	3	4
604	1992-95 DWT littoral survey of the Axmouth	DWT (1996)	7	20
611	1992 DWT littoral survey of the Plym estuary	DWT (1993)	10	30
613	1994-95 DWT littoral survey of the River Dart	DWT (Unpublished data)	2	13
622	1991 NRA SW Region littoral survey of the Avon estuary	NRA (Unpublished data)	3	3
703	1994 Kerr McGee Lyme Bay Environmental Study, Exmouth to Burton Bradstock	DWT (Unpublished data)	4	6
Total			805	2,240

Abbreviations: HRE = surveys of Harbours, Rias & Estuaries (FSC/OPRU); MNCR = Marine Nature Conservation Review (JNCC); NRA = National Rivers Authority; SMBA/MBA = Scottish Marine Biological Association & Marine Biological Association Intertidal Survey Unit; UCW = University College of Wales.

## Area summaries and their format

Sixteen marine inlets occur along the coast of MNCR Sector 8 (Figure 1) and each has been described in the standard MNCR *area summary* format. The 16 areas described are:

- |  |                                     |
|--|-------------------------------------|
| 1. Weymouth Harbour                            | 9. River Avon                       |
| 2. Portland Harbour                            | 10. River Erme                      |
| 3. River Axe                                   | 11. River Yealm                     |
| 4. River Otter                                 | 12. Plymouth Sound                  |
| 5. River Exe                                   | 13. East and West River Looe        |
| 6. River Teign                                 | 14. River Fowey                     |
| 7. River Dart                                  | 15. Carrick Roads and the River Fal |
| 8. Salcombe Harbour and Kingsbridge<br>estuary | 16. Helford River                   |

The names used for each inlet are taken from the Ordnance Survey Landranger map series; those place names used may not reflect the type of physiographic feature described (see below under Physical Features).

Each *area summary* contains the following sections:

### Location

The geographic location is given as the central latitude/longitude position and Ordnance Survey grid reference, together with the local government administrative area and the relevant nature conservation agency (English Nature) local area. A location map shows the main features of the area, key place names, bathymetry, and the limit of the area considered by the *area summary*. The sites surveyed are shown according to four main types of survey: recording on littoral (▲) or sublittoral (●) rock/hard substrata and sampling in littoral (Δ) or sublittoral (○) sediment habitats.

### Marine biological surveys

Marine biological surveys of the shores and sublittoral which have been used in compiling the *area summary* are listed to include the survey type (littoral/sublittoral), survey method, date of survey and reference source. The distribution of survey sites is shown on the location map and sites are listed at the end of each area summary.

### Introduction

This section describes the overall physical characteristics of the area and any significant human influences and activities. Water quality information is from Buck (1997).

### Physical features

A summary of the main physical features includes: the type of physiographic feature as defined in Connor & Hiscock (1996) or, for estuary types, in Davidson *et al.* (1991); the area of the inlet, taken from Buck (1997); the length of the inlet measured from the relevant 1:50,000 Ordnance Survey (Landranger series) map or Admiralty chart, taken from the mouth of the inlet to the limit of tidal influence; the bathymetry, summarised from Admiralty charts; wave exposure and tidal streams taken from Admiralty charts and field observations, as defined in Connor & Hiscock (1996); tidal range figures are for maximum spring and minimum neap tidal range, quoted for the nearest secondary port, and based on Admiralty tide tables; and the salinity is either as estimated at the time of survey or as given in available literature; categories as in Connor & Hiscock (1996).

### Marine biology

The biological nature of the area is described with reference to the biotopes present and their distribution within each area, based on the findings of the surveys listed. The heights and depths



noted in the text are corrected to chart datum. The biotope codes given in parentheses are from the MNCR national classification, as listed in Appendix A and a summary of the biotopes present within each area is presented in Appendix B. Species nomenclature follows Howson & Picton (1997); that for lichens follows Purvis *et al.* (1992) and that for higher plants follows Stace (1991).

A map illustrates the distribution of the main biotopes within the area. **NOTE:** this map gives an indication of the *likely* distribution and extent of biotopes, based on the data available, including sketch maps of biotope distribution made at the time of survey, cited literature and information on Admiralty charts. In some areas data are sparse and additional data or more comprehensive survey would enable more accurate maps to be drawn.

### Nature conservation

A summary of statutory and non-statutory wildlife and landscape conservation designations for the marine and coastal parts of the area is shown (from Barne *et al.* 1996 a,b,c, where further information on each designation can be found).

#### Key to abbreviations used:

AGLV	Area of Great Landscape Value
AONB	Area of Outstanding Natural Beauty
CP	Country Park
CPA	Coastal Preservation Area
CWT	Cornwall Wildlife Trust nature reserve
DWT	Dorset Wildlife Trust / Devon Wildlife Trust nature reserve
ESA	Environmentally Sensitive Area
GCR	Geological Conservation Review site
HC	Heritage Coast
LNR	Local Nature Reserve
NCR	Nature Conservation Review site
NNR	National Nature Reserve
NT	National Trust
Ramsar	Ramsar site
RSPB	Royal Society for the Protection of Birds nature reserve
cSAC	candidate Special Area of Conservation
SMA	Sensitive Marine Area
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
VMCA	Voluntary Marine Conservation Area
VMNR	Voluntary Marine Nature Reserve

### Human influences

This section describes the main uses and activities of the area, including urbanisation, industrial or commercial activities that have (or potentially have) an impact within the area described. These may include sewage discharges, industrial effluents, development, dredging, spoil dumping, commercial fishing, recreation and shipping.

### References and further reading

This lists cited references and other relevant literature.

### Sites surveyed

This provides a listing of the sites surveyed within the area (from those surveys listed in Table 1) with information on the location of each site (OS grid reference and latitude/longitude) and an inventory of the biotopes known to be present at the time of survey.

## Acknowledgements

Anita Barnard at OPRU helped in the preparation of the area summaries. Thanks to the following for their comments: Mike Camplin, Devon Wildlife Trust (now at Countryside Council for Wales) for his comments on the draft of this volume; Vicki Copley, Roger Covey and Jo Cricks (English Nature); Keith Hiscock (formally JNCC).

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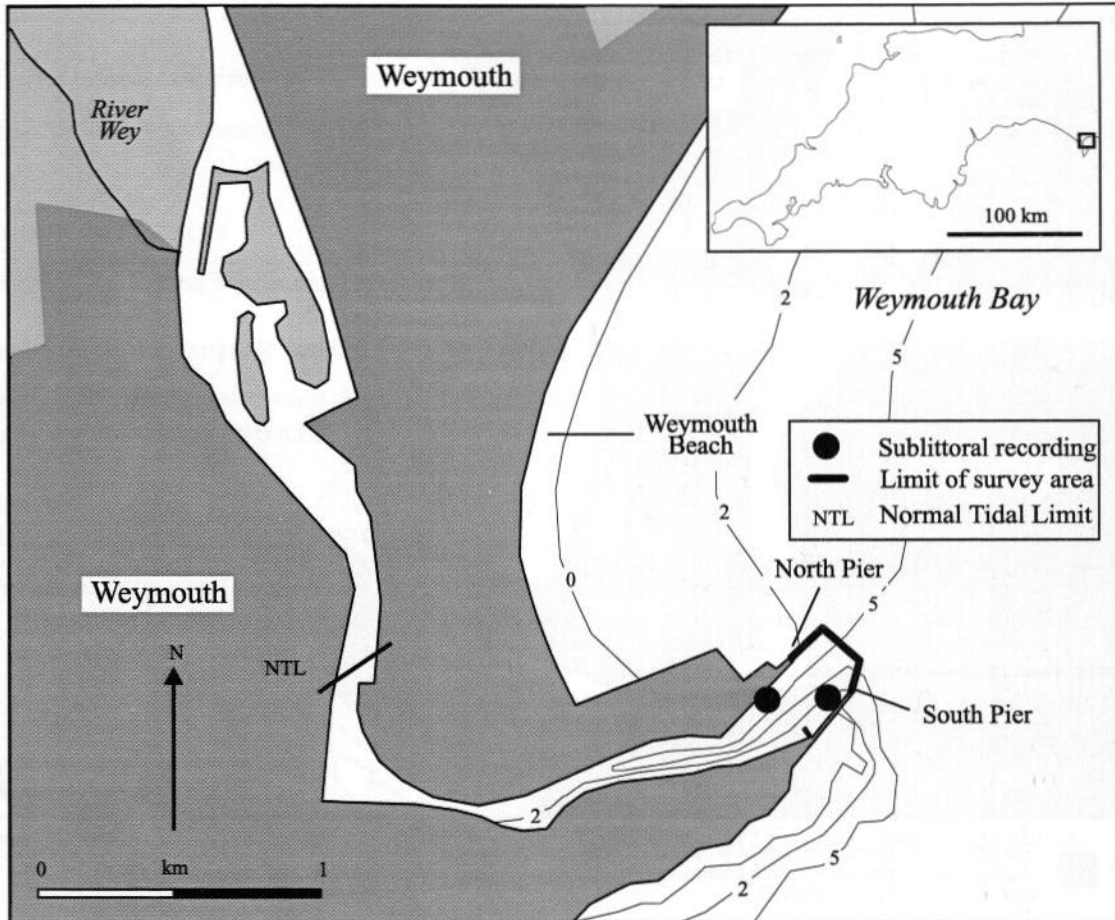
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## 1

## Weymouth Harbour

## Location

<i>Position (centre)</i>	SY6980	50° 36' N 02° 26' W
<i>Administrative area</i>	Dorset	Weymouth and Portland
<i>Conservation agency/area</i>	English Nature	Dorset



**Figure 1.1** Main features of the area, and sites surveyed.

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## Physical features

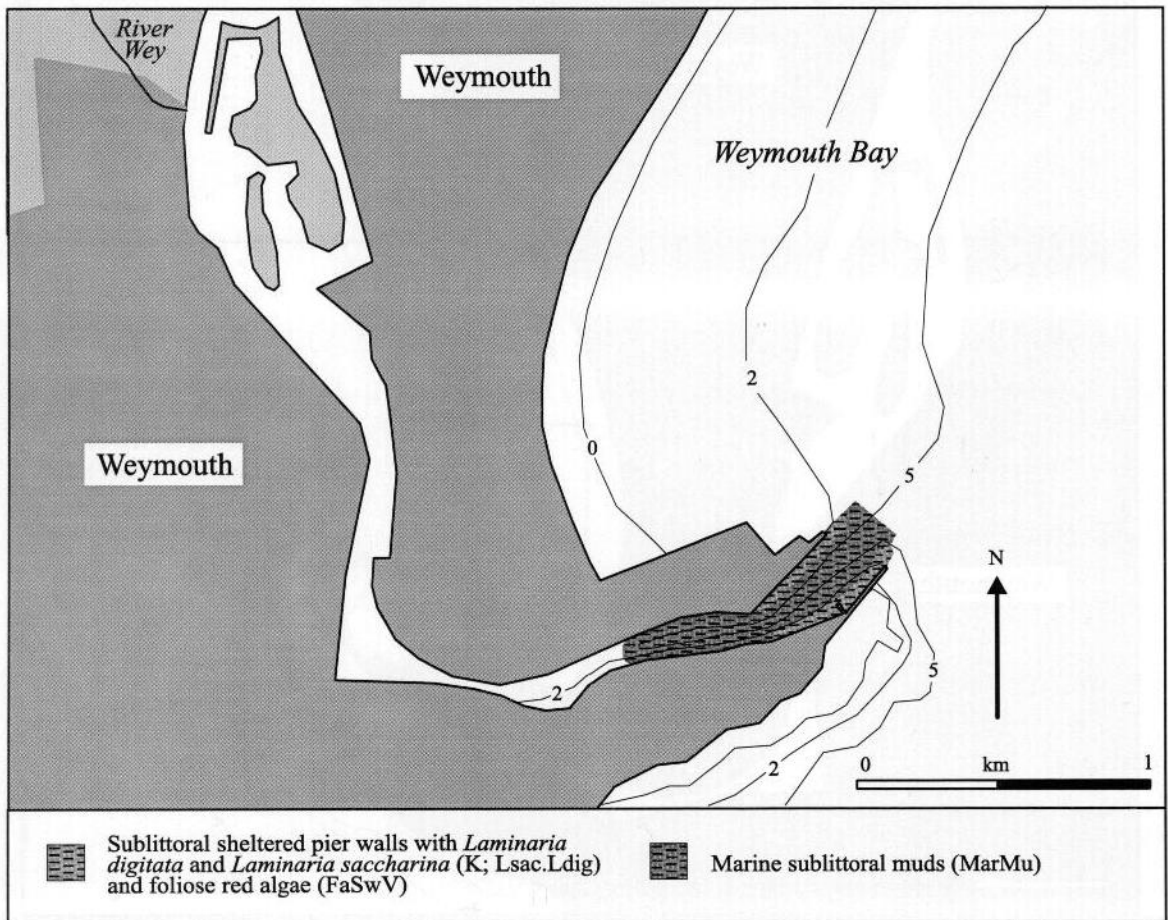
<i>Physiographic type</i>	Modified estuary
<i>Length of coast</i>	4.5 km
<i>Area of inlet</i>	20 ha
<i>Length of inlet</i>	2 km
<i>Bathymetry</i>	Maximum depth 7 m
<i>Wave exposure range</i>	Sheltered to very sheltered
<i>Tidal stream range</i>	Moderate to very weak
<i>Tidal range</i>	2 m (spring); 0.6 m (neap)
<i>Salinity range</i>	Fully marine to variable



**Introduction**

Weymouth Harbour is small and narrow and lies at the mouth of the River Wey. It has no intertidal areas except for the vertical walls of the breakwater and the pier pilings. The bottom is sandy and muddy and is dredged to between 5 and 7 m. The inlet has no current conservation designations.

Marine biological surveys		
Survey methods	Date(s) of survey	Source
Sublittoral Recording	April 1987	Howard <i>et al.</i> (1988)



**Figure 1.2** Indicative distribution of the main biotopes in the inlet (based on data from survey sites shown in Figure 1.1, cited literature and additional field observations).

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**Marine biology**

The vertical walls at the mouth of Weymouth Harbour are composed of limestone blocks which are dominated by dense growths of kelp *Laminaria digitata* with *Laminaria saccharina* above a band of foliose red algae (Lsac.Ldig). The red algal band reaches a maximum depth of only 2 m. Fauna associated with the kelp band include sponges, hydroids and ascidians. The wooden and concrete piles of the pier are subject to a certain amount of wave action and a moderately rich algal community is

present. The upper 50 cm of the piles support large plants of the kelps *L. saccharina* and *Saccorhiza polyschides* with some *Sargassum muticum* (Lsac.Ldig). Below this band, the surfaces of the piles are covered in tufts of red and brown algae including *Pterothamnion plumula*, *Lomentaria orcadensis* and *Desmarestia viridis*. Up to 27 algal species have been recorded from this habitat. However, relatively few fauna are present including the hydroid *Obelia plicata* and several ascidians including *Morchellium argus* and *Diplosoma listerianum* (FaSwV).

A compacted mud slope extends from the base of the pier and harbour walls towards the shipping channel in the harbour entrance (MarMu). A diatom-rich muddy/fine sand layer overlies a stiff clay. Lugworms *Arenicola marina* and the burrowing anemone *Cerianthus lloydii* are common along with patchily distributed nematodes, the shore crab *Carcinus maenas* and the hermit crab *Pagurus bernhardus*.

## Nature conservation

Conservation sites - none at present.

## Human influences

The entire hinterland is industrialised/urban, comprising the town of Weymouth. There are a number of wharves and boat yards and a large number of moorings in the backwater. A cross-channel ferry to Cherbourg runs in summer and ferries to the Channel Islands leave throughout the year.

A variety of fishing vessels use Weymouth Harbour, but no fishing/mariculture or leisure activities take place within the Harbour itself.

## References and further reading

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## Sites surveyed

Survey 249: 1987 HRE survey of Portland and Weymouth Harbour (Howard, Howson & Moore 1988).

Sublittoral sites					
Survey	Site	Place	Grid reference	Latitude/longitude	Biotopes present
249	W1	S Pier, Weymouth Harbour.	SY 688 789	50°36.5'N 02°26.4'W	FaSwV, Lsac.Ldig, MarMu
249	W2	N Pier, Weymouth Harbour.	SY 686 789	50°36.5'N 02°26.6'W	Lsac.Ldig, MarMu

Compiled by: Jan Smith and Jon Moore



## 2

## Portland Harbour

## Location

Position (centre)	SY6976	50° 35' N 02° 26' W
Administrative area	Dorset	Weymouth and Portland
Conservation agency/area	English Nature	Dorset

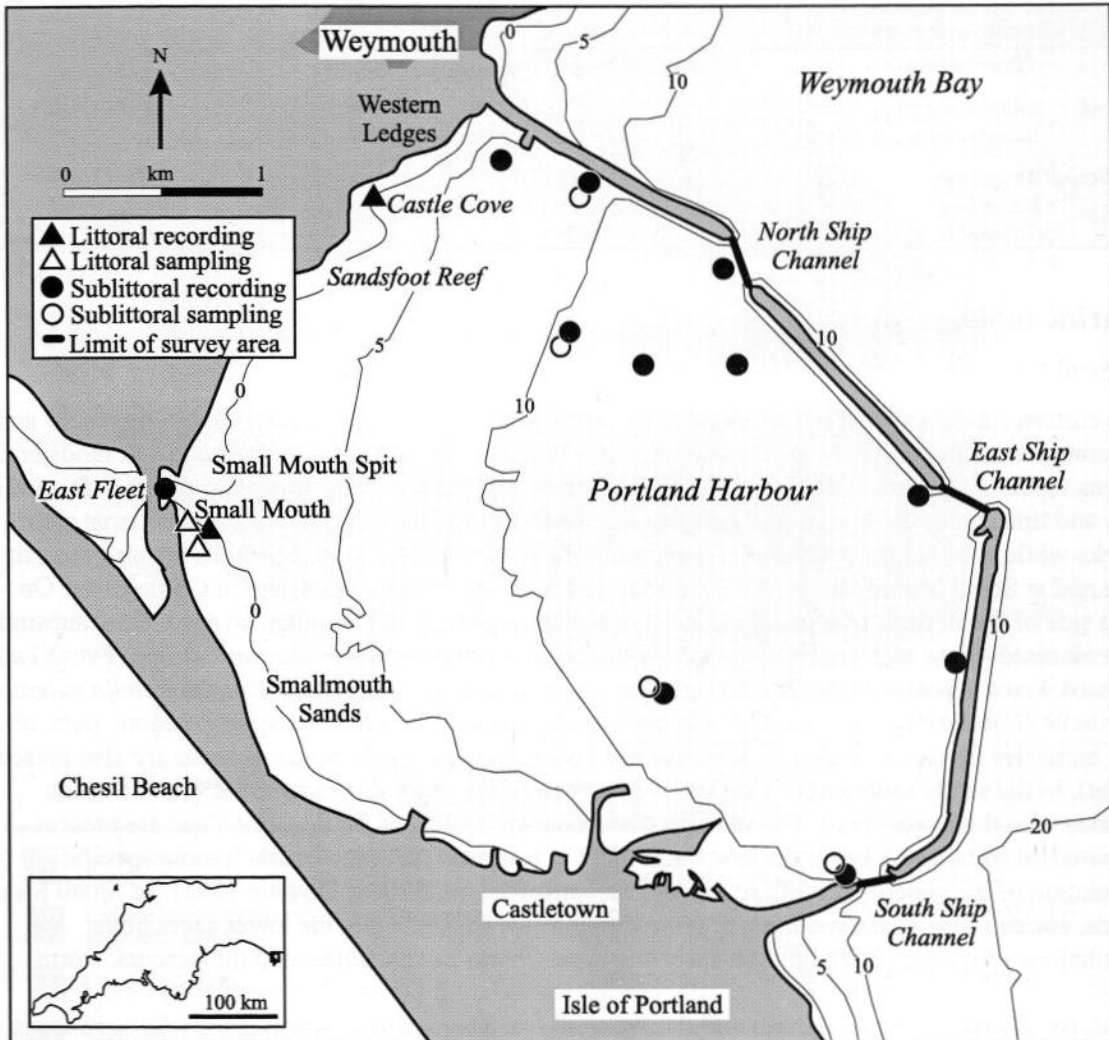


Figure 2.1 Main features of the area, and sites surveyed.

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## Physical features

<i>Physiographic type</i>	Embayment with breakwaters
<i>Length of coast</i>	12 km
<i>Area of inlet</i>	1,100 ha
<i>Length of inlet</i>	3.5 km
<i>Bathymetry</i>	Sloping to maximum depth of 17 m
<i>Wave exposure range</i>	Very sheltered
<i>Tidal stream range</i>	Max. of 1 knot in north and east shipping channels
<i>Tidal range</i>	2.0 m (spring); 0.6 m (neap)
<i>Salinity range</i>	Fully marine

## Introduction

Portland Harbour encloses a large area of seabed and is sheltered in all weather by the Portland peninsula to the south, Chesil Beach to the west and by four breakwaters to the east. The entrance to the Fleet lagoon lies on the north-west side of the harbour. Freshwater input is minimal and in summer, water temperature may become significantly elevated compared with the open sea. The conditions of sheltered, warm, clear and fully marine water are unique in Britain, resulting in the presence of a large number of warm-water species. Additionally, species are present which are usually found in much deeper water. Portland Harbour is the type locality for the rare burrowing worm anemone *Scolanthus callimorphus*.

### Marine biological surveys

	Survey methods	Date(s) of survey	Source
<i>Littoral</i>	Infaunal sampling (cores)	September 1995	Downie (1996)
	Infaunal sampling (cores)	October 1994	Downie (1995)
<i>Sublittoral</i>	Recording	April 1987	Howard, Howson & Moore (1988)
	Recording	August 1983	Dyrynda (1984)
	Infaunal sampling (Day grab)	April 1987	Howard, Howson & Moore (1988)

## Marine biology

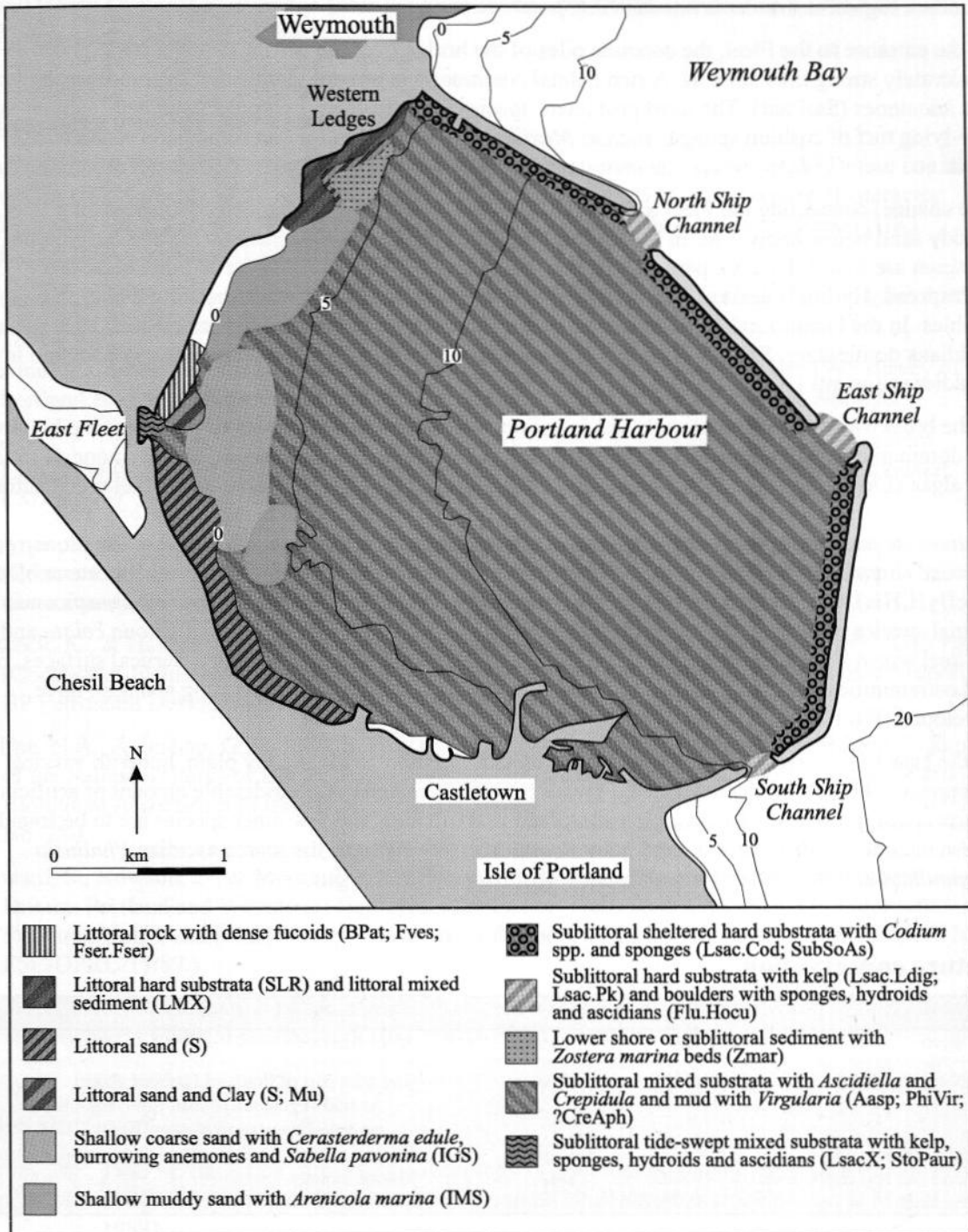
### Littoral biotopes

The eastern side of the harbour is bounded by artificial substrata in the form of limestone blocks and concrete walls. Shores on the north-west side (the Western Ledges) are flat limestone and sandstone ledges separated by areas of slowly-draining silty clay and pebbles. The upper shore here is formed of clay and limestone rubble from the cliff behind. North of Smallmouth Spit is an area of large stone blocks while much of the spit itself is composed of clay covered by sand. Sandflats are also present here and at Small Mouth Sands (AP.P) (uncovered only on very low tides) and in Castle Cove. On each side of Small Mouth the shores consist of pebbles, cobbles and boulders on sand. Hard substrata are colonised by the egg wrack *Ascophyllum nodosum*, bladder wrack *Fucus vesiculosus* (FvesX) and serrated wrack *Fucus serratus* (Fser.Fser). Grazing molluscs present include limpets *Patella vulgata*, top shells *Gibbula cineraria* and *Gibbula umbilicalis* and winkles *Littorina* spp. (J. Moore, pers. obs.) The barnacles *Elminius modestus*, *Semibalanus balanoides* and *Chthamalus stellatus* are also present (BPat). In the sandy sediment of Castle Cove is a bed of sea grass *Zostera marina* (Zmar) which extends onto the lower shore. The red alga *Ceramium* sp. and other filamentous algae are present lower down the shore. Clay at the low water mark at Smallmouth Spit contains a monospecific population of the venerupid mollusc *Loripes lucinalis* (Seaward 1986; Downie 1995). At Small Mouth Sands, cockles *Cerastoderma edule* are found in the coarse sand while the lower shore holds populations of species, including the daisy anemone *Cereus pedunculatus* and the peacock worm *Sabella pavonina*, which are more usually considered to be sublittoral. The meiofauna includes cirratulids *Cirriformia* spp. (LMX) and the nationally rare lagoon sand worm *Armandia cirrhosa* is also present in these sediments (Downie 1995, 1996). Also at Small Mouth Sands, a population of the rare sea slug *Aeolidiella alderi* has been found among the boulders (Seaward 1986; Downie 1995).

### Sublittoral biotopes

The seabed of Portland Harbour is carpeted with expanses of muddy clay. This extensive habitat is dominated by large numbers of the seapen *Virgularia mirabilis* (PhiVir). Other species present in varying abundances include the opisthobranch mollusc *Philine aperta*, the pelican's foot shell *Aporrhais pespelecani* and the anemones *Edwardsia claparedii* and *Sagartiogeton undatus*. The Mediterranean red-band fish *Cepola rubescens*, usually found in deep water, is known to live in these muddy sediments. There are occasional areas of hard substrata on the otherwise soft seabed. Shells of the slipper limpet *Crepidula fornicata* (live and dead) are densely packed over large areas of the northern harbour, with an associated community mostly of sponges and ascidians (CreAph). An area of metal debris and occasional boulders in the southern half of the harbour provide a substratum for the

solitary ascidian *Ascidiella aspersa* (Aasp). The calcareous tubeworm *Serpula vermicularis* is commonly found on the metal rods and several mobile crustacean species find shelter here. Brittlestars and the ascidian *Botryllus schlosseri* are present in low densities.



**Figure 2.2** Indicative distribution of the main biotopes in the inlet (based on data from survey sites shown in Figure 2.1, cited literature and additional field observations).

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The infauna of the soft muddy plain is dominated by polychaetes including *Melinna palmata* and the rare Mediterranean polychaete *Sternaspis scutata* (PhiVir). The bivalve mollusc *Abra alba* is also abundant in this habitat. Shallow sand between Castle Cove and Small Mouth is dominated by abundant lugworm *Arenicola marina* (IMS).

At the entrance to the Fleet, the concrete piles of the bridge over the narrow channel are exposed to moderately strong tidal streams. A rich animal community is present, dominated by ascidians, hydroids and anemones (StoPaur). The most prominent species is the feathery hydroid *Plumularia setacea*. A low-lying turf of cushion sponges such as *Myxilla incrustans* is present on some parts of the bridge piles.

The channel connecting the Fleet to Portland Harbour is floored with rounded cobbles grading into muddy sand below about 5 m. In the infralittoral, patches of *Laminaria saccharina* and *Sargassum muticum* are found (LsacX), particularly along the edges of the channel. Several other algae are widespread. Hydroids and ascidians are present but not dominant and gobies are found over the cobbles. In the circalittoral, the community composition differs from the infralittoral with hydroids and ascidians dominating. *Sabella pavonina* is present in gravel and *Cereus pedunculatus* is common in muddier sediments (Aasp). Sea slugs are occasionally found.

In the breakwater shipping channels, the infralittoral upward-facing surfaces of the limestone blocks are dominated by a dense growth of kelp *Laminaria digitata* and *L. saccharina* above a zone of foliose red algae (Lsac.Ldig; Lsac.Pk). Faunal species include sponges and hydroids. In the sheltered central areas of the breakwaters, little kelp is present and the infralittoral is dominated by the green alga *Codium* sp. and red algae (Lsac.Cod). Animal communities here are similar to those of the more exposed shipping channels. The rock-boring bivalve *Hiatella arctica* is present in the limestone blocks (AlcByH.Hia). Circalittoral rock along the breakwater is silty with little algae and few conspicuous animal species present. The sponges *Dysidea fragilis* and the rock-boring form of *Cliona celata* and the keel worm *Pomatoceros triqueter* are frequent (?SubSoAs). On the less silty, vertical surfaces, rich turf communities, including foliose bryozoans, hydroids, ascidians and encrusting sponges, have developed (Flu.Hocu).

At the base of the breakwaters, the limestone blocks give way to the muddy plain, but with varying amounts of cobbles, boulders and shell gravel (FaMx; ?CreAph). A considerable amount of artificial debris is also present. *C. fornicata* is widespread in this habitat but few other species are to be found. These include *V. mirabilis*, the sand goby *Pomatoschistus minutus*, the scarce ascidian *Phallusia mammillata* and the sea lemon (nudibranch) *Archidoris pseudoargus*.

## Nature conservation

Conservation sites			
Site name	Position	Status	Main features
Chesil and the Fleet	SY605815	cSAC	(Includes part of Portland Harbour shore) Annual vegetation of drift lines; lagoons; perennial vegetation of stony banks.
Portland Harbour shore	SY675747	SSSI	Geological, maritime grassland and intertidal interest
Portland Bill and Harbour and the Fleet	SY496883- SY737815	SMA	Marine biology

## Human influences

The extensive breakwaters combine to form a highly sheltered muddy embayment with very different conditions from those of the open coast. The only industrial activity within the harbour is at the naval dock.

Fish and oyster farming is carried out on a small scale. There is a licensed oyster fishery. Fishing vessels work from the harbour but fish outside it. Bait-digging and collection of cockles *Cerastoderma edule* occurs on the littoral flats between Smallmouth and Small Mouth.

Leisure activities are numerous and include canoeing, sailboarding, scuba diving and snorkelling. There is a sailing and windsurfing centre at Smallmouth Castle and moorings for sail boats around Smallmouth. Beach recreation is most intensive at Smallmouth Cove, Western Ledges and Ham beach. Chesil Beach Centre at Ferrybridge (near the Fleet entrance) provides information on the area and a warden manages some recreational activities.

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## Sites surveyed

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 Survey 249: 1987 HRE survey of Portland and Weymouth Harbour (Howard, Howson & Moore 1988).

Littoral sites					
Survey	Site	Place	Grid reference	Latitude/longitude	Biotopes present
655	1	Small Mouth Spit, Small Mouth Spit Area, Portland Harbour	SY 668 761	50°35.3 N 02°28.2 W	AP.P, LMX
655	3	Small Mouth Sand, Portland Harbour foreshore on south side Ferry Bridge	SY 669 758	50°34.9 N 02°28.2 W	LMX



<b>Sublittoral sites (listed in geographical order from north to south)</b>					
<i>Survey</i>	<i>Site</i>	<i>Place</i>	<i>Grid reference</i>	<i>Latitude/longitude</i>	<i>Biotopes present</i>
168	1	N entrance to Portland Harbour.	SY 696 777	50°35.8'N 02°25.7'W	CreAph
168	2	Portland Harbour central deep water basin.	SY 690 770	50°35.4'N 02°26.2'W	PhiVir
249	P1	Mid N Breakwater, Portland Harbour.	SY 688 778	50°35.9'N 02°26.4'W	Sac, Lsac.Cod, AlcByH.Hia, PhiVir
249	P2	Mooring M8, Portland Harbour.	SY 689 772	50°35.5'N 02°26.3'W	PhiVir, CMX
249	P3	Buoy A3, Portland Harbour.	SY 695 758	50°34.8'N 02°25.8'W	Aasp, PhiVir
249	P4	W Wall, S Ship Channel, Portland Harbour.	SY 701 745	50°34.1'N 02°25.3'W	Lsac.Ldig, Lsac.Cod, SubSoAs, CreAph
249	P6	Outer Breakwater, Portland Harbour.	SY 706 758	50°34.8'N 02°24.9'W	Fser.Fser, Lsac.Cod, SubSoAs, PhiVir
249	P7	NE Breakwater, Portland Harbour.	SY 703 764	50°35.1'N 02°25.1'W	Lsac.Cod, SubSoAs, SubSoAs, FaMx
249	P8	N Ship Channel, Portland Harbour.	SY 695 773	50°35.6'N 02°25.8'W	Lsac.Ldig, Lsac.Pk, Flu.Hocu, CMX
249	P10	Fleet entrance, Portland Harbour.	SY 667 763	50°35.0'N 02°28.2'W	StoPaur, LsacX,

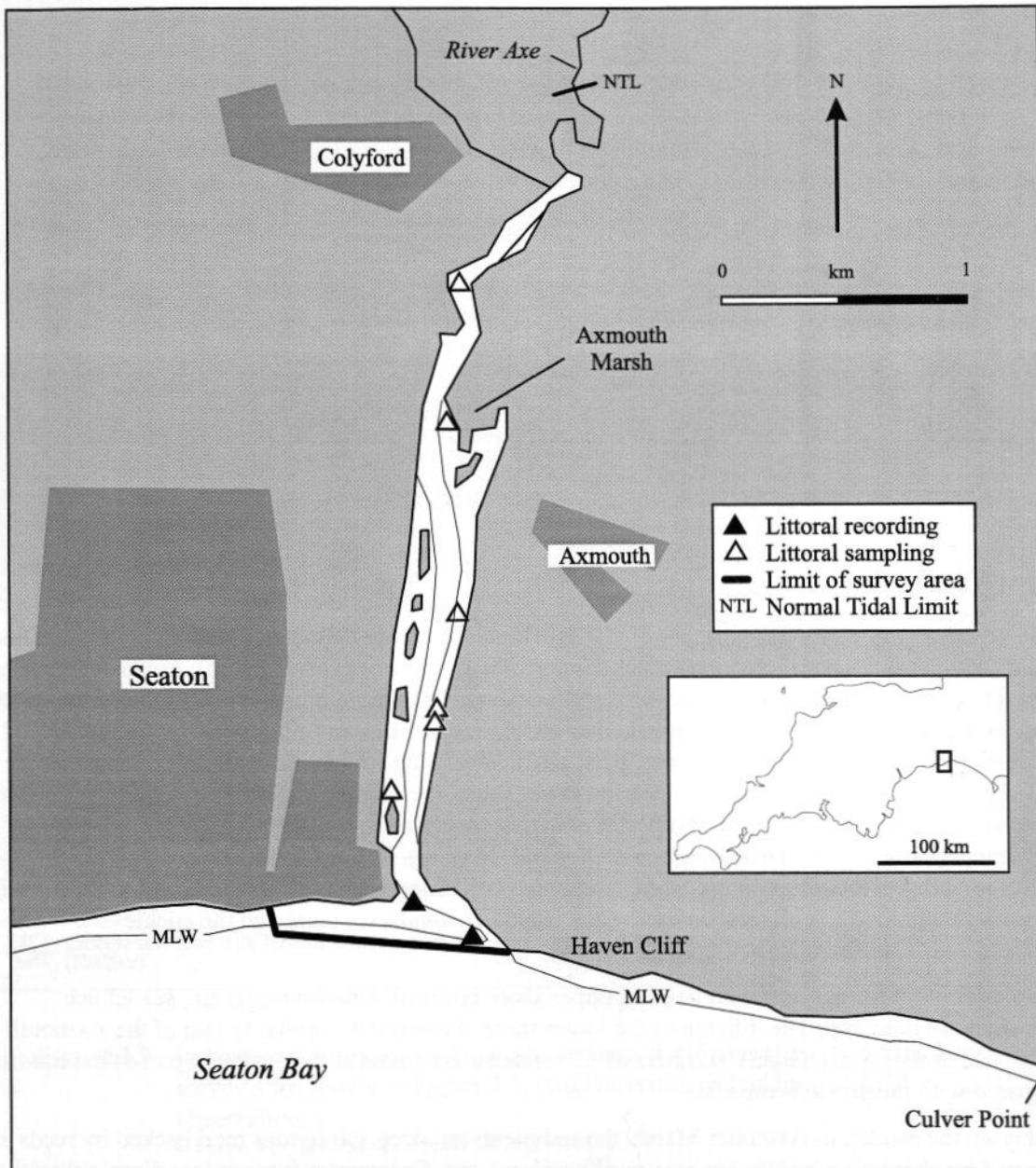
Compiled by: Jan Smith and Jon Moore

## 3

## River Axe

## Location

Position (centre)	SY2591	50° 42' N 03° 03' W
Administrative area	Devon	East Devon
Conservation agency/area	English Nature	Devon & Cornwall



**Figure 3.1** Main features of the area, and sites surveyed.

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Physical features	
<i>Physiographic type</i>	Bar-built estuary
<i>Length of coast</i>	8.1 km
<i>Area of inlet</i>	Total 79 ha; intertidal 62 ha
<i>Length of inlet</i>	3.8 km
<i>Bathymetry</i>	Shallow; maximum depth not recorded
<i>Wave exposure range</i>	Extremely sheltered
<i>Tidal stream range</i>	Weak
<i>Tidal range</i>	3.5 m (spring); 1.2 m (neap)
<i>Salinity range</i>	Variable (only in mouth) to low

## Introduction

The River Axe lies on the south coast of Devon and empties into Seaton Bay through a mouth which is narrowed by a sand and pebble spit. There are large areas of intertidal mudflats flanked by saltmarsh and on the western and northern shores are moderately extensive reed beds and freshwater marshes. Water quality is classified as grade A (highest quality). Atlantic salmon *Salmo salar* and sea trout *Salmo trutta* migrate to the inlet to spawn upriver.

The entire inlet is a Nature Conservation Zone, a Coastal Preservation Area and an Area of Great Landscape Value as designated by Devon County Council. The upper shore at the entrance of the inlet from Axmouth eastwards lies within the East Devon Area of Outstanding Natural Beauty. The inlet supports a variety of wintering waders and wildfowl, though not in any great numbers.

Marine biological surveys			
	<i>Survey methods</i>	<i>Date(s) of survey</i>	<i>Source</i>
<i>Littoral</i>	Recording	September 1994	Devon Wildlife Trust (unpublished data)
	Recording	June 1994	Kerr McGee (UK) Ltd (unpublished data)
	Infaunal sampling (cores)	September 1990	National Rivers Authority (1992)

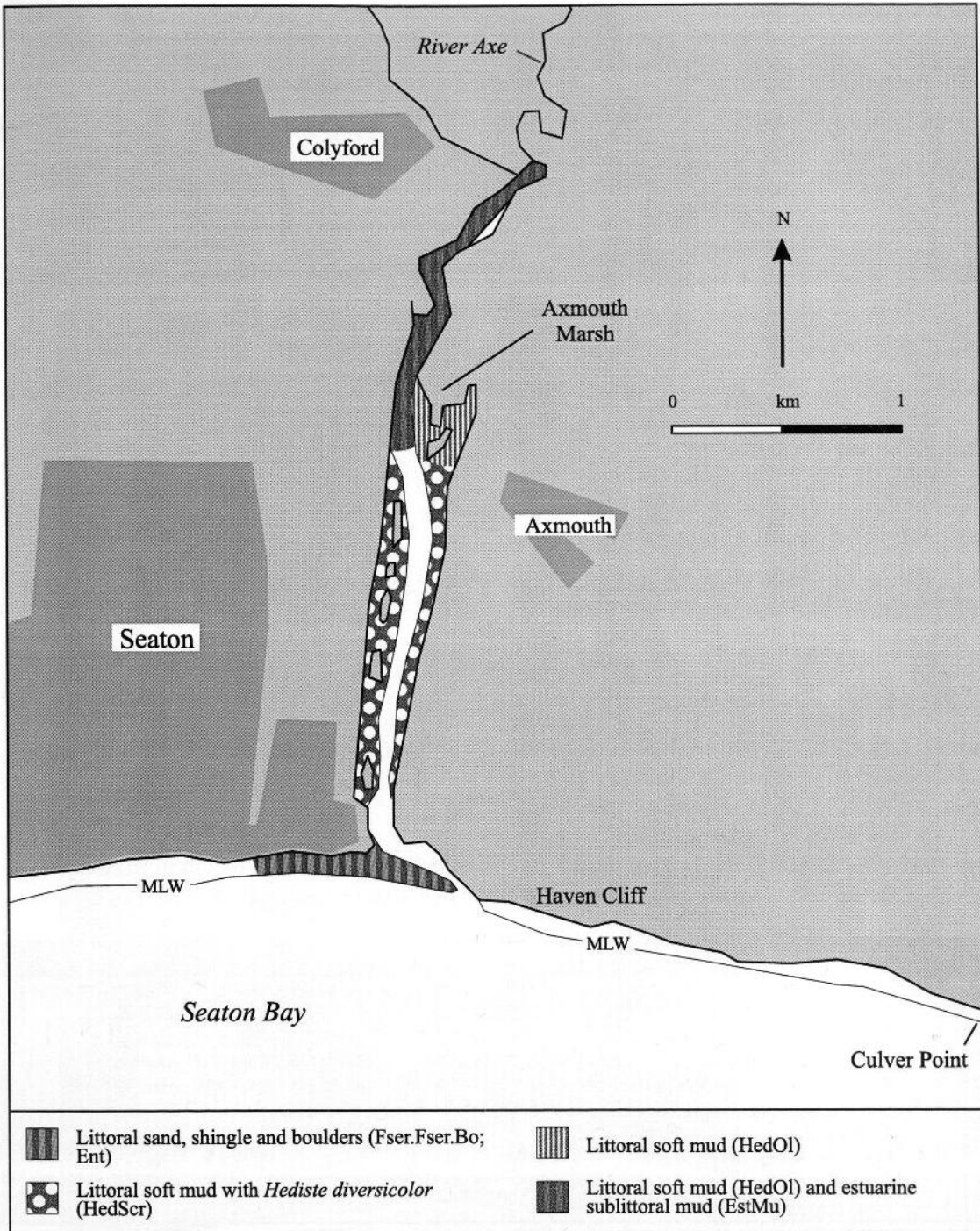
## Marine biology

The spit, extending eastwards across the entrance of the inlet, is mostly barren pebbles, with occasional fucoids. Lower shore boulders and cobbles support *Fucus serratus* (Fser.Fser.Bo). *Fucus ceranoides* is present in the lower inlet on muddy shingle and boulders. The bridge piling at the mouth of the inlet provides additional hard substratum to which algae *Fucus serratus* and *Fucus vesiculosus* with *Enteromorpha* spp. can attach (J. Moore, pers. obs.). Where hard substrata occur on the upper shore *Enteromorpha* sp. can be found (Ent). On the lower shore, the infauna is dominated by the oligochaete *Heterochaeta costata* and the polychaetes *Streblospio shrubsolii* and *Hediste diversicolor* with abundant peppery furrow shells *Scrobicularia plana* (HedScr). Other oligochaete and polychaete species are present including *Tubificoides pseudogaster*, *Manayunkia aestuarina* and *Capitella* sp. The burrowing amphipod *Corophium volutator*, the isopod *Cyathura carinata* and the cockle *Cerastoderma edule* are also present.

Mudflats slightly further upstream have an upper shore cover of *Enteromorpha* sp., sea lettuce *Ulva* sp. and *Fucus* spp. The infauna of the lower shore is essentially similar to that of the Axmouth Bridge site downstream. Higher numbers of *C. volutator* are found at the upstream part of the mudflat compared with the downstream site.

Further up the estuary at Axmouth Marsh, the sediments are deep sulphurous mud backed by reeds and dissected by channels. Cobbles are colonised by *Fucus* spp. Sediment infauna is less diverse than the downstream sites and is restricted to several polychaetes and tubificid oligochaetes, and occasional amphipods and isopods (HedOl). Further upstream at Axe Marsh is an area of mudflat backed by reeds. The mid-shore has an impoverished fauna, limited to tubificids, *H. diversicolor* and very few other species (HedOl). Saltmarsh fringes the river from north of Axmouth to the road bridge across the lower inlet.





**Figure 3.2** Indicative distribution of the main biotopes in the inlet (based on data from survey sites shown in Figure 3.1, cited literature and additional field observations).

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## Nature conservation

Conservation sites			
Site name	Position	Status	Main features
East Devon	SY072829- SY332913	AONB	High scenic quality
Sidmouth to West Bay	SY335914	cSAC	Vegetated sea cliffs of the Atlantic and Baltic coasts.
Lyme Bay	SY227878- SY462903	SMA	Marine biology
Axmouth to Lyme Regis cliffs	SY256896	SSSI/NNR/GCR	Geological, biological

## Human influences

The saltmarsh in the upper estuary is grazed. Sailing is concentrated around the mouth of the estuary where there are a number of moorings. Power boating, angling and bird watching are also known to occur.

## References and further reading

National Rivers Authority South West Region. 1992. *NRA South-west Region estuary data 1990 to 1992*. Unpublished, National Rivers Authority South-west Region.

## Sites surveyed

Survey 431: 1990 NRA SW Region littoral survey of the Axe estuary (National Rivers Authority 1992).

Survey 604: 1992-95 Devon Wildlife Trust littoral survey of the Axmouth (Devon Wildlife Trust, unpublished data).

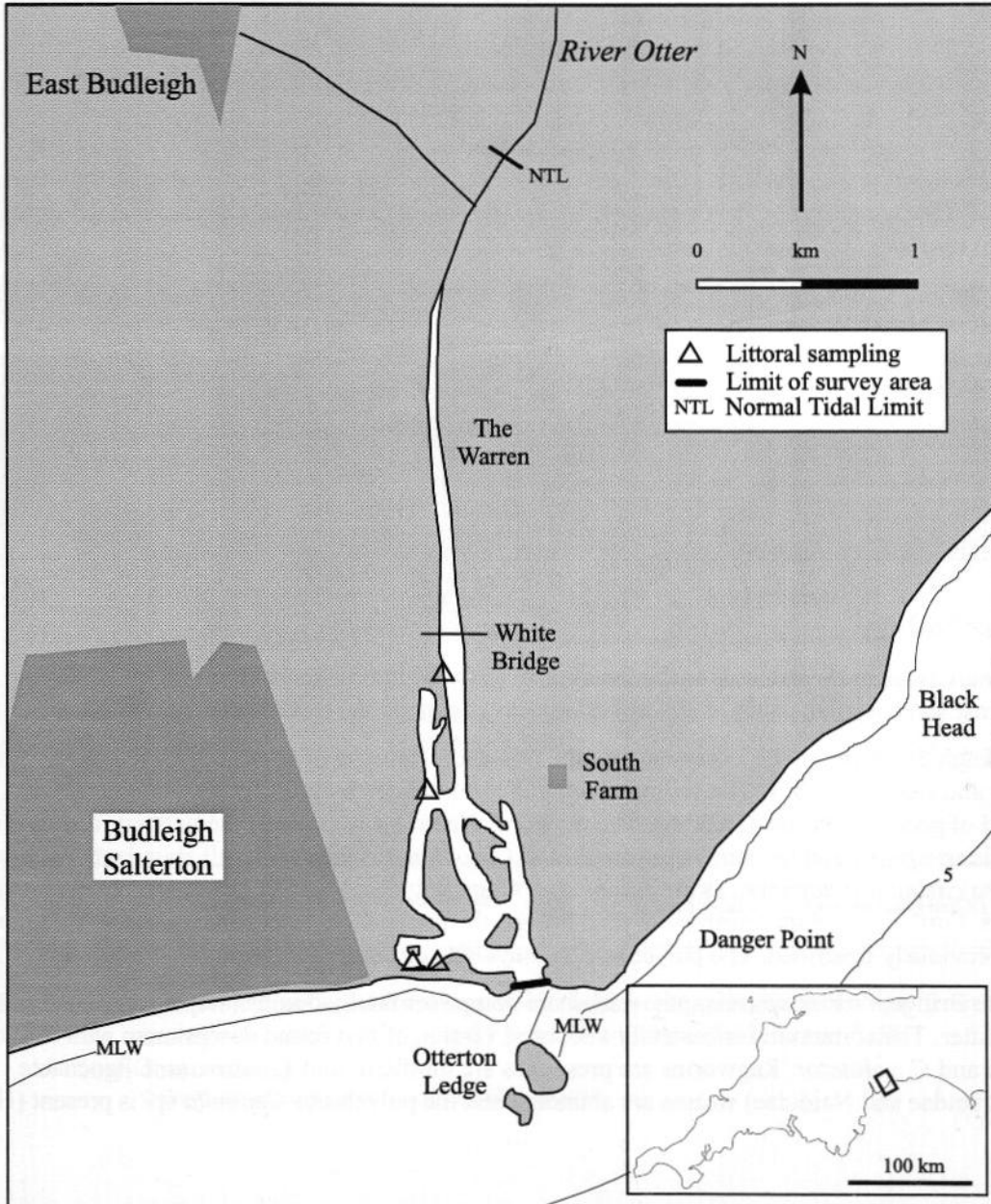
Survey 703: 1994 Devon Wildlife Trust Lyme Bay Environmental Study, Exmouth to Burton Bradstock; Kerr McGee (UK) Ltd (unpublished data).

Littoral sites					
Survey	Site	Place	Grid reference	Latitude/longitude	Biotopes present
431	2	Axe Marsh, Axe estuary.	SY 255 919	50°43.2'N 03°03.3'W	HedOl
431	3	Axmouth Marsh, Axe estuary.	SY 255 915	50°43.0'N 03°03.3'W	HedOl
431	4	Axmouth, Axe estuary.	SY 255 908	50°42.6'N 03°03.3'W	HedScr
431	5	N of Axmouth Bridge, Axe estuary.	SY 254 905	50°42.5'N 03°03.4'W	HedScr
703	5	Axe estuary, near Seaton, Beer Head to Burton Bradstock.	SY 254 904	50°42.4'N 03°03.4'W	HedScr
431	6	Axmouth Bridge, Axe estuary.	SY 253 902	50°42.3'N 03°03.4'W	HedScr
604	5	River Ledge, Culverhole Point to Entrance to R. Axe (E).	SY 257 896	50°42.0'N 03°03.0'W	Ent, Fser.Fser.Bo

Compiled by: Jan Smith and Jon Moore

**Location**

<i>Position (centre)</i>	SY0782	50° 38' N 03° 18' W
<i>Administrative area</i>	Devon	East Devon
<i>Conservation agency/area</i>	English Nature	Devon & Cornwall



**Figure 4.1** Main features of the area, and sites surveyed.

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**Physical features**

<i>Physiographic type</i>	Bar-built estuary
<i>Length of coast</i>	6.1 km
<i>Area of inlet</i>	Total 36 ha; intertidal 19 ha
<i>Length of inlet</i>	2.5 km
<i>Bathymetry</i>	Shallow; maximum depth not recorded
<i>Wave exposure range</i>	Extremely sheltered
<i>Tidal stream range</i>	Weak
<i>Tidal range</i>	3.8 m (spring); 1.5 m (neap)
<i>Salinity range</i>	Variable

**Introduction**

The River Otter is a small and narrow estuary on the south coast of Devon. It is bounded by sea embankments to the west and a 10 m high sandstone cliff to the east, and is essentially a channel with an intertidal area of saltmarsh. The marshes in the lower reaches are well developed; further upstream they grade into reed beds. On the west, the inlet is flanked by freshwater marshes. A sand and shingle spit across the mouth of the inlet virtually closes it from the open sea. Water quality is classified as grade A (highest quality). Atlantic salmon *Salmo salar* and sea trout *Salmo trutta* migrate to the inlet to spawn upriver.

Almost the entire inlet is a Site of Special Scientific Interest; it also lies within the East Devon Area of Outstanding Natural Beauty and is a Coastal Preservation Area (designated by Devon County Council). The River Otter is of importance for wintering wildfowl as it provides an additional feeding area for birds from the nearby River Exe, especially during severe weather.

**Marine biological surveys**

	<i>Survey methods</i>	<i>Date(s) of survey</i>	<i>Source</i>
<i>Littoral</i>	Infaunal sampling (cores)	August 1994	Kerr McGee (UK) Ltd (unpublished data)
	Infaunal sampling (cores)	October 1990	National Rivers Authority (1992)

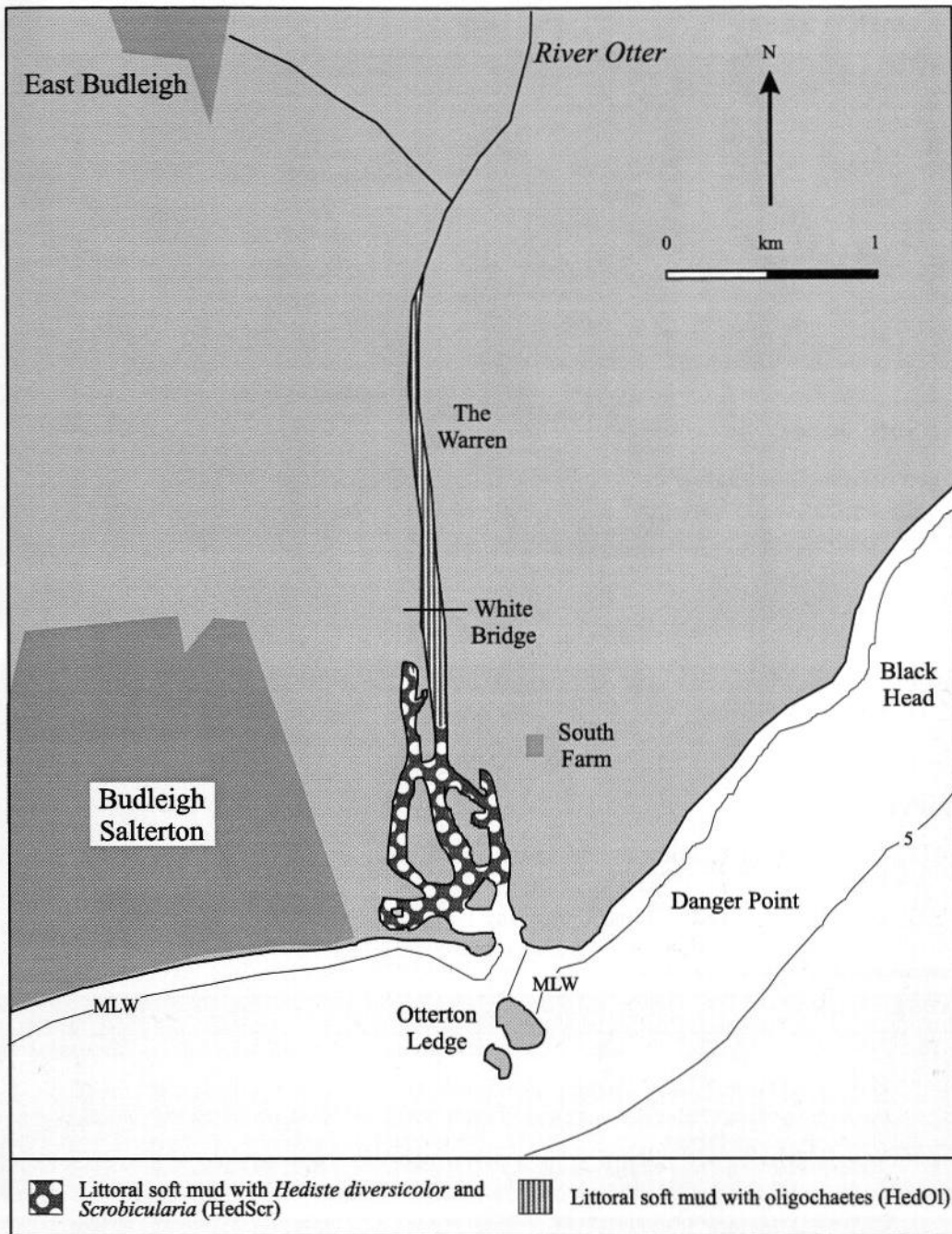
**Marine biology**

The shingle ridge at the entrance to the inlet is barren in the littoral zone. However, opposite the spit, on the east shore a small patch of *Fucus vesiculosus* occurs on the moderately exposed shingle.

At Budleigh Salterton, in the lower estuary, the mid-shore consists of sticky red mud strewn with cobbles and seaweed debris. The sediment infauna is dominated by polychaetes, amphipods and tubificid oligochaete worms (HedScr). The ragworm *Hediste diversicolor*, the peppery furrow shell *Scrobicularia plana* and the burrowing amphipod *Corophium volutator* are all abundant. The isopod *Cyathura carinata* is common, as are nematodes. Other polychaetes and crustaceans are present in low numbers. Further upstream towards the road bridge, the upper shore mud contains a similar community to that previously described. The polychaete *Manayunkia aestuarina* is common at this point.

At White Bridge, further upstream, the mid-shore comprises thick odorous (sulphurous) mud enriched by leaf litter. The community is basically a reduced version of that found downstream with infrequent *S. plana* and *C. volutator*. Ragworms are present as are tubificids and *C. carinata*. Oligochaete (Enchytraeidae and Naididae) worms are abundant and the polychaete *Capitella* sp. is present (HedOl).





**Figure 4.2** Indicative distribution of the main biotopes in the inlet (based on data from survey sites shown in Figure 4.1, cited literature and additional field observations).

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## Nature conservation

Conservation sites			
Site name	Position	Status	Main features
East Devon	N/A	AONB	High scenic quality
East Devon	SY072829- SY332913	HC	Coastal scenery
Otter estuary	N/A	CPA	
Otter estuary	SY073830	SSSI	Mixed
Ottertton Point	SY077819	GCR	Geological
Budleigh Salterton	SY040801/ SY055815	GCR	Geological
Otter estuary	SY075824	DWT	

## Human influences

Leisure activities include angling and occasional sailing and canoeing. The banks of the inlet are popular with walkers while bird watchers frequent the Devon Wildlife Trust reserve in the lower estuary. Wildfowling is known to occur only very rarely.

## References and further reading

National Rivers Authority South-west Region. 1992. *NRA South-west Region estuary data 1990 to 1992*. Unpublished, National Rivers Authority South-west Region.

## Sites surveyed

Survey 438: 1990 NRA SW Region littoral survey of the Otter estuary (National Rivers Authority 1992).

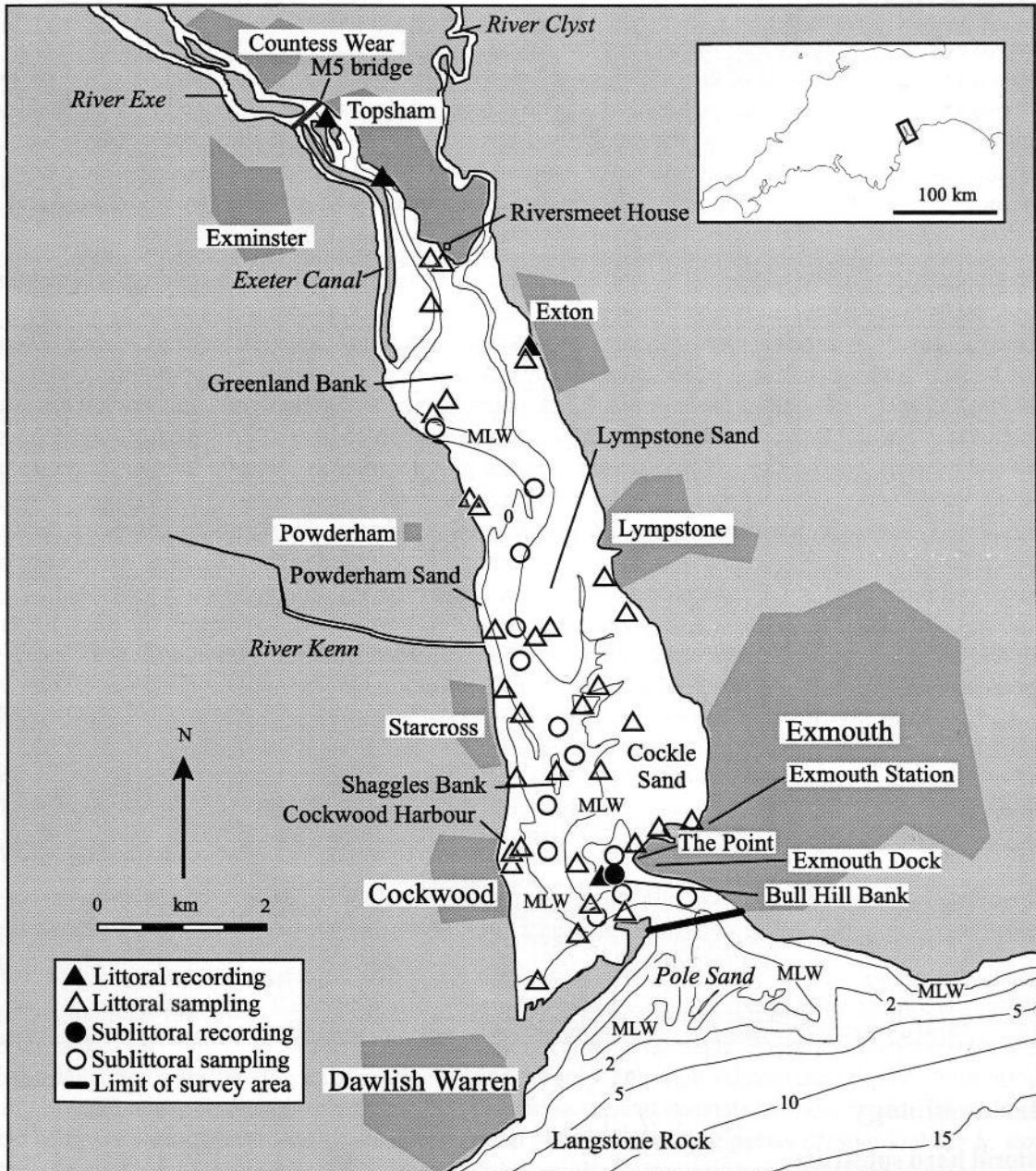
Survey 703: 1994 Devon Wildlife Trust Lyme Bay Environmental Study, Exmouth to Burton Bradstock (Kerr McGee (UK) Ltd, unpublished data). ).

Littoral sites					
Survey	Site	Place	Grid reference	Latitude/longitude	Biotopes present
438	1	White Bridge, Otter estuary, South Devon	SY 075 827	50°38.1'N 03°18.4'W	HedOl
438	2	Budleigh Salterton Cricket Ground, Otter estuary, South Devon.	SY 074 824	50°38.0'N 03°18.5'W	HedScr
438	3	Budleigh Salterton, Otter estuary, South Devon.	SY 074 820	50°37.7'N 03°18.5'W	HedScr
703	6	Otter, Budleigh Salterton, Exmouth to Ottertton Point.	SY 075 820	50°37.7'N 03°18.4'W	HedScr

Compiled by: Jan Smith and Jon Moore

## Location

Position (centre)	SX9884	50° 38' N 03° 28' W
Administrative area	Devon	East Devon; Teignbridge; Exeter
Conservation agency/area	English Nature	Devon & Cornwall



**Figure 5.1** Main features of the area, and sites surveyed.

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Physical features	
<i>Physiographic type</i>	Bar-built estuary
<i>Length of coast</i>	40 km
<i>Area of inlet</i>	Total 1,425 ha; intertidal 1,100 ha
<i>Length of inlet</i>	14.7 km
<i>Bathymetry</i>	Shallow; maximum depth 13 m off Exmouth Dock
<i>Wave exposure range</i>	Exposed to extremely sheltered
<i>Tidal stream range</i>	1.5 to 4.5 knots
<i>Tidal range</i>	3.8 m (spring); 1.5 m (neap)
<i>Salinity range</i>	Fully marine to upper estuarine

## Introduction

The River Exe, an estuary into which flow the Rivers Clyst and Exe, lies in south-east Devon and opens into Lyme Bay. Most of the inlet dries at low water leaving a narrow channel only 500 m wide at its widest point. The inlet is sheltered to a large extent from prevailing winds and wave action by the double spit of Dawlish Warren which has formed across its mouth. The shallow bank of Pole Sands also helps to restrict the entrance to the inlet, leading to rapid tidal streams and currents in the narrow entrance channel. The inlet predominantly consists of sediments with extensive intertidal sand and mudflats. Saltmarsh and patches of eelgrass *Zostera* spp. occur in the muddier reaches.

The whole inlet is a Site of Special Scientific Interest; additionally the Exe is a Nature Conservation Zone, an Area of Great Landscape Value and a Coastal Preservation Area (designated by Devon County Council). A sanctuary order covers the western shore to protect wildfowl and waders. The area is of national and international importance for several species of passage and overwintering waterfowl, including avocet, dark-bellied brent goose, black-tailed godwit and greenshank, and as such has been designated a Special Protection Area. The inlet is also a designated bass *Dicentrarchus labrax* nursery area and as such is subject to a closed season over the summer months. Atlantic salmon *Salmo salar* and sea trout *Salmo trutta* migrate to the inlet to spawn up river. These salmonids are protected by Net Limitation Orders which restrict the number of nets used in the inlet. The lampren *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* were once commonly recorded in the Exe; both species are now considered threatened in UK waters and are protected under the Wildlife and Countryside Act. Similarly, allis shad *Alosa alosa* and twaite shad *Alosa fallax* are known to occur in the inlet. Several rare and notable flora and invertebrate fauna have been recorded from the inlet including the sand crocus *Romulea columnae* and the polychaete *Ophelia bicornis*.

Marine biological surveys			
	<i>Survey methods</i>	<i>Date(s) of survey</i>	<i>Source</i>
<i>Littoral</i>	Recording	March/June 1992	Devon Wildlife Trust (unpublished data)
	Recording	August 1985	Dixon (1986)
	Infaunal sampling (cores)	August 1994	Kerr McGee (UK) Ltd (unpublished data)
	Infaunal sampling (cores)	September 1990	NRA (1992)
	Infaunal sampling (grab)	September 1990	NRA (1992)
	Infaunal sampling (cores)	August 1985	Dixon (1986)
<i>Sublittoral</i>	Recording	August 1985	Dixon (1986)
	Infaunal sampling (grab)	September 1990	NRA (1992)
	Pipe dredge/trawl sampling	August 1985	Dixon (1986)

## Marine biology

### Littoral hard substrata

The most generally available hard substrata within the inlet are the stones and small boulders which overlie the sediments around the mean high water mark. In the southern half of the inlet, particularly on the western shore, stones occur over much of the littoral zone. In addition, beds of mussels *Mytilus edulis* (MytX) are found on both sides of the southern inlet and provide a habitat for small epifaunal species. Other hard substrata are provided by: the railway embankments which run south down each



side of the inlet along the upper shore from Exton and Topsham; the effluent pipe from the old mussel cleaning station at Lympstone; and the earthenware tiles which are laid out to attract moulting crabs. The algal and faunal diversity is low in general, but is highest in the southern half of the inlet below Lympstone where the area of suitable substrata is greatest and the salinity regime is more stable.

The most widespread species of epibiota are the green algae *Enteromorpha* spp. and *Ulva* spp., the barnacles *Semibalanus balanoides* and *Elminius modestus*, the wrinkle *Littorina littorea* and the laver spire shell *Hydrobia ulvae*. These species occur over the whole littoral range as far north as Exton. The algae are found as far upstream as Riversmeet House. The *Hydrobia* sp. is particularly abundant in the larger areas of developing saltmarsh at Exmouth Station and Dawlish Warren.

Fucoids as a group are widespread and exhibit both vertical zonation on the shores and zonation along the inlet as individual species. *Fucus spiralis* (Fspi) occupies the highest position on the shores, found also on the railway embankment, with *Fucus vesiculosus* (Fves; FvesX) occurring lower down over most of the mid-shore and lower shore where suitable substrata are available. *Fucus serratus* has been recorded from the lower mid-shore north of Starcross, but not in any great abundance. In the upper inlet, between the River Kenn and Topsham, the reduced salinity furoid *Fucus ceranoides* is common on upper mid-shore hard substrata (FcerX). Lichens have been reported from the sea walls between Dawlish Warren and Powderham (YG; Ver.Ver).

Fucoids in general provide an important refuge for isopods and amphipods, including the sea slater *Ligia oceanica* and *Bathyporeia sarsi*; juvenile shore crab *Carcinus maenas*; and molluscs including littorinids and the top shell *Osilinus lineatus*. Species which are widespread in the southern half of the inlet include the red algae *Gelidium* spp., the insect *Anurida maritima*, the limpet *Patella vulgata* and the rough periwinkle *Littorina saxatilis* agg. The barnacle *Chthamalus montagui* has been recorded from the upper shore north of Starcross. Mussels *Mytilus edulis* occur throughout the southern inlet over the mid-shore range; dense beds (MytX) are present on the top of Bull Hill Bank, Lympstone mussel farm and Mid Cockle Sand. The edible wrinkle *Littorina littorea* invariably occurs in conjunction with the mussels, together with *S. balanoides* and *E. modestus*. A limited range of red algae is found where suitable substrata are available on the mid-to lower shores south of Lympstone, although *Gracilaria gracilis* occurs as far upstream as Exton. The filamentous brown algae *Pilayella littoralis*, *Hincksia* sp. and ectocarpoids are patchily distributed in low abundance.

Animals usually considered to be typical of the lower shore are only rarely recorded in the Exe owing to the limited amount of hard substrata. These include the breadcrumb sponge *Halichondria panicea*, the keel worm *Pomatoceros* sp., the starfish *Asterias rubens* and the bryozoan *Alcyonidium gelatinosum*. All of these are found south of Starcross in the most marine-influenced and stony part of the inlet. The beadlet anemone *Actinia equina* occurs on the mid-shore at Lympstone in the mud-free shelter of the disused effluent pipe.

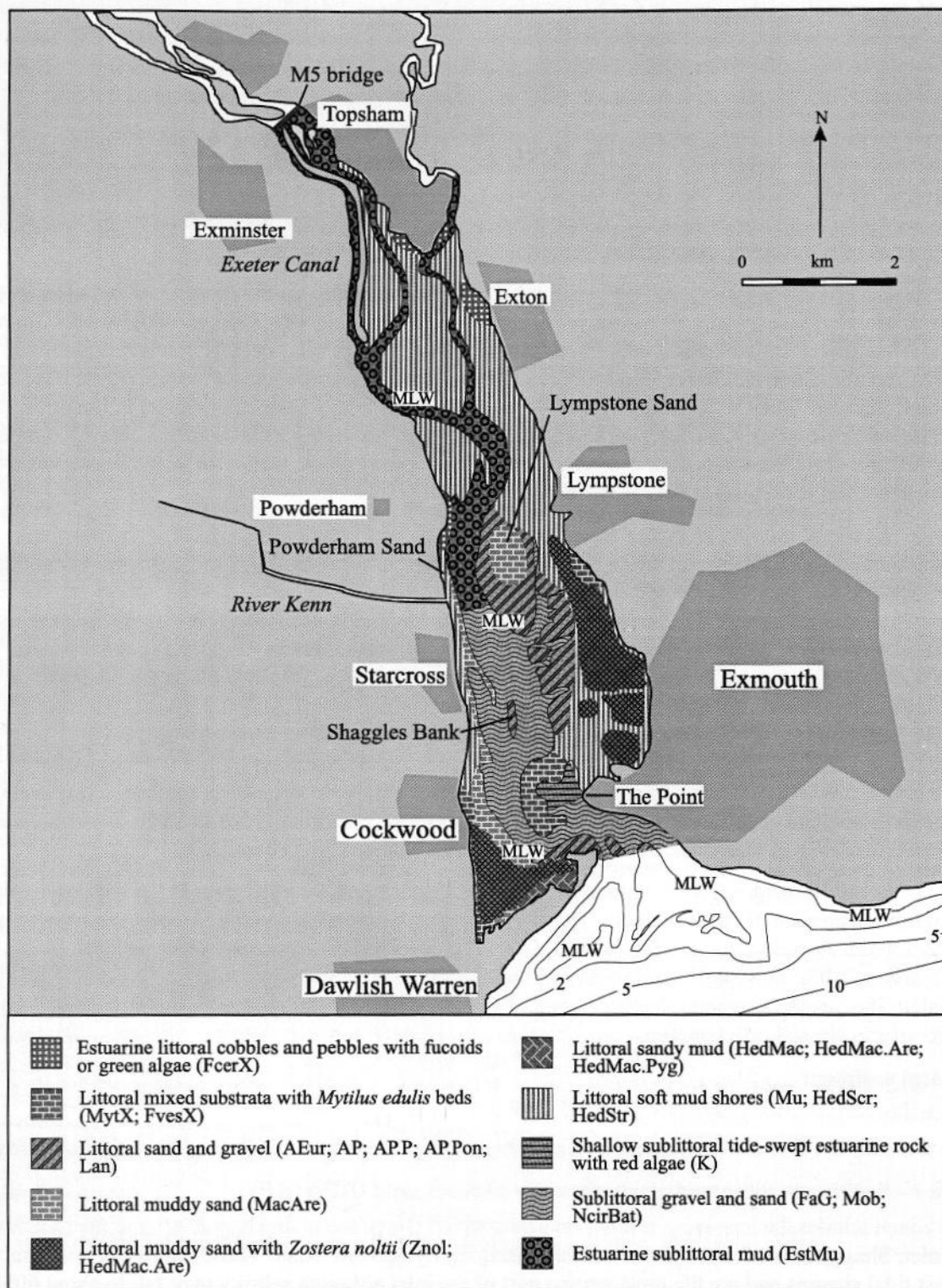
### Littoral sediment

The distributions of the sediment fauna are related to environmental factors, predominantly sediment type and salinity. The inlet can be divided into three zones based on these factors, as described below.

#### Zone 1 - Sediments composed predominantly of clean sand (AEur; AP).

This zone includes the low-lying tide-swept sands which fringe the main channel around the mouth of the inlet, Shaggles Bank in the lower inlet and fringing Lympstone Sand. These sediments are scoured by fast tidal streams and are the most marine part of the inlet although salinity may fall to about 60% of full seawater at the furthest upstream extent. The fauna present consists of species considered to be typical of lower shore, marine-influenced sand and is of low diversity. Species present include *B. sarsi*, the polychaete *Nephtys cirrosa* and the tellin *Angulus tenuis*. Communities dominated by the rare polychaete *Ophelia bicornis* are found in mobile, well-drained sand on Shaggles Bank (AEur) and along the northern edge of Pole Sand.





**Figure 5.2** Indicative distribution of the main biotopes in the inlet (based on data from survey sites shown in Figure 5.1, cited literature and additional field observations).

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**Zone 2 - Sediments composed predominantly of mud and sand** (HedMac; MacAre; ZnoI; Lan).

This area forms a boundary between the previous, predominantly sandy, zone and the muddier sediments found in the more sheltered parts of the inlet. The sediments of this zone range from mud with very little sand (HedMac; HedScr) (for example at Exmouth Station and lower Dawlish Warren) to coarse sands with little or no mud, for example at Powderham Sand (AP.P) and Dawlish Warren Point (Lan). Species diversity is highest in these coarser sediments. Upper-mid shore muddier sediment pockets support eelgrass *Zostera noltii* beds (ZnoI), on the north-west corner of Dawlish Warren, south of Lympstone and off The Point at Exmouth. Water-saturated muddy sand on the lower shore off Cockwood and in the centre of Lympstone Sand supports large populations of polychaete worms: *Scoloplos armiger*, *Hediste diversicolor*, *Pygospio elegans* and the more obvious fauna of lugworms *Arenicola marina* and the cockle *Cerastoderma edule* (MacAre).

A large part of the fauna of this zone consists of species which 'overlap' from the communities of the muddier and sandier sediments of the other two zones, such as the polychaetes *H. diversicolor*, *N. cirrosa*, *P. elegans* and *A. marina* and the bivalves *Scrobicularia plana* and *A. tenuis*.

**Zone 3 - Sediments composed predominantly of mud** (Sm; HedScr; HedStr).

This is the most extensive habitat and includes that part of the inlet upstream of Powderham to the M5 road bridge, together with several higher shore areas downstream towards the sheltered angles behind Dawlish Warren and Exmouth Point. Ragworms *H. diversicolor* and peppery furrow shells *S. plana*, both typical of estuarine muds, are ubiquitous (HedScr; HedStr). The fauna in the southern half of the inlet includes several species more characteristic of muddy sands, for example *C. edule* and *A. marina*. North of Powderham, the comparatively uniform mudflats support an infauna characterised by the spionid worm *Streblospio shrubsolii* and the isopod *Cyathura carinata* in addition to high numbers of *H. diversicolor* and *S. plana* (HedScr).

**Sublittoral biotopes**

The sublittoral habitats of the Exe are limited in variety, being relatively shallow, basically sediment in nature and confined to a long narrow channel scoured by fast tidal streams. The sediments in the main channel, between the mouth of the inlet and Shaggles Buoy, consist of fine sand, coarse sand and gravel (NcirBat). No attached algae are found in this channel and, apart from fish, the predominant species are shore crabs *Carcinus maenas* and prawns *Crangon crangon*. At a more sheltered area of pebbly coarse sand, between Bull Hill bank and Exmouth Dock, the community is characterised by an extensive and dense population of the sand mason worm *Lanice conchilega*. Other species found only in this area include the colonial hydroid *Sertularia cupressina* (white weed), the anemone *Urticina felina*, the barnacle *Balanus balanus* and the swimming crab *Liocarcinus* sp. Many algal species are found here including the sea lettuce *Ulva* sp. and the red algae *Polysiphonia fibrata* and *Ceramium nodulosum* (K).

The substratum of the main channel north of the River Kenn consists entirely of mud mixed with twigs and leaves (EstMu; EstMx). The sediment just downstream of the River Kenn is mud with gravel and pebbles (PolMtru). Very few algal species are present apart from *Ulva* sp. (probably drift) and (possibly) *Chondrus crispus* south of the Kenn. Mobile epifauna comprise ubiquitous shore crabs, prawn species, eels *Anguilla anguilla*, juvenile plaice *Pleuronectes platessa* and the sand goby *Pomatoschistus minutus*. At the confluence of the River Clyst with the Exe, the infauna is very sparse, consisting primarily of very low numbers of ragworm. Further downstream, south of the River Kenn, the sediment fauna is more varied and includes polychaetes, barnacles, prawns, crabs, amphipods and oligochaetes.

## Nature conservation

Conservation sites			
Site name	Position	Status	Main features
Exe estuary	SX980845	Ramsar/SPA SSSI/NCR	Overwintering waterfowl, including avocet, dark-bellied brent goose, black-tailed godwit and greenshank
Dawlish Warren	SX985795	SSSI/GCR/LNR	Biological/geological
Dawlish cliffs	SX960759	SSSI	Geological
Exe estuary	SX980845	SMA	Marine biological
Exmouth	SX995815	LNR	
Exminster Marshes	SX973875	RSPB	Coastal grazing marshes, breeding waders and wintering waterfowl
Bowling Green Marshes	SX954872	RSPB	Coastal grazing marshes, breeding waders and wintering waterfowl
Orcombe & Prattshayes	SY025808	NT	Cliff, foreshore and fields
Lympstone	SX988842	NT	Coast
Old Sludge Beds	SX952888	SSSI/DWT	Wetland, reedswamp
Exe Reed Beds	SX956885	SSSI/DWT	Wetland, reedswamp
Inner Dawlish Warren	SX986794	SSSI/LNR/DWT	Dunes, scrub, marsh

## Human influences

There are docks at Exmouth, Exeter and Topsham with three boat-building and repair yards. A harbour at Exmouth provides mooring facilities for the fishing fleet. Part of the dune system at Dawlish Warren is managed by stabilisation. The majority of the hinterland is rural or semi-rural.

Exploitation of the natural resources of the River Exe include bag netting for fish, fyke-netting for eels *Anguilla anguilla*, mussel *Mytilus edulis* and Pacific oyster *Crassostrea gigas* cultivation and winkle *Littorina littorea* gathering. The natural stocks of mussel are re-seeded and harvested by hand. Bait-digging and collecting occur, including trawling for sand-eels *Ammodytes* sp. and the use of tiles to attract moulting crabs *Carcinus maenas*.

Leisure activities are numerous; sailing and boating are especially popular throughout the area and there are over 2,500 moorings within the inlet. Windsurfing, water skiing and scuba diving take place at Dawlish Warren and Exmouth, with some canoeing also known to occur. Terrestrial activities include golf and bird watching. Wildfowling is carried out over the whole inlet except for those areas of the western shore which are covered by the sanctuary order. Walking is most intensive along Exminster marshes, Exmouth and Dawlish Warren; the latter two areas are also centres of beach recreation.

## References and further reading

- Dixon, I.M.T. 1986. Surveys of harbours, rias and estuaries in southern Britain: Exe. (Contractor: Field Studies Council, Oil Pollution Research Unit, Pembroke.) *Nature Conservancy Council, CSD Report*, No. 670. (FSC Report, No. FSC/OPRU/52/85.)
- Hughes, M.R. 1992. *Distribution of bird and marine life in the Exe estuary and the factors affecting that distribution*. Unpublished report to English Nature, South-West Region.
- National Rivers Authority South West Region. 1992. *NRA South-west Region estuary data 1990 to 1992*. Unpublished, National Rivers Authority South-west Region.



## Sites surveyed

Survey 243: 1985 HRE survey of the Exe estuary (Dixon 1986).

Survey 432: 1990 NRA SW Region littoral survey of the Exe estuary (National Rivers Authority 1992).

Survey 603: 1992-93 Devon Wildlife Trust littoral survey of the Exe estuary (Devon Wildlife Trust, unpublished data).

Survey 703: 1994 Kerr McGee (UK) Ltd. Lyme Bay environmental study (Devon Wildlife Trust, unpublished data).

Littoral sites (listed north to south)					
Survey	Site	Place	Grid reference	Latitude/longitude	Biotopes present
243	1	M5 Bridge, Exe estuary.	SX 957 887	50°41.2'N 03°28.6'W	Mu
243	2	Topsham village, Exe estuary.	SX 963 881	50°40.9'N 03°28.0'W	Mu
243	3	Riversmeet House, Exe estuary.	SX 969 872	50°40.4'N 03°27.5'W	FcerX, HedScr
243	4	NW of Riversmeet House, Exe estuary.	SX 968 872	50°40.4'N 03°27.6'W	HedScr
243	5	W Mud, Exe estuary.	SX 969 868	50°40.2'N 03°27.5'W	HedScr
603	1	Exton, Exe estuary.	SX 980 864	50°40.0'N 03°26.6'W	FcerX, HedScr
243	6	Exton Station, Exe estuary.	SX 979 863	50°40.0'N 03°26.6'W	YG, Ent, FcerX, HedScr
243	7	Mid Greenland Bank, Exe estuary.	SX 970 857	50°39.6'N 03°27.4'W	HedScr
243	8	Greenland, Exe estuary.	SX 968 855	50°39.5'N 03°27.6'W	HedScr
243	10	Powderham Sand lower, Exe estuary.	SX 974 846	50°39.0'N 03°27.0'W	AP
243	9	Powderham Sand, Exe estuary.	SX 974 844	50°38.9'N 03°27.0'W	YG, Ver.Ver, HedScr
432	A	Turf Perch, Exe estuary.	SX 980 840	50°38.7'N 03°26.5'W	HedStr
432	B	Commando Barracks, Exe estuary.	SX 980 840	50°38.7'N 03°26.5'W	HedStr
703	8	Exe estuary at Exmouth.	SX 988 839	50°38.7'N 03°25.8'W	HedScr
243	11	Lympstone Mussel Farm, Exe estuary.	SX 990 836	50°38.5'N 03°25.7'W	FvesX, EphX, MytX, ZnoI, HedScr
243	12	Lympstone Sand Centre, Exe estuary.	SX 982 833	50°38.3'N 03°26.3'W	MacAre
243	13	Lympstone Sand, Exe estuary.	SX 979 831	50°38.2'N 03°26.6'W	EphX
243	14	River Kenn, Exe estuary.	SX 976 831	50°38.2'N 03°26.8'W	FvesX, FcerX, HedStr
243	15	W Mid-shore, Exe estuary.	SX 977 826	50°38.0'N 03°26.8'W	Fspi, Fves, FvesX
243	18	E mid-shore, Exe estuary.	SX 986 826	50°38.0'N 03°26.0'W	AP.Pon
243	16	W Lower shore, Exe estuary.	SX 978 824	50°37.9'N 03°26.7'W	AP.Pon
243	17	E Lower shore, Exe estuary.	SX 985 824	50°37.9'N 03°26.1'W	NcirBat
243	19	Mid Cockle Sand, Exe estuary.	SX 991 822	50°37.8'N 03°25.6'W	MytX, HedScr
243	20	Shaggles mid-channel, Exe estuary.	SX 983 818	50°37.5'N 03°26.2'W	AEur
243	21	Starcross, Exe estuary.	SX 979 817	50°37.5'N 03°26.6'W	EphX
432	C	Powderham, Exe estuary.	SX 979 828	50°38.1'N 03°26.6'W	HedStr
243	24	W shore, Cockle sand, Exe estuary.	SX 987 817	50°37.5'N 03°25.9'W	AP.Pon
243	22	Exmouth Station, Exe estuary.	SX 998 812	50°37.2'N 03°25.0'W	Fspi, MacAre, ZnoI, NVC SM8
432	3	Exmouth Station, Exe estuary.	SX 998 812	50°37.2'N 03°25.0'W	ZnoI
243	23	The Point, Exe estuary.	SX 995 811	50°37.2'N 03°25.2'W	EphX, HedMac.Are
243	28	Cockwood Lower shore, Exe estuary.	SX 979 809	50°37.0'N 03°26.6'W	FvesX, MacAre
703	7	Exe estuary at Exmouth.	SX 991 808	50°37.0'N 03°25.5'W	HedMac.Pyg
243	26	Cockwood Harbour, Exe estuary.	SX 976 808	50°37.0'N 03°26.8'W	HedScr
243	27	Cockwood, Exe estuary.	SX 978 808	50°37.0'N 03°26.6'W	Fspi, Fves, MytX, Cor
432	2	Exmouth, The Point, Exe estuary.	SX 991 808	50°37.0'N 03°25.5'W	ZnoI
243	25	Bull Hill near Buoy 17, Exe estuary.	SX 985 807	50°36.9'N 03°26.0'W	EntPor, LMX
432	D	Starcross, Exe estuary.	SX 985 819	50°37.6'N 03°26.1'W	AP.P
603	2	Bull Hill Bank, Exe estuary.	SX 986 805	50°36.8'N 03°26.0'W	MytX
243	32	Dawlish Warren Point, Exe estuary.	SX 990 802	50°36.7'N 03°25.6'W	FvesX, Lan
243	29	Bull Hill Bank, Exe estuary.	SX 987 802	50°36.7'N 03°25.9'W	AEur
243	31	Dawlish Warren Oyster beds, Exe estuary.	SX 985 800	50°36.6'N 03°26.0'W	HedMac, Ost
243	30	Dawlish Warren, Exe estuary.	SX 980 794	50°36.2'N 03°26.4'W	MytX, ZnoI, Sm
432	E	Dawlish Warren, Exe estuary.	SX 987 802	50°36.7'N 03°25.9'W	AP.P

**Sublittoral sites (listed north to south)**

<i>Survey</i>	<i>Site</i>	<i>Place</i>	<i>Grid reference</i>	<i>Latitude/longitude</i>	<i>Biotopes present</i>
243	36	Haul 2. Post No.5, Exe estuary.	SX 968 854	50°39.5'N 03°27.6'W	EstMu
243	37	Haul 3. Buoy 29 - 27, Exe estuary.	SX 980 848	50°39.2'N 03°26.5'W	EstMx
243	38	Haul 4. Off River Kenn, Exe estuary.	SX 977 832	50°38.3'N 03°26.8'W	PolMtru
243	39	Haul 5. Shaggles Buoy, Exe estuary.	SX 983 821	50°37.7'N 03°26.2'W	FaG
243	40	Haul 6. Spit Buoy (W Channel), Exe estuary.	SX 982 815	50°37.4'N 03°26.3'W	Mob, NcirBat
243	41	Haul 7. Buoy 17 - 15, Exe estuary.	SX 983 809	50°37.1'N 03°26.2'W	FaG
243	47	Inside Bull Hill Bank, Exe estuary.	SX 989 807	50°37.0'N 03°25.7'W	Mob, K
432	F	Exmouth, Exe estuary.	SX 989 807	50°37.0'N 03°25.7'W	VscnMtru
243	42	Haul 8. Near Buoy 13, Exe estuary.	SX 989 803	50°36.7'N 03°25.7'W	FaG

Compiled by: Jan Smith and Jon Moore

## River Teign

## Location

<i>Position (centre)</i>	SX9172	50° 32' N 03° 30' W
<i>Administrative area</i>	Devon	Teignbridge
<i>Conservation agency/area</i>	English Nature	Devon & Cornwall

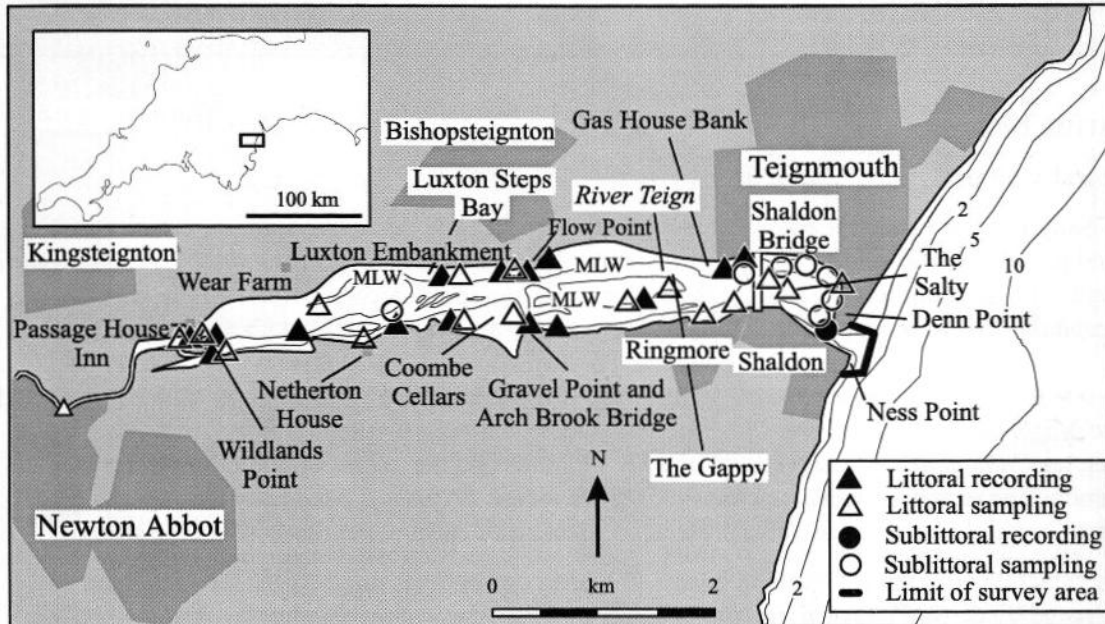


Figure 6.1 Main features of the area, and sites surveyed.

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## Physical features

<i>Physiographic type</i>	Ria
<i>Length of coast</i>	20.4 km
<i>Area of inlet</i>	Total 370 ha; intertidal 219 ha
<i>Length of inlet</i>	9.1 km
<i>Bathymetry</i>	Shallow; maximum depth 9 m in pit at mouth of inlet
<i>Wave exposure range</i>	Sheltered
<i>Tidal stream range</i>	Max. 5 knots off Denn Point
<i>Tidal range</i>	3.8 m (spring); 1.5 m (neap)
<i>Salinity range</i>	Fully marine to upper estuarine

## Introduction

The River Teign lies on the south coast of Devon and opens into Babbacombe Bay. At Teignmouth, the permanent spit of Denn Point extends south-west across the entrance to the ria. This effectively shelters the whole inlet from the effects of wave action. In the lower inlet, downstream of Shaldon bridge, a shingle bank known as The Salty lies in a sharp bend of the river. The substrata are predominantly sedimentary throughout, becoming increasingly finer and muddier upstream. The middle section is bounded by artificial structures on both sides. The upper reaches are very shallow with muddy intertidal flats near Newton Abbot.

The entire inlet lies within a Coastal Preservation Area and is an Area of Great Landscape Value (designated by Devon County Council). The inlet is a major nursery area for bass *Dicentrarchus*



*labrax* and as such is subject to a closed season over the summer months. Atlantic salmon *Salmo salar* and sea trout *Salmo trutta* migrate to the inlet to spawn up river. These salmonids are protected by Net Limitation Orders which restrict the number of nets used in the inlet. The water quality of the River Teign is classified as grade A (highest quality).

Marine biological surveys			
	Survey methods	Date(s) of survey	Source
<b>Littoral</b>	Recording	July-August 1988	Frid (1989)
	Infaunal sampling (cores)	August 1990	National Rivers Authority (1992)
	Infaunal sampling (cores)	July-August 1988	Frid (1989)
<b>Sublittoral</b>	Recording	August 1988	Frid (1989)
	Infaunal sampling (grab)	August 1990	National Rivers Authority (1992)
	Infaunal sampling (pipe dredge)	August 1988	Frid (1989)

## Marine biology

### Littoral biotopes

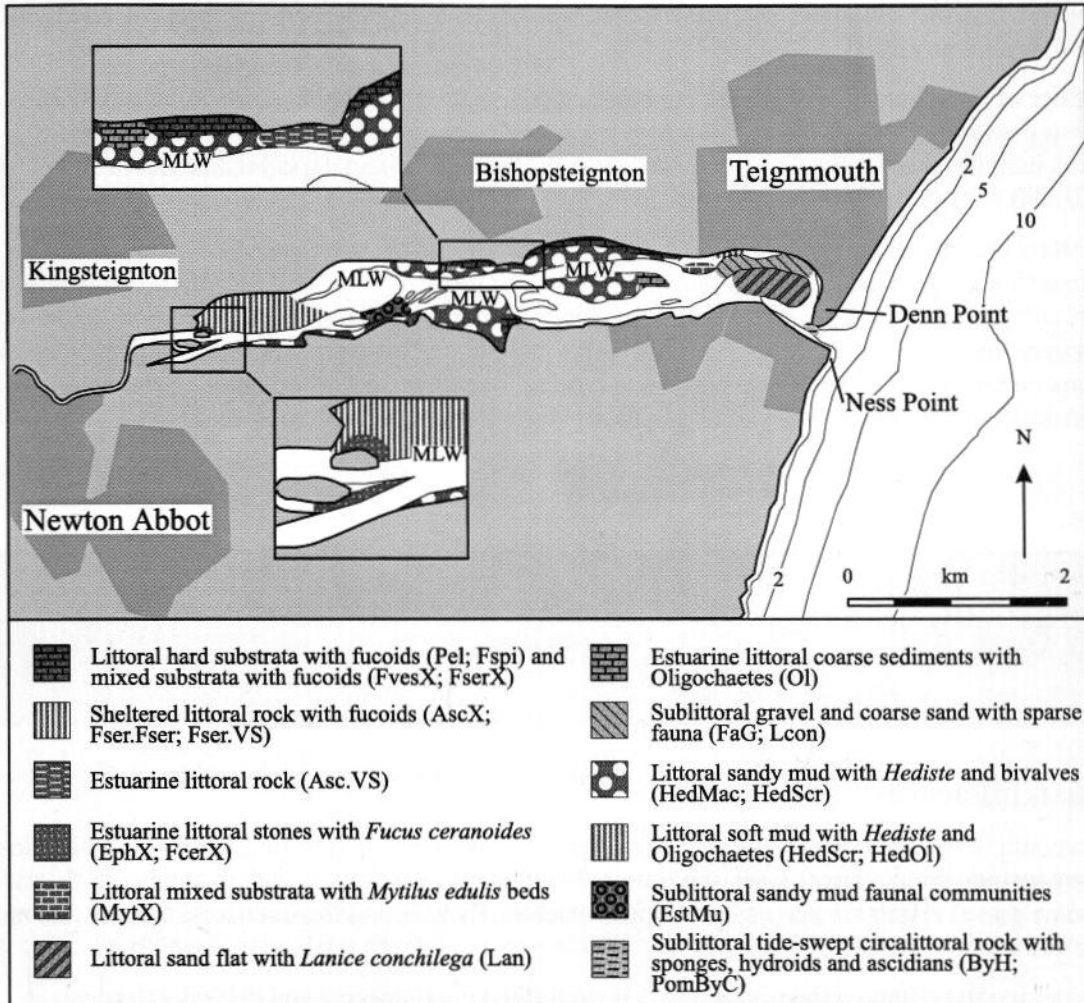
The Salty lies just inside the mouth of the inlet behind Denn Point. In the medium-coarse sand and gravel just above low water (springs) is a community of sand mason worms *Lanice conchilega* which extends into the sublittoral (Lan). On the lower shore, the spionids *Streblospio shrubsolii*, *Aonides oxycephala*, *Pygospio elegans* and *Scolecopsis squamata* are present along with the cockle *Cerastoderma edule* and the polychaete *Ophelia rathkei*. Extensive shallow pools are found at about mid-tide level on the coarse sand and stones (H). The larger stones are sparsely colonised by the red algae *Mastocarpus stellatus* and *Chondrus crispus*, sea lettuce *Ulva* sp. and *Enteromorpha* sp. The barnacles *Chthamalus montagui* and *Elminius modestus* and the edible wrinkle *Littorina littorea* are common. The chiton *Leptochiton cinereus*, the sea lemon *Archidoris pseudoargus* and the slipper limpet *Crepidula fornicata* are also present. Bryozoan and rhodophyte crusts cover the stones.

Hard substrata are found at Shaldon bridge. Boulders and cobbles on gravel in the mid-shore are dominated by dense *Fucus vesiculosus* and *Ascophyllum nodosum* with other less frequent red and green algae (AscX). The fauna is dominated by barnacles *Semibalanus balanoides*, littorinids and limpets *Patella vulgata*. Spirorbid worms, mussels *Mytilus edulis* and chitons are also present. The lower shore vertical bridge piles possess an abundant fauna and flora, particularly of red algae and sponges (Fves; Fser.Fser). The bryozoan *Cryptosula pallasiana* is frequent here and the spionid worms *Polydora* spp. are occasionally encountered lower down the piles, becoming dominant in the sublittoral fringe. The sea mat *Electra pilosa* and hydroids are frequent here. Boulders below the bridge possess a similar fauna and flora to the bridge piles, with the addition of abundant mussels (Fserr.VS). *M. edulis* also form a bed in which their shells act as substrata for the attachment of furoids and other algae. The availability of lower shore hard substrata, along with conditions of extreme shelter and almost fully marine water, make this area the richest littoral site for sponges and red algae within the inlet.

Mussel beds are also found upstream of Shaldon Bridge in the mid-inlet. At Gas House Bank, the bed is on the lower shore and is dominated by *Ulva* spp. with smaller amounts of *Ceramium* spp., *Gracilaria gracilis* and *Fucus vesiculosus* (MytX). *C. fornicata*, littorinids and *C. edule* are frequent. At Arch Brook Bridge, further upstream and higher on the shore, the mussel bed supports *Fucus spiralis*, *Enteromorpha* spp. and *Ulva* spp. (MytX). Fauna include barnacles, littorinids, shore crabs *Carcinus maenas* and ragworm *Hediste diversicolor*.

Littoral flats of coarse sand are present in the mid-inlet between Luxton Steps Bay and Shaldon Bridge. On the south shore, at the Shipwrights, the muddy sand is dominated by nematodes and nemertean with common tellins *Macoma balthica* and frequent polychaetes (HedMac). Slightly upstream, at the Gappy, the spionid worm *S. squamata* is common; *H. diversicolor* are occasional (AP.P). At Luxton Steps Bay, the well-aerated coarse sand and gravel is impoverished and only occasional oligochaetes are present (OI).

Littoral mudflats occur in the middle reach of the inlet, south of Bishopsteignton. The infauna is dominated by *H. diversicolor* and the peppery furrow shell *Scrobicularia plana* (HedScr). Nematodes, polychaetes and *C. maenas* are also found here.



**Figure 6.2** Indicative distribution of the main biotopes in the inlet (based on data from survey sites shown in Figure 6.1, cited literature and additional field observations).

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Upper shore bedrock and stone walls are present in the mid-and upper parts of the inlet and are colonised by algae - *Pelvetia canaliculata* (Pel) and *F. spiralis* (Fspi) with the red algae *Rhodothamniella floridula* and *Catenella caespitosa*. Upstream of Arch Brook Bridge red algae are absent or rare. Where cobbles lie on the upper and mid-shore, algae are present as on the bedrock and walls (Fspi, FvesX and FserX). At sites west of Coombe Cellars, *H. diversicolor* are present under the boulders, while at Gravel Point, occasional barnacles, *M. edulis*, *C. edule*, gammarids and crabs are found (AscX).

Littoral mudflats are present in the upper inlet, west of Coombe Cellars. The infauna is primarily composed of *H. diversicolor*, *S. plana*, oligochaetes, nematodes and other polychaetes (HedScr). On the upper and mid-shore, areas of cobbles, slates and boulders are colonised by ephemeral green algae, *Fucus ceranoides* and barnacles (EphX; FcerX). *C. maenas*, amphipods, mud snails *Hydrobia ulvae* and eels *Anguilla anguilla* are found under and among the hard substrata. At Wildlands Point, east of

the A380 road bridge, the saltmarsh plants sea purslane *Halimione portulacoides* and sea plantain *Plantago maritima* extend across the upper and mid-shore.

### Sublittoral biotopes

Off Den Point, just outside the inlet, a sublittoral scour pit, as much as 9 m deep, is present. The slope of the pit is boulders colonised by a dense turf of bryozoans, hydroids and occasional red algae. Sponges, ascidians, anemones and many mobile species including crabs, dogwhelks *Nucella lapillus* and fish are found (ByH).

The floor of the scour pit is of gravel, cobbles and coarse sand. The cobbles are colonised by barnacles *Balanus crenatus* and *Balanus balanus*, bryozoans and calcareous worms (PomByC). Sediment infauna includes the bivalve *Gari fervensis*, mussel *Mytilus edulis* spat, polychaetes and the amphipod *Gammarus locusta*.

Sublittoral coarse sand is present at the Salty in the entrance to the inlet below the Shaldon Bridge and continues for some distance up into the inlet (FaG). The proportion of sand decreases up the inlet and there is a concomitant decrease in the species richness. Stones and cobbles are colonised by red algae, anthozoans and *B. crenatus*. Mobile surface fauna include starfish *Asterias rubens*, crabs and urchins. Infauna include polychaetes, *G. fervensis* and *Lanice conchilega*. Sublittoral muddy sediments, dominated by oligochaetes are confined to the upper estuarine areas of the inlet (Tub).

### Nature conservation

#### Conservation sites

Site name	Position	Status	Main features
Hackney Marshes reserve	N/A	DWT/ Devon Wildfowlers' Association	Wildfowl

### Human influences

Teignmouth is an important commercial port, being the main British port for the export of ball clay. Imports include grain, animal feeds and timber. Maintenance dredging is undertaken in the channel and some gravel extraction occurs in the upper reaches. There is no other industrial activity and much of the hinterland is rural.

Seine netting for salmon *Salmo salar* and eels *Anguilla anguilla* occurs and there is extensive cultivation of mussels *Mytilus edulis*, native oyster *Ostrea edulis* and Pacific oysters *Crassostrea gigas*. The natural stocks of mussel are re-seeded and harvested by hand. Bait-digging and peeler crab collection are widespread and winkles *Littorina littorea* are gathered by hand. Wildfowling is carried out on the northern shore opposite Hackney Marshes.

Leisure activities are numerous and widespread throughout the Teign inlet. There are seven dinghy parks and over 1,200 moorings, concentrated on the Salty, the southern shore and east of the A380 road bridge. Sailing is very popular and centred on Teignmouth. Water skiing and windsurfing occur off Coombe Cellars and canoeing throughout the inlet. Beach recreation takes place primarily at the Shaldon and Ness beaches at the mouth of the inlet.

### References and further reading

- Frid, C. 1989. Surveys of harbours, rias and estuaries in southern Britain: the Teign estuary. (Contractor: Field Studies Council, Oil Pollution Research Unit, Pembroke.) *Nature Conservancy Council, CSD Report*, No. 920. (FSC Report, No. FSC/OPRU/15/88.)



National Rivers Authority South West Region. 1992. *National Rivers Authority South-west Region estuary data 1990 to 1992*. Unpublished, National Rivers Authority South-west Region.

## Sites surveyed

Survey 254: 1988 HRE survey of the Teign estuary (Frid 1989).

Survey 451: 1992 National Rivers Authority SW Region littoral and sublittoral survey of the Teign estuary (National Rivers Authority 1992).

<b>Littoral sites (listed west to east)</b>					
<i>Survey</i>	<i>Site</i>	<i>Place</i>	<i>Grid reference</i>	<i>Latitude/longitude</i>	<i>Biotopes present</i>
451	1	Newton Abbot, Teign estuary.	SX 869 717	50°32.0'N 03°35.7'W	Ol
254	5	S Shore, River Teign, Teign estuary.	SX 873 717	50°32.0'N 03°35.4'W	Ent, Fcer, FcerX, HedOl
254	6	S Shore Brook, Teign estuary.	SX 874 717	50°32.0'N 03°35.3'W	HedOl
254	3	Passage House Inn, Teign estuary.	SX 879 724	50°32.4'N 03°34.9'W	HedScr
254	7	W of Wildlands Point, Teign estuary.	SX 880 720	50°32.1'N 03°34.8'W	Fcer, EphX, FcerX, HedOl
451	2	Passage House Inn, Kingsteignton, Teign estuary.	SX 881 723	50°32.3'N 03°34.7'W	NVC SM8
254	30	Wear Farm Point, Teign estuary.	SX 882 723	50°32.3'N 03°34.6'W	FcerX
254	8	Buckland Point, Teign estuary.	SX 883 722	50°32.3'N 03°34.5'W	FcerX, HedScr, HedOl, LMX
254	9	E of Nether-ton Point, Teign estuary.	SX 890 723	50°32.3'N 03°33.9'W	HedScr
254	4	S of Wear Farm, Teign estuary.	SX 892 726	50°32.5'N 03°33.8'W	Fspi, FvesX, HedOl
451	3	Nether-ton House, Teign estuary.	SX 895 722	50°32.3'N 03°33.5'W	LMX
254	10	E of Coombe Cellars, Teign estuary.	SX 898 723	50°32.3'N 03°33.3'W	Fspi, Asc.VS, HedOl
254	18	Luxton Steps Cliff, Teign estuary.	SX 903 728	50°32.6'N 03°32.9'W	Pel, Fspi
254	19	Luxton Steps Bay, Teign estuary.	SX 903 727	50°32.5'N 03°32.9'W	Ol
451	4	Coombe Cellars Inn, Elmfield, Teign estuary.	SX 903 724	50°32.4'N 03°32.9'W	HedMac.Are
254	13	Luxton Embankment, Teign estuary.	SX 907 727	50°32.5'N 03°32.5'W	Pel, Fspi, FvesX, Asc.VS, Fcer, EphX
254	14	Point E of Arch Brook Bridge, Teign estuary.	SX 910 723	50°32.3'N 03°32.3'W	Ent, Fspi, Asc.VS, FvesX, AscX
254	20	Bay W of Flow Point, Teign estuary.	SX 910 728	50°32.6'N 03°32.3'W	Pel, Asc.VS, HedScr
254	21	Arch Brook Bridge, Teign estuary.	SX 910 724	50°32.4'N 03°32.3'W	MytX, HedMac.Pyg, HedScr
451	5	Flow Point, Bishopsteignton, Teign estuary.	SX 910 728	50°32.6'N 03°32.3'W	MacAre
254	12	W of Flow Point, Teign estuary.	SX 911 728	50°32.6'N 03°32.2'W	Asc.VS
254	11	E of Flow Point, Teign estuary.	SX 912 729	50°32.7'N 03°32.1'W	FvesX
451	6	W of Gravel Point, Teign estuary.	SX 920 724	50°32.4'N 03°31.4'W	HedMac.Are
254	27	W of Gravel Point, Teign estuary.	SX 921 724	50°32.4'N 03°31.3'W	Fspi, Asc.VS, AscX, FserX
254	22	The Gappy, Teign estuary.	SX 923 727	50°32.6'N 03°31.2'W	AP.P
451	7	Shaldon, Teign estuary.	SX 926 723	50°32.4'N 03°30.9'W	LMX
254	29	Gas House Bank, Teign estuary.	SX 927 728	50°32.6'N 03°30.8'W	MytX
254	26	The Shipwrights, Teign estuary.	SX 929 724	50°32.4'N 03°30.6'W	FvesX, HedMac
254	28	Shaldon Bridge NW-side, Teign estuary.	SX 931 729	50°32.7'N 03°30.5'W	Fves, Fser.Fser, Fserr.VS, AscX
451	8	The Salty, Shaldon Bridge, Teign estuary.	SX 932 727	50°32.6'N 03°30.4'W	BLlit
254	25	The Salty, Teign estuary.	SX 933 726	50°32.5'N 03°30.3'W	Fspi, H, Lan

**Sublittoral sites (listed west to east)**

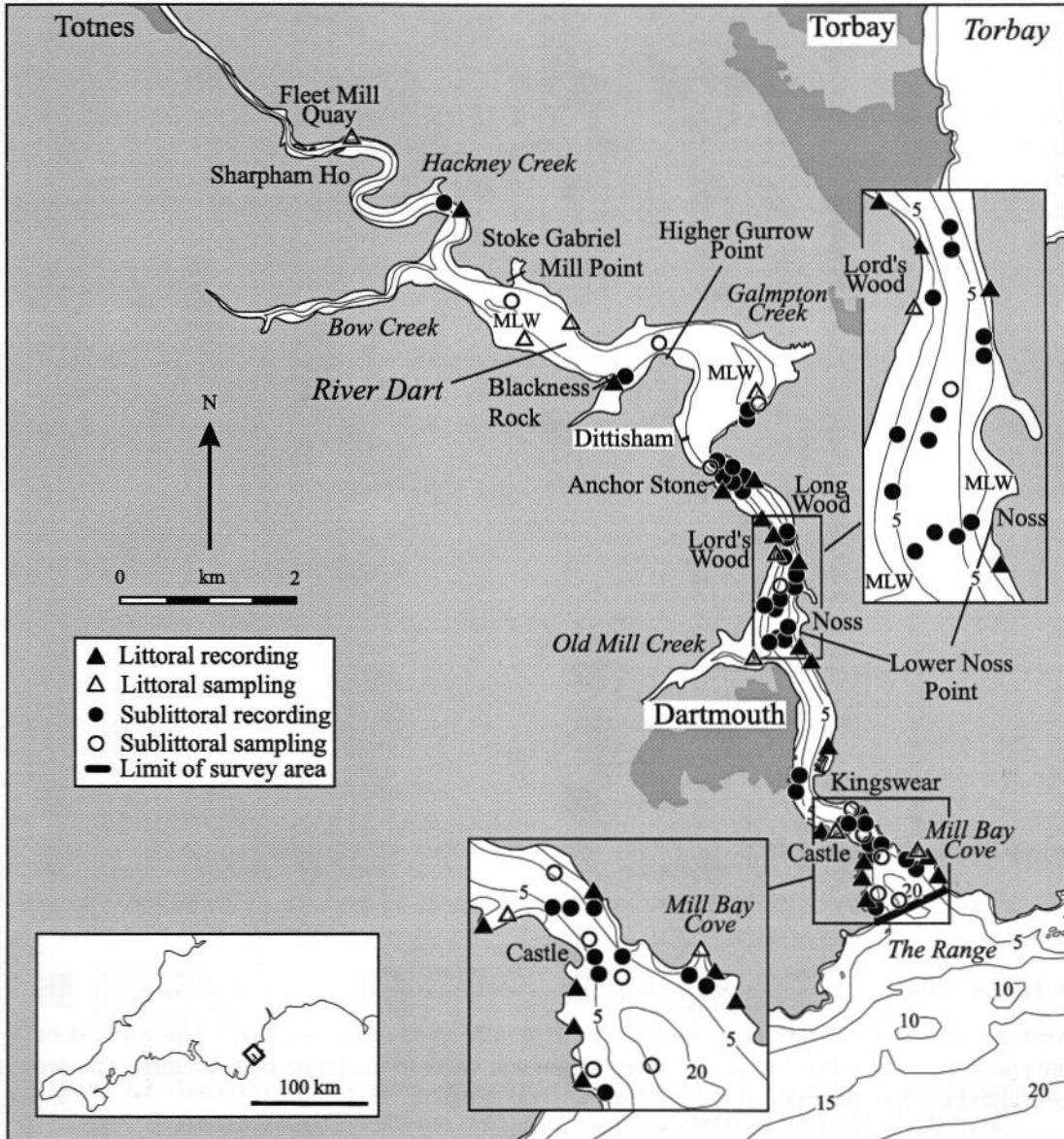
<i>Survey</i>	<i>Site</i>	<i>Place</i>	<i>Grid reference</i>	<i>Latitude/longitude</i>	<i>Biotopes present</i>
254	1	E of Knowle Hill, Teign estuary.	SX 862 718	50°32.0'N 03°36.3'W	Tub
451	A	W of Coombe Cellars, Teign estuary.	SX 898 723	50°32.3'N 03°33.3'W	EstMu
254	D7	W of Shaldon Bridge, Teign estuary.	SX 929 727	50°32.6'N 03°30.7'W	FaG
254	D7	W of Shaldon Bridge, Teign estuary.	SX 929 727	50°32.6'N 03°30.7'W	FaG
254	D6	Salty Channel, Teign estuary.	SX 932 728	50°32.6'N 03°30.4'W	FaG
254	D6	Salty Channel, Teign estuary.	SX 932 728	50°32.6'N 03°30.4'W	FaG
254	D5	Teignmouth Quays, Teign estuary.	SX 936 728	50°32.6'N 03°30.1'W	Lcon
254	24	Shaldon Pool, Teign estuary.	SX 937 722	50°32.3'N 03°30.0'W	PomByC, ByH
254	D3	Conger Pit, Teign estuary.	SX 937 725	50°32.5'N 03°30.0'W	FaG
451	B	Offshore of The Salty, Teign estuary.	SX 937 727	50°32.6'N 03°30.0'W	Lcon
254	D3	Conger Pit, Teign estuary.	SX 937 725	50°32.5'N 03°30.0'W	FaG
254	D4	Teignmouth outfall, Teign estuary.	SX 938 726	50°32.5'N 03°29.9'W	FaG
254	D4	Teignmouth outfall, Teign estuary.	SX 938 726	50°32.5'N 03°29.9'W	FaG

**Compiled by:** Jan Smith and Jon Moore

## River Dart

## Location

<i>Position (centre)</i>	SX8756	50° 21' N 03° 34' W
<i>Administrative area</i>	Devon	South Hams
<i>Conservation agency/area</i>	English Nature	Devon & Cornwall



**Figure 7.1** Main features of the area, and sites surveyed.

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Physical features	
<i>Physiographic type</i>	Ria
<i>Length of coast</i>	58 km
<i>Area of inlet</i>	Total 750 ha; intertidal 300 ha
<i>Length of inlet</i>	19 km
<i>Bathymetry</i>	Deep mid-channel; maximum depth 25 m
<i>Wave exposure range</i>	Exposed to extremely sheltered
<i>Tidal stream range</i>	Maximum 1.5 knots in the narrows at mouth
<i>Tidal range</i>	4.3 m (spring); 1.8 m (neap)
<i>Salinity range</i>	Fully marine to upper estuarine

## Introduction

The River Dart, including several tributaries, lies on the south coast of Devon and opens into Start Bay. It runs through a steep-sided channel south from Totnes to Dartmouth and empties through a very narrow entrance into a bay known as the Range. Much of the ria is subtidal and sedimentary with narrow strips of fringing mudflats particularly in the tributaries. Hard substrata are more common in the lower reaches with steep bedrock in the Range and artificial walls around Dartmouth and Kingswear. Freshwater input to the inlet is relatively large with the result that the water is less than fully marine from just inside the entrance. Sewage is discharged to the inlet but the water quality (1994-96) is classified as grade B.

The whole of the inlet lies within the South Devon Area of Outstanding Natural Beauty and the South Devon Heritage Coast. The Dart is a Coastal Protection Area and a Nature Conservation Zone (designated by Devon County Council). The inlet is a major nursery area for bass *Dicentrarchus labrax* and as such is subject to a closed season over the summer months. Atlantic salmon *Salmo salar* and sea trout *Salmo trutta* migrate to the inlet to spawn up river. These salmonids are protected by Net Limitation Orders which restrict the number of nets used in the inlet.

Marine biological surveys			
	<i>Survey methods</i>	<i>Date(s) of survey</i>	<i>Source</i>
<i>Littoral</i>	Recording	February/October 1994	Devon Wildlife Trust (unpublished data)
	Recording	May 1987	Moore (1988)
	Infaunal sampling	May 1987	Moore (1988)
<i>Sublittoral</i>	Recording	July 1987	Moore (1988)
	Recording	August 1986	Horsman (1986)
	Infaunal sampling (pipe dredge)	July 1987	Moore (1988)

## Marine biology

The River Dart inlet may be divided into five ecological zones on the basis of the biotopes present. These zones are described below.

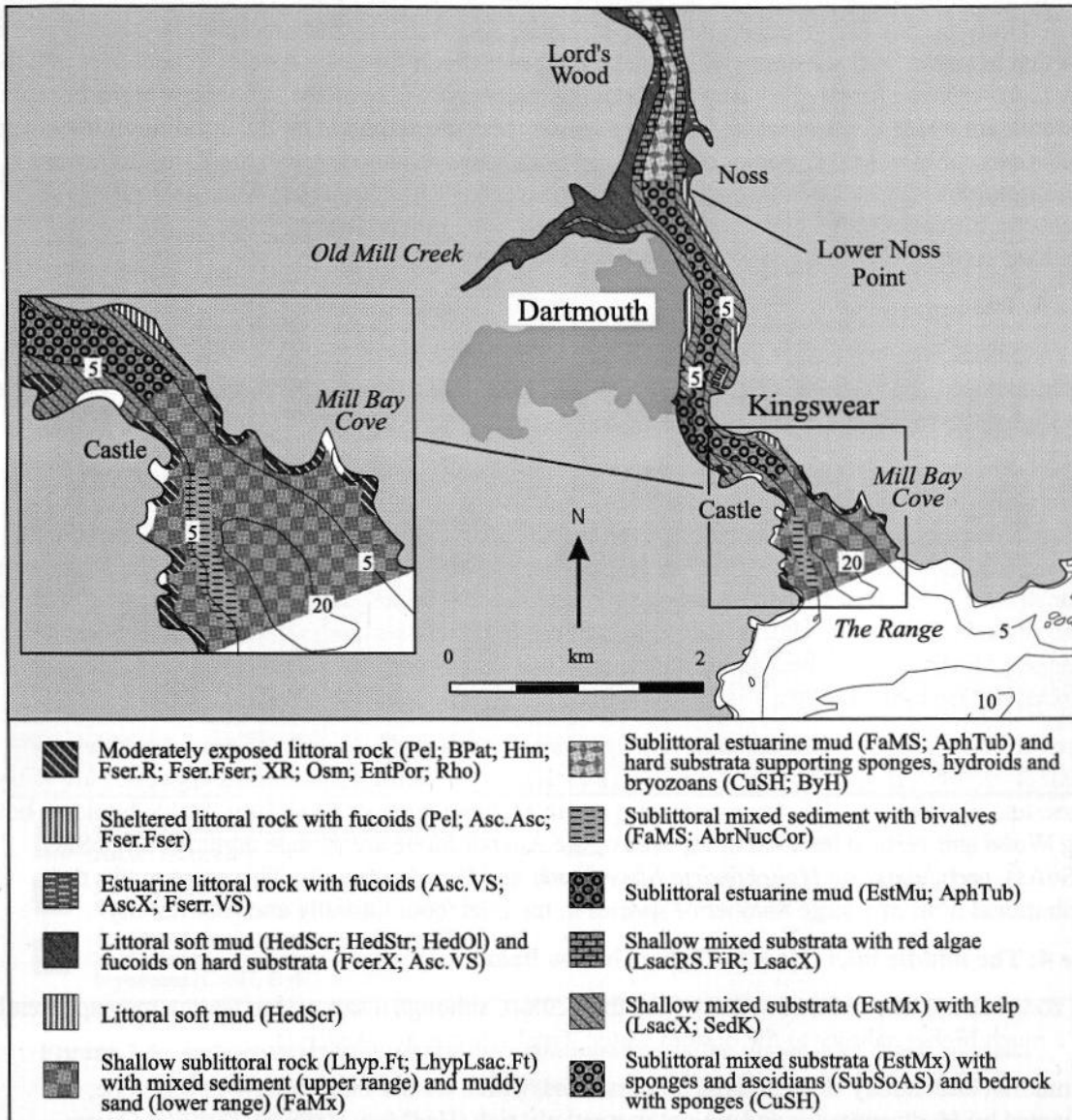
### Zone 1: The Range

The communities and habitats in the Range are essentially of an open coast type. The water is fully marine and the area is subject to strong wave action and weak to moderate tidal streams. The west side is more sheltered than the east.

The open shore communities are typical of the open coast, with an easily visible zonation pattern of upper shore lichens (YG; Ver.Ver), middle shore barnacles and limpets (BPat) and lower shore algae (Him; XR; Ldig.Ldig). Vertical, overhanging and other shaded lower shore rock has a wide variety of species, many of which are more common sublittorally (SR). Lower shore underboulder communities (Fser.R) are typical of the habitat, but not particularly rich.

Muddy sand, the major substratum in the sublittoral in the Range, holds a fairly rich community of bivalves (*Abra alba* and *Mya truncata*), polychaetes, echinoderms (*Ophiothrix fragilis*, *Amphiura* spp. and *Echinocardium cordatum*) and other infauna (AbrNucCor). The infralittoral rock is dominated by

kelp *Laminaria hyperborea* (Lhyp.Ft) and rich foliose red algae; bryozoan turf is found on the vertical and overhanging surfaces (SCAs.ByH). Low-lying rock outcrops in some areas are apparently sediment scoured with a reduced diversity of species typical of mobile and scoured substrata. The vertical walls of the shallow caves west of Mill Bay Cove (below Kingswear Castle) are colonised by encrusting species typical of surge gullies (SCAn; CC.BalPom).



**Figure 7.2** Indicative distribution of the main biotopes in the lower inlet (based on data from survey sites shown in Figure 7.1, cited literature and additional field observations).

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### Zone 2: The entrance to the inlet (north of the Range to the castle narrows)

This zone is one of rapid transition from the wave exposed fully marine conditions of the Range to the very sheltered reduced salinity conditions inside the inlet. Tidal streams are fairly strong and the narrow channel is scoured very deep.

The open shore communities are well zoned and in the more exposed areas they follow a similar pattern to those in the Range. Species composition, however, changes markedly as one moves from exposure to shelter. The channelled wrack *Pelvetia canaliculata* becomes abundant on the upper shore (Pel), barnacles of *Chthamalus* spp. are absent from the middle shore, the limpet *Patella vulgata* dominates over the other *Patella* spp., the barnacle *Elminius modestus* becomes more abundant, the periwinkles *Melarhapha neritoides* and *Littorina neglecta* are absent and a wide variety of algae are no longer found on the lower shore.

Sublittoral communities in this zone are most like those of the lower inlet. The change from the exposed fully marine Range communities is dramatic, aggravated by the stronger tidal streams and the reduction in stable hard substrata, which make it more difficult for many species to penetrate into the inlet. *L. hyperborea* forest gives way to *Laminaria saccharina* (LhypLsac.Ft); foliose algae become less abundant while filamentous and feathery species become dominant on the infralittoral tide-swept pebbles and cobbles. Many species of fauna and flora found in abundance in the Range either are absent from this zone or become rare and do not penetrate further upstream. The communities of animals on the cobbles and pebbles (ByH; SubSoAs), and in the sediment (EstMu; AphTub) on which these hard substrata are lying, are very rich and diverse.

### **Zone 3: The lower inlet** (Castle narrows to Lower Noss Point)

The conditions of this zone are of reduced and variable salinity, very wave-sheltered and moderately current-exposed. The salinity gradient appears to be only gradual as the species complement changes only slightly up the inlet.

Fucoids dominate the hard substrata on the shore in this zone (Pel; BPat; Fves; Asc.Asc; Fser.Fser). On the stone walls and oyster grids on the east bank below Noss, and on the bedrock shores at the Anchor Stone, the algal, barnacle and limpet communities are dense and fairly rich. On the shingle shores (FvesX; FserX) the diversity of algae and animals on hard substrata is reduced but a variety of infauna (mostly polychaetes and bivalves) and underboulder fauna (particularly gammarid amphipods) is also present. The muddy shores have abundant but fairly species-poor communities of typically estuarine polychaetes, bivalves and crustaceans and are dominated by the ragworm *Hediste diversicolor* (HedScr; HedStr).

In the sublittoral, the infralittoral algae and the animals on the tide-swept pebbles and cobbles are typical of mobile substrata (SedK; SubSoAs; LsacX). The infaunal communities, however, are fairly diverse and are dominated by the ampharetid worm *Melinna palmata* (AphTub). Stable boulders below Long Wood and vertical bedrock in the area of the Anchor Stone are sponge dominated (CuSH; SubSoAs), particularly by *Halichondria bowerbanki* and *Dysidea fragilis*. This point marks the distributional limit of a large number of species in the inlet, both littorally and sublittorally.

### **Zone 4: The middle inlet** (Noss to Higher Gurrew Point)

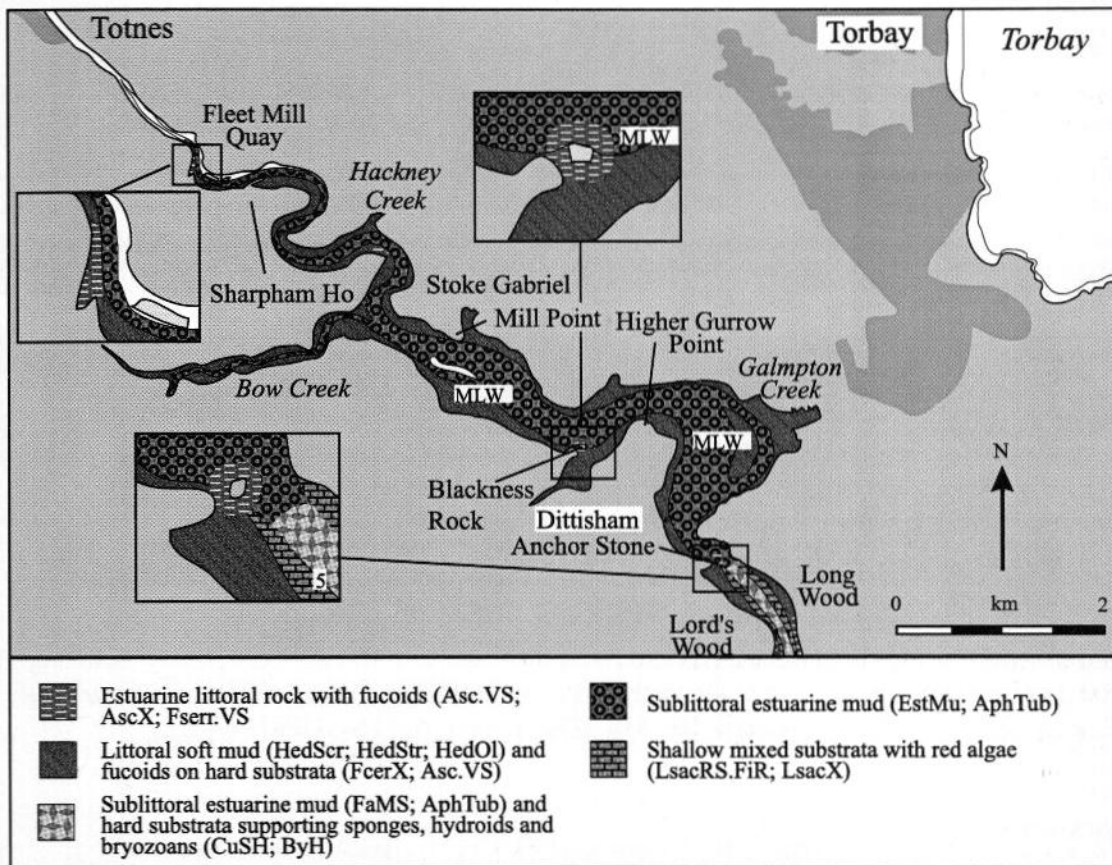
This zone has a much-reduced salinity (less than 20‰), although a salt wedge feature may apparently give a much higher salinity to the bottom water. Tidal streams are moderate.

The mudflat and muddy shingle shore communities, which are the main feature of this zone, are dominated by *H. diversicolor* and are not particularly rich (HedMac, HedScr). The Flat Owers, however, has large concentrations of cockles *Cerastoderma edule* and is generally quite rich (HedScr). Blackness Rock, the only shore to include lower shore bedrock in this zone (Asc.VS, Fserr.VS), marks the distributional limit up the inlet of many littoral species, including *Semibalanus balanoides*, the littorinids, the isopod *Dynamene bidentata* and many red algae. The sublittoral in this zone is dominated by mud and some shingle and the infauna is dominated by the cirratulid worm *Tharyx* sp. (AphTub). A few other red algae and animals reach their upstream distributional limits on the shallow sublittoral shingle at Blackness Rock (LsacRS.FiR).



### Zone 5: The upper inlet (Higher Gurrew Point to Sharpham Ho)

This zone has a very low salinity and moderate tidal streams. The littoral mudflats have species-poor estuarine communities, similar to those further down the inlet (HedScr). The hard substratum shores are also colonised by a small variety of species tolerant to low salinity water. The shore south of Hackney Creek is the upstream limit for the barnacles *Balanus crenatus* and *E. modestus* and the fucoids *Ascophyllum nodosum*, *Fucus serratus* and *Fucus vesiculosus* (Asc.VS). Not much further north, west of Fleet Mill Quay, the bedrock shore is affected by freshwater run-off and is dominated by *Fucus ceranoides* (Fcer).



**Figure 7.3** Indicative distribution of the main biotopes in the upper inlet (based on data from survey sites shown in Figure 7.1, cited literature and additional field observations).

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## Nature conservation

Conservation sites			
Site name	Position	Status	Main features
South Devon	N/A	AONB	High scenic quality
East Devon	SY072829- SY332913	HC	Coastal scenery
Berry Head to the Dart estuary	SX883487- SX895604	SMA	Marine biology
Lord's Wood	SX874539	SSSI	Biological
Crownley Wood	SX817563	NT	Foreshore and woodland
Long Wood	SX881535	NT	Foreshore and woodland

## Human influences

The River Dart is not industrialised to any degree. There are port facilities at Totnes and Kingswear from which operate a crab fishing fleet and a boat building yard at Noss Point. The lower inlet is used extensively for exercises by the Naval College. The hinterland is predominantly rural.

Fishing for salmon *Salmo salar* occurs within the inlet and there is a mussel *Mytilus edulis* farm at Dittisham. Native oysters *Ostrea edulis* were harvested until the 1980s when the populations crashed owing to the effects of anti-fouling paint (TBT). Plans to restock the oyster beds are being considered. Pacific oysters *Crassostrea gigas* are cultivated. Bait-digging takes place in the mudflats off Galmpton and winkles *Littorina littorea* are gathered.

The River Dart is a very popular centre for sailing with several marinas and around 2,000 moorings for leisure craft, particularly at Dartmouth, Totnes, Dittisham and Stoke Gabriel. Power boating, windsurfing and canoeing occur and angling is popular throughout the inlet.

## References and further reading

Horsman, P. 1986. A report on the River Dart survey. (Contractor: Marine Conservation Society, Ross-on-Wye.) *Nature Conservancy Council, CSD Report*, No. 695.

Moore, J. 1988. Surveys of harbours, rias and estuaries in southern Britain: Dart estuary including The Range. (Contractor: Field Studies Council Oil Pollution Research Unit, Pembroke.) *Nature Conservancy Council, CSD Report*, No. 818. (FSC Report, No. FSC/OPRU/6/87.)

## Sites surveyed

Survey 126: 1986 survey of the River Dart (Horsman 1986).

Survey 253: 1987 HRE survey of the Dart estuary including The Range (Moore 1988).

Survey 613: 1994-95 Devon Wildlife Trust littoral survey of the River Dart (Devon Wildlife Trust, unpublished data).

**Littoral sites (listed north to south)**

<i>Survey</i>	<i>Site</i>	<i>Place</i>	<i>Grid reference</i>	<i>Latitude/longitude</i>	<i>Biotopes present</i>
253	12	W of Fleet Mill Quay, Dart estuary.	SX 822 583	50°24.7'N 03°39.4'W	Fcer, HedOl
253	13	Fleet Mill Quay, Dart estuary.	SX 828 582	50°24.7'N 03°38.9'W	HedStr
253	11	S of Hackney Creek, Dart estuary.	SX 840 576	50°24.3'N 03°37.9'W	Asc.VS
253	10	Middle Back E, Dart estuary.	SX 853 563	50°23.6'N 03°36.8'W	HedScr
253	9	Middle Back W, Dart estuary.	SX 848 561	50°23.5'N 03°37.2'W	HedStr
253	8	Blackness Rock, Dart estuary.	SX 858 556	50°23.3'N 03°36.3'W	Pel, Fspi, Asc.VS, Rho, Fserr.VS
253	6	Flat Owers, Dart estuary.	SX 873 554	50°23.2'N 03°35.1'W	SLR, HedScr, HedOl, AphTub
253	5	Off Anchor Stone, Dart estuary.	SX 873 545	50°22.7'N 03°35.1'W	YG, Ver.Ver, Pel, Fspi, BPat.Sem, Asc.VS, Fserr.VS
253	7	Anchor Stone, Dart estuary.	SX 872 545	50°22.7'N 03°35.1'W	Asc.Asc, Fser.Fser, SByAs
253	4	Below Lord's Wood, Dart estuary.	SX 875 540	50°22.4'N 03°34.9'W	Pel, BPat.Sem, Asc, BLlit
253	3	Lower Kilngate, Dart estuary.	SX 877 537	50°22.3'N 03°34.7'W	AscX, FserX, AphTub
253	1	Below Long Wood, Dart estuary.	SX 880 535	50°22.2'N 03°34.5'W	YG, Ver.Ver, Pel, Fspi, BPat.Sem, Asc.Asc, Asc.VS, FserX
253	25	Oyster Grid at Lower Noss Point, Dart estuary.	SX 879 526	50°21.7'N 03°34.5'W	Pel, Fspi, BPat.Sem, Fves, FvesX, Asc.Asc, Fser.Fser, Fser.Pid, FserX
253	26	S of Lower Noss Point, Dart estuary.	SX 880 524	50°21.6'N 03°34.4'W	FvesX, HedScr, Mu
253	2	Old Mill Creek, Dart estuary.	SX 874 524	50°21.6'N 03°34.9'W	HedScr, HedStr
253	27	N of Dart Haven Marina, Dart estuary.	SX 883 515	50°21.1'N 03°34.1'W	Ver.Ver, Pel, Asc.Asc, Fser.Fser, HedOl
253	28	Opposite Dartmouth Castle, Dart estuary.	SX 888 505	50°20.6'N 03°33.7'W	Pel, BPat, Fves, Fser.Fser, SR, Ldig.Ldig
253	24	Outer Warfleet Creek, Dart estuary.	SX 882 505	50°20.5'N 03°34.2'W	YG, Ver.Ver, Pel, BPat.Sem, Fves, Fser.Fser
253	21	Warfleet Creek, Dart estuary.	SX 882 504	50°20.5'N 03°34.2'W	AphTub
253	20	Mill Bay Cove, Dart estuary.	SX 893 503	50°20.5'N 03°33.3'W	EphX, AP.P
253	18	W of Mill Bay Cove, Dart estuary.	SX 893 502	50°20.4'N 03°33.3'W	Ver.B, BPat.Lic, Fves, Him, FK, SR
613	1	Dartmouth Castle Rock, Dart estuary.	SX 887 502	50°20.4'N 03°33.8'W	YG, Ver.Ver, Pel, BPat.Lic, BPat.Sem, Fser.Fser, Cor, SR, Ldig.Ldig
253	17	Dartmouth Castle, Dart estuary.	SX 887 502	50°20.4'N 03°33.8'W	BPat.Sem, Cor, SR, SByAs
253	19	Below Warren Cottage, Dart estuary.	SX 895 502	50°20.4'N 03°33.1'W	Fser.Fser, SR
253	23	Western Ledge, Dart estuary.	SX 887 501	50°20.3'N 03°33.8'W	Fserr.VS, SByAs
253	16	Ladies Cove, Dart estuary.	SX 887 496	50°20.1'N 03°33.8'W	BPat.Sem, EntPor, Osm, Fser.R, FK, SR
613	2	Blackstone Point, Dart estuary.	SX 888 495	50°20.0'N 03°33.7'W	YG, Ver.B, BPat.Lic, XR, Cor.Cys, SByAs, Ldig.Ldig.Bo



**Sublittoral sites (listed north to south)**

<i>Survey</i>	<i>Site</i>	<i>Place</i>	<i>Grid reference</i>	<i>Latitude/longitude</i>	<i>Biotopes present</i>
253	D1	Off Mill Point, Dart estuary.	SX 845 565	50°23.7'N 03°37.5'W	EstMx
253	D2	Higher Gurrow Point, Dart estuary.	SX 863 559	50°23.4'N 03°35.9'W	AphTub
253	34	Blackness Rock, Dart estuary.	SX 859 556	50°23.3'N 03°36.3'W	Fscr.Fscr, LsacRS.FiR, EstMx
253	D3	N of White Boulders, Dart estuary.	SX 875 553	50°23.1'N 03°34.9'W	AphTub
126	16	Below Hare Wood, River Dart.	SX 872 552	50°23.1'N 03°35.2'W	EstMu
126	4	S of Ned's Point, River Dart.	SX 871 546	50°22.7'N 03°35.2'W	CuSH, EstMx
253	D4	Ned's Point, Dart estuary.	SX 870 546	50°22.7'N 03°35.3'W	AbrNucCor
253	43	Anchor Stone, Dart estuary.	SX 872 545	50°22.7'N 03°35.2'W	CuSH, LsacRS.FiR, Ost
253	44	Opposite Anchor Stone, Dart estuary.	SX 873 545	50°22.7'N 03°35.1'W	LsacRS.FiR, CuSH, Flu.Hocu
126	3	Point E of Anchor stone, River Dart.	SX 873 545	50°22.7'N 03°35.1'W	LsacRS.FiR, CuSH, ErSPbolSH, Flu.ScrHyd, Pid
126	12	Anchor Stone, River Dart.	SX 872 545	50°22.7'N 03°35.2'W	CuSH, CMX
126	13	Off Parson's Mud, River Dart.	SX 872 545	50°22.7'N 03°35.2'W	Flu.ScrHyd, Pid, EstMx
126	19	Mid-channel off Maypool, River Dart.	SX 875 543	50°22.6'N 03°34.9'W	FaMS, CMX
253	49	S of Maypool, Dart estuary.	SX 879 538	50°22.3'N 03°34.5'W	CuSH, Flu.Hocu, LsacX
126	1	Below Longwood, River Dart.	SX 879 537	50°22.3'N 03°34.5'W	Flu.ScrHyd, SedK
126	7	Below Longwood (second visit), River Dart.	SX 879 537	50°22.3'N 03°34.5'W	SubSoAs
126	18	Off Lower Kilngate, River Dart.	SX 877 535	50°22.2'N 03°34.7'W	ByH, EstMu, CMX
126	2	N of Noss Point, River Dart.	SX 879 532	50°22.0'N 03°34.5'W	CuSH
126	17	N of Noss Point, River Dart.	SX 879 532	50°22.0'N 03°34.5'W	Marc, SubSoAs, LsacX
253	D5	Noss Point, Dart estuary.	SX 878 531	50°21.9'N 03°34.6'W	EstMx
253	50	Barges opposite Noss, Dart estuary.	SX 876 530	50°21.9'N 03°34.8'W	Lsac.Ldig, MytHAs
126	5	Opposite the Noss, River Dart.	SX 876 530	50°21.9'N 03°34.8'W	EstMu
126	6	Barge opposite Noss, River Dart.	SX 877 530	50°21.9'N 03°34.7'W	CuSH
126	11	Off Lower Noss Point, River Dart.	SX 876 527	50°21.7'N 03°34.8'W	PomByC
253	42	Off Lower Noss Point, Dart estuary.	SX 878 526	50°21.7'N 03°34.6'W	LsacRS.FiR
126	10	Off Lower Noss Point oyster grids, River Dart.	SX 879 526	50°21.7'N 03°34.5'W	CreAph?
126	8	Pontoon opposite old mill creek, River Dart.	SX 877 525	50°21.6'N 03°34.7'W	SubSoAs
126	9	Off Dartmouth yacht club, River Dart.	SX 879 511	50°20.9'N 03°34.5'W	EstMx
253	33	Bayards Cove, Dart estuary.	SX 879 509	50°20.8'N 03°34.5'W	SubSoAs, AphTub
253	41	Lighthouse Cove, Dart estuary.	SX 887 507	50°20.7'N 03°33.8'W	Lsac.Pk, SedK, EstMu, LsacX
253	37	One Gun Point, Dart estuary.	SX 888 505	50°20.6'N 03°33.7'W	SubSoAs, LsacX, FaMx
126	15	Off One Gun Point, River Dart.	SX 885 505	50°20.5'N 03°34.0'W	Flu.HByS, SubSoAs, FaMS
253	D6	One Gun Point, Dart estuary.	SX 886 505	50°20.5'N 03°33.9'W	FaMx
253	40	W of Mill Bay Cove, Dart estuary.	SX 892 502	50°20.4'N 03°33.3'W	Ldig.Ldig, SCA, n, CC.BalPom, Lhyp.Ft
253	38	Whitmore Rocks, Dart estuary.	SX 893 502	50°20.4'N 03°33.3'W	Lhyp.Pk, SCAs.ByH, FaMS
253	D7	Checkstone, Dart estuary.	SX 888 502	50°20.4'N 03°33.7'W	AbrNucCor
253	D12	Lighthouse Cove, Dart estuary.	SX 885 502	50°20.4'N 03°34.0'W	AbrNucCor
253	51	Ladies Cove, Dart estuary.	SX 887 498	50°20.2'N 03°33.8'W	LhypLsac.Ft, FaMS
253	D8	N of Blackstone Point, Dart estuary.	SX 888 497	50°20.1'N 03°33.7'W	AbrNucCor
253	D9	Mid Range, Dart estuary.	SX 892 497	50°20.1'N 03°33.4'W	AbrNucCor

Compiled by: Jan Smith, Jon Moore and Kate Northen

## Salcombe Harbour and Kingsbridge estuary

## Location

<i>Position (centre)</i>	SX7441	50° 14' N 03° 46' W
<i>Administrative area</i>	Devon	South Hams
<i>Conservation agency/area</i>	English Nature	Devon & Cornwall

## Physical features

<i>Physiographic type</i>	Ria
<i>Length of coast</i>	48.6 km
<i>Area of inlet</i>	Total 674 ha; intertidal 446 ha
<i>Length of inlet</i>	8.3 km
<i>Bathymetry</i>	Shallow; maximum depth 12.5 m in navigation channel
<i>Wave exposure range</i>	Exposed to extremely sheltered
<i>Tidal stream range</i>	Maximum 3 knots off Salcombe
<i>Tidal range</i>	4.6 m (spring); 2.0 m (neap)
<i>Salinity range</i>	Fully marine to upper estuarine

## Introduction

Salcombe Harbour and the Kingsbridge estuary lie on the south coast of Devon and comprise a steep-sided main channel with several branches. The inlet is sheltered from the open sea by a submerged sand bar at the entrance. The lower estuary is characterised by rocky shores and sandy bays while the upper reaches are predominantly intertidal mudflats. The low volume of freshwater input results in marine conditions throughout much of the inlet. Extensive beds of eelgrass *Zostera marina* occur around Salcombe Harbour and the inlet is a major bass *Dicentrarchus labrax* nursery area. Water quality is classified as grade A (highest quality) (NRA 1991).

The entire inlet is a Site of Special Scientific Interest, a Nature Conservation Zone, Local Nature Reserve and a Coastal Protection Area (designated by Devon County Council). The inlet lies within the South Devon Area of Outstanding Natural Beauty and the South Devon Heritage Coast. It is an important feeding ground for over-wintering and passage wildfowl and waders. Nationally important populations of greenshank and common sandpiper occur.

## Marine biological surveys

	<i>Survey methods</i>	<i>Date(s) of survey</i>	<i>Source</i>
<i>Littoral</i>	Recording	January 1992	Devon Wildlife Trust (unpublished data)
	Recording	October 1990	NRA (1992)
	Recording	April/June 1985	Hiscock (1986)
	Recording	January 1976/ September 1977	Powell <i>et al.</i> (1978)
	Infaunal sampling (cores)	October 1990	NRA (1992)
	Infaunal sampling (cores)	April 1985	Hiscock (1986)
<i>Sublittoral</i>	Recording	November 1991	Devon Wildlife Trust (Seasearch data)
	Recording	September 1987	Little (1987)
	Recording	September 1985	Hiscock (1986)
	Infaunal sampling (grab)	October 1990	NRA (1992)
	Pipe dredge/trawl sampling	September 1985	Hiscock (1986)

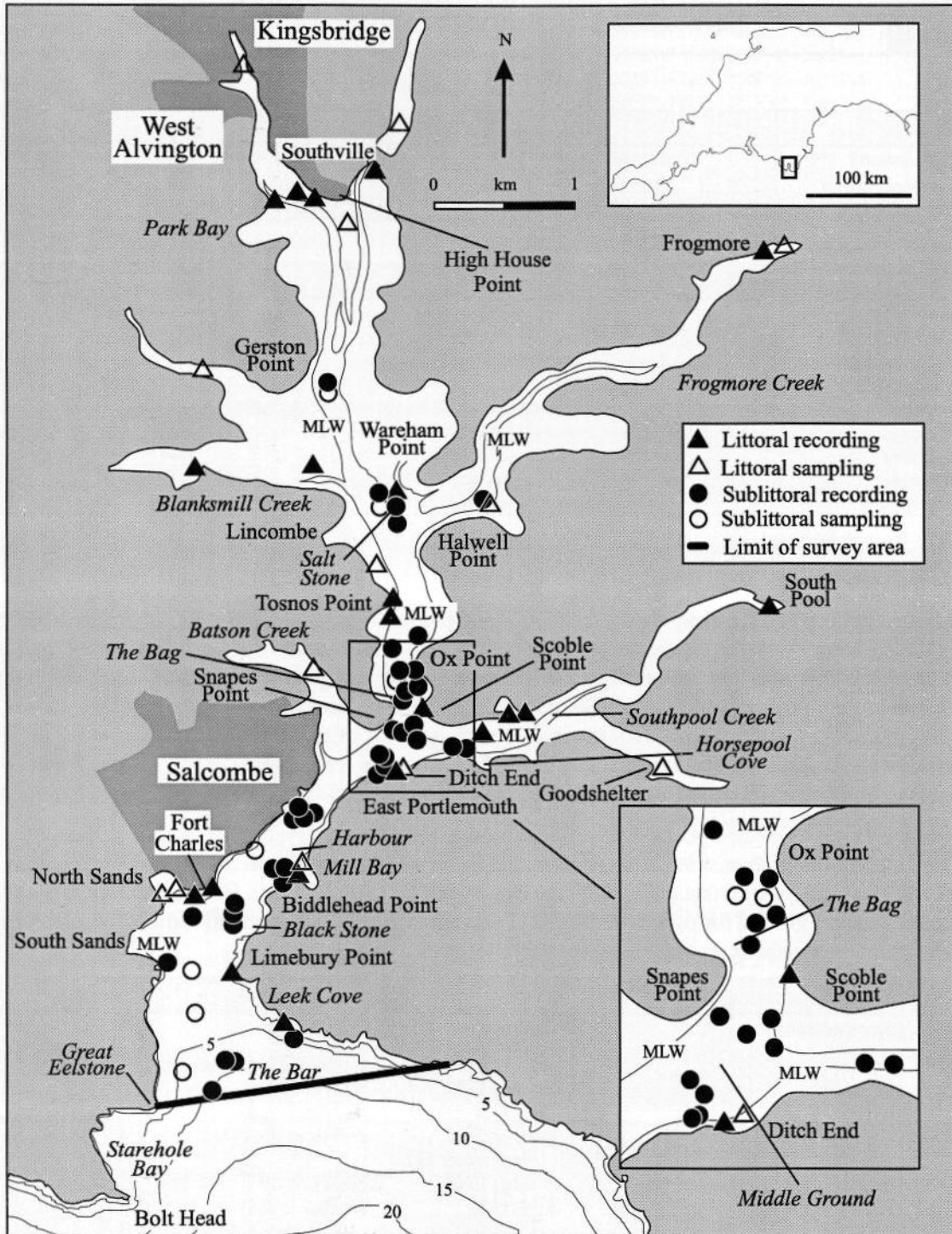


Figure 8.1 Main features of the area, and sites surveyed.

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## Marine biology

### Littoral biotopes

On the wave exposed coast near to or outside The Bar, the shores are broken bedrock with typical open coast communities dominated by limpets and barnacles. Lichens, especially *Xanthoria parietina* and



*Ramalina siliquosa*, dominate the splash zone (YG; Ver). Barnacles on the mid-shore are predominantly *Chthamalus montagui* (BPat.Cht), with other species appearing lower down (BPat.Lic; BPat.Sem). Littorinids and the beadlet anemone *Actinia equina* are frequent. On the lower shore, mussels *Mytilus edulis* and limpets *Patella vulgata* are common. The lowest point of the shore is dominated by algae, mainly the red alga *Corallina officinalis*, the foliose red algae *Mastocarpus stellatus*, *Chondrus crispus* and *Palmaria palmata* and the oarweed *Laminaria digitata* (Him; Ldig.Ldig). Rockpools (Cor; FK) and overhangs (SR) are present, with often rich communities of algae and animals. With an increase of shelter upstream and in the lee of seaward rocks, open shores have a lower abundance of lichens; fucoids present include the channel wrack *Pelvetia canaliculata* (PelB). At Fort Charles, an extensive system of gullies and overhangs (SByAs) provides a habitat for a very rich variety of animals including sponges, anemones and ascidians in particular.

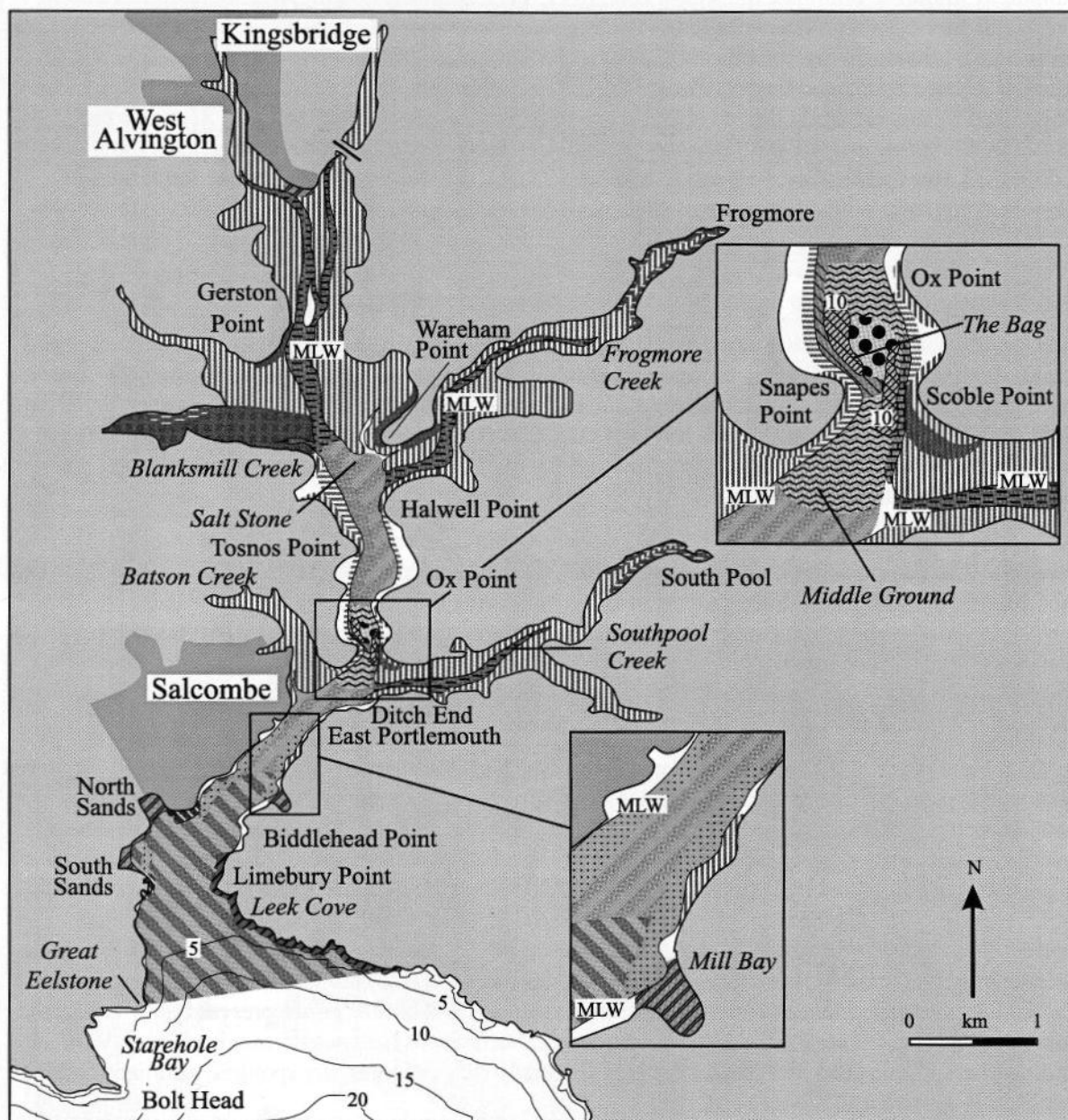
At North Sands and Mill Bay, extensive sandy beaches (AP.P; Lan) are backed by bedrock with sand near to high water level. Further upstream at Ditch End Cove, areas of sandy mud are present (HedMac.Pyg). An impoverished fauna is found at North Sands, dominated by polychaetes including *Scolecopsis squamata* (AP.P). The burrowing fauna at Mill Bay is richer - species present include the polychaetes *Nephtys caeca*, *Magelona allenii* and the sand mason worm *Lanice conchilega* and the bivalve mollusc *Abra tenuis* (Lan).

At Snapes Point and Scoble Point, there are steeply sloping sheltered shores of bedrock or stable boulders. The communities are dominated by limpets and barnacles with scattered fucoids (BPat; Fves; Asc.Asc; Fser.Fser). Lichens are present in the splash zone (YG; Ver.Ver); the upper shore is *Pelvetia/Fucus spiralis* dominated (Pel; Fspi) below which *Patella vulgata* and *Elminius modestus* (Snapes Point) or *Semibalanus balanoides* (Scoble Point) are present. *Fucus serratus* dominates the lower mid-shore and large numbers of sponges and erect bryozoans are also found here (SByAs). *Balanus perforatus* and *Balanus crenatus* are common on the lower shore.

In the middle reach of the estuary, between Ditch End and Wareham Point, are gently sloping sheltered shores of broken bedrock grading into muddy coarse sediments on the lower shores north of the headlands. The communities are typical of sheltered 'mouth-of-estuary' conditions, very rich where overhangs or steeply sloping rock occurs towards the lower shore (SR; SByAs). Where a splash zone is present it is dominated by lichens. *P. canaliculata* occurs on the upper shore (Pel), often with *Catenella caespitosa* and *Enteromorpha* sp. A *F. spiralis* zone is well developed (Fspi); animals present include *Littorina saxatilis* agg. North of Horsepool Cove, the amphipod *Gammarus locusta* is present in large numbers. *Ascophyllum/Fucus vesiculosus* (Asc.Asc) dominate from the upper mid-shore to the furthest extent of rock and gastropod molluscs and barnacles are present below the fucoid canopy. *F. serratus* (Fser.Fser) dominates the lower shore where hard substratum is present. Vertical and overhanging surfaces at Tosnos Point are especially rich, colonised by sponges, ascidians and the barnacle *B. perforatus* (SByAs).

In the Kingsbridge estuary at the Salt Stone, north of Scoble Point and Tosnos Point, the lower shore is of muddy shale gravel with stones and stable hard substrata (LMX) and the communities are rich. The sea lettuce *Ulva* sp., kelp *Laminaria saccharina*, the non-native alga *Sargassum muticum* and filamentous red algae are all common or abundant (LsacX). The surface fauna is dominated by ascidians, sponges and encrusting bryozoans. The topshells *Calliostoma zizyphinum* and *Gibbula cineraria* are also present. Many other species are found, including the brittlestar *Ophiothrix fragilis*, squat lobster *Galathea* spp. and the peacock worm *Sabella pavonina*. Burrowing anemones and polychaetes are present in the sediment.

In the upper estuary are broad mudflats extending to the sublittoral channels via a fairly steep bank. Conspicuous species on the surface of the flats include dense laver spire shells *Hydrobia ulvae* and patches of winkles *Littorina littorea* and *L. saxatilis* agg. Cockles *Cerastoderma edule* are evident in places. At Park Bay just south of Kingsbridge, the upper shore is colonised by the eelgrass *Zostera noltii* and green algae. Shore crabs *Carcinus maenas* are found at the edges of water courses in west Blanksmill Creek. Sediment infauna is rich, dominated by nematodes, polychaetes, oligochaetes and the sipunculan *Golfingia* sp. (HedOl). Other species present include the ragworm *Hediste diversicolor*, *Scoloplos armiger*, *Abra tenuis* and *Corophium volutator* (HedScr; HedStr).























**Figure 8.2** Indicative distribution of the main biotopes in the inlet (based on data from survey sites shown in Figure 8.1, cited literature and additional field observations) (Key to biotope symbols on next page).

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At the heads of the creeks at South Pool, Frogmore and in the Kingsbridge estuary, the upper shore rock possesses a reduced open coast community with some additional species (Fspi; Fcer). The saltmarsh plant *Salicornia* sp. and *P. canaliculata* grow together on broken shale at west Blanksmill Creek (Pel); *Rhodothamniella floridula* colonises bare rock below the *Ascophyllum* canopy at Southpool. Animals present include littorinids, *H. ulvae*, *G. locusta*, *C. maenas* and *E. modestus*. The upper mid-shore is of mud with shale and gravel. Fucoids colonise hard substrata and the fauna are similar to those of the upper shore (Asc.VS). Burrowing species include polychaetes and amphipods. The peppery furrow shell *Scrobicularia plana* is found at High House Point (HedScr); *L. conchilega* and cockles are found in muddy gravel near Southville Landing jetty (Lan). An unusual habitat is



found at the Boat Pool in an outflow channel. The biota on the stones is particularly rich in sponges, hydroids and ascidians with abundant brittlestars (?Fser.Fser.Bo).

 Exposed littoral rock with <i>Mytilus edulis</i> and barnacles (Ver.Por; PelB; BPat.Cht; Cor)	 Shallow sublittoral rock with <i>Laminaria digitata</i> and <i>Laminaria hyperborea</i> (Ldig.Ldig; Lhyp.Ft; Lhyp.Pk; Sac; XKScrR) and sand (Sell; FaS)
 Moderately exposed littoral rock with barnacles, fucoids and red algal turfs (Pel; BPat; Him; FvesB; Osm; Him)	 Sheltered shallow sublittoral rock with <i>Laminaria saccharina</i> (Lsac.Cod) and sublittoral mixed sediment (FaMx)
 Sheltered littoral rock (SLR) (no data)	 Shallow sublittoral tide-swept sheltered rock with <i>Laminaria saccharina</i> (Lsac.T)
 Littoral rock with fucoids and barnacles (Pel; Fspi; BPat.Sem; Fves; Asc.Asc; Fser.Fser; Fser.Fser.Bo)	 Shallow sublittoral mixed substrata with sponges, bryozoans and hydroids (SNemAdia)
 Saltmarsh (Sm; NVC SM8) and littoral rock with dense fucoids (Pel)	 Deep sublittoral mixed substrata with sponges, bryozoans and hydroids (XFa; SNemAdia; Flu.Hocu)
 Littoral mixed substrata with fucoids (FvesX; FserX) and littoral mixed sediments (LMX)	 Sublittoral silty rock with sponges and/or ascidians (SubSoAs; Aasp)
 Estuarine littoral rock with fucoids (Fspi; Asc.VS; Fcer)	 Lower shore or sublittoral sediment with <i>Zostera marina</i> beds (Zmar)
 Littoral sand and gravel (AP; AP.P; Lan; HedScr)	 Sublittoral muddy sand (FaMS; AbrNucCor) and sublittoral mixed sediment (FaMX; VsenMtru; EstMx)
 Soft mud shores (Mu; HedScr; HedStr; HedOl)	 Marine and estuarine sublittoral muds (MarMu; EstMu; AphTub)
 Littoral mixed sediments (LMX; VsenMtru)	 Sublittoral mixed substrata with <i>Laminaria saccharina</i> (LsacX)

### Sublittoral biotopes

On the open coast and at the entrance to Salcombe Harbour, areas of broken bedrock extend to a sand plain. Surge gullies and tunnels are widespread and possess characteristic communities (SCAn.Tub). The nearby sand covers the edge of the nearshore rock slope (FaG; Sell; FaS) and rock outcrops are present on the sand plain. On open rock surfaces that are clear of sand, the sublittoral fringe is dominated by crustose algae with large patches of mussels *Mytilus edulis* (Ldig.Ldig). The variety of foliose algae and animals is low. Rock below this sublittoral fringe is colonised by a dense forest of kelp *Laminaria hyperborea* and *Saccorhiza polyschides* (Lhyp.Ft or Sac). Notable is the presence of the southern ascidian *Distomus variolosus* usually in kelp holdfasts. Fish present include the ballan wrasse *Labrus bergylta*, the corkwing wrasse *Crenilabrus melops* and the two-spotted goby *Gobiusculus flavescens*. Crevices and overhangs are colonised by sponges, anemones and erect bryozoans (SCAs.ByH).

On moderately-exposed bedrock within the entrance to Salcombe Harbour, kelps *Laminaria ochroleuca*, *Laminaria saccharina* and *S. polyschides* are frequent and the ascidian *Stolonica socialis* is present (LsacSac). At the Black Stone, large numbers of conger eels *Conger conger* have been recorded and dense populations of tubicolous amphipods infest vertical surfaces. The slipper limpet *Crepidula fornicata* is frequent at Fort Charles. Tunnels and surge gullies (SCAn.Tub) are dominated by the bryozoans *Scrupocellaria* spp. Jewel anemones *Corynactis viridis* are common and the sponge *Leuconia caminus* is a particular feature. The featherstar *Antedon bifida* is found in gullies.

Rock partly-covered by sand is found at Great Eelstone and south of Leek Cove (XKScrR). Algae protrude through the sand or encrust bare rock, including the rarely recorded red alga *Gracilaria multipartita*. Animals are rare on the rock - species present include the anemone *Urticina felina* and the blue-rayed limpet *Helcion pellucidum*. Mussels *M. edulis* dominate the rock slopes south-west of Leek Cove. In the region of The Bar the bottom is of coarse rippled sand (Sell). Conspicuous species include hermit crabs, shrimp species, the netted dog whelk *Hinia reticulata*, the sea potato *Echinocardium cordatum* and bivalve molluscs. Sediment infauna is sparse and dominated by the polychaetes *Nephtys caeca* and *Chaetozone* sp. A few amphipods and venerupid bivalves are also present.



Off South Sands and Mill Bay, rock outcrops and mooring blocks are colonised by foliose algae and *L. saccharina* with *H. reticulata*, anemones, sponges and ascidians (Lsac.Cod). Tubicolous amphipods, mostly *Corophium volutator*, are abundant at South Sands Bay. At both sites, areas of level coarse sand are colonised by eelgrass *Zostera marina* (Zmar). At Mill Bay, streamers of sea lettuce *Ulva* sp. and the sand mason worm *Lanice conchilega* are present (Lcon). The banded chink shell *Lacuna vincta* is frequent on eelgrass leaves. Small flatfish and gobies inhabit the shallow bed. The sediment at South Sands is more species-rich, with a community similar to that of the coarse sand at The Bar (Sell). *Zostera* leaves are colonised by a variety of epibiota. The infauna at this site is fairly rich and includes the tube-dwelling polychaete *Lagis koreni*.

A very extensive area of tide-swept pebbles, gravel and muddy sand occurs across almost the whole inlet from Fort Charles to south of Batson Creek. Several distinct biotopes occur within this zone. Fringing the shore, shallow muddy sand is colonised by *Z. marina* (Zmar). Animal species include the anemones *Cereus pedunculatus* and *Cerianthus lloydii*, the top shell *Gibbula cineraria* and ascidians. Ballan wrasse *Labrus bergylta*, gobies and pollack *Pollachius pollachius* swim along the eelgrass. Areas of muddy sand with pebbles and shells, between patches of dense *Zostera*, support kelp *L. saccharina* (Lsac.Ft); no faunal species are recorded from this habitat. Areas of steeply sloping muddy sand with some pebbles, between about 2 and 5 m depth, support a variety of algae (LsacX). Sea hare *Aplysia punctata* and the urchin *Psammechinus miliaris* are additional to an otherwise similar fauna found in the *Zostera* bed. At about 6.5 m, pebbles and gravel on silty sand are colonised by abundant algae, predominantly *Gracilaria gracilis*, and a wide variety of animals, including anemones, the topshell *Calliostoma zizyphinum* and *Crepidula fornicata* (FaMS). At a similar depth, coarse sand waves are present. *Gracilaria* spp. colonise shells and hermit crabs; the common whelk *Buccinum undatum* and the starfish *Asterias rubens* are present. Dunes of clean sand have a sparse fauna including plaice *Pleuronectes platessa* (FaS). Sediments at Salcombe ferry and off Mill Bay have a very rich infauna including nemerteans, polychaetes, amphipods and bivalves (VsenMtru). The brittlestar *Amphipholis squamata* is present in fairly large numbers here.

Off Snapes Point and Scoble Point steep slopes of boulders and gravel on clay are present. This hard substratum is dominated by algae including foliose reds and *Sargassum muticum* (LsacX). Anthozoans and ascidians are present. The barnacle *Verruca stroemia* is dominant on cobbles and tubicolous amphipods are abundant. Deeper mixed substrata have a sparser algal cover; sponges, bryozoans and ascidians are common (SNemAdia; Flu.Hocu). On the level seabed at Scoble Point, cobbles are dominated by *V. stroemia* with anthozoans and hydroids conspicuous. Deeper boulders protruding from the clay slope provide a point of attachment for a variety of animals: sponge, bryozoan crusts and the ascidian *Ascidiella aspersa* (Aasp).

Muddy sand with shell gravel and pebbles extends throughout the main channel from Salcombe to the Salt Stone (FaMx; VsenMtru). Burrowing species includes many conspicuous species, like the anemones *C. lloydii*, *C. pedunculatus* and *Sagartiogeton undatus*, and the sabellid worms *Myxicola infundibulum*, *Sabella pavonina* and *Megalomma vesiculosum*. Several crab and fish species frequent the area. The sediment infauna is characterised by a rich polychaete and amphipod assemblage. Algae are present throughout, where stable hard substrata occur. On a very shallow bank at Middle Ground, there is a dense algal covering with a rich associated fauna of sponges, ascidians and brittlestars (?LsacRS.FiR); with increasing depth the algae disappear but a rich faunal community remains (?SubSoAs; Aasp). Shallow fine sand and mud with gravel at Salt Stone is colonised by silt-tolerant algae and *L. saccharina* with ascidians *A. aspersa* and *Styela clava* (LsacX).

*Ascidiella aspersa* also dominates in Southpool Creek; on the sandy mud in the middle of the creek, large clumps of the ascidian are colonised by sponges and anemones. Burrowing anemones and polychaetes inhabit the sediment (EstMu). At the edges of the channel are dense but patchy algae; brittlestars *Ophiothrix fragilis* are common and fan worms *Sabella* spp. are present (LsacX). At the mouth of Frogmore Creek and off Gerston Point there are very little hard substrata - the bottom is smooth, diatom-filmed mud. Groves of the peacock worm *S. pavonina* are the most conspicuous feature. Ascidians and burrowing polychaetes and anemones are also found here. The infauna here and at the mouth of Southpool Creek is impoverished and dominated by cirratulid polychaetes (EstMu).

*Nephtys hombergii* and *Chaetozone* sp. are present in high numbers. Bivalves, particularly *Thyasira flexuosa* and *Abra* spp., are more abundant at the mouth of Southpool Creek. Ditch End Cove, at the mouth of Southpool creek, contains a rich mud community (AphTub) - high numbers of the sipunculan worm *Golfingia* sp., several species of polychaetes, oligochaetes and the burrowing amphipod *Corophium volutator*.

The floats of a pontoon at The Bag, opposite Ox Point, are colonised by a community unique within the estuary. Algae extend down the vertical sides of the floats. Species present are mostly also found elsewhere but the presence of the red algae *Corallina officinalis* and *Palmaria palmata* is unusual. Dense animal communities are present below the algal belt including many anemones and the hydroid *Tubularia larynx*, jassid amphipods and mussels *M. edulis*. Ascidians cover the underside of the floats. Most unusually, large numbers of jewel anemones *C. viridis* are found on the floats.

## Nature conservation

Conservation sites			
Site name	Position	Status	Main features
South Devon	N/A	AONB	High scenic quality
South Devon	SX517484- SX928543	HC	Coastal scenery
Salcombe and Kingsbridge estuary	SX746406	SSSI/LNR	Biological
Bolt Tail to Salcombe (including Kingsbridge estuary)	SX674406- SX837458	SMA	Marine biological
Bolt Head to Bolt Tail	SX700370	SSSI; NT	Biological; cliffs and farmland
Mill Bay to Prawle Point	SX740375	NT	Headland, cliff and farmland
Snapes Point	SX735395	NT	Coastal farmland

## Human influences

Industrial activities within the inlet are restricted to the harbour at Salcombe and boat building and repair yards at Lincombe and Goodshelter. The hinterland is predominantly rural in nature.

Oyster *Ostrea edulis* cultivation, fyke-netting for eels *Anguilla anguilla*, fish netting and shrimping take place within the inlet. Bait-digging and collecting occur as does commercial gathering of winkles *Littorina littorea*, cockles *Cerastoderma edule*, mussels *Mytilus edulis* and oysters which are harvested by hand. Fishing vessels use Salcombe Harbour but their activities are almost entirely outside the estuary.

There are around two thousand moorings within the inlet and a marina and dinghy/boat park at Salcombe. Power boating and sailing take place throughout and angling is particularly popular. Beach recreation is most intensive on the lower reaches, especially at North Sands, South Sands and the area from Mill Bay to Ditch End.

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- Survey 241: 1985 HRE survey of Salcombe Harbour and the Kingsbridge estuary (Hiscock 1986).
- Survey 265: 1970-1980 SMBA/MBA Great Britain intertidal survey (Powell *et al.* 1978).
- Survey 300: 1991 Devon Wildlife Trust Seasearch survey of Salcombe Harbour (Devon Wildlife Trust, unpublished data).
- Survey 303: 1991-93 Devon Wildlife Trust littoral survey of Salcombe estuary (Devon Wildlife Trust, unpublished data).
- Survey 437: 1990 NRA SW Region littoral and sublittoral survey of the Kingsbridge estuary (National Rivers Authority SW Region 1992).

Littoral sites (listed north to south)					
Survey	Site	Place	Grid reference	Latitude/longitude	Biotopes present
437	1	Kingsbridge, Kingsbridge estuary.	SX 736 437	50°16.7'N 03°46.4'W	HedStr
437	2	Bowcombe Creek, Kingsbridge estuary.	SX 747 434	50°16.6'N 03°45.5'W	HedScr
241	16	High House Point, N of Salt Stone.	SX 743 428	50°16.2'N 03°45.8'W	Ver.Ver, Pel, Fspi, Asc.Asc, FserX, Lan, HedScr
241	17	Southville Landing Jetty, N of Salt Stone.	SX 742 428	50°16.2'N 03°45.9'W	Fves, Fser.Fser
437	3	High House Point, Kingsbridge estuary.	SX 743 427	50°16.2'N 03°45.8'W	HedScr
437	5	Frogmore, Kingsbridge estuary.	SX 772 426	50°16.2'N 03°43.4'W	HedStr
241	18	Frogmore, Frogmore Creek.	SX 773 425	50°16.1'N 03°43.3'W	Fspi, Asc.VS, HedStr, HedOl
437	4	Collapit Creek House, Kingsbridge estuary.	SX 733 418	50°15.7'N 03°46.6'W	HedStr
241	19	W. Blanksmill, N of Salt Stone.	SX 733 410	50°15.2'N 03°46.6'W	Pel, Fspi, Asc.Asc, FvesX, ZnoI, Mu
241	7	Salt Stone, Salt Stone to Scoble Point.	SX 746 407	50°15.1'N 03°45.5'W	Asc.Asc, Fser.Fser, SByAs, HedOl, LMX, Lsac.Ft, VsenMtru
303	1	Saltstone, Salcombe estuary.	SX 746 407	50°15.1'N 03°45.5'W	Pel, Fspi, Fser.Fser.Bo, AscX, Lan
437	6	Halwell Wood, Kingsbridge estuary.	SX 753 407	50°15.1'N 03°44.9'W	HedStr
437	7	Lincombe boatyard, Kingsbridge estuary.	SX 744 404	50°14.9'N 03°45.7'W	HedStr



## Littoral sites (listed north to south) continued

<i>Survey</i>	<i>Site</i>	<i>Place</i>	<i>Grid reference</i>	<i>Latitude/longitude</i>	<i>Biotores present</i>
241	5	N Tosnos Point, Salt Stone to Scoble Point.	SX 747 402	50°14.8'N 03°45.4'W	Ver.Ver, Pel, Fspi, Asc.Asc, Fserr.T, SByAs, LMX
241	4	S Tosnos Point, Salt Stone to Scoble Point.	SX 746 401	50°14.8'N 03°45.5'W	Pel, Fspi, Asc.Asc, Fser.Fser, Fser.Fser.Bo
241	20	Southpool, Southpool Creek.	SX 773 401	50°14.8'N 03°43.2'W	Fspi, Asc.VS, Fcer
437	10	Snapes Manor, Kingsbridge estuary.	SX 741 397	50°14.5'N 03°45.9'W	HedStr
241	10	Scoble Point, Salt Stone to Scoble Point.	SX 748 394	50°14.4'N 03°45.3'W	YG, Ver.Ver, Pel, BPat.Sem, Fspi, Fves, Rho, Fser.Fser, Fser.Fser.Bo
241	13	Boat Lake, Southpool Creek.	SX 755 394	50°14.4'N 03°44.7'W	YG, Ver.Ver, Pel, Fspi, Fves, Asc.Asc, Fser.Fser.Bo, FvesX, FserX
241	14	Snapes Point, Salt Stone to Scoble Point.	SX 746 394	50°14.4'N 03°45.5'W	YG, Ver.Ver, Pel, BPat, Fspi, Asc.Asc, Fser.Fser, Fser.Fser.Bo
241	11	N. Horsepool Cove, Southpool Creek.	SX 753 392	50°14.3'N 03°44.9'W	Pel, Fspi, Asc.Asc, FvesX, FserX, HedStr, AphTub
241	12	Ditchend Cove, Ditch End to Mill Bay.	SX 747 389	50°14.1'N 03°45.4'W	YG, Ver.Ver, Pel, BPat.Sem, Fspi, Fves, FserX, Lan, HedMac.Pyg, AphTub
437	8	Waterhead Creek, Kingsbridge estuary.	SX 765 389	50°14.1'N 03°43.9'W	HedStr
437	9	Ditchend Cove, Kingsbridge estuary.	SX 747 389	50°14.1'N 03°45.4'W	AphTub
265	320	Mill Bay, Salcombe estuary.	SX 740 383	50°13.8'N 03°46.0'W	VsenMtru
437	11	Mill Bay, Kingsbridge estuary.	SX 740 383	50°13.8'N 03°46.0'W	Lan
241	1	North Sands.	SX 731 381	50°13.7'N 03°46.7'W	AP.P
241	9	Salcombe Castle (Fort Charles), Black Stone and The Bar.	SX 734 381	50°13.7'N 03°46.5'W	YG, Ver.Ver, Pel, BPat.Sem, Fspi, Osm, Him, Cor, FK, SR, SByAs
265	304	Fort Charles, Salcombe estuary.	SX 734 381	50°13.7'N 03°46.5'W	Pel, FvesB, Fser.Fser
265	322	North Sands, Salcombe estuary.	SX 732 381	50°13.7'N 03°46.6'W	AP.P
437	12	North Sands Bay, Kingsbridge estuary.	SX 732 381	50°13.7'N 03°46.6'W	AP
241	3	Limebury Point, Black Stone and The Bar.	SX 736 375	50°13.4'N 03°46.3'W	YG, Ver.Ver, PelB, BPat.Cht, Him, Cor, Cor.Bif, FK, Lsac.Ldig
241	2	E of Leek Cove, Black Stone and The Bar.	SX 737 373	50°13.2'N 03°46.2'W	YG, Ver.Ver, BPat.Cht, BPat.Lic, Fspi, Him, Cor, G, SR, Ldig.Ldig

<b>Sublittoral sites (listed north to south)</b>					
<i>Survey</i>	<i>Site</i>	<i>Place</i>	<i>Grid reference</i>	<i>Latitude/longitude</i>	<i>Biotores present</i>
241	D1	Gerston Point Deep.	SX 740 416	50°15.6'N 03°46.0'W	AphTub
241	43	Gerston Point, N of Salt Stone.	SX 742 416	50°15.6'N 03°45.9'W	EstMu
241	D2	Gerston Point Shallow.	SX 740 415	50°15.5'N 03°46.0'W	AphTub
241	40	W of Salt Stone, Salt Stone to Scoble Point.	SX 745 408	50°15.1'N 03°45.6'W	FaMS, LsacX
241	42	Frogmore Creek.	SX 753 407	50°15.1'N 03°44.9'W	EstMu
241	D3	Salt Stone, Salt Stone to Scoble Point.	SX 744 407	50°15.1'N 03°45.6'W	VsenMtru
241	41	S of Salt Stone, Salt Stone to Scoble Point.	SX 747 406	50°15.0'N 03°45.4'W	LsacX
300	1	Saltstone (SW).	SX 747 406	50°15.0'N 03°45.4'W	LsacX
437	A	Halwell Point, Kingsbridge estuary.	SX 748 403	50°14.9'N 03°45.3'W	VsenMtru
241	D4	Tosnos-Hallwell Point, Salt Stone to Scoble Point.	SX 745 402	50°14.9'N 03°45.5'W	VsenMtru
241	36	N Tosnos Point, Salt Stone to Scoble Point.	SX 747 402	50°14.8'N 03°45.4'W	Lsac.Cod, LsacX
300	2	Ox Point, The Bag.	SX 748 398	50°14.6'N 03°45.3'W	LsacX
300	3	Pontoons, The Bag.	SX 746 397	50°14.6'N 03°45.5'W	CuSH
241	D5	Ox Point, Salt Stone to Scoble Point.	SX 745 396	50°14.5'N 03°45.6'W	VsenMtru
197	12	Ox Point, Salcombe and Kingsbridge estuary.	SX 747 396	50°14.5'N 03°45.4'W	LsacX
241	35	Pontoon, The Bag, Salt Stone to Scoble Point.	SX 746 396	50°14.5'N 03°45.5'W	Ent, Lsac.T, Aasp, FaMS, LsacX
437	B	Ox Point, Kingsbridge estuary.	SX 747 396	50°14.5'N 03°45.4'W	VsenMtru
241	D6	The Bag (deep pit), Southpool Creek.	SX 745 395	50°14.5'N 03°45.6'W	AbrNucCor
197	11	The Bag, Salcombe and Kingsbridge estuary.	SX 746 395	50°14.4'N 03°45.5'W	EstMu
197	6	Recent spoil northwards to E. Herbert Bank, Salcombe and Kingsbridge estuary.	SX 748 394	50°14.4'N 03°45.3'W	Aasp
300	4	Halfway between Scoble Point and Snape's Point, Snapes Point to Scoble Point.	SX 748 394	50°14.4'N 03°45.3'W	EstMx
300	5	Scoble Point to Snapes Point, Snapes Point to Scoble Point.	SX 748 394	50°14.4'N 03°45.3'W	Lsac.T, EstMx
300	6	Scoble Pt. to Snapes Pt, Snapes Point to Scoble Point.	SX 746 394	50°14.4'N 03°45.5'W	Lsac.T
197	34	Scoble Point, Salcombe and Kingsbridge estuary.	SX 748 393	50°14.3'N 03°45.3'W	Aasp, LsacX
241	33	Snapes Point, Salt Stone to Scoble Point.	SX 746 393	50°14.3'N 03°45.5'W	Lsac.T, ByH, Flu.Hocu, Aasp, FaMS, LsacX
241	34	Scoble Point, Salt Stone to Scoble Point.	SX 748 393	50°14.3'N 03°45.3'W	Lsac.T, SNemAdia
197	38	Middle Ground, Salcombe and Kingsbridge estuary.	SX 746 392	50°14.3'N 03°45.4'W	FaG, ?LsacRS.FiR
197	7	Middle Ground (Recent spoil west to Snape Point), Salcombe and Kingsbridge estuary.	SX 747 392	50°14.3'N 03°45.4'W	LsacX
241	38	Middle Ground, Ditch End to Mill Bay.	SX 747 392	50°14.3'N 03°45.4'W	Lsac.Ft, LsacX
300	7	Parallel to Scoble Point, Middle Ground.	SX 748 392	50°14.3'N 03°45.3'W	Aasp, MarMu
300	9	Off Ditch End, Middle Ground.	SX 747 392	50°14.3'N 03°45.4'W	FaG
241	D8	Southpool Creek.	SX 748 391	50°14.3'N 03°45.3'W	AphTub
241	39	Southpool Creek.	SX 751 391	50°14.2'N 03°45.1'W	FaMS, LsacX
300	8	Southpool Creek.	SX 752 391	50°14.2'N 03°45.0'W	EstMu
241	D7	Ditch End, Ditch End to Mill Bay.	SX 745 390	50°14.2'N 03°45.5'W	AbrNucCor
197	8	DTP-licensed dredge spoil ground, Salcombe and Kingsbridge estuary.	SX 746 390	50°14.2'N 03°45.5'W	SubSoAs
197	37	SW Ditchend Salcombe Harbour, Salcombe and Kingsbridge estuary.	SX 746 389	50°14.1'N 03°45.5'W	SubSoAs, Aasp, FaMS
241	37	Ditch End, Ditch End to Mill Bay.	SX 746 389	50°14.1'N 03°45.5'W	Aasp, FaMS
300	10	Ditch End, Middle Ground.	SX 747 389	50°14.1'N 03°45.4'W	FaMx
241	D9	Salcombe Ferry, Ditch End to Mill Bay.	SX 740 388	50°14.1'N 03°45.9'W	VsenMtru
241	30	Salcombe Drift, Ditch End to Mill Bay.	SX 740 387	50°14.0'N 03°46.0'W	LsacX



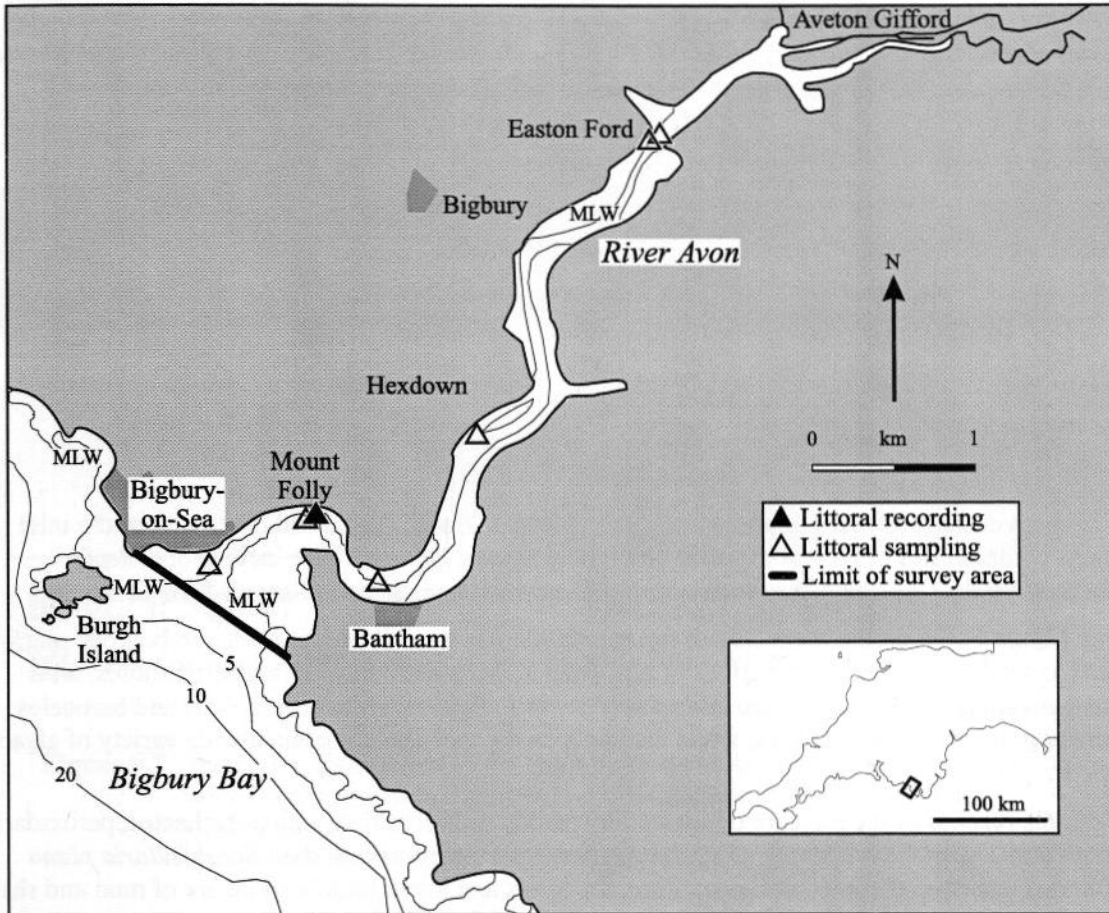
## Sublittoral sites (listed north to south) continued

Survey	Site	Place	Grid reference	Latitude/longitude	Biotores present
197	30	Salcombe 'drift' (Marine Hotel), Salcombe and Kingsbridge estuary.	SX 740 386	50°14.0'N 03°46.0'W	LsacX
241	31	Marine Hotel, Ditch End to Mill Bay.	SX 741 386	50°14.0'N 03°45.9'W	Lsac.Ft, FaS, Zmar, FaMS, LsacX
300	11	Smalls Cove to Marine Hotel, Millbay to Marine Hotel.	SX 742 386	50°14.0'N 03°45.8'W	FaS, Zmar, LsacX
437	C	Mill Bay, Kingsbridge estuary.	SX 737 384	50°13.8'N 03°46.2'W	Sell
241	45	Mill Bay, Ditch End to Mill Bay.	SX 739 382	50°13.7'N 03°46.0'W	XKScrR, FaS, Lcon, Zmar, LsacX
241	D10	Mill Bay, Ditch End to Mill Bay.	SX 735 382	50°13.7'N 03°46.3'W	VsenMtru
300	13	Off Bridlehead Point, Middle Ground.	SX 738 382	50°13.7'N 03°46.1'W	FaS, Zmar
300	12	Millbay to Smalls Cove, Millbay to Marine Hotel.	SX 739 381	50°13.7'N 03°46.0'W	FaS, Zmar, LsacX
241	32	Fort Charles, Black Stone and The Bar.	SX 735 380	50°13.6'N 03°46.4'W	LsacSac, SCAs.ByH, MCR, FaS, LsacX
300	15	Fort Charles, The Bag.	SX 735 380	50°13.6'N 03°46.4'W	Lhyp.Pk, LsacX
300	16	Sandhill Point (Towards N Sands), Fort Charles.	SX 735 380	50°13.6'N 03°46.4'W	XKScrR
300	18	Blackstone Reef, Salcombe.	SX 736 379	50°13.6'N 03°46.3'W	Lhyp.Pk
241	44	Black Stone, Black Stone and The Bar.	SX 736 378	50°13.5'N 03°46.3'W	SCAs.ByH, Sac, XKScrR, LsacX
300	14	Blackstone.	SX 736 378	50°13.5'N 03°46.3'W	LsacX
300	17	Fort Charles.	SX 733 378	50°13.5'N 03°46.5'W	XKScrR
300	19	Blackstone Reef.	SX 736 377	50°13.5'N 03°46.3'W	XKScrR
241	27	S. Southsands, Black Stone and The Bar.	SX 731 376	50°13.4'N 03°46.7'W	Lsac.Cod, FabMag, Zmar
437	D	Bass Rock, Kingsbridge estuary.	SX 733 376	50°13.4'N 03°46.5'W	Sell
300	20	W of Limebury Point, Bar.	SX 736 375	50°13.4'N 03°46.3'W	XKScrR
241	28	N of the Bar, Black Stone and The Bar.	SX 734 374	50°13.3'N 03°46.4'W	FaS, LsacX
241	29	SE of Leck Cove, Black Stone and The Bar.	SX 738 372	50°13.2'N 03°46.1'W	Lhyp.Ft, SCAn.Tub, XKScrR
300	21	The Bar.	SX 736 371	50°13.1'N 03°46.3'W	XKScrR
437	E	The Bar, Kingsbridge estuary.	SX 732 371	50°13.1'N 03°46.6'W	Sell
241	21	S of the Bar, Black Stone and The Bar.	SX 735 370	50°13.1'N 03°46.4'W	Sell, FaS
437	F	Little Eelstone, Kingsbridge estuary.	SX 734 367	50°12.9'N 03°46.4'W	Sell
241	22	Great Eelstone, Starehole Bay.	SX 731 366	50°12.9'N 03°46.7'W	Ldig.Ldig, Sac, XKScrR, Lsac.Ldig, AlcMaS, FaS



**Location**

<i>Position (centre)</i>	SX6745	50° 16' N 03° 53' W
<i>Administrative area</i>	Devon	South Hams
<i>Conservation agency/area</i>	English Nature	Devon & Cornwall



**Figure 9.1** Main features of the area, and sites surveyed.

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**Physical features**

<i>Physiographic type</i>	Ria
<i>Length of coast</i>	17.8 km
<i>Area of inlet</i>	Total 170 ha; intertidal 130 ha
<i>Length of inlet</i>	7 km
<i>Bathymetry</i>	Very shallow; maximum depth not recorded
<i>Wave exposure range</i>	Exposed to extremely sheltered
<i>Tidal stream range</i>	Weak
<i>Tidal range</i>	4.7 m (spring); 2.2 m (neap)
<i>Salinity range</i>	Fully marine to upper estuarine

## Introduction

This ria, which includes the River Avon and three small tributaries, lies on the south coast of Devon. The river winds through a narrow steep-sided valley from Aveton Gifford to the sea where it empties into Bigbury Bay. The inlet has been substantially filled with predominantly alluvial sediments and almost dries at low tide except for the very shallow river channel. Sediments, therefore, dominate the inlet with some areas of bedrock at the entrance and some upper shore hard substrata in the upper reaches. Saltmarsh is present between Aveton Gifford and Hexdown. Water quality is classified as grade A.

The inlet lies within the South Devon Area of Outstanding Natural Beauty and is a Coastal Preservation Area (designated by Devon County Council). Small colonies of seabirds are known to breed within the inlet and it is a nationally important site for overwintering common sandpiper and greenshank. The inlet is a major nursery area for bass *Dicentrarchus labrax* and as such is subject to a closed season over the summer months. Atlantic salmon *Salmo salar* and sea trout *Salmo trutta* migrate to the inlet to spawn up river. These salmonids are protected by Net Limitation Orders that restrict the number of nets used in the inlet.

### Marine biological surveys

	<i>Survey methods</i>	<i>Date(s) of survey</i>	<i>Source</i>
<i>Littoral</i>	Recording	May 1987	Moore (1988)
	Infaunal sampling (cores)	May 1991	NRA (unpublished data)
	Infaunal sampling (cores)	May 1987	Moore (1988)

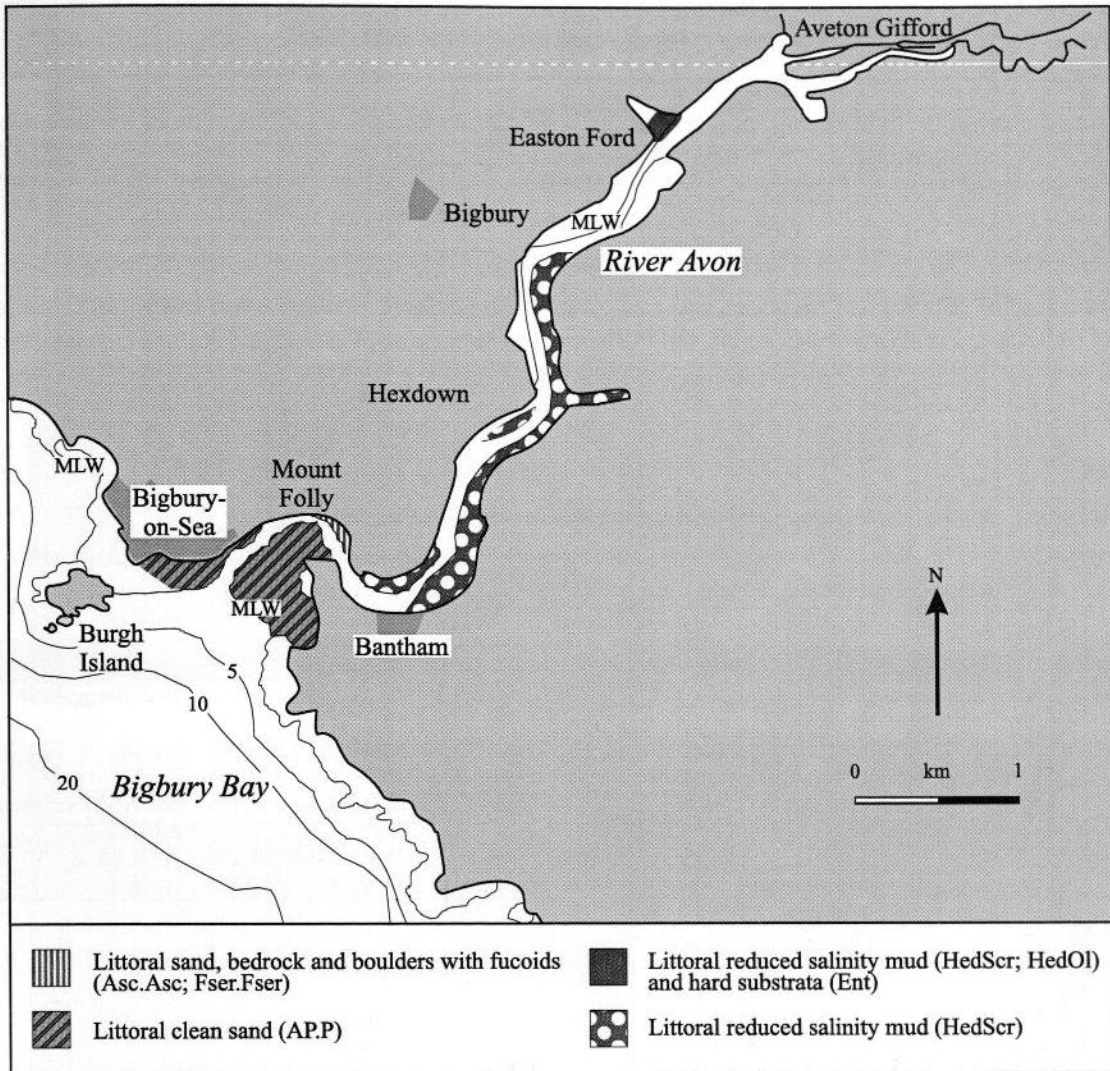
## Marine biology

There is a paucity of data on the marine biology of this inlet.

The extensive beach of wave-exposed clean sand between Burgh Island and the mouth of the inlet contains communities of typical exposed-beach polychaetes (AP.P). These include *Scolecopsis tridentata*, *Nephtys* sp. and *Magelona mirabilis*. Sand eels *Ammodytes* sp. are also frequent.

Below Mount Folly, on the north side of the mouth, there is a small area of sheltered bedrock platform subject to sand-scour. The communities of algae and animals are typical of sheltered shores, with *Fucus vesiculosus* and *Ascophyllum nodosum* (Asc.Asc), *Fucus serratus* (Fser.Fser) and barnacles dominating the open rock surfaces, while the pools on the mid-shore contain a wide variety of algae (SwSed).

The middle reaches of the inlet are dominated by muddy sediment flats with polychaetes, particularly the ragworm *Hediste diversicolor*, oligochaetes and the peppery furrow shell *Scrobicularia plana* (HedScr). Further up the inlet, at Easton Ford, the lower and lower middle shore are of mud and shale gravel. The banks are narrow and this habitat is not extensive. The infaunal community is again dominated by *H. diversicolor* and *S. plana* in addition to typical upper estuarine species of oligochaetes and amphipods including *Corophium volutator* (HedScr; HedOl). The middle and upper middle shore is of steep bedrock and boulders which are affected by freshwater run-off. These shores are covered by filamentous green algae with some *Fucus vesiculosus* and *Fucus spiralis* (Ent). On the upper shore the black lichen *Verrucaria maura* is present.



**Figure 9.2** Indicative distribution of the main biotopes in the inlet (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	Position	Status	Main features
South Devon	N/A	AONB	High scenic quality
South Devon	SX517484- SX928543	HC	Coastal scenery
Cleaton Hill	SX655442	NT	Coastal hill

## Human influences

The hinterland is predominantly rural and there is no industry within the inlet. A passenger ferry runs from Bantham in summer.

Seine netting for salmon *Salmo salar* takes place and bait-digging and collecting (lugworms *Arenicola marina*, shore crab *Carcinus maenas* and razor shells *Ensis* sp.) is carried out. Exploitable populations



of mussel *Mytilus edulis* occur in the inlet. The natural stocks of mussel are re-seeded and harvested by hand. Pacific oysters *Crassostrea gigas* are cultivated in the inlet. Some grazing occurs on the saltmarsh.

Leisure activities include sailing, power boating, windsurfing and water skiing, centred on the lower reaches. Beach recreation and surfing are popular at Bantham.

### References and further reading

Moore, J. 1988. Surveys of harbours, rias and estuaries in southern Britain: Avon and Erme estuaries. (Contractor: Field Studies Council, Oil Pollution Research Unit, Pembroke.) *Nature Conservancy Council, CSD Report*, No. 854. (FSC Report, No. FSC/OPRU/5/88.)

### Sites surveyed

Survey 252: 1987 HRE survey of the Avon and Erme estuaries (Moore 1988).

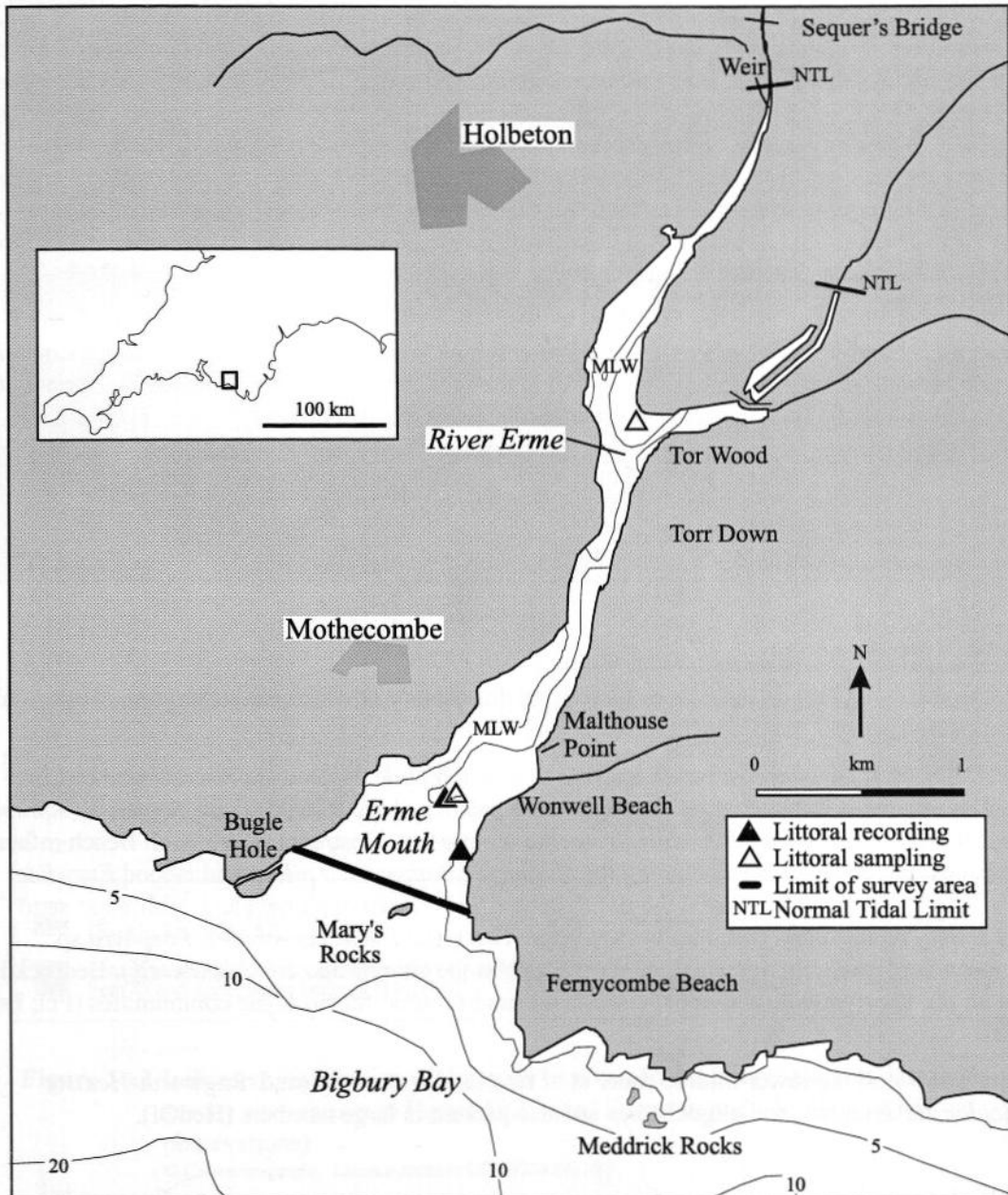
Survey 622: 1991 NRA SW Region littoral survey of the Avon estuary (National Rivers Authority, unpublished data).

Littoral sites (listed north to south)					
Survey	Site	Place	Grid reference	Latitude/longitude	Biotopes present
252	A3	Easton Ford, Avon estuary.	SX 683 467	50°18.2'N 03°50.9'W	Ent, HedScr
622	1	Easton Ford, Avon estuary (South Hams).	SX 683 467	50°18.2'N 03°50.9'W	HedOl
622	2	Villa Crusoe, Avon estuary (South Hams).	SX 672 448	50°17.2'N 03°51.8'W	HedScr
252	A4	Below Mount Folly, Avon estuary.	SX 662 444	50°17.0'N 03°52.7'W	Asc.Asc, Fscr.Fscr, SwSed
252	A2	Bigbury Sands, Avon estuary.	SX 655 440	50°16.8'N 03°53.2'W	AP.P, Ol
622	3	Cockleridge, Avon estuary (South Hams).	SX 665 439	50°16.7'N 03°52.4'W	HedScr

Compiled by: Jan Smith and Jon Moore

## Location

<i>Position (centre)</i>	SX6248	50° 18' N 03° 57' W
<i>Administrative area</i>	Devon	South Hams
<i>Conservation agency/area</i>	English Nature	Devon & Cornwall



**Figure 10.1** Main features of the area, and sites surveyed.

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Physical features	
<i>Physiographic type</i>	Ria
<i>Length of coast</i>	16 km
<i>Area of inlet</i>	Total 100 ha; intertidal 60 ha
<i>Length of inlet</i>	6 km
<i>Bathymetry</i>	Very shallow; maximum depth not recorded
<i>Wave exposure range</i>	Exposed to extremely sheltered
<i>Tidal stream range</i>	Weak
<i>Tidal range</i>	4.7 m (spring); 2.2 m (neap)
<i>Salinity range</i>	Fully marine to upper estuarine

## Introduction

The River Erme lies on the south coast of Devon and runs through a narrow wooded valley from a weir just south of Sequer's Bridge to the sea where it empties into Bigbury Bay. It is very secluded and almost completely unspoilt. The inlet has been substantially infilled and at low water the river channel is very shallow and broad. The sediments remain sandy for some distance away from the entrance where there are areas of bedrock. The shores within the estuary are often steep and rugged. Saltmarsh is present in the upper reaches, grading into woodland and wet meadows. Freshwater input is low and the water quality is classified as grade A (highest quality). Atlantic salmon *Salmo salar* and sea trout *Salmo trutta* migrate to the inlet to spawn upriver.

The entire inlet is a Site of Special Scientific Interest. It also lies within the South Devon Area of Outstanding Natural Beauty and is a Coastal Preservation Area (defined by Devon County Council). Small numbers of waterfowl feed and roost within the inlet, which is also frequented by otters *Lutra lutra*. Rare and notable flora and coastal invertebrate fauna are also present.

Marine biological surveys			
	<i>Survey methods</i>	<i>Date(s) of survey</i>	<i>Source</i>
<i>Littoral</i>	Recording	May 1987	Moore (1988)
	Infaunal sampling (cores)	May 1987	Moore (1988)

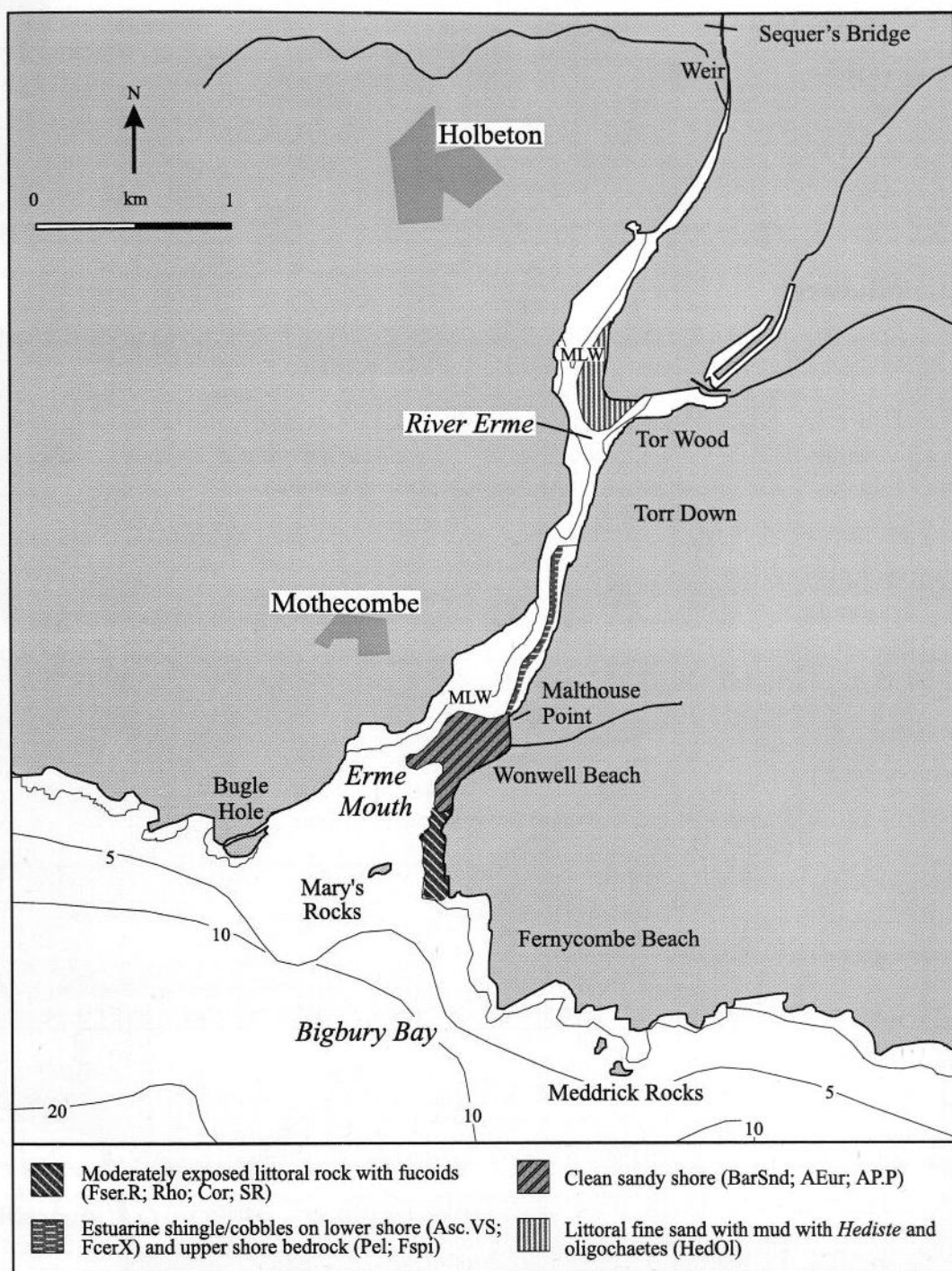
## Marine biology

There is a paucity of data on the marine biology of this estuary in which the substratum is essentially all sediment.

At Wonwell Beach an extensive beach consists of clean, mobile, rippled and waved sand (AEur; AP.P). The infauna is impoverished although dense patches of the spionid worm *Scolecopsis squamata* are present and a few lugworms *Arenicola marina* are present. Upstream at Wonwell Beach infauna are typical of mobile sediments including the amphipod *Bathyporeia pilosa* and isopod *Eurydice pulchra*. The lower shore banks and the river channel bed consist of shingle and cobbles on sand. The salinity is very reduced and communities are poor. The algae *Fucus ceranoides*, *Porphyra* sp., *Enteromorpha* sp. and other green algae are present on the shingle and cobbles (FcerX). Bedrock is present on the upper-middle and upper shore with sand-scoured fucoid algae communities (Pel; Fspi; Asc.VS).

Opposite Tor Wood the lower-middle shore is of fine sand with some mud. Ragworm *Hediste diversicolor* are abundant and oligochaetes are also present in large numbers (HedOl).





**Figure 10.2** Indicative distribution of the main biotopes in the inlet (based on data from survey sites shown in Figure 10.1, cited literature and additional field observations).

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## Nature conservation

Conservation sites			
Site name	Position	Status	Main features
South Devon	N/A	AONB	High scenic quality
South Devon	SX517484- SX928543	HC	Coastal scenery
Erme estuary	SX623490	SSSI	Biological

## Human influences

The estuary and adjacent land is owned by the Flete estate, which has maintained its essentially natural character. Some sand extraction takes place upstream of Mothecombe.

There is a fish farm on the inlet.

Leisure activities are limited. Sailing, power boating and windsurfing occur in the lower reaches as far upstream as Wonwell. Riding and beach recreation take place in this area.

## References and further reading

Moore, J. 1988. Surveys of harbours, rias and estuaries in southern Britain: Avon and Erme estuaries. (Contractor: Field Studies Council, Oil Pollution Research Unit, Pembroke.) *Nature Conservancy Council, CSD Report*, No. 854. (FSC Report, No. FSC/OPRU/5/88.)

## Sites surveyed

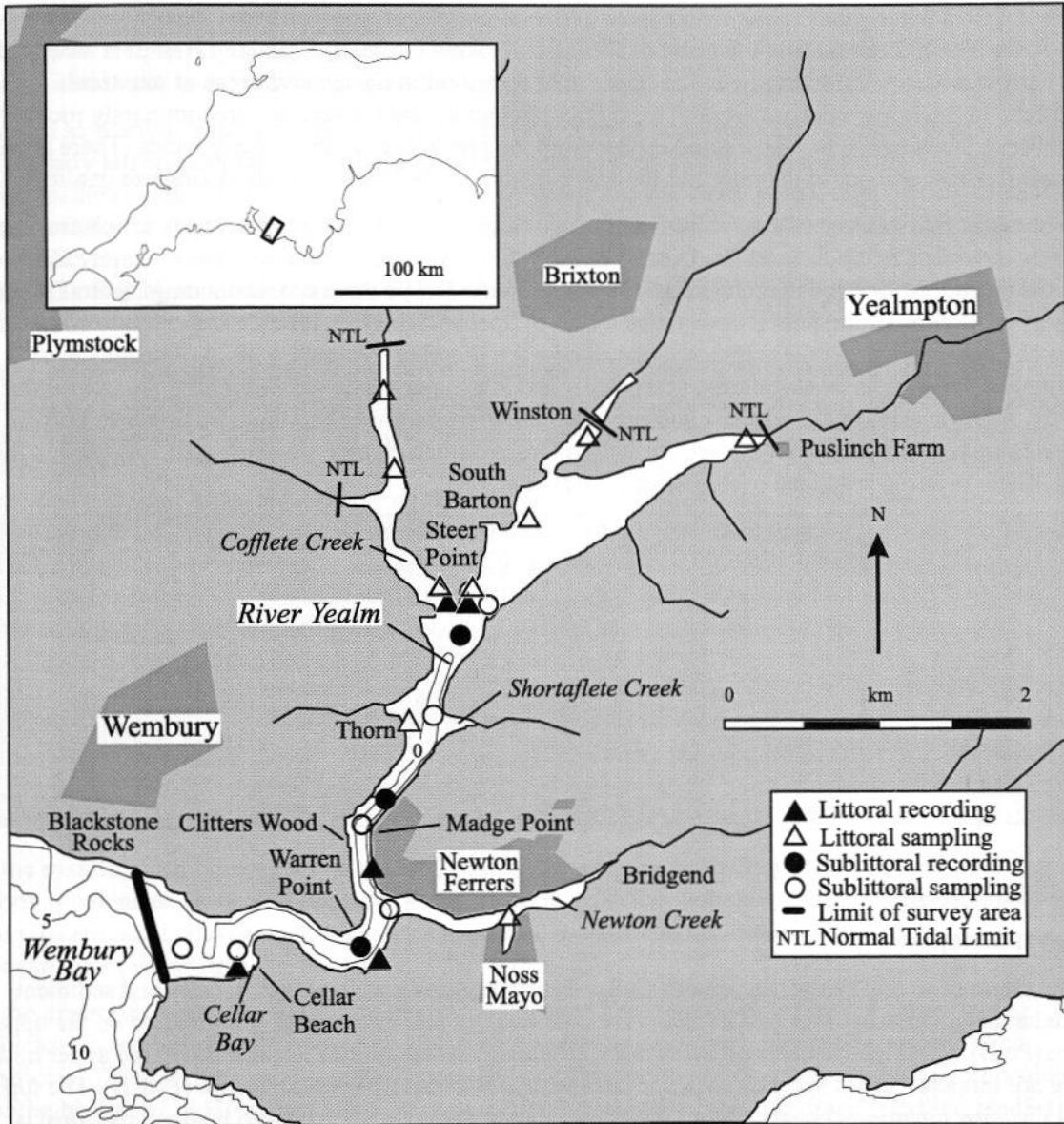
Survey 252: 1987 HRE survey of the Avon and Erme estuaries (Moore 1988).

Littoral sites (listed north to south)					
Survey	Site	Place	Grid reference	Latitude/longitude	Biotopes present
252	E3	Below Torr Wood, Erme estuary.	SX 623 488	50°19.3'N 03°56.0'W	HedOl
252	E2	Wonwell beach, Erme estuary.	SX 613 471	50°18.4'N 03°56.8'W	Pcl, Fspi, Asc.VS, FcerX, BarSnd, AEur, AP.P
252	E1	Red Cove, Erme estuary.	SX 614 468	50°18.2'N 03°56.7'W	Fser.R, Rho, Cor, FK, SR

Compiled by: Jan Smith and Jon Moore

**Location**

<i>Position (centre)</i>	SX5449	50° 18' N 04° 03' W
<i>Administrative area</i>	Devon	South Hams
<i>Conservation agency/area</i>	English Nature	Devon & Cornwall



**Figure 11.1** Main features of the area, and sites surveyed.

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Physical features	
<i>Physiographic type</i>	Ria
<i>Length of coast</i>	28.1 km
<i>Area of inlet</i>	Total 446 ha; intertidal 154 ha
<i>Length of inlet</i>	7.7 km
<i>Bathymetry</i>	Shallow; maximum depth 13 m in Wembury Bay
<i>Wave exposure range</i>	Exposed to extremely sheltered
<i>Tidal stream range</i>	Max. 4 knots
<i>Tidal range</i>	4.7 m (spring); 2.2 m (neap)
<i>Salinity range</i>	Fully marine to low

## Introduction

The River Yealm lies on the south coast of Devon and enters the sea at Wembury Bay. It is steep sided and narrow with several tributaries. The upper inlet opens out into extensive areas of intertidal mudflats. In the lower inlet are areas of sand flat although the shores here are predominantly rocky. A sand bar at the entrance provides some shelter from the prevailing south-westerly winds. There is only a small freshwater input to the inlet and the water quality is classified as grade A (highest quality).

The conservation interest of the Yealm is high due mainly to the diversity of biotopes which are almost entirely natural. The whole inlet is a Coastal Preservation Area (designated by Devon County Council) and lies within the South Devon Heritage Coast and South Devon Area of Outstanding Natural Beauty. A large proportion of the inlet is designated a Site of Special Scientific Interest and candidate Special Area of Conservation. At the entrance to the inlet is the Wembury voluntary MCA. The inlet is of national importance to overwintering greenshank and is a major nursery area for bass *Dicentrarchus labrax*. Atlantic salmon *Salmo salar* and sea trout *Salmo trutta* migrate to the inlet to spawn upriver. These salmonids are protected by Net Limitation Orders which restrict the number of nets used in the inlet. There is also a regulated oyster fishery within the inlet.

Marine biological surveys			
	<i>Survey methods</i>	<i>Date(s) of survey</i>	<i>Source</i>
<i>Littoral</i>	Recording	July 1991	NRA (1992)
	Recording	March 1989	MNCR survey 14 (unpublished data)
	Recording	May 1986	Hiscock & Moore (1986)
	Recording	September 1977	Powell <i>et al.</i> (1978)
	Infaunal sampling (cores)	July 1991	NRA (1992)
	Infaunal sampling (cores)	May 1986	Hiscock & Moore (1986)
<i>Sublittoral</i>	Recording	July 1986	Hiscock & Moore (1986)
	Pipe dredge sampling	July 1986	Hiscock & Moore (1986)

## Marine biology

### Littoral biotopes

At the entrance to the Yealm, the area of Cellar Beach includes a wide range of rocky and sediment shore habitats. Open bedrock and boulders are colonised by patchy *Pelvetia canaliculata* on the upper shore (PeIB) with high numbers of barnacles *Chthamalus montagui* and littorinids. On the upper mid-shore are limpets *Patella* spp., barnacles, *Fucus vesiculosus* and *Enteromorpha* sp. (FvesB). The top shell *Osilinus lineatus* is occasionally found here. Below mid-shore, the broken bedrock platform is covered by *Fucus serratus* with the red algae *Mastocarpus stellatus* and *Osmundea* spp. (Fser.R). Protruding rocks are dominated by barnacles and limpets. Vertical rock above mid-shore is colonised by patchy *Fucus spiralis* (Fspi) and barnacles (BPat). Below mid-shore, broken vertical rock is generally dominated again by *F. serratus* and foliose red algae with occasional barnacle patches (Fser.R). The *F. serratus* is densely colonised by hydroids, spirorbid worms and bryozoans. The sponges *Halichondria panicea* and *Hymeniacidon perleve* are found on lower mid-shore rocks (SR). Rocks on the lower shore are colonised by species typical of the sublittoral fringe including the kelp

*Laminaria saccharina*, the red alga *Palmaria palmata* and the invasive non-native alga *Sargassum muticum*.

Overhangs and small caves on the lower shore are colonised by a rich and characteristic fauna (SByAs). Several species not generally found on the open shore occur here, including the anemones *Metridium senile* and *Sagartiogeton undatus* and the ascidians *Morchellium argus* and *Sidnyum turbinatum*. Algae are present in the less shaded areas and communities are similar to those of the vertical rock, excepting *F. serratus* which is absent. Additional algae found only in this habitat are the reds *Antithamnion* sp. and *Rhodothamniella* sp. and the green *Bryopsis plumosa*.

Cellar Beach extends down to a wide area of sand with gravel and pebbles. The communities present on the lower mid-shore and lower shore are dominated by the sand mason worm *Lanice conchilega* (Lan). The polychaete species *Pygospio elegans* and *Spio martinensis* and the amphipod *Corophium crassicornis* are present in large numbers. The razor shell *Ensis ensis* and the lugworm *Arenicola marina* also occur in the sediments (EcorEns).

The spit at Warren Point opposite Newton Creek is an area of deposition for various debris, particularly artificial on the lower shore and algal and tree debris further up the shore. The main substrata are shingle and muddy sand colonised by patchy fucoid cover with a high density of edible winkles *Littorina littorea* (FvesX). On the lower shore, hard substrata provide points of attachment for the slipper limpet *Crepidula fornicata*, chinaman's hat *Calyptraea chinensis* and *S. muticum* (FserX.T). Red algae are also present and notable fauna include the painted top shell *Calliostoma zizyphinum* and the sea hare *Aplysia punctata*.

Along much of the narrow part of the Yealm, from below Warren Point to Thorn Quay, areas of bedrock and boulders on the upper shore extend to shingle and boulders on the lower shore. The upper shore is dominated by dense fucoid algae including a belt of *P. canaliculata* (Pel) on the uppermost shore followed by *F. spiralis* (Fspi) and *Ascophyllum nodosum* (Asc.Asc, Asc.VS). Other filamentous green and red algae are present on the uppermost shore with frequent sea slaters *Ligia oceanica*. On steep and vertical surfaces of the upper mid-shore, rocks are dominated by limpets *Patella vulgata* and barnacles (mostly *Semibalanus balanoides* and *Elminius modestus*) (BPat). The winkles *Littorina mariae* and *L. littorea* are found in fairly high numbers among the algae. Mid-shore and lower mid-shore areas have patchy fucoid algae and a small variety of other species including shore crabs *Carcinus maenas* and the bryozoan *Bowerbankia imbricata*. Lower shore shingle is colonised by encrusting algae with some filamentous algae and fucoids (FserX). Hydroids and bryozoans grow on the fucoid algae while edible winkles are abundant and eels *Anguilla anguilla* are present under stones. Although certain species reach their limits of penetration along this section of the Yealm, the main rocky shore species, including limpets, continue to be present as far north as Steer Point and along Newton Creek (Asc.VS).

In the middle of the inlet, south of Madge Point, an area of coarse shelly gravel and sand overlying tree debris is colonised by occasional razor shells *Ensis* sp., together with polychaetes *Nephtys hombergii* and *Glycera* sp., *L. conchilega*, lugworms *Arenicola marina* and the carpet shell *Venerupis senegalensis* (VsenMtru).

In the upper reaches of the Yealm, mud and muddy sand flats are colonised by a wide variety of polychaetes, with especially high abundances of *Ampharete acutifrons*, cirratulids, spionids and tubificids. These sediments also support populations of ragworms *Hediste diversicolor*, *L. conchilega* and the bivalves *Cerastoderma edule*, *Macoma balthica* and *Scrobicularia plana* (HedScr; HedStr).

### Sublittoral biotopes

Off Cellar Bay and the sand bar at the mouth of the inlet are areas of fine clean sand colonised by eelgrass *Zostera marina* (Zmar). A small variety of algae and animals are found on and among the eelgrass. Filamentous brown algae and colonial diatoms are dominant with frequent red and encrusting calcareous algae. Occasional anemones *Anemonia viridis* are found on the leaves and greater pipefish *Syngnathus acus* has been found amongst the *Zostera*. Areas of sand which are free of eelgrass are very rich particularly in burrowing species. Fauna evident on the surface include the sea potato

*Echinocardium cordatum*, razor shells *Ensis ensis*, the netted dogwhelk *Hinia reticulata* and gobies *Pomatoschistus* sp. (EcorEns). Sediment infauna include large numbers of bivalves, particularly the striped venus *Chamelea gallina*, with *Abra nitida* and *Spisula elliptica* also common. A great variety of amphipods is also present, including *Dexamine spinosa*, *Gammarus locusta* and *Ampelisca brevicornis*. The tanaid crustacean *Apseudes latreilli* is very abundant. Polychaetes are restricted with *Platynereis dumerilii* and *Spio martinensis* present.

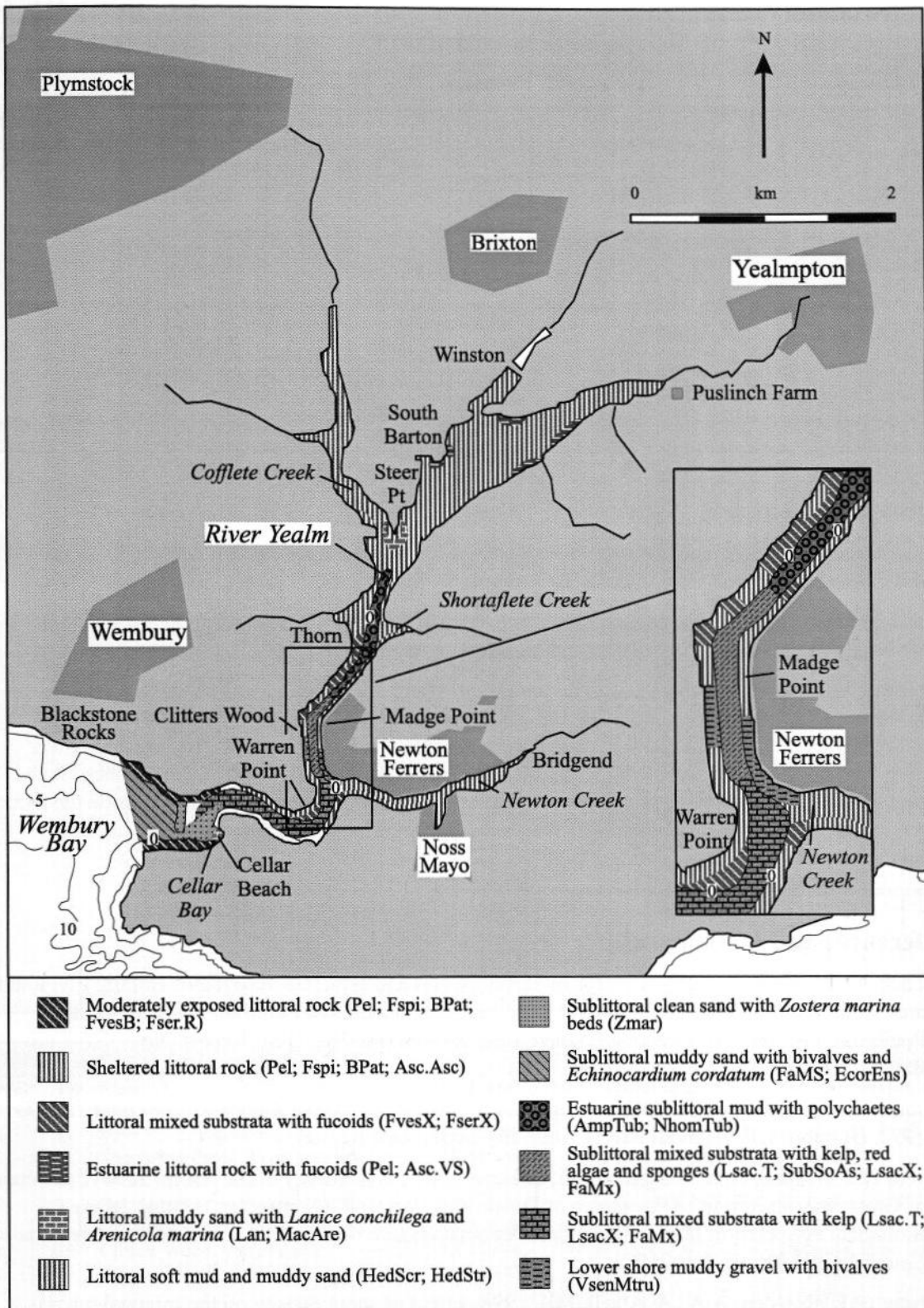
Cobbles, including shale and oyster shells in the upper river, occur on the bed of the Yealm from near the entrance opposite Cellar Beach to Madge Point. In shallow depths at the ria entrance, hard substrata are dominated by kelp *Laminaria saccharina* and the green algae *Ulva* sp. and *Enteromorpha* sp. (XKScrR). Other algae include *Saccorhiza polyschides* which is not present further upstream, and *Sargassum muticum*. The fauna is rich with high abundances of hydroids, anemones, keel worms and ascidians. With increasing distance from the sea, the species composition of the communities changes in response to the prevailing conditions. The variety of algae in general decreases, while the abundance and variety of fine filamentous red algae increase. The variety of species recorded on cobbles increases with distance upriver. Species which are not recorded at the entrance but present upstream include the sponges *Halichondria panicea* and *Hymeniacion perleve*, several hydroids, the anemone *Metridium senile* and the slipper limpet *Crepidula fornicata* (Lsac.T).

The infauna of the muddy shell gravel in the region of Clitters' Wood is dominated by the spionid worm *Aonides oxycephala* with *Notomastus latericeus* common. Several species of bivalves are present including tellins and cockles *Cerastoderma edule* (FaMx).

Adjacent to the rocky shore at Clitters' Wood is a sublittoral upper infralittoral tumble of boulders. The boulders are dominated by large *L. saccharina* and other algae (Lsac). Below this canopy the rocks are invested with a turf of brown filamentous algae. Few animals are present although the barnacle *Balanus crenatus*, the topshell *Gibbula cineraria* and ascidians are frequent. Sponges and bryozoans are also present.

From below Newton Creek as far upstream as Steer Point, the sublittoral contains areas of fairly bare muddy sand with scattered hard substrata to which a few algae are attached (LsacX). Species present south of Newton Creek include an occasional sand mason worm *Lanice conchilega*, the anemone *Cereus pedunculatus*, crabs, *H. reticulata*, the dragonet *Callionymus lyra* and the painted goby *Pomatoschistus pictus*. Above Madge Point, dense carpets of the red alga *Gracilaria gracilis* are found on available hard substrata (LsacX). Off Shortaflete Creek, the finer sediments are inhabited by anemones, terebellid worms, gastropods and bivalves (AphTub). Hard substrata are colonised by an impoverished fauna including sponges, bryozoans and *B. crenatus* (SubSoAs). Off Steer Point, firm muddy sand is present and colonised by dense patches of lugworm *Arenicola marina* and *L. conchilega* (FaMS). Hard substratum (a power cable) is colonised by encrusting bryozoans and common *M. senile* (SR). Sediment infauna are generally sparse throughout the middle/upper inlet, dominated by polychaetes including *Capitella* sp., *Tharyx* sp. and *Melinna palmata* (AphTub; NhomTub).





**Figure 11.2** Indicative distribution of the main biotopes in the inlet (based on data from survey sites shown in Figure 11.1, cited literature and additional field observations).

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## Nature conservation

Conservation sites			
Site name	Position	Status	Main features
Plymouth Sound and estuaries	SX475505	cSAC	<i>Rumex rupestris</i> (shore dock). Estuaries. Large shallow inlets and bays. Sandbanks which are slightly covered by sea water all the time.
South Devon	N/A	AONB	High scenic quality
South Devon	SX517484- SX928543	HC	Coastal scenery
Plymouth Sound, Tamar and Yealm	SX418481- SX524468	SMA	Marine biology
Wembury Point	SX500483	SSSI	Biological
Wheal Emily	SX541498	SSSI	
Wembury Bay and Yealm estuary (north and south)	SX530480	NT	Foreshore, woodland, cliff, beach and farmland
Wembury (the seabed from Gara Point to Fort Bovisand)	N/A	VMCA/VMNR	Marine biology

## Human influences

The hinterland is almost entirely undeveloped except for aggregate abstraction at Steer Point brick works. Secondary treated sewage is discharged into the upper inlet.

Seine and gill-netting for fish occurs within the inlet and crab potting takes place in Wembury Bay. There is an oyster farm off Steer Point and bait-digging is limited.

Leisure activities are numerous though not intensive. There are moorings at Yealm Pool and Steer Point but only limited harbour facilities. Cellar Bay provides a popular anchorage. The yacht club at Newton Ferrers provides full facilities and is very popular with visiting yachts. Sailing and power boating take place throughout the inlet and windsurfing is concentrated in the lower reaches. Scuba diving, snorkelling and surfing take place within the Wembury voluntary MCA just outside the mouth. Beach recreation is limited to beaches in Wembury Bay and Cellar Beach while Wembury Point is a popular bird watching site.

## References and further reading

- Hiscock, K., & Moore, J. 1986. Surveys of harbours, rias and estuaries in southern Britain: Plymouth area including the Yealm. (Contractor: Field Studies Council, Oil Pollution Research Unit, Pembroke.) *Nature Conservancy Council, CSD Report, No. 752*. (FSC Report, No. FSC/OPRU/36/86.)
- National Rivers Authority South West Region. 1992. *NRA South-west Region estuary data 1990 to 1992*. Unpublished, National Rivers Authority South-west Region.
- Powell, H.T., Holme, N.A., Knight, S.J.T., & Harvey, R. 1978. Survey of the littoral zone of the coast of Great Britain: Report of the shores of Devon and Cornwall. (Contractor: Scottish Marine Biological Association/Marine Biological Association Intertidal Survey Unit.) *Nature Conservancy Council, CSD Report, No. 209*.
- Webster, P.J., Rowden, A.A., & Attrill, M.J. 1998. Effect of shoot density on the infaunal macro-invertebrate community within a *Zostera marina* seagrass bed. *Estuarine, Coastal and Shelf Science*, 47: 351-357.

## Sites surveyed

Survey 14: 1986-89 MNCR general surveys of Sector 8 - western Channel (MNCR, unpublished data).

Survey 242: 1986 HRE survey of Plymouth Harbour and the Yealm estuary (Hiscock & Moore 1986).

Survey 265: 1970-1980 SMBA/MBA Great Britain intertidal survey (Powell *et al.* 1978).

Survey 452: 1991 NRA SW Region littoral survey of the Yealm estuary (National Rivers Authority 1992).

### Littoral sites (listed north to south)

Survey	Site	Place	Grid reference	Latitude/longitude	Biotopes present
452	5	Cofflete Creek 1, Yealm estuary.	SX 542 514	50°20.6'N 04°02.9'W	HedStr
452	1	Winston, Yealm estuary.	SX 554 511	50°20.4'N 04°01.9'W	HedStr
452	6	Cofflete Creek 2, Yealm estuary.	SX 542 509	50°20.3'N 04°02.9'W	HedStr
452	2	Puslinch Farm, Yealm estuary.	SX 565 508	50°20.3'N 04°01.0'W	HedStr
452	3	S Barton, Yealm estuary.	SX 549 506	50°20.2'N 04°02.3'W	HedStr
452	4	Steer Point 1, Yealm estuary.	SX 546 501	50°19.9'N 04°02.5'W	HedStr
452	7	Steer Point 2, Yealm estuary.	SX 544 501	50°19.9'N 04°02.7'W	HedStr
242	60	Steer Point Slip, Yealm estuary.	SX 544 499	50°19.8'N 04°02.7'W	Pel, Asc.VS, Lan, HedStr
242	61	Steer Point East, Yealm estuary.	SX 546 499	50°19.8'N 04°02.5'W	YG, Pel, FvesX, AscX, FserX, Lan
242	62	Crawl Wood Beacons, Yealm estuary.	SX 546 495	50°19.6'N 04°02.5'W	YG, Ver.Ver, Pel, Fspi, BPat, Asc.VS, FvesX, HedStr
452	8	Thorn, Yealm estuary.	SX 542 492	50°19.4'N 04°02.9'W	HedStr
242	59	Madge Point, Yealm estuary.	SX 539 484	50°19.0'N 04°03.1'W	Pel, Fspi, BPat.Cat, Fves, Asc.Asc, Fser.Fser, FserX.T, SR
242	58	S of Madge Point Newton Ferrers, Yealm estuary.	SX 539 482	50°18.9'N 04°03.1'W	VsenMtru
242	56	Warren Point West, Yealm estuary.	SX 535 478	50°18.6'N 04°03.4'W	BPat, Fves, BLlit, FK.Sar
242	57	Warren Point, Yealm estuary.	SX 538 478	50°18.6'N 04°03.2'W	FvesX, FserX.T
452	9	Bridge End, Yealm estuary.	SX 548 478	50°18.7'N 04°02.3'W	HedStr
452	10	Noss Mayo, Yealm estuary.	SX 543 478	50°18.6'N 04°02.7'W	HedStr
242	55	Cellar Beach, Yealm estuary.	SX 530 476	50°18.5'N 04°03.8'W	Ver.Ver, PelB, Fspi, BPat, FvesB, Fser.R, Fser.Fser, Rkp, SByAs, SR, Lan, MacArc
14	4	S bank, mouth of Yealm estuary.	SX 539 475	50°18.5'N 04°03.1'W	Pel, Fspi

### Sublittoral sites (listed north to south)

Survey	Site	Place	Grid reference	Latitude/longitude	Biotopes present
242	D17	E of Steer Point, Yealm estuary.	SX 546 499	50°19.8'N 04°02.5'W	AphTub
242	85	Steer Point, Yealm estuary.	SX 450 496	50°19.5'N 04°10.6'W	SR, FaMS
242	84	Shortaflete Creek, Yealm estuary.	SX 543 492	50°19.4'N 04°02.8'W	LsacRS.FiR
242	D16	W Shortaflete Creek, Yealm estuary.	SX 543 492	50°19.4'N 04°02.8'W	AphTub
242	96	Northern Yealm, Yealm estuary.	SX 540 486	50°19.1'N 04°03.0'W	SubSoAs, LsacX
242	D18	Off Madge Point, Yealm estuary.	SX 538 484	50°19.0'N 04°03.2'W	VsenMtru
242	83	Clitters Wood, Yealm estuary.	SX 538 483	50°18.9'N 04°03.2'W	SubSoAs, Lsac, LsacX
242	94	Off Cellar Bay, Yealm estuary.	SX 530 479	50°18.7'N 04°03.8'W	Sac, XKScrR, Zmar, EcorEns
242	D19	Newton Ferrers entrance River Yealm, Yealm estuary.	SX 541 479	50°18.7'N 04°02.9'W	NhomTub
242	D20	Off Cellar Beach Wembury Bay, Yealm estuary.	SX 530 477	50°18.6'N 04°03.8'W	FaMx
242	D21	Yealm sand bar Wembury Bay, Yealm estuary.	SX 526 477	50°18.6'N 04°04.2'W	FaMS
242	95	Ferry Cottage, Yealm estuary.	SX 538 475	50°18.5'N 04°03.2'W	Lsac.T, FaMx