JOINT NATURE CONSERVATION COMMITTEE

Coasts and seas of the United Kingdom

Region 5 North-east England: Berwick-upon-Tweed to Filey Bay

edited by
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Contents

Foreword

Information is vital for sound policy formulation. Decision makers at national and local level need to know more than just the scale, location and importance of natural resources that are of value to humans. They have to understand how human activities affect the value of those resources and how to conduct those activities in an environmentally sustainable way. This is true for virtually every activity that impinges on the natural environment. In the coastal zone the complexity of the relationships between the physical and biological systems adds another dimension to the problems of formulating management policy.

I am pleased, therefore, to be introducing the *Coasts and seas of the United Kingdom* series. The Coastal Directories project, of which this series of seventeen regional reports, covering the whole of the UK coast, is an important product, has brought together an encyclopaedic range of information on our coastal resources and the human activities that are associated with them. Amongst the topics covered are the basic geology of the coasts around the United Kingdom and measures taken for coast defence and sea protection, the distribution and importance of the wildlife and habitats of our coasts and seas, including fish and fisheries, and the climate and sea level changes to which they all are subject.

In addition to the value of the information itself, the way the project has been run and the data collected has made an important contribution to the quality of the product. A wide range of individuals and organisations concerned with the conservation and use of the coastal margin have collaborated in collating the information, their variety reflecting the extent of the interplay between the coastal environment and human activities. These organisations included the Ministry of Agriculture, Fisheries and Food, the Scottish Office Agriculture and Fisheries Department, the National Rivers Authority, the Countryside Commission, the Scottish Office, the Welsh Office, the Department of the Environment, the Sea Fisheries Committees, English Nature, Scottish Natural Heritage and the Countryside Council for Wales, together with local authorities, voluntary conservation organisations and private companies (notably those in the oil industry, through the UK Offshore Operators Association). I am also pleased to be able to acknowledge the contribution made by the staff of the Joint Nature Conservation Committee. As the work has evolved since the first meetings of the Steering Group in 1990, the value of involving such a broad span of interests has been highlighted by the extent to which it has allowed new approaches and information sources to be identified.

The regional reports will be of value to all who live and work in the maritime areas of the UK, where informed management is the key to the sustainable use of resources. The reports should become indispensible reference sources for organisations shouldering new or expanded responsibilities for the management of marine Special Areas of Conservation under the EC Habitats Directive. In addition, the reports will make an important contribution to the implementation of the UK Biodiversity Action Plan.

The Earl of Selborne
Chairman, Joint Nature Conservation Committee

How to use this book

These notes provide some general guidance about finding and interpreting the information in this book.

Structure

The book is divided into ten chapters, each split into sections containing summary data on the topics shown in the Contents list. Chapter 2 provides an overview of the general physical background to the region. Sections in Chapters 3, 4 and 5 have been compiled to the following standard format:

- **Introduction**: presents the important features of the topic as it relates to the region and sets the region in a national context.
- **Important locations and species**: gives more detail on the region's features in relation to the topic.
- **Human activities**: describes management and other activities that can have an effect on the resource in the region.
- **Information sources used**: describes the sources of information, including surveys, on which the section is based, and notes any limitations on their use or interpretation.
- **Further sources of information**: lists references cited, recommended further reading, and names, addresses and telephone numbers of contacts able to give more detailed information.
- **Acknowledgements**

Sections in the remaining chapters all have the last three subsections and follow the other elements as closely as practicable, given their subject nature. At the end of the book there is a list of the addresses and telephone numbers of organisations most frequently cited as contacts, as well as a core reading list of books that cover the region or the subject matter particularly well. Finally there is a full list of authors' names and addresses.

Within this series of regional directories presentation within sections may vary slightly, depending on the information available for each region; the general structure and principles will, however, remain constant.

Definitions and contexts

The word 'region' (as in 'Region 12') is used throughout this book to refer to the coastal and nearshore zone, broadly defined, between the two points given in the title of this book. The area covered varies between chapter sections, depending on the form in which data is available. Coverage is usually either coastal 10 km squares, sites within one kilometre of Mean High Water Mark, or an offshore area that may extend out to the median line between the UK and neighbouring states. Inland parts of the counties concerned are not included unless specifically stated.

'Britain' here means Great Britain, i.e. including only England, Scotland and Wales. 'United Kingdom' also includes Northern Ireland. The term 'North Sea Coast', as used here, means the coast of Britain covered by *The directory of the North Sea coastal margin* (Doody, Johnston & Smith 1993): that is, from Cape Wrath (longitude 5°W) along the east and south coasts of Britain to Falmouth (again longitude 5°W), and including Orkney and Shetland. The 'West Coast', as used here, normally includes the coast and seas from Falmouth to Cape Wrath along the west coast of Britain. Only where explicitly stated have data for the Isle of Man and/or Northern Ireland been included in West Coast descriptions.

Sites within each chapter section are described in clockwise order around the coast, incorporating islands within the sequence. Maps and tables are numbered sequentially within their chapter section; for example in section 5.4, Map 5.4.1 is the first map referred to and Table 5.4.2 is the second table.

Throughout the book, the information given is a summary of the best available knowledge. The sites mentioned as important, the numbers and distributions of species, archaeological features discovered and information on all the other elements of the natural and man-made environment are as known at January 1995, unless otherwise stated. The fact that no information is presented about a topic in relation to a locality should not be taken to mean that there are no features of interest there, and fuller details should be sought from the further sources of information listed at the end of each section. Note, however, that under the Environmental Information Regulations (1992; Statutory Instrument No. 3240) you may be asked to pay for information provided by organisations.

Acknowledgements

This regional report is one of a series of products from the Coastal Directories Project of the JNCC. The compilation and publication of the series has been made possible by generous contributions from the members of the Coastal Directories Funding Consortium listed below:

Arco British Ltd [1]
Avon County Council
Banff and Buchan District Council
BHP Petroleum Ltd [1]
Ceredigion District Council
Cheshire County Council
Chevron UK Ltd [1]
Cleveland County Council
Clwyd County Council
Clyde River Purification Board
Colwyn Borough Council
Copeland Borough Council
Countryside Commission
Countryside Council For Wales
Cumbria County Council
Cunninghame District Council
Department of the Environment
Department of the Environment for Northern Ireland
Devon County Council
Dorset County Council
Dumfries and Galloway Regional Council
Dyfed County Council
Eastbourne Borough Council
English Nature
Fife Regional Council
Forest of Dean District Council
Gwynedd County Council
Hampshire County Council
Highland River Purification Board
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Isle of Man Government, Department of Local Government and the Environment
Isle of Man Government, Department of Transport
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Lancashire County Council
Lincolnshire County Council
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Ministry of Agriculture, Fisheries and Food Directorate of Fisheries Research
National Rivers Authority
Neath Borough Council
Norfolk County Council
North Cornwall District Council
Nuclear Electric plc
Preseli Pembrokeshire District Council
Scottish Natural Heritage
Scottish Office Agriculture and Fisheries Department
Scottish Salmon Growers Association Ltd
Sefton Borough Council
Shepway District Council
Solway River Purification Board
Somerset County Council
South Pembrokeshire District Council
Standing Conference on Regional Policy in South Wales[2]
Stroud District Council
Tayside Regional Council
Torridge District Council
UK Offshore Operators Association [3]
Vale of Glamorgan Borough Council
Water Services Association
Welsh Office
World Wide Fund for Nature (UK)

Notes

[1] Funding from these companies was given to the Cardigan Bay Forum to fund the supply of information to the Project.

[2] Members of the Standing Conference on Regional Policy in South Wales are: Blaenau Gwent Borough Council, Cardiff City Council, Dinefwr Borough Council, Gwent County Council, Llanelli Borough Council, Lliw Valley Borough Council, Mid Glamorgan County Council, Monmouth Borough Council, Port Talbot City Council, South Glamorgan County Council, Swansea City Council, Taff Ely Borough Council, West Glamorgan County Council.

[3] The UK Offshore Operators Association is the representative organisation for the British offshore oil and gas industry. Its 34 members are the companies licensed by HM Government to explore for and produce oil and gas in UK waters.

This collaborative project involves many other branches of JNCC in addition to the project team listed on page 2. These are: Marine Conservation Branch (Keith Hiscock, Tim Hill, Bill Sanderson, Colin McLeod), Vertebrate Ecology and Conservation Branch (Deirdre Craddock, David Stroud, Steve Gibson), Species Conservation Branch (Nick Hodgetts, Deborah Procter, Martin Wigginton), and Seabirds and Cetaceans Branch (Mark Tasker, Paul Walsh, Andy Webb). We thank them all for their help and support.

The project has also received widespread support from the country conservation agencies: Countryside Council for Wales, English Nature, Scottish Natural Heritage and the Department of the Environment (Northern Ireland). We are grateful to the many regional and headquarters staff listed below as well as the representatives on the Core Steering Group.

The editors would also like to thank the many people who have provided information for the project or gave their time to comment on drafts, as well as those who gave editorial assistance (where appropriate, individual acknowledgements are given also at the end of each section).

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Chapter 1 Overview

1.1 The Coastal Directories project

Dr J.P. Doody

The Coastal Directories project sets out to collect and collate summary information that will provide an overview of coastal and marine resources and human activities at national and regional levels. It also provides an index to more detailed references and other sources of information.

Information on the coastal resource and its use is vital to the development of policy for environmental management. Because of the inter-related nature of the many components of the coastal zone, including both habitats and species, coastal management requires a knowledge of the interactions between human activities and the physical functioning of the zone and its biological components. In addition, it is essential to adopt a wide-ranging approach to collecting and collating this information.

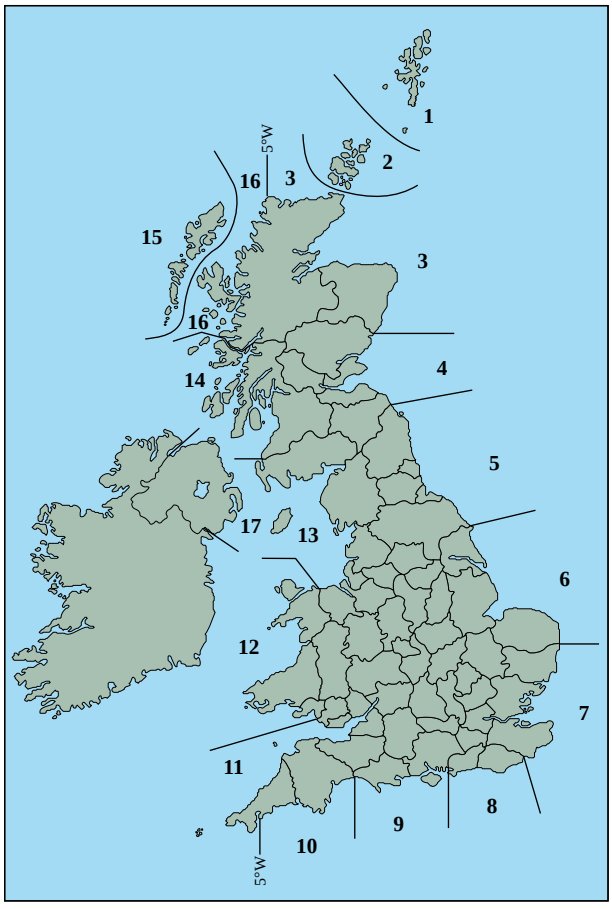
For these reports, the definition of the coastal margin encompasses all the main marine, coastal and maritime zones, from offshore waters to terrestrial maritime habitats. By their nature the limits of the coastal, shoreline and marine zones are indistinct, as tidal movement, storms and the effects of sea level rise influence their relative positions. A wide definition of maritime habitats has been adopted here: tidal areas (mudflats, sand flats, saltmarshes and transitions to brackish marsh, swamps and salt-influenced grasslands) are included; rocky shores, shingle beaches, cliffs subject to salt spray, and terrestrial features including sand dunes and shingle structures that are maintained by marine processes are also covered. In addition, we have considered areas where combinations of these habitats occur. Examples include estuaries where lagoons or land claimed from the sea, such as coastal grazing marsh, form part of the functioning system. Also covered are habitats used by coastal species for at least part of their life cycle.

In the marine and nearshore environment we have not set any artificial limits to the areas to be discussed, except those imposed by the availability of information or the limits of national jurisdiction. A minimum distance of 35 km offshore has been agreed as a notional limit to the coastal zone for the Coastal Directories project, but in effect the median line between Britain and neighbouring states may be said to form the boundary in many instances. Important factors in this regard include the offshore limits of geomorphological processes, which may affect both the coast and the subtidal waters, and the seaward boundaries of nearshore benthic plant and animal communities.

Because of the potentially wide influence of human use, the area from which we have derived data is occasionally wider than the strictly coastal zone. Fisheries, infrastructure development and sources of pollution are among the activities for which it is difficult to define a precise limit. The historical context, derived from archaeological evidence, must also be taken into account. However, when all these interactions are revealed they will help to inform the process of coastal management so that it allows for sustainable use and the maintenance of biological diversity.

1.1.1 Origins and aims of the work

Recognising the significant gaps that existed in scientific understanding of the North Sea, the Second International Conference on Protection of the North Sea established the North Sea Task Force in 1987. Under the guidance of the International Council for the Exploration of the Sea (ICES) and the Oslo and Paris Commissions, it organised a co-ordinated programme of research and monitoring with a primary aim of producing an assessment of the North Sea (the *Quality Status Report* (QSR)) by 1993.



Map 1.1.1 Regions in the series. Region names are given in Table 1.1.2.

The Coastal Directories project began following a suggestion in 1989 by the UK at the second meeting of the North Sea Task Force to include consideration of coastal habitats and species of conservation importance in the North Sea QSR. The work initially involved the collection and collation of information along the coastal margin of the North Sea, from Cape Wrath around the North Sea and the English Channel to the Fal Estuary. Funded as a joint project between the Department of the Environment and the Nature Conservancy Council (NCC), the information was compiled during 1990 and 1991 and a draft *Directory of the North Sea coastal margin* was circulated for comment in August 1991.

The principal original aim was to produce "a comprehensive description of the North Sea coastal margin, its habitats, species and human activities, as an example to other North Sea states" (North Sea Task Force 1993). It was hoped that this would help to ensure that habitats and species were considered in the QSR. The programme fulfilled this original aim, and the QSR published in 1993 included descriptions of both habitats and species in several of the sub-regional reports, together with an assessment of the human impacts on the ecosystems.

The *Directory of the North Sea coastal margin* was published in December 1993 (Doody *et al.* 1993). It was presented to Ministers at the Intermediate Ministerial Meeting on the North Sea held in Denmark in the same month.

The North Sea Task Force was wound up in December 1993 following completion of the QSR. Continuing work was subsumed into a new Assessment and Monitoring Committee (ASMO) under the 1992 Convention for the Protection of the Marine Environment of the North East Atlantic (the OSPAR Convention). The new OSPAR Convention requires that assessments similar to the *North Sea Quality Status Report* be produced for all the constituent parts of the north-east Atlantic and for that area as a whole (which we have called for simplicity 'the West Coast') by the year 2000. The Irish Sea will be one of the first areas subject to assessment. The extension of the Coastal Directories project to the West Coast of Great Britain (thereby covering all the coast not included in the *Directory of the North Sea coastal margin*, and also including the Isle of Man and Northern Ireland) and the production of regional reports such as this one contribute to that assessment.

1.1.2 Methods - the North Sea and West Coast Directories

Throughout the work on the directories a simple approach to compiling the information has been adopted. This has involved identifying existing sources of compiled information at national, regional and local levels. The *Directory of the North Sea coastal margin* was largely produced by staff within the Nature Conservancy Council (NCC); following reorganisation of the NCC in 1991, responsibility for the work has rested with the Joint Nature Conservation Committee (JNCC). Table 1.1.1 shows how the Coastal Directories project is managed.

At the outset it was agreed that the work should involve a wide variety of individuals and organisations concerned with the conservation and use of the coastal margin, to reflect the complex nature of the habitats and species and the wide-ranging influence of human activities. Initially, a small group of individuals and organisations (including the Ministry of Agriculture, Fisheries and Food (MAFF), the National Rivers Authority (NRA), the Countryside Commission (CC), the Scottish Office (SO), the Welsh Office (WO), the Department of the Environment (DoE) and the conservation agencies for England, Scotland and Wales (English Nature, Scottish Natural Heritage, Countryside Council for Wales)) was invited to help steer the project and to identify and provide information. As the work evolved from the first meetings in 1990, the value of this approach was highlighted by the extent to which new information sources were identified.

Unlike for the preceding work on the North Sea coastal margin, which was funded principally through the DoE and the NCC/JNCC, a decision was made to seek funding for the continuation of the work on the West Coast from a consortium of private organisations and public bodies, including coastal local authorities. Early in 1993, JNCC appointed a co-ordinator for this work. Part of the co-ordinator's responsibility was to obtain funding for the project. In the event a large number of organisations agreed to participate and showed a keen interest in the development of the work. Members of the Funding Consortium are listed in the Acknowledgements section of the book.

This interest was reflected in the extent of external funding that the project received (including an injection of funds from the UK Offshore Operators Association, see below), and in the commitment shown by the steering groups, which meet regularly. Of particular importance is the annual Main Steering Group seminar: so far it has reviewed the *Role of the Directories in the development of coastal zone management* (January 1994), and considered the *Use of electronic storage and retrieval mechanisms for data publication* (February 1995).

1.1.3 The Coastal Directories' contribution to coastal management

As the work on the *Directory of the North Sea coastal margin*

Table 1.1.1 The structure of the management arrangements

Group	*Role*	*Undertaken by*
JNCC Coastal Conservation Branch (CCB)	Day to day management	Head of CCB
Management Board	Liaison & executive decisions	Country agencies/JNCC Coastal Conservation Branch
Core Steering Group	Steer work, provide information and support	See page following title page
Main Steering Group	Review progress, consider new developments, provide advice	All Steering Group members, conferring annually at Steering Group Meeting

has proceeded, the emphasis of the approach changed. In the UK during the period 1990 - 1993 there was a considerable upsurge of interest in the principles of coastal management. The House of Commons Environment Committee examined the issues during November 1991 and in January/February 1992 and published their report on *Coastal zone protection and planning* in March 1992 (House of Commons Environment Committee 1992).

That report, together with other initiatives at UK and European levels, continues to encourage a more integrated approach to management issues. The dialogue between the project consortium members has confirmed the importance of the Coastal Directories in providing basic resource information to support these new approaches. Increasingly, therefore, the Directories are seen as providing essential information to inform the development of coastal zone management policy at national levels.

The Directories provide information that complements the sectoral approach (control of different activities by separate regulations) currently being promoted by a range of Government reports. These include PPG 20: *Coastal planning* (Department of the Environment/Welsh Office 1992), and the two consultation documents that followed up the House of Commons Environment Committee report: *Development below low water mark* (Department of the Environment/Welsh Office 1993) and *Managing the coast* (Department of the Environment/Welsh Office 1993). MAFF too is promoting the setting up of 'coastal cell groups', to encourage sustainable shoreline management.

1.1.4 Regional reports

The coastal management developments fostered interest in the Coastal Directories project, and also increased demand for information at a regional level. It was decided, therefore, to produce a series of regional reports to cover the whole coast of Britain, in addition to the two overview volumes (*The Directory of the North Sea coastal margin*, published in 1993, and the *West Coast Directory)*. Discussions among consortium members indicated that early completion of the regional volumes should be the priority. Seventeen regions were identified for which reports are being prepared. These provide a more detailed level of information than the overview volumes, to help set each region in a national context and facilitate the preparation of regional plans.

It was also recognised that the summary data in the regional reports is valuable in preparing and assessing applications for oil and gas licensing around the coastal margin. An injection of funds from the United Kingdom Offshore Operators Association (UKOOA) made possible the early production of reports for most of the potential licensing areas in the 16th Offshore Oil and Gas Licensing Round.

The areas covered by the complete series of regional reports are shown in Map 1.1.1: Regions 1 - 10 cover the area of the *Directory of the North Sea coastal margin*; Regions 11 - 17 deal with the area of the *West Coast Directory*.

1.1.5 Outputs

The reports are published as conventional paper reports; in addition a first version using UKDMAP (the electronic atlas developed by the British Oceanographic Data Centre, Birkenhead) was published in 1994 (Barne *et al.* 1994). Other forms of electronic publication are being evaluated. The position on publication as at March 1995 is shown in Table 1.1.2.

1.1.6 Further sources of information

A. References cited

Barne, J., Davidson, N.C., Hill, T.O., & Jones, M. 1994. *Coastal and Marine UKDMAP datasets: a user manual.* Peterborough, Joint Nature Conservation Committee.

DoE/Welsh Office. 1992. *Planning policy guidance - coastal planning*. PPG 20. London, HMSO.

DoE/Welsh Office. 1993. *Development below Low Water Mark* - a review of regulation in England and Wales. London, HMSO.

DoE/Welsh Office. 1993. *Managing the coast: a review of coastal management plans in England and Wales and the powers supporting them*. London, HMSO.

Table 1.1.2 Provisional titles and publication dates of the Coastal Directories reports

Directory of the North Sea Coastal Margin	Published 1993
Regional Report 1. Shetland	Publication due 1997
Regional Report 2. Orkney	Publication due 1997
Regional Report 3. North-east Scotland: Cape Wrath to St Cyrus	Publication due 1995
Regional Report 4. South-east Scotland: Montrose to Eyemouth	Publication due 1996
Regional Report 5. North-east England: Berwick-on-Tweed to Filey Bay	Published 1995
Regional Report 6. Eastern England: Flamborough Head to Great Yarmouth	Publication due 1995
Regional Report 7. South-east England: Lowestoft to Dungeness	Publication due 1996
Regional Report 8. Sussex: Rye Bay to Chichester Harbour	Publication due 1996
Regional Report 9. Southern England: Hayling Island to Lyme Regis	Publication due 1995
Regional Report 10. South-west England: Seaton to Falmouth Bay	Publication due 1996
Regional Report 11. The Western Appproaches: Falmouth Bay to Kenfig	Publication due 1996
Regional Report 12. Wales: Margam to Little Orme	Published 1995
Regional Report 13. Northern Irish Sea: Colwyn Bay to Stranraer	Publication due 1995
Regional Report 14. South-west Scotland: Ballantrae to Mull	Publication due 1996
Regional Report 15. The Outer Hebrides	Publication due 1996
Regional Report 16. North-west Scotland: Loch Linnhe to Cape Wrath	Publication due 1996
Regional Report 17. Northern Ireland	Publication due 1996
West Coast Directory	Publication due 1996
Coastal and marine UKDMAP datasets: Version 1	Published 1994

Doody, J.P., Johnson, C., & Smith, B. 1993. *Directory of the North Sea coastal margin*. Peterborough, Joint Nature Conservation Committee.

House of Commons Environment Committee. 1992. *Coastal zone protection and planning*. Second Report. 2 volumes. London, HMSO.

North Sea Task Force. 1993. *North Sea quality status report*. London, Oslo and Paris Commissions.

B. Further reading

Bird, E.C.F. 1984. *Coasts - an introduction to coastal geomorphology*. 3rd ed. Oxford, Basil Blackwell.

British Oceanographic Data Centre. 1992. *United Kingdom Digital Marine Atlas. User Guide. Version 2.0*. Birkenhead, Natural Environment Research Council, British Oceanographic Data Centre.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Information about the Directories project and UKDMAP version	*Coastal Conservation Branch, JNCC, Peterborough, tel: 01733 62626
Sales outlet for the regional volumes, the Directories and other JNCC publications	Natural History Book Service Ltd, 2-3 Wills Road, Totnes, Devon TQ9 5XN, tel: 01803 865913

* Starred contact addresses are given in full in the Appendix

Marsden Rock and Cliffs, Tyne & Wear. Throughout the region there are long stretches of cliffs of great landscape and wildlife interest. At Marsden Rock the Magnesian Limestone cliffs and stack have a large breeding colony of cormorants and kittiwakes. At the foot of the cliffs and reached by a lift is a grotto, now a public house, constructed in Georgian times as a subterranean folly. Photo: P. Wakely, English Nature.

1.2 Regional summary

Dr J.P. Doody

1.2.1 Introduction

This section gives a brief introduction to the character of the region, its wildlife and the extent of its human use and development, synthesising information presented in Chapters 2 - 10. The main coastal locations are shown on Map 1.2.1.

Region 5 comprises the coast of north-east England from the Scottish border to just north of Flamborough Head. Although extending for several degrees of longitude from north to south, the region's 505 km of coastline represents less than 10% of the total coastline of England and less than 3% of that of Great Britain. The coastline is relatively short because it has few bays, headlands or estuaries. Nevertheless it is varied, cliffs alternating with stretches of lower relief, and much of it is unspoilt countryside of great scenic and wildlife conservation value. Only around the estuaries of the Tyne, Wear and Tees is the character of the region predominantly urban and industrialised rather than rural and agricultural. The Tyne & Wear, Durham and Cleveland coasts, which once were marked by heavy industry, particularly coal mining, are slowly assuming a more natural aspect.

1.2.2 Structure and landscape

The nature of the region's coast is strongly influenced by its geology. Rocks in the region range in age from Carboniferous (up to 360 million years old) in Northumberland, Tyne & Wear and northern Co. Durham, through progressively younger strata - Permo-Triassic (286-213 million years) - in southern Co. Durham, Cleveland and north North Yorkshire, to Jurassic (213-144 million years) in the south of the region. Throughout, the solid geology onshore is often obscured by varying thicknesses of glacial deposits (boulder clay) from the Pleistocene period.

Reflecting the different qualities of these rocks, the coast falls into three distinct sections. The first coincides with the exposure from the Tweed to the Tyne of the harder Carboniferous strata as steep cliffs and rocky islands (Holy Island, the Farne Islands and Coquet Island), interspersed with sweeping sandy bays, such as Druridge Bay, Beadnell Bay and Alnmouth Bay. Between Holy Island and the mainland lies a large area of intertidal mud and sand. The second section - from the Tyne to the Tees - where limestones are overlain with glacial till, comprises slumping cliffs of boulder clay or vertical cliffs of limestone, interrupted in Co. Durham by precipitous wooded gorges (denes) as well as the estuaries of the Tyne, Wear and Tees. From the Tees to Flamborough Head, the third section - a coast of (mostly small) coves, such as Robin Hood's Bay, backed by sloping cliffs - takes its character from the relatively soft rocks from which it is carved.

In this region the sea bed shelves steeply but uniformly from the shore to a depth of around 60 m. Roughly the same sequence of underlying geological structures is found as on land, but it is generally covered by glacial sand and gravel from the more recent Holocene period. This sand, and material eroded from the cliffs, is moved on and offshore in a seasonal pattern, with little long-shore sediment movement. Along the rocky sections of the coast in the north and south of the region, the clear, unpolluted waters are of high marine nature conservation importance. However, off Tyne & Wear and along the Co. Durham and Cleveland coasts, pollution, particularly from dumped colliery waste, has long impoverished the marine and shoreline environment.

1.2.3 The natural environment

The varied coast of the region contains examples of all the main coastal habitat types found in the UK, except shingle structures. The region is especially important in a national context for the extent and types of its sand dunes and sea cliffs, and particularly their invertebrates; for the internationally important populations of breeding seabirds on its non-estuarine shores and of migrant and wintering waterfowl on its estuaries; and for the extensive pristine marine areas present in the north and south of the region and their diverse flora and fauna. The region's most significant and characteristic habitats and their associated wildlife are described below.

The sea and sea bed

Of the 336 fish species present in Great Britain, 167 have been recorded from the region, including all seven protected British marine fish species (although these are known mostly from single records). Further unusual species are seen from time to time, including starry ray *Raja radiata*, at the southern limit of its distribution, and the tadpole fish *Raniceps raninus*. The highly productive waters close to the shore off the north Northumberland coast are important feeding areas, in both summer and winter, for seabirds and seals. Druridge Bay is believed to be a spawning ground for the sandeel *Ammodytes tobianus*, an important food species for seabirds and exploited sea fish, amongst others. Allis shad *Alosa alosa* are found in the Tweed estuary, and sea lampreys *Petromyzon marinus* are present in the rivers Coquet and Tees. The three diadromous fish species widespread in British waters, the Atlantic salmon *Salmo salar*, sea trout *Salmo trutta* and eel *Anguilla anguilla*, have all been recorded in six rivers in the region. Both grey and common seals *Halichoerus grypus* and *Phoca vitulina* occur in the region; grey seals are regularly seen and breed in large numbers on the Farne Islands. Five species of cetaceans regularly occur in the region and a further seven out of the UK total of 26 species have also been recorded. Harbour porpoise *Phocoena phocoena*, minke whale *Balaenoptera acutorostrata* and white-beaked dolphin *Lagenorhynchus albirostris* are the commonest species.

Both intertidal and subtidal habitats in the region contain a wide variety of sea-bed communities; in particular,

Map 1.2.1 Rivers, major towns and other coastal locations

Table 1.2.1 Main landscape and nature conservation designations in Region 5

Designation	*No. of sites in region*	*Total area/ length in region (ha/km)*	*Regional % of area in GB so designated*
Ramsar	1	3,625	1.5
SPA	3.5*	3,850*	1.5
NNR	4	4,134	4.9
SSSI	55	10,303	1.5
Local Nature Reserve	6	165	1.2
National Trust	35	1,450	2.3
Wildlife Trusts	13	399	1.4
Royal Society for the Protection of Birds (RSPB)	1	6	<0.1
Heritage Coasts	2	153	10.0
Areas of Outstanding Natural Beauty	1	13,500	1.5

* One site lies half in this region and half in Region 6 - half of its area has been included in the total. See section 7.1.

the areas off north Northumberland and the North Yorkshire coast adjacent to Robin Hood's Bay have been identified by English Nature as Sensitive Marine Areas of particular wildlife interest and importance. The sea bed around Holy Island and the Farne Islands supports an unusually diverse range of habitats, compared with the rest of the region. This fact is reflected in the presence here of most of the rare and scarce sea-bed species known from the region. Sediments in the lee of Holy Island support one of the largest seagrass *Zostera* spp. beds in Great Britain. The relatively sheltered areas around Robin Hood's Bay include extensive rocky shores, which are of special interest for their plant and animal communities.

Estuarine shores

There are only ten estuarine areas in the region and they are mostly small, together representing around 1% of the UK estuarine resource. However they vary widely in the degree to which they have been modified by human use, from the largely unspoilt estuarine areas in the extreme north of the region to the mostly enclosed and developed tidal reaches of the Tyne and Tees in the centre. Despite this development, the region, and especially its estuaries, is important for migrant waterfowl in spring and autumn, as many birds, moving between wintering areas on the African, Mediterranean and south-west European coasts and their arctic breeding grounds, pass through here. The estuarine areas around Holy Island (Lindisfarne National Nature Reserve (NNR)) and the Tees (Teesmouth NNR) both support internationally significant numbers of wintering waterfowl. Holy Island is the most notable, harbouring six species in internationally important numbers and a further nine in nationally important numbers.

The region now holds less than 1% of the saltmarsh resource of Great Britain. This is partly because the region contains only three sizeable estuaries (in whose sheltered, shallow tidal expanses saltmarshes accumulate) and partly because on the Tyne and Tees estuaries especially, where saltmarshes were once extensive, they have largely been destroyed by industrial development. The only significant areas of saltmarsh remaining are in Lindisfarne NNR, although good (but smaller) examples occur also at Alnmouth and Amble. At Lindisfarne, transitions from saltmarsh to dune vegetation are particularly important and species typical of upper saltmarsh, such as sea wormwood *Artemisia maritima* and the northern species saltmarsh flat-sedge *Blysmus rufus* are present. Common cord grass *Spartina anglica* has expanded rapidly onto the tidal flats in recent years, and this has given rise to great concern. Extensive trials have taken place to control its spread over the seagrass beds, which provide food for the large populations of light-bellied brent geese *Branta bernicla hrota* and wigeon *Anas penelope* that winter at the site. The saltmarshes and wet grasslands around Lindisfarne NNR are important in a regional context for breeding waders, including significant numbers of redshank, lapwing and oystercatcher.

Sand dunes

The region contains 3% of the sand dune resource of Great Britain, a figure in proportion with the length of its coastline. However, its sand dunes represent 15% of the English resource. The largest areas of wind-blown sand occur in the north, notably around Holy Island and Ross Links (555 ha), where nationally important examples of certain dune types occur. Ross Links has small areas of dune heath, which contrast with the calcareous dune vegetation on Holy Island itself. The wet dune slacks are an important feature and their vegetation includes one rare liverwort, *Petalophyllum ralfsii*, protected under the EC Habitats Directive and the Bern Convention. This site, and the Northumberland sand dunes generally, are also of considerable importance for their invertebrate fauna, which include many rare and scarce species. Elsewhere along the coast sand dunes are mostly small. Those at the mouth of the Tees estuary are nevertheless interesting, as despite the considerable industrial development in the area they support a reasonably intact and varied sequence of dune vegetation. At Hart Warren, to the north of Teesmouth, burnt orchid *Orchis ustulata* occurs, probably at the northern limit of its distribution in England. The beaches of north Northumberland, especially the Farne Islands, are of special significance for breeding birds of non-estuarine shores. These include the oystercatcher, the region's most abundant wintering waterfowl species.

Sea cliffs

Sea cliffs, which occur throughout the region, provide important nesting sites for seabirds and have distinctive vegetation which can include several rare plants. Along the coast of north Northumberland, the cliffs of Marsden Bay and the Farne Islands and Coquet Island are the most important sites in the region for breeding seabirds (the Farne Islands are one of the most celebrated seabird nesting sites in Great Britain). Eight species are present in internationally important numbers, including puffin and guillemot. The cliff-tops on the islands are important for Sandwich, roseate and little terns.

The cliffs along the coasts of Durham and North Yorkshire are nationally important for their vegetation. In North Yorkshire - unusually for British cliffs - the vegetation includes woodland and other mature communities more typical of sheltered, inland locations. This reflects the prevalence in the region of relatively gentle offshore winds.

On the cliff tops of the Durham coast occur some of the best examples of Magnesian Limestone grassland in Great Britain. They are of particular interest because they include several plants near the southern limits of their distribution, including blue sesleria *Sesleria albicans*. The denes in Co. Durham contain some of the most interesting and natural coastal woodlands in the country: the slumping boulder clay cliffs support good examples of ephemeral vegetation adapted to these unstable conditions, including plants such as pyramidal orchid *Orchis pyramidalis*, together with a number of rare and scarce invertebrate species.

1.2.4 Landscape and nature conservation

The value of the region for landscape and nature conservation is reflected in the number and extent of sites afforded official protection. There are 55 Sites of Special Scientific Interest (SSSIs), four National Nature Reserves (NNRs), four Special Protection Areas (SPAs) designated for their importance for birds, and one Ramsar site (a wetland of international importance), as well as two Heritage Coasts and one coastal Area of Outstanding Natural Beauty (AONB)). The North York Moors National Park has a substantial extent of open, rugged coastline. In addition, the voluntary conservation movement is very active in this area; for example, the National Trust has interests in 35 coastal properties (other than buildings), including the Farne Islands. The area covered by each designation is given in Table 1.2.1, although it should be noted that sites may have more than one designation and the boundaries may not be the same.

1.2.5 Human activities, past and present

The archaeological record shows that humans have been present in the area for more than 5,000 years. Evidence has been recovered from several locations on the sea bed, including offshore peat deposits, which shows that people once farmed extensively over what is now the bed of the North Sea. During Roman times the east coast was a major sea route and the Tyne an important military supply base. Offshore there is an extensive legacy of shipwrecks from all periods.

Early trade in coal, from the 1600s onwards, had a major impact on the area and resulted in Newcastle becoming an important centre for commerce and iron and steel production. The shipbuilding industry grew in importance both here and on the Wear at Sunderland, and by the 1790s it was producing 15% of the tonnage of all ships built in England. This industrial development had a major impact on the nature and even shape of the coastline, in that it greatly reduced the area of intertidal land in the Tyne, Wear and Tees estuaries. The nature of the industries present, frequently on land claimed from the estuaries, has now changed considerably, with the more recent growth of oil-related port and harbour facilities and petrochemical works on the Tees and the decline of shipbuilding throughout the region. However, there is still a major steel works at Redcar. Much of the coast of the three main estuaries is protected by artificial sea defences, and the beaches of cliffed sections elsewhere have been built up by colliery waste dumping, particularly along the Durham coast and at Lynemouth in Northumberland. This has to some extent protected the cliffs from erosion. The recent decline in heavy industry in the region and, in particular, the closure of coal mines, has resulted in efforts to regenerate the area.

The three major fishing ports in the region are North Shields, Whitby and Scarborough, where demersal fish and shellfish species such as *Nephrops*, lobsters and queen scallops are landed. The fishing fleets along the coast of Northumberland and Tyne & Wear traditionally fished inshore, in the once rich fishing grounds near the ports, although these have declined in importance in recent years as a result of overfishing. There is a small amount of shellfish farming in the region, at Holy Island in Northumberland.

Much of the coastal land in the region, especially in Northumberland and North Yorkshire, is now in intensive agricultural use, including both arable and livestock farming. In many areas the former has reduced cliff-top vegetation to a narrow fringe at the edge of the cliff, whilst the latter has caused nutrient enrichment at a number of sites, particularly sand dunes. Here the vegetation has become less diverse as a result of overgrazing.

Generally, the intensity of tourism in the region is in keeping with the ability of the environment to absorb its impacts. Occasionally, however, problems of high levels of use and the need for infrastructure such as car parks and other facilities puts pressure on coastal habitats such as sand dunes, though the effects are relatively localised. The largely unspoilt and scenic coast of much of the region is a draw to tourists, who are attracted to important wildlife areas such as the Farne Islands. Here regular boat trips take visitors to see the seals and the spectacular seabird colonies. The North York Moors National Park also attracts tourists who make their base in the traditional holiday resorts of North Yorkshire, particularly Scarborough.

1.2.6 Further sources of information

A. Further reading

Chapman, A. 1889. *Birdlife of the Borders*. London, Gurney & Jackson.

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

Doody, J.P. 1981. The conservation of semi-natural vegetation of the Magnesian Limestone. 3: The Durham coast. *The Vasculum, 66*: 17-28.

English Nature. 1994. *Important areas for marine wildlife around England*. Peterborough, English Nature.

Mitchell, D.N., Davison, A.W., & Cooke, J.A. 1994. The flora and vegetation of Magnesian Limestone sea cliffs, County Durham. *Transactions of the Natural History Society of Northumberland, 57:* 153-175.

Perry, R. 1946. *A naturalist on Lindisfarne.* London, Lindsay Drummond.

Robinson, A., & Millward, R. 1983. *The Shell book of the British coast*, 367-378 (general setting and history). Newton Abbot, David and Charles.

Steers, J.A. 1969. *The coastline of England and Wales.* 2nd ed. Cambridge University Press.

Tegner, H. 1968. *The long Bay of Druridge*. Newcastle-upon-Tyne, Frank Graham.

Chapter 2 Geology and physical environment

2.1 Coastal geology

A. Crosby

2.1.1 Introduction

The coast from the Scottish border to Flamborough Head can be divided into three geological sections. In Northumberland and southwards to the River Tyne only rocks of Carboniferous age outcrop at the coast, apart from some Permian outliers. Southwards from the Tyne and through Durham and Cleveland to the Tees, the coastal strata are Permian and Triassic, and in north-eastern Yorkshire a full and well-exposed Jurassic and Cretaceous section gives a coast of particular beauty (Map 2.1.1). Table 2.1.1 shows the geological column and highlights the ages of important rocks in the region.

2.1.2 Stratigraphy

Berwick upon Tweed — the Tyne

From the northern limit of the region to Howick the coast is formed mostly of rocks of Lower Carboniferous age, comprising a repetitive sequence of limestones and sandstones. North of Bamburgh a series of small islands lie offshore, with Holy Island (Lindisfarne) in the north and the Farne Islands in the south. Holy Island consists of almost flat-lying Carboniferous sandstone with a prominent dyke of quartz dolerite (a rock type known by quarrymen as 'whin') at its southern margin. A series of such dykes, with a general ENE trend, occurs on the coast from the Tweed to Holy Island and another group from the North Tyne to Boulmer (just north of Alnmouth). The Farne Islands are all parts of the quartz dolerite Whin Sill, an igneous intrusion of late Carboniferous age, which, because of its relative resistance to weathering, forms crags where it intrudes into Carboniferous sedimentary rocks on the coast. It is encountered at Budle Point and southwards from Dunstanburgh.

Namurian (Upper Carboniferous) strata extend from Longhoughton, just north of Boulmer, to the mouth of the River Coquet at Warkworth. They form a succession of sandstones, shales, thin coals and limestones, well exposed in low cliffs near Longhoughton. Southwards from the mouth of the Coquet, Coal Measures of Westphalian age reach the coast and form off-lying islands or rocks, including Coquet Island. The Coal Measures consist of a cyclic sequence of mudstone, siltstone, sandstone, seat earth and coal. Each cycle represents a shallowing from marine or near-marine conditions to the establishment of coal forests on newly formed land.

One of the best natural exposures of productive Coal Measures anywhere in the British Isles occurs on the section of coast between St Mary's Island and Seaton Sluice. Coal mining from Ellington Colliery has extended underground for several kilometres offshore. A small outlier of Permian strata is seen in the cliffs at Tynemouth.

The Tyne — the Tees

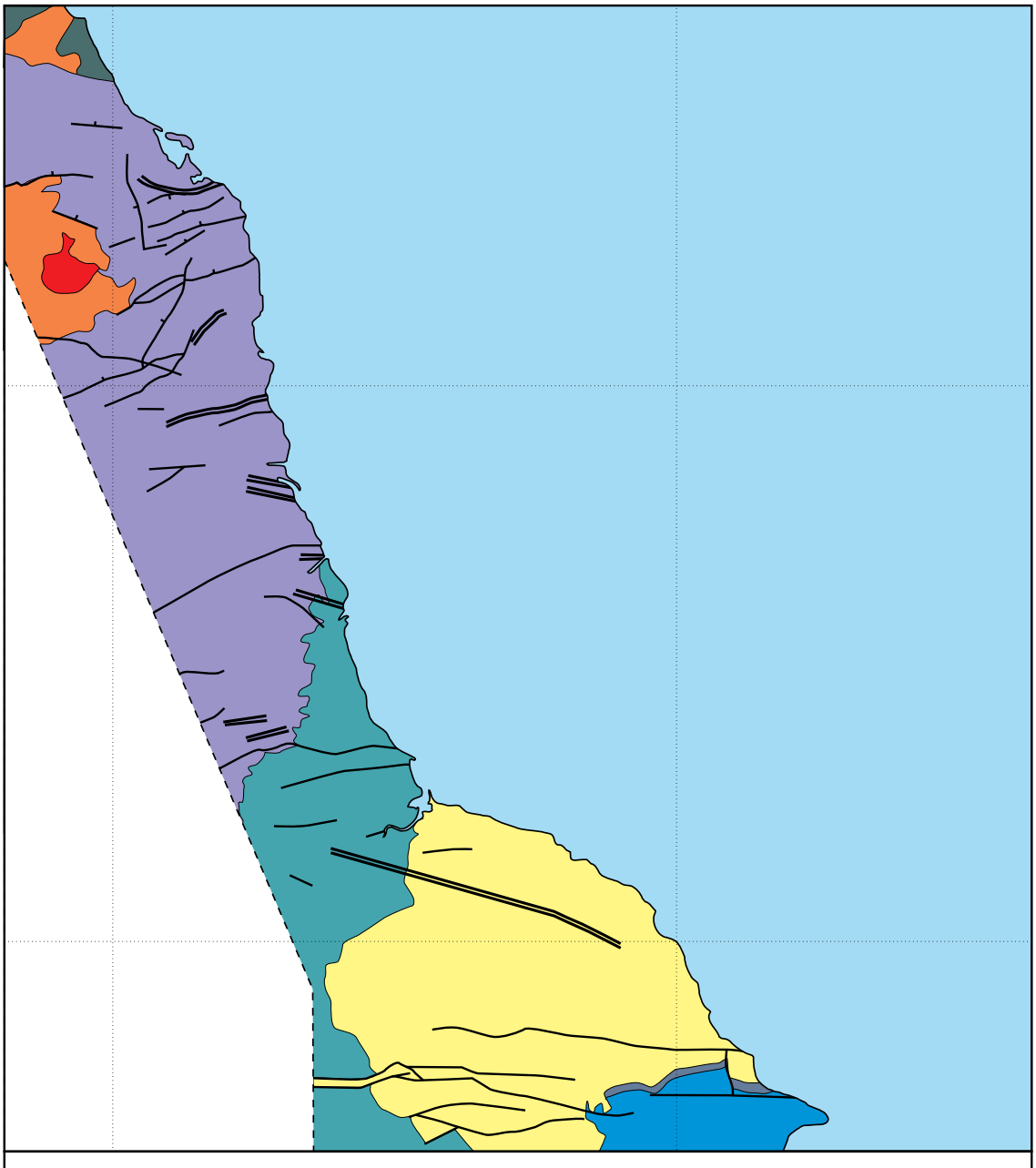
From South Shields to Hartlepool the Permian rocks form a particularly interesting coastal cliff section. The Permian and Triassic rocks of north-east England accumulated near the western margin of the North Sea sedimentary basin. Above a generally thin sequence of Lower Permian continental rocks consisting of breccia and sand, they comprise a thick cyclic sequence of marine limestone and dolomite. The cliffs include several designated 'type sections' of Permian formations. The West Hartlepool Fault intercepts the coast at Hartlepool Bay and marks the boundary between the Magnesian Limestone and the generally less resistant Triassic sandstones and mudstones, which form low cliffs.

South of the Tees

The boundary between the Triassic mudstones and the Lower Jurassic Lias lies to the west of Redcar, the Lias being exposed in the intertidal zone. Thence to Filey the coastal rocks are entirely Jurassic, of a variety of types formed mainly in marine conditions, comprising alternating shales and clay with limestone and ironstone, siltstone and sandstone.

The shale beds of the Lias, with ironstones near the top, are well seen in the northern and eastern cliffs of Cleveland. There is a fine clay section in Lower Jurassic between Saltwick and Robin Hood's Bay. Robin Hood's Bay itself is one of the finest features of the coast; calcareous sandstones appear as scars in an anticlinal structure of the foreshore, being more resistant than the interbedded shales. Middle Jurassic rocks are exposed south of Robin Hood's Bay as far as Scarborough. Between Gristhorpe and Filey the vertical cliffs are formed of southerly-dipping Upper Jurassic rocks, mainly the Oxford Clay and Lower Calcareous Grit. The latter formation provides the foundation of Filey Brigg.

At Speeton the Lower Cretaceous Speeton Clay is exposed, a sequence of clays with nodule beds. The clay is overlain by the Upper Cretaceous Chalk which forms the cliffs of Flamborough Head.



Map 2.1.1 Onshore coastal geology

Table 2.1.1 Geological column

Era	*Period*	*Epoch*	*Age of start (million yrs)*	*Stratigraphic units mentioned in the text*	*Significant geological events*
Cenozoic	Quaternary	Holocene	0.01		Rapid sea-level rise
		Pleistocene	1.6		Glaciations (Devensian, Wolstonian, Anglian)
	Tertiary (Neogene)	Pliocene	5.1		
		Miocene	25		
	Tertiary (Palaeogene)	Oligocene	38		
		Eocene	55		
		Palaeocene	65		
Mesozoic	Cretaceous		144	Chalk	
				Speeton Clay	
	Jurassic		213	Kimmeridgian	Subsidence in the North
				Oxford Clay	Sea Basin; region forms
				Lias	western border to this basin
	Triassic		248	Rhaetian	
Palaeozoic (Upper)	Permian		286	Magnesian Limestone	
	Carboniferous	Stephanian			Whin Sill intruded
		Westphalian		Coal Measures	
		Namurian		Millstone Grit	
		Dinantian	360	Carboniferous Limestone	
	Devonian		408		Caledonian earth movements
Palaeozoic (Lower)	Silurian		438		
	Ordovician		505		
	Cambrian		590		
	Precambrian				

Note: Shaded boxes show ages of rocks with important or extensive exposures in the region

2.1.3 Structure

The general dip of the rocks at the coast swings from north-easterly at the Scottish border to south-easterly near Howick, reflecting the concentric disposition of the strata around the inland Cheviot dome, the dominant structural feature in north Northumberland. However, a shallow syncline opens towards the sea at Berwick and a number of ENE-trending folds, including the Holburn Anticline and similarly trending faults, intercept the coast.

On the section of coast between St Mary's Island and Seaton Sluice a number of generally east-west faults intercept the coast. At Cullercoats Bay, north of Tynemouth, the best known of these faults, the Ninety-Fathom Dyke, is exposed, cutting an outlier of Permian Yellow Sands which rests unconformably on the Coal Measures.

Between Robin Hood's Bay and Scarborough the coastline is influenced by a series of faults which trend roughly north - south.

2.1.4 Glaciation

During the last (Devensian) glaciation, the whole region was covered by ice. Along many of the coastal sections, glacial till (otherwise known as boulder clay) overlies the bedrock to form a cap to the cliffs. Such a cap is especially well-developed along the cliffs north of Flamborough Head.

2.1.5 Further sources of information

A. Maps

British Geological Survey. 1991. *Geology of the United Kingdom, Ireland and the adjacent continental shelf (North Sheet).* 1:1 000 000 scale.

British Geological Survey. 1991. *Geology of the United Kingdom, Ireland and the adjacent continental shelf (South Sheet).* 1:1 000 000 scale.

British Geological Survey. 1981. Tyne-Tees. Sheet 54°N-0°W, solid geology. 1:250,000 series.

British Geological Survey. 1988. Farne. Sheet 55°N-02°W, solid geology. 1:250,000 series.

British Geological Survey. 1988. Farne. Sheet 55°N-02°W, Quaternary geology. 1:250,000 series.

Note that 1:50 000 scale sheets are available for much of coast of the region and further information may be obtained from the British Geological Survey, Keyworth, Nottingham.

B. Further reading

Carruthers, R.G., Burnett, G.A., & Anderson, W. 1930. The geology of the Alnwick District. *Memoir of the Geological Survey of Great Britain.* London, HMSO.

Carruthers, R.G., Dinham, C.H., Burnett, G.A., & Maden, J. 1927. The geology of Belford, Holy Island and the Farne Islands. *Memoir of the Geological Survey of Great Britain.* London, HMSO.

Cleal, C.J., & Thomas, B.A. In prep. *British Upper Carboniferous stratigraphy.* London, Chapman & Hall. (Geological Conservation Review series.)

Fowler, A. 1926. The geology of Berwick-on-Tweed, Norham and Scremerston. *Memoir of the Geological Survey of Great Britain.* London, HMSO.

Gregory, K.J. In prep. *Fluvial geomorphology of Great Britain.* London, Chapman & Hall.

Joint Nature Conservation Committee. In prep. *Introduction to the Geological Conservation Review.* London, Chapman & Hall.
Kent, P., Gaunt, G.D., & Wood, C.J. 1980. *British regional geology: eastern England from the Tees to the Wash.* 2nd ed. London, HMSO.
Land, D.H. 1974. The geology of the Tynemouth district. *Memoir of the Geological Survey of Great Britain.* London, HMSO.
Robson, D.A., *ed*. 1980. *The geology of North East England*. Newcastle upon Tyne, Special publication of the Natural History Society of Northumbria.
Smith, D.B. 1995. *Marine Permian of England*. London, Chapman & Hall. (Geological Conservation Review series.)
Smith, D.B.,& Francis, E.A. 1967. Geology of the country between Durham and West Hartlepool. *Memoir of the Geological Survey of Great Britain*. London, HMSO.
Taylor, B.J., Burgess, I.C., Land, D.H., Mills, D.A.C., Smith, D.B., & Warren, P.T. 1971. *British Regional Geology: northern England*. 4th ed. London, HMSO.

Detailed descriptions of Geological Conservation Review (GCR) sites can be found in published volumes of the Geological Conservation Review (e.g. Smith (1995) above). See also section 7.4 for a discussion of the GCR sites in the region.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Geological information for region and the whole of Britain	Coastal Geology Group, British Geological Survey, Keyworth, Nottingham NG12 5GG, tel: 0115 936 3100
Geological Conservation Review sites in Northumberland, Durham, Tyne and Wear and Cleveland	*English Nature Local Team, Newcastle upon Tyne, tel: 0191 281 6316
Geological Conservation Review sites in North Yorkshire	*English Nature Local Team, York, tel: 01904 432700

* Starred contact addresses are given in full in the Appendix

2.2 Offshore geology

A. Crosby

This section deals briefly with the geology of the rocks and sediments at and below the sea bed. The bulk of the information is shown on the maps, with some additional explanation provided by the text.

2.2.1 Holocene sea-bed sediments

Sea-bed sediments are defined here as the unconsolidated sediments at sea bed laid down since the sea transgressed across the area during the early Holocene.

Gravels dominate the sea-bed sediments around the Farne Islands (Map 2.2.1). Here bedrock comprising sandstones, limestones, mudstones and basic igneous intrusions is subject to strong current action, which washes away finer sediments leaving a patchy veneer of gravel resting upon bedrock. The carbonate content of the gravel in this area is less than 25%. Between the Tyne and the Tees estuaries the shell content is generally less than 60%, decreasing off the coast north of Newcastle. A discontinuous belt of sand occurs in a narrow inshore zone extending from the Tees Estuary to Flamborough Head. Beyond this inshore sand belt, a broader belt of mud-rich, often gravelly sediments runs parallel to the coast. The composition of this gravel varies across the region. Offshore from North Yorkshire, south of Saltburn, the shell content of gravels may exceed 80%.

Muddy sediments - reworked older glacial/marine muds and glacial till (boulder clay) - have accumulated in the Tyne and Tees estuaries, and offshore. Along the Durham and Northumberland coasts some sediments are dumped colliery waste. A broad belt of muddy sand extends north-eastwards from Newcastle to the Farne Deeps.

2.2.2 Pleistocene geology

The Pleistocene is the period of time from about 1.6 million years to about 10,000 years before present during which the surface of the Earth was subject to a number of glacial and inter-glacial climatic cycles.

The sea floor of the region is covered by a discontinuous sheet of glacial till (boulder clay) of Late Devensian age, the Wee Bankie Formation; the unit is thin and patchy close to the coast (Map 2.2.2, shown as Q and Q<5). Although for the main part it forms a thin veneer on bedrock, the boulder clay locally thickens to 40 m in overdeepened channels. It is red-brown in colour, and may be sandy or silty with a variable clast content, including local rock types such as Carboniferous Limestone, Permian dolomites and mudstones and occasional Quartzite pebbles. Glaciomarine muds (St. Abb's Formation) with sporadic small pebbles occur on the sea bed south from Amble towards the Tees Estuary. Some deposits (shown as QLP on the map) belong to the Forth Formation, a sequence of interbedded sands, silts and muds deposited in an estuarine to marine environment at the end of the last glaciation, spanning the Pleistocene - Holocene boundary (late Devensian to earliest Holocene).

2.2.3 Solid (pre-Quaternary) geology

Rocks formed before the start of the Quaternary Period (1.6 million years BP) are included by geologists in the category of 'solid geology'. Offshore in this region these rocks are largely concealed by sea-bed sediments (Map 2.2.3).

North of Newcastle-upon-Tyne, Carboniferous strata crop out at the sea bed in a belt that extends approximately parallel with the coast. In the offshore area as far south as the Farne Islands, the Carboniferous strata are Dinantian (Lower Carboniferous) in age, comprising rhythmic sequences of limestones as well as shales, sandstones and coals of various thicknesses. Basic igneous rocks have, in places, intruded into the sedimentary sequences. From just south of the Farne Islands to Whitley Bay the Carboniferous strata comprise faulted Westphalian Coal Measures: sandstones and mudstones with coal seams and marine and non-marine fossiliferous bands. Further offshore, the Farne Deeps depression, south-east of the Farne Islands, is underlain by relatively soft Permo-Triassic 'red-bed' sandstones and mudstones which extend in a belt southwards to the coast between Newcastle-upon-Tyne and the Tees Estuary. North of Hartlepool these beds consist largely of Upper Permian Magnesian Limestone comprising dolomitised limestones with intercalated evaporite deposits.

Extending from near the Tees Estuary to north of Filey Brigg, Jurassic strata crop out at the sea bed and in the rock platforms seaward of the cliffline. The spectacular coastline of cliff, bays and headlands reveals a complete geological section through the uplifted Cleveland Basin; these rocks continue offshore. The strata range in age from Rhaetian (Upper Triassic) to Kimmeridgian (Upper Jurassic) and comprise interbedded sandstones, mudstones and limestones deposited in a variety of shallow marine and marginal environments. Lower Jurassic strata are dominant, with Middle Jurassic strata forming the sea floor in a coastal belt north and south of Scarborough. A small inlier of Triassic rocks occurs 15 km offshore from Scarborough.

2.2.4 Further sources of information

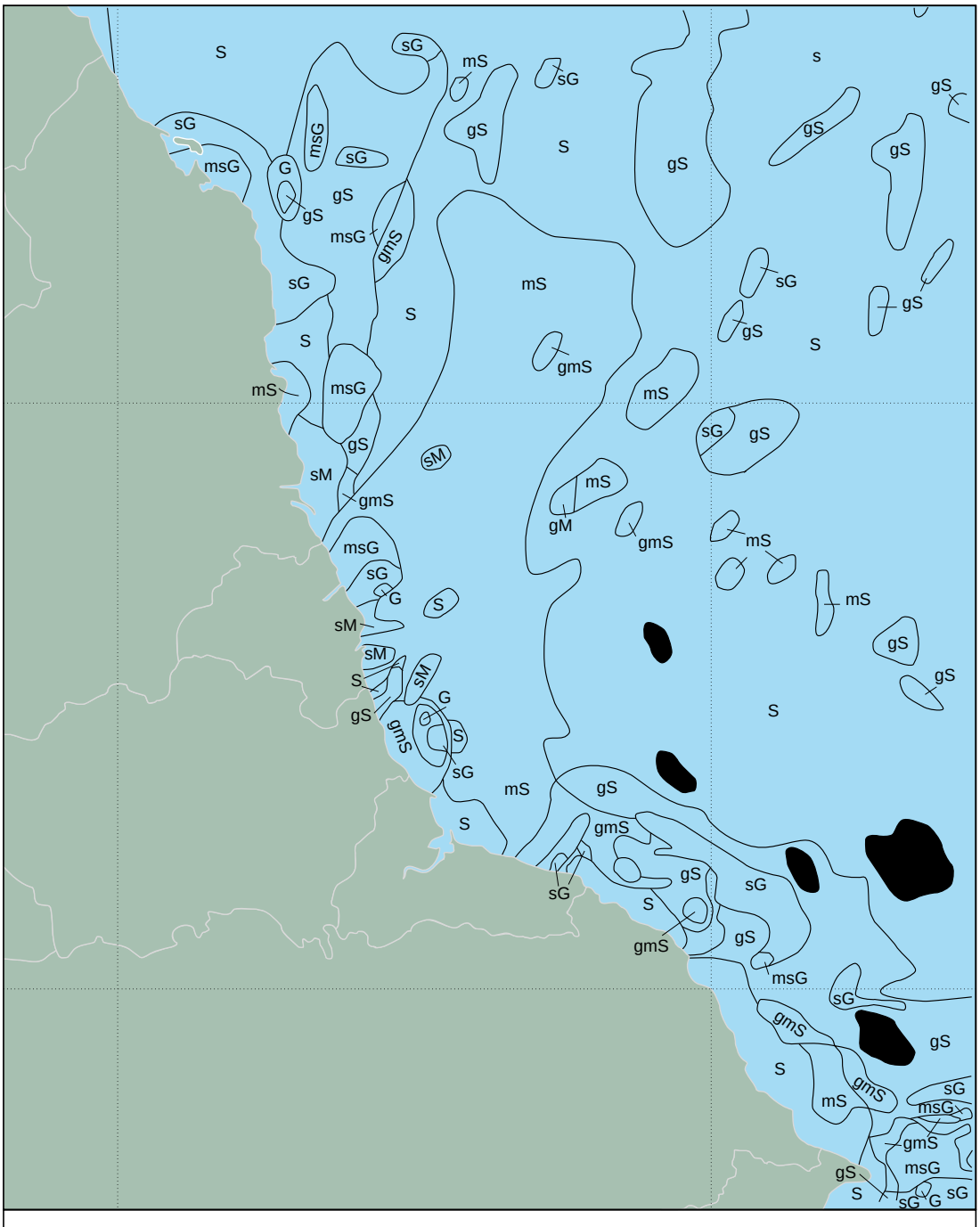
A. Maps

British Geological Survey. 1986. Tyne-Tees. Sheet 54°N-0°W, sea bed sediments and Quaternary geology. 1:250,000 series.

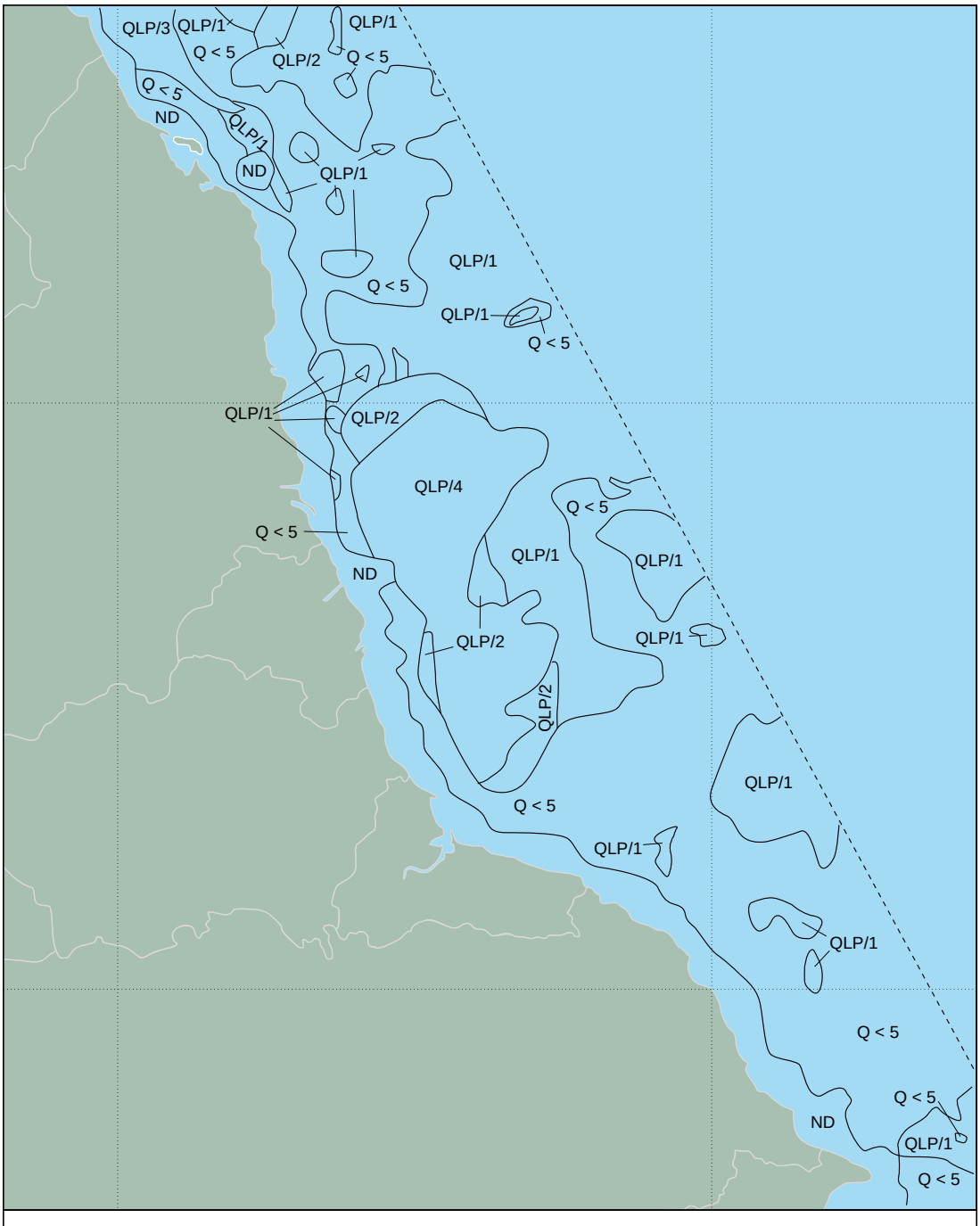
British Geological Survey. 1989. Farne. Sheet 55°N-02°W, sea bed sediments. 1:250,000 series.

British Geological Survey. 1991. Geology of the United Kingdom, Ireland and the adjacent continental shelf (North and South Sheets). 1:1,000,000 scale.

British Geological Survey. 1994. Quaternary Geology around the United Kingdom (North and South Sheets). 1:1,000,000 scale.



Map 2.2.1 Seabed sediments

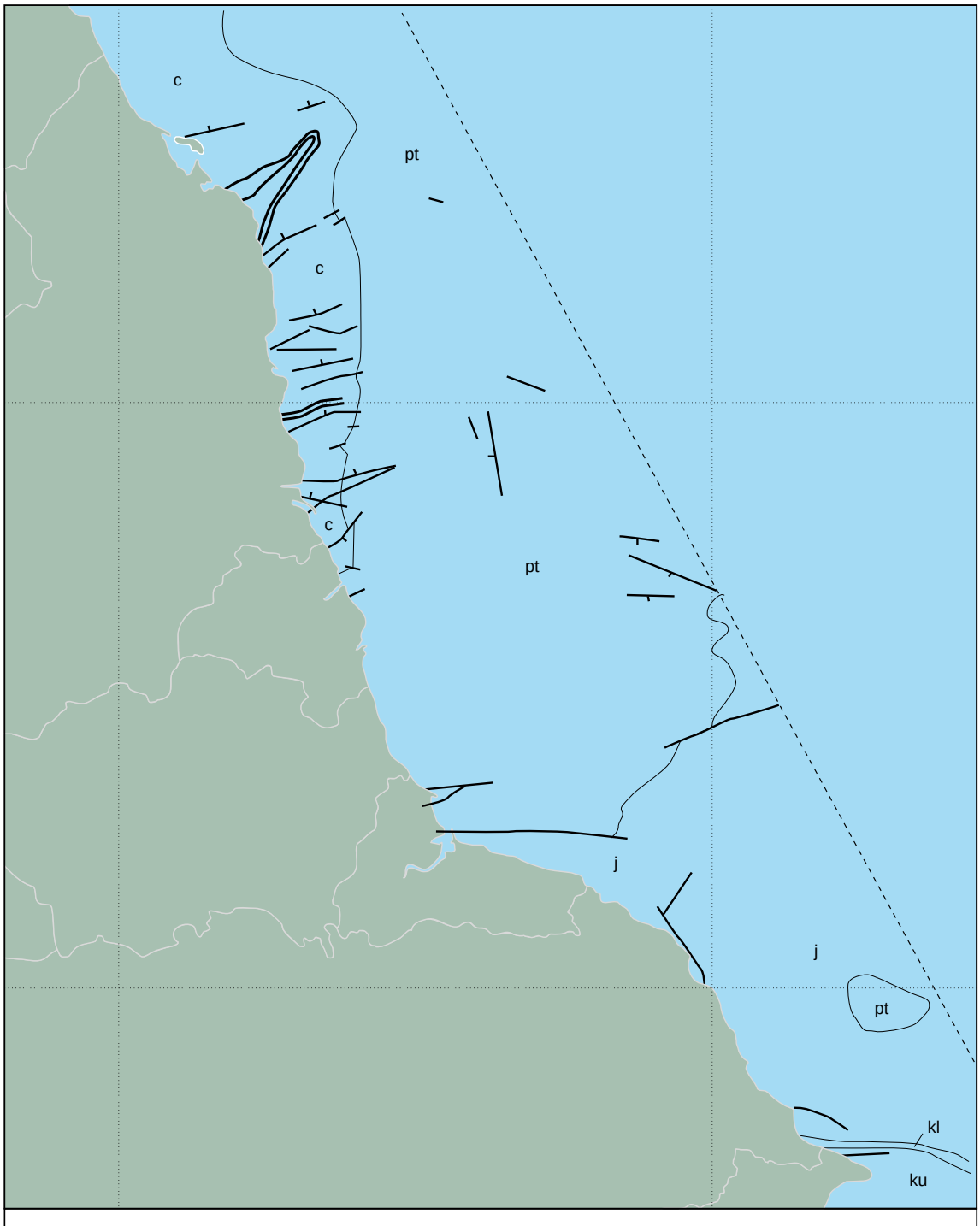


Key to seabed sediment symbols

QLP	Late Pleistocene to Early Holocene	1	Predominantly till
Q	Quaternary, undivided	2	Predominantly mud
Q<5	Quaternary generally < 5 m thick	3	Predominantly interbedded mud and sand
ND	No data	4	Predominantly sand

Source: Adapted from Holmes *et al.* (1993). Quaternary Geology around the United Kingdom (North and South Sheets). British Geological Survey, Edinburgh.

Map 2.2.2 Offshore Pleistocene deposits



Stratigraphy

ku	Upper Cretaceous	Chalk, flint
kl	Lower Cretaceous	Clay
j	Jurassic	Mudstone, shale, sandstone, limestone
pt	Permian–Triassic	Mudstone, sandstone, evaporites
c	Carboniferous	Mudstone, sandstone, limestone, coal

Igneous rocks

Intrusive dyke

Structures

Fault, tick on downthrow side

Source: British Geological Survey, Geology of the United Kingdom, Ireland and the adjacent continental shelf. 1:1,000,000 scale (1991).

Map 2.2.3 Offshore solid (pre-Quaternary) geology

British Geological Survey. 1987. Sea bed sediment around the United Kingdom (North and South Sheets). 1:1,000,000 scale.

B. References cited

Folk R.,L. 1954. The distinction between grain-size and mineral composition in sedimentary rock nomenclature. *Journal of Geology, 62: 344-359*.

C. Further reading

Cameron, T.D.J., Crosby, A., Balson, P.S., Jeffery, D.H., Lott, G.K., Bulat, J., & Harrison, D.J. 1992. *United Kingdom offshore regional report: the geology of the southern North Sea.* London, HMSO.

Gatliff, R.W., Richards, P.C., Smith, K., Graham, C.C., McCormac, M., Smith, N.J.P., Long, D., Cameron, T.D.J., Evans, D., Stevenson, A.G., Bulat, J., & Ritchie, J.D. 1994. *United Kingdom Offshore Regional Report: The geology of the central North Sea. London,* HMSO.

Motyka, J.M., & Bevan, S.M. 1986. *A macro-review of the coastline of England and Wales. Vol 1. The north-east. St Abb's Head to the Tees.* Wallingford, HR Wallingford Report SR 90.

D. Contact names and addresses

Type of information	*Contact address and telephone no.*
Geological information for region and the whole of Britain	Coastal Geology Group, British Geological Survey, Keyworth, Nottingham NG12 5GG, tel: 0115 936 3100
UKDMAP 1992. Version 2. United Kingdom digital marine atlas. Oceanographic maps	British Oceanographic Data Centre, Proudman Oceanographic Laboratory, Bidston Observatory, Birkenhead, Merseyside L43 7RA, tel: 0151 652 3950

2.3 Wind and water

A. Crosby

2.3.1 Wind

Westerly to south-westerly (offshore) winds dominate (Maps 2.3.1 and 2.3.2 and Figure 2.3.1), with winds from the northeastern sector being least common. Strong winds (greater than 16 m/s) are uncommon in this region, although when they occur they can have a major impact on coastal defences, as they tend to be from the north (onshore).

2.3.2 Water depth

The 20 m, 40 m and, north of the Tees estuary, the 60 m bathymetric contours run approximately parallel to the coast in this region, and the sea floor slopes steeply but uniformly away from the coast (Map 2.3.3). Seaward of the 60 m contour the sea floor flattens out, and for the most part forms a gently undulating surface. South-east of the Farne Islands there is a conspicuous depression, the Farne Deeps, where in places the sea floor lies over 100 m below mean sea level.

2.3.3 Tidal currents

Spring tides are most important for sediment transport: north of the Farne Islands, nearshore maximum tidal current speed during mean spring tides is 0.5 metres/second,

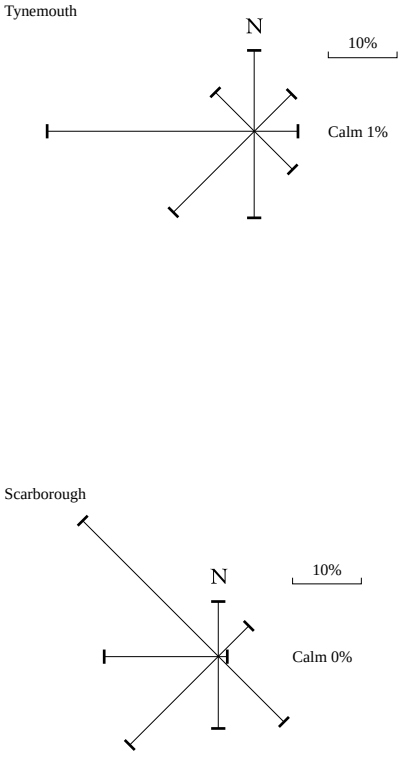
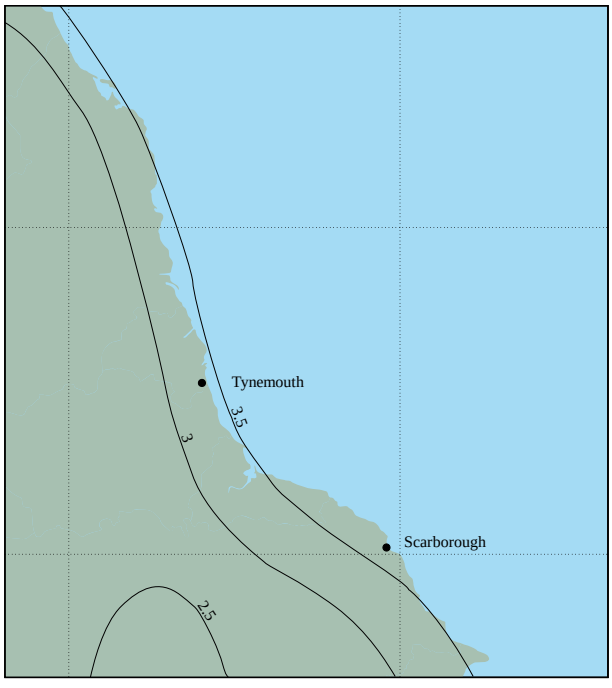
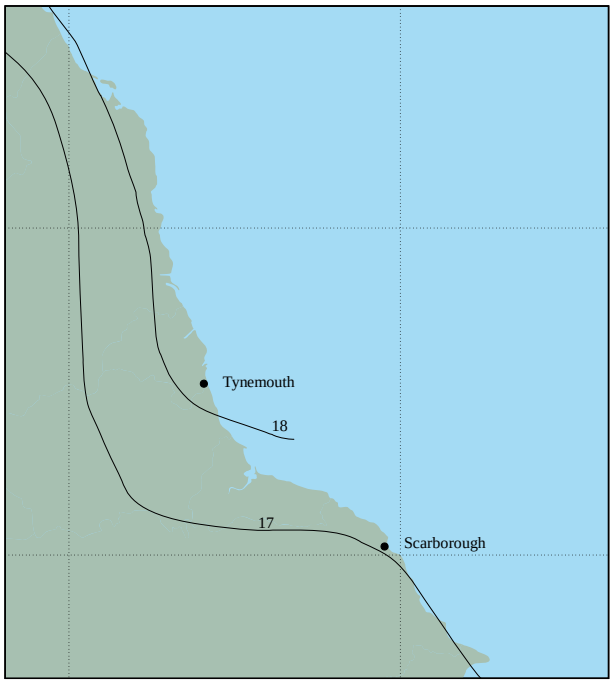


Fig 2.3.1 Wind directions at Tynemouth and Scarborough shown as % of observations through the years 1916 - 1950. Source: Hydrographic Office (1960).

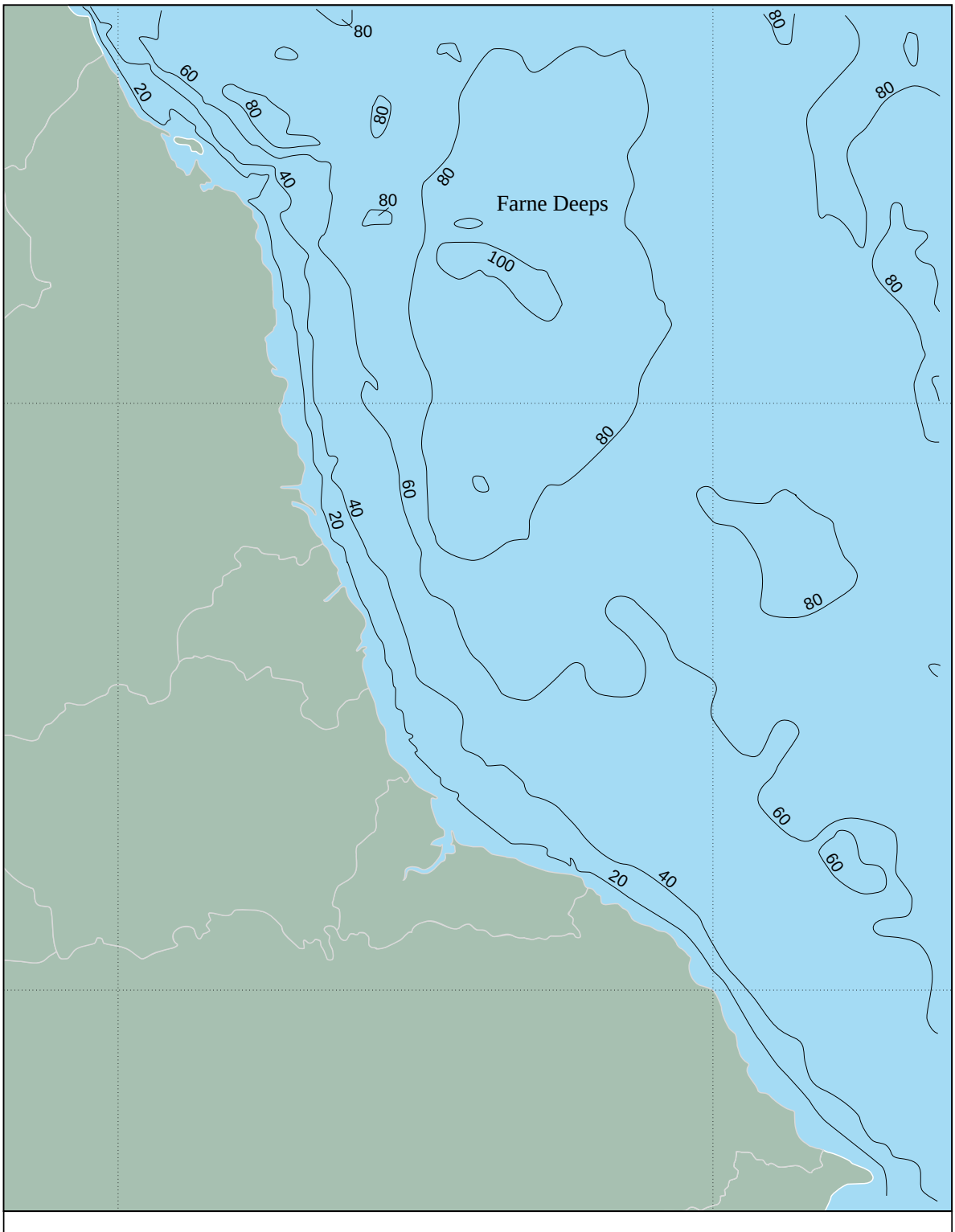


Map 2.3.1 Hourly mean windspeed (in m/s) exceeded for 75% of the time. Source: Caton (1976).

increasing to about 0.7 metres/second in Tees Bay (Map 2.3.4). Because of the asymmetrical nature of the tidal wave, the maximum speed at flood flow is generally higher than the maximum at ebb flow, and this produces a net movement of sediment in a southward direction. While tidal current flow offshore runs more or less north-south,



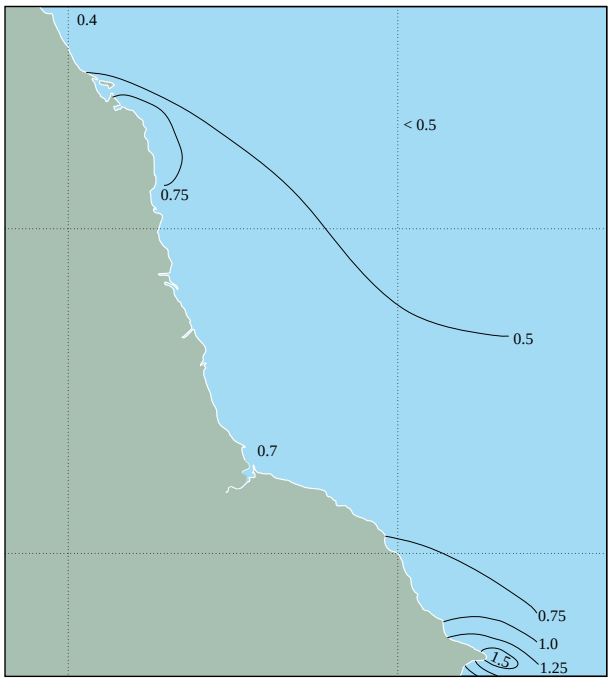
Map 2.3.2 Hourly mean windspeed (in m/s) exceeded for 0.1% of the time. Source: Caton (1976).



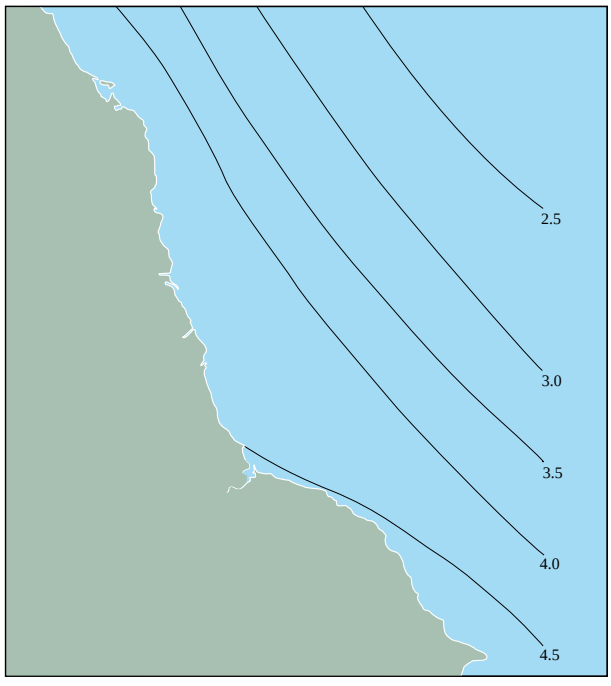
60 Bathymetric contours in metres; figures on the deep side of the line

Source: British Geological Survey. Sea bed sediment around the UK. 1:1,000,000 scale.

Map 2.3.3 Bathymetry



Map 2.3.4 Maximum tidal current speed (in knots) at mean spring tides. Source: Sager & Sammler (1968).



Map 2.3.5 Tidal range (m) at mean spring tides. Source: Lee & Ramster (1981). (c) Crown copyright.

that close inshore is affected by the form of the coast. For example, tidal currents are stronger locally as they flow past prominent headlands, giving rise to eddies within embayments. Within Druridge Bay and Hartlepool Bay, for instance, a clockwise circulation is developed.

2.3.4 Tidal range

The tidal ranges in the region (Map 2.3.5) are smaller than along some other parts of the British North Sea coast (e.g. the Firth of Forth and the Humber and Thames estuaries) but larger than those elsewhere in the North Sea. Due to the earth's rotation, as the tide flows southwards down the eastern coast of Britain water tends to 'pile up' along the coast. As the ebb tide flows northwards about six hours later, the reverse happens and water moves away from the coastal zone. The net results throughout the region are higher high waters and lower low waters than might otherwise be expected. As each tidal wave propagates southwards so it increases in height. Thus the mean spring tidal range increases from just over 4 m off the Farne Islands to over 4.5 m off the mouth of the Tees.

Tidal surges occur relatively frequently along the North Sea coast, increasing in height towards the south. Surges typically occur when an intense, fairly static low pressure area is situated to the north of Scotland and strong northerly winds persist over the North Sea. The combined effects of atmospheric pressure, wind stress and the funnelling effect caused by the shape of the southern North Sea cause a build-up of water to the south of this region. Extremely high water levels occur if these conditions coincide with high water spring tides, as was the case in 1953, when major flooding resulted along the low-lying areas of the east coast.

2.3.5 Wave exposure and sea state

Along the coast from St Abb's Head to Flamborough Head there are no enclosed bays to provide shelter from north-easterly and south-easterly waves. Some shelter is provided by local small headlands, depending on the wind direction.

Map 2.3.6 shows the significant wave heights which can be expected to be exceeded for 10% and 75% during the year. Except near the mouth of the river Tees the significant wave height on the coast is between 0.5 and 1.0 m for 75% of the year and between 1.5 and 2.0 m for 10% of the year.

2.3.6 Water characteristics

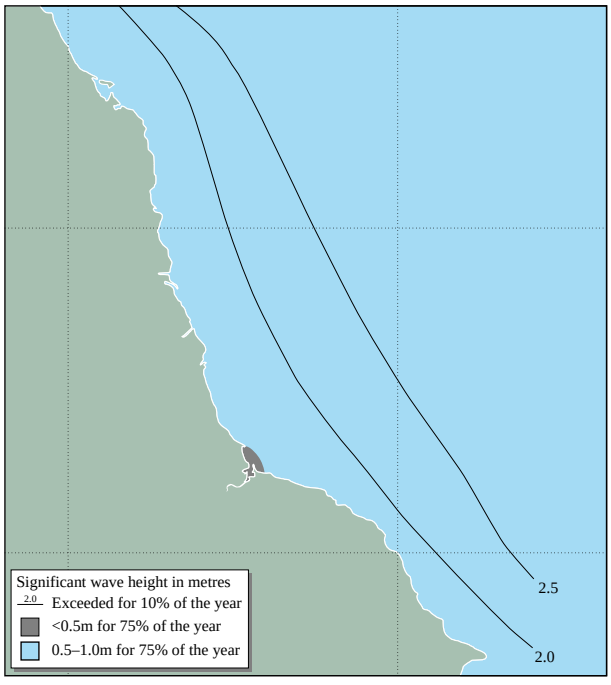
Temperature

The mean monthly sea surface temperatures for summer and winter are shown on Map 2.3.7. The isotherms are based on data for August, the warmest month on average, and February, the coldest month.

Although the freshwater inputs from the rivers Tyne, Wear and Tees affect temperatures locally, offshore sea surface temperatures in this region are relatively uniform, suggesting a homogeneous water mass. In February the surface water averages 5.5 - 6°C. In summer the average temperature varies from 13 to 14°C in August, becoming progressively warmer to the south.

Salinity

Salinity is relatively uniform in this region, on average between 34.25 and 34.5‰ in summer and 34 and 34.25‰ in winter (Map 2.3.8). Salinities decrease slightly approaching the coast and in the vicinity of river mouths (Tyne, Wear and Tees) where there is dilution by freshwater river inputs.



Map 2.3.6 Significant wave height (m) exceeded for 10% and 75% of the year. Source: Draper (1992).

2.3.7 Further sources of information

A. Further reading

Banner, F.T., Collins, M.B., & Massie, K.S., *eds*. 1980. *The north-west European shelf seas: the seabed and the sea in motion. Vol.2.* Amsterdam, Elsevier.

Department of the Environment. 1992. *Digest of environmental protection and water statistics.* London, HMSO. (Government Statistical Service.)

Draper, L. 1991. *Wave climate atlas of the British Isles.* London, HMSO.

Hydrographic Office. 1993. *Admiralty tide tables. Vol.1. European waters.* Taunton, British Admiralty.

ICES. 1962. *Mean monthly temperature and salinity of the surface layer of the North Sea and adjacent waters*, 1905-54. Copenhagen, Denmark, International Council for the Exploration of the Sea.

Jones, S.R., & Jeffs, T.M. 1991. *Near-surface sea temperatures in coastal waters of the North Sea, English Channel and Irish Sea*. Lowestoft, Ministry of Agriculture, Fisheries and Food (Directorate of Fisheries Research, Data Report No. 24).

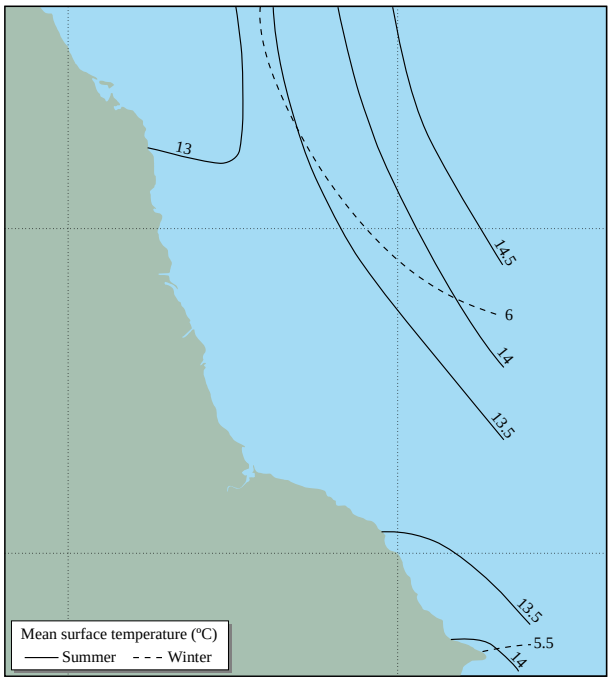
Lee, A.J., & Ramster, J.W. 1981. *Atlas of the seas around the British Isles*. Lowestoft, Ministry of Agriculture, Fisheries and Food.

Pantin, H.M. 1991. *The sea bed sediments around the United Kingdom: their bathymetric and physical environment, grain size, mineral composition and associated bedforms*. London, HMSO. (British Geological Survey Research Report. SB/90/1.)

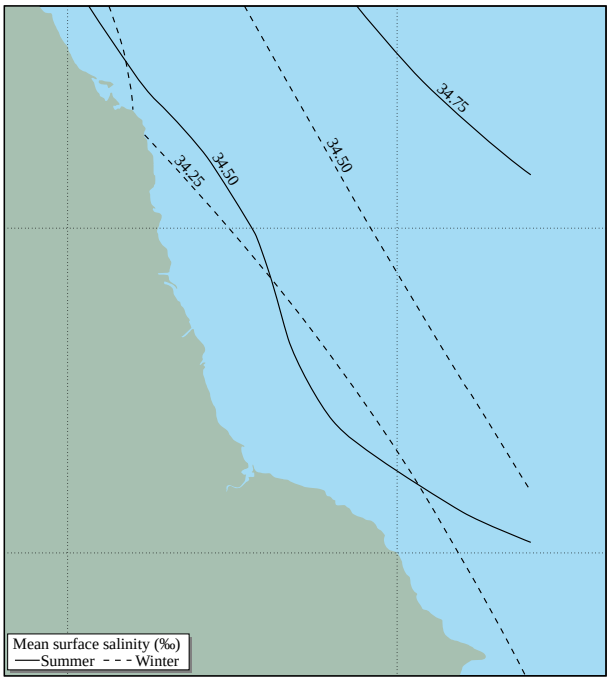
University of Newcastle upon Tyne. 1989. *The north-east coast of England, environment appraisal*. Newcastle upon Tyne, Shell UK Exploration and Production.

B. Contact names and addresses

Type of information	*Contact address and telephone no.*
Windroses for rectangular areas defined by latitude and longitude for monthly/ seasonal or annual periods based on 10 or 20 year data from ships of passage.	Meteorological Office Marine Enquiry Service, Johnstone House, London Road, Bracknell RG12 2SY, tel: 01344 854979
UKDMAP 1992. Version 2. United Kingdom digital marine atlas. Oceanographic maps	British Oceanographic Data Centre, Proudman Oceanographic Laboratory, Bidston Observatory, Birkenhead, Merseyside L43 7RA, tel: 0151 652 3950



Map 2.3.7 Mean surface water temperature in summer and winter (°C). Source: Lee & Ramster (1981). © Crown copyright.



Map 2.3.8 Mean surface salinity of seawater in summer and winter in g/kg of total dissolved salt. Source: Lee & Ramster (1981). © Crown copyright.

2.4 Sediment transport

A. Crosby

2.4.1 Description

Sediment transport is described within the context of coastal cells and sub-cells. These divide the coastline into sections within which sediment erosion and accretion are inter-related and largely independent of other cells (Motyka & Brampton 1993). The region's coast is all part of one coastal cell, divided into four sub-cells (Map 2.4.1), St Abb's Head to the Tyne, the Tyne to Seaham Harbour, Seaham Harbour to Saltburn, and Saltburn to Flamborough Head. These are described below. Note that the sediment transport shown is of sand and gravel 'bed load', not suspended sediments.

Between St Abb's Head and the Tyne littoral drift is low and intermittent: sand transport is interrupted by rock reefs and headlands. Wave action produces strong seasonal onshore/offshore sand movement, while the tidal currents reinforce southerly sand transport along the beach and nearshore sea bed (see section 2.3.2). Sand and silt accrete at Holy Island, whereas on much of Druridge Bay there is severe sand dune erosion, associated with the lowering of beach levels. At Newbiggin and Blyth the beach and cliff are eroding, and beach despoliation occurs at Lynmouth Bay and Cambois as colliery waste is eroded, following the cessation of tipping. Clay cliffs from Seaton Sluice to the Tyne are prone to erosion.

From the mouth of the Tyne to Seaham Harbour sediment transport patterns are similar: low and intermittent southward drift and wave action producing strong seasonal onshore/offshore sand movement. Between Sunderland and Seaham cliff-derived pebbles are accreting. There is localised sand-dune erosion at South Shields and cliff erosion is widespread from South Shields to Seaham.

Between Seaham Harbour and Saltburn there is moderate southward sediment drift; tidal currents again have a southerly residual effect, and wave action produces seasonal onshore/offshore sand movement. Beaches extend beyond the natural coastline because of former large-scale colliery waste disposal, so rocky cliffs only partly interrupt drift. There is sand accretion at the mouth of the Tees. Only short stretches of cliff are subject to erosion, but there is dune erosion from Crimdon Park to Hartlepool and beach erosion in the Tees and Hartlepool bays.

From Saltburn to Flamborough Head the littoral drift is low and intermittent. Wave action produces seasonal onshore/offshore movement but material is generally retained within indented bays. Tidal currents dominate the southward transport of material in the nearshore zone. Cliffs provide an important supply of sand in bays. A large volume of fine sediment is transported offshore and then southwards by tidal currents. Cliff erosion occurs along most of the coastline, with cliff instability, weathering and scouring of the cliff toe in most bays. There is small but significant interchange of sediment around Flamborough Headland, between Filey and Bridlington Bays.

2.4.2 Further sources of information

A. Further reading

Hydraulics Research Wallingford. 1986. *A macro review of the coastline of England and Wales: Vol. 1. The north-east. St Abb's Head to the Tees*. Wallingford, Hydraulics Research Wallingford Report No. SR 90.

Hydraulics Research Wallingford. 1986. *A macro review of the coastline of England and Wales: Vol. 2. The east coast: the Tees to the Wash*. Wallingford, Hydraulics Research Wallingford Report No. SR 107.

Lowry, R.K., Cramer, R.N., & Rickards, L.J. 1992. *North Sea project data set*. CD-ROM. Birkenhead, British Oceanographic Data Centre, NERC.

Motyka, J.M., & Brampton, A.H. 1993. *Coastal management: mapping of littoral cells*. Report to MAFF. HR Wallingford, Report SR 328.

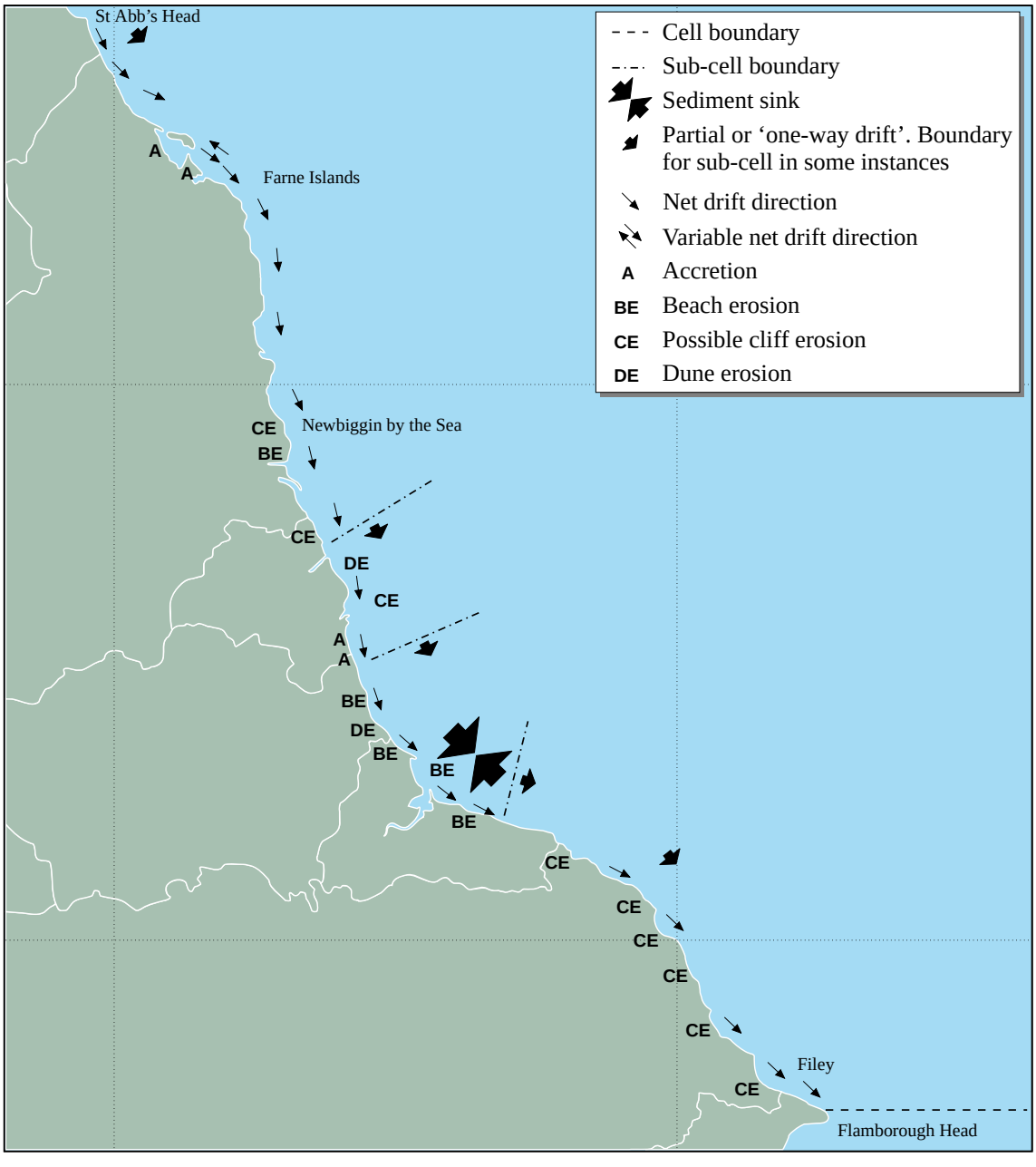
Posford Duvivier. 1993. *Durham coast management plan, coastal processes report*. Durham County Council.

Rendel Geotechnics. 1995. *Coastal planning and management: a review of earth science information needs*. London, HMSO.

Stapleton, C.M. 1994. *Humber Estuary and coast*. Hull, Humberside County Council.

B. Contact names and addresses

Type of information	*Contact address and telephone no.*
Coast protection policy; coast protection survey England	Ministry of Agriculture, Fisheries and Food (MAFF), Flood and of Coastal Defence Division, Eastbury House, 30/34 Albert Embankment, London SE1 7TL, tel: 0171 238 3000
Sediment cells	HR Wallingford Ltd, Howbury Park, Wallingford, Oxfordshire OX10 8BA, tel: 01491 835381
North Sea Project data set CD ROM	British Oceanographic Data Centre, Proudman Oceanographic Laboratory, Bidston Observatory, Birkenhead, Merseyside L43 7RA, tel: 0151 652 3950



Map 2.4.1 Sediment transport and coastal cells. Source: Motyka & Brampton (1993). Adapted with permission from MAFF Flood and Coastal Defence Division.

2.5 Sea-level rise and flooding

A. Crosby

2.5.1 Description

Apparent sea-level rise is the combined effect of local crustal movements (owing to the removal of the weight of ice since the last glacial period, Scotland is rising whereas southern England is sinking) and global rises in sea level. The crustal change in land levels across the region is small, with the zero change line postulated by Shennan (1989) passing through the Tees estuary. The tide gauge data examined by Emery & Aubrey (1991) confirm that the sea level across the area is rising at between 0 to 2 mm/year.

The coasts of this region are not generally at risk from flooding (Map 2.5.1; see also section 8.4). However, parts of Lindisfarne National Nature Reserve landward of Holy Island and some adjacent areas of low-lying agricultural land are susceptible. During the winter of 1994-95 there was extensive flooding of low-lying land at Cresswell and Druridge Pools. The main risk of flooding in the region lies within the Tees Estuary, where much of the industrial development has taken place on claimed land within the confines of the old estuary, including the nuclear power station at Hartlepool, which could be at risk. South of the Tees there are no major estuaries within the region and the flooding risk is minimal.

2.5.2 Further sources of information

A. References cited

Emery, K.O., & Aubrey, D.G. 1991. *Sea levels, land levels, and tide gauges*. New York, Springer-Verlag.

Shennan, I. 1989. Holocene crustal movements and sea-level changes in Great Britain. *Journal of Quaternary Science, Vol. 4*(1): 77-89.

B. Further reading

Burd, F., & Doody, P. 1990. *Sea level rise and nature conservation. A review of NCC experience*. Peterborough, Nature Conservancy Council. (Coastal Habitat Network Paper No 3.)

Cannell, M.G.R., & Hooper, M.D. 1990. *The greenhouse effect and terrestrial ecosystems of the UK*. London, Natural Environment Research Council. (Institute of Terrestrial Ecology Research Publication No. 4.)

Carter, B. 1989. *Rising sea level. Geology Today:* Vol 5, 63-67.

Conference of River and Coastal Engineers. 1989. *The greenhouse effect, consequences for rivers and coastal zones*. London, MAFF Flood Defence Division.

Department of the Environment & the Meteorological Office. 1990. *Global climate change*. London, HMSO.

Department of the Environment. 1992. *The UK environment: coast erosion, flooding and sea level change*. London, HMSO.

Department of the Environment. 1988. *Possible impacts of climate change on the natural environment in the United Kingdom*. London, HMSO.

Doornkamp, J.C. 1990, *ed*. *The greenhouse effect and rising sea levels in the UK*. Nottingham, M1 Press.

Hollis, T., Thomas, D., & Heard, S. 1989. *The effects of sea level rise on sites of conservation value in Britain and North West Europe*. Department of Geography, University of London, World Wide Fund for Nature. (Project 120/88.)

Posford Duvivier Environment. 1991. *Environmental opportunities in low lying coastal areas under a scenario of climate change*. Peterborough, Report to National Rivers Authority, Department of Environment, Nature Conservancy Council and Countryside Commission.

Pugh, D.T. 1987. *Tides, surges and mean sea-level*. Chichester, John Wiley.

Pugh, D.T. 1990. Is there a sea level problem? *Proceedings of the Institution of Civil Engineers, Part 1: Design & Construction, Volume 88*, 347-366 (Serial).

Shennan, I. 1993. Sea-level changes and the threat of coastal inundation. *The Geographical Journal, Vol. 159*, No.2: 148-156.

Tooley, M.J., & Shennan, I., *eds.* 1987. *Sea level changes*. Oxford, Basil Blackwell. (The Institute of British Geographers Special Publication Series, No. 20.)

Whittle, I.R. 1989. *The greenhouse effect, land at risk, an assessment*. Paper presented at MAFF Conference of of river and coastal Engineers, Loughborough. London, MAFF.

Woodworth, P. 1990. Measuring and predicting long term sea level changes. *NERC news*. No. 15: 22-25. Swindon, NERC.

Woodworth, P.L. 1987. Trends in UK mean sea level. *Marine Geodesy, Vol. 11*: 57-87.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Flood and coastal defence policy	Ministry of Agriculture, Fisheries and Food (MAFF), Flood and Coastal Defence Division, Eastbury House, 30/34 Albert Embankment, London SE1 7TL, tel: 0171 238 3000
Flood defence (see also section 8.4)	*NRA Northumbria Region, Eldon House, Regent Centre, Gosforth, Newcastle upon Tyne NE3 3UD, tel: 0191 213 0266
	*NRA Yorkshire Region, 21 Park Square South, Leeds LS1 2QG, tel: 01532 440191
Tide gauge data	British Oceanographic Data Centre, Proudman Oceanographic Laboratory, Bidston Observatory, Birkenhead, Merseyside L43 7RA, tel: 0151 652 3950

* Starred contact addresses are given in full in the Appendix

Map 2.5.1 Areas below 5 m above OD and thus susceptible to flooding, and estimated rates of crustal movement. After Shennan (1989).

2.6 Coastal landforms

2.6.1 Introduction

This section describes the landforms of the coast, focusing on the areas subject to short- and longer-term accretion and erosion (Map 2.6.1; see also section 2.4). The region's coastline is a sequence of wide bays separated by stretches of cliffs. Small islands lie offshore in the northern part. Although the varying resistance to wave erosion of the 'solid' rock types is one factor fundamental to the coastal morphology of the region, glacial drift plays a large part in shaping the scenery throughout the whole stretch of coast, both in the supply of sediment and in forming the cliff line in many areas. As a result of the Quaternary glaciations there are numerous sediment-filled valleys. As sea level rose during the late Pleistocene and the Holocene, unconsolidated sediments provided a plentiful supply of sediment for onshore and longshore drift.

2.6.2 Description

Berwick-upon-Tweed — Alnmouth

Except near the mouth of the Tweed, where there are beach deposits of mud and sand and a raised beach, cliffs of Lower Carboniferous rocks extend south from the Scottish border to Cheswick, where the coast takes on an entirely different form. An almost continuous fringe of sand dunes extends from Cheswick to Beal, separating the sea from alluvial flats inland. A tract of sandy beach deposits extends southwards to Holy Island. The island protects an area of several square kilometres of recent marine alluvium, the northern part consisting mainly of sand, but the southern of silt and mud. Holy Island is also notable for excellent examples of storm beaches which skirt its coast and for a small, but markedly recurved, shingle ridge at Castle Point, indicating a southerly longshore drift.

Blown sand covers a good deal of Holy Island, and sand dunes (links) form a great part of the coastline southwards to Embleton, notably to the south of Bamburgh and following the curve of Beadnell and Embleton bays. The cliffs formed by the weathering-resistant quartz dolerite Whin Sill at Budle Point contrast markedly with the remainder of this section of the coast. Southwards from Seahouses to just north of Alnmouth, with the exception of the major bays, Carboniferous rocks are exposed as wave-cut platforms and in low, till-capped cliffs. The Whin Sill again forms a dominant cliff between Dunstanburgh and Cullernose Point.

Alnmouth — Hartlepool Headland

The coast from Alnmouth to Seaton Sluice mainly comprises a series of low-lying sandy bays, backed by sand dunes or low cliffs of till. These are flanked by rocky headlands composed predominantly of Coal Measures sandstone and fronted for the most part by wave-cut rock platforms. Several wide bays mark the outlets of sediment-filled valleys. Good sections of till occur at intervals. In general, beach deposits consist of sand in the bays and shingle immediately around and to the south of the headlands. The general direction of longshore drift is to the south, as seen in the small spits deflecting the Aln, Coquet, Lyne and Wansbeck. A submerged 'forest bed' has been exposed at various times on the foreshore on the Howick coast and in Druridge Bay, most notably at Hauxley and Cresswell.

From Seaton Sluice to the Tyne most of the coastline is cliffed but subject to erosion. Numerous landslips have occurred, particularly in till sections. Opposite Lynemouth the beach is largely made of colliery waste tipped on the foreshore, as is the beach south of Cambois Colliery.

South of the Tyne as far as Hartlepool the cliffs provide dramatic coastal scenery arising from the differential erosion of the various formations of Permian rocks. These rocks form steep, often vertical cliffs behind wave-cut rock platforms, shingle and sand beaches. The cliffs are mostly capped by glacial drift but there are also extensive areas of magnesian limestone grassland. A number of stacks and arches occur along the coast; those at Marsden Bay are particularly fine. South of Seaham the cliffs are cut by several deep valleys (denes), all of which are postglacial in age. They are mostly cut through till, but locally they also cut through the underlying Permian rocks. At Easington, where the cliff face is partly colliery waste, beach material has been supplied by the large-scale tipping of colliery spoil. The spoil has built up locally, providing protection at the base of the cliffs to the south. The cliffs decrease in height towards Crimdon where the beach is much wider, and there is a spit of sand and dunes extending to the Magnesian Limestone outlier at Hartlepool Headland.

Tees Bay

Southwards from Hartlepool the coast is fringed by sand dunes, then low cliffs of Triassic sandstone. These give way in Tees Bay to a substantial area of mudflats, which have been subject to extensive land claim. Hartlepool Bay and Tees Bay act as sediment traps and there has been much sediment infilling throughout the Holocene in both bays, enhanced by human land claim. Between the Tees entrance and Redcar there is accretion of sand associated with a local reversal (westwards) of the littoral drift. Near Redcar, till forms small cliffs partly capped by blown sand and fronted by a good beach. Lias rocks are exposed in the intertidal zone off Redcar.

Redcar — Flamborough Head

Between Redcar and Saltburn the solid geology is masked by glacial till and blown sand, but to the east of Saltburn cliffs Jurassic rocks rise to 120 metres, fronted by a wave-cut platform. The effect of wave action and differential erosion on the varied lithologies which comprise the Jurassic rocks has resulted, between Saltburn and Speeton, in a coast of bays, headlands and high cliffs. The cliffs vary greatly in altitude, reaching up to 200 m high near Boulby. A number of the intervening embayments are filled with glacial deposits, which form much lower cliffs commonly characterised by rotational slips.

Robin Hood's Bay is backed by low cliffs of glacial drift

Map 2.6.1 Major coastal landforms. Source: British Geological Survey.

between the sandstone headlands to the north and south. Further 'lows' within the cliffed coastline are found at Hayburn Wyke and Cloughton Wyke. The Middle and Upper Jurassic rocks forming the cliffs are commonly topped with glacial till. Landslips are a feature of this coast, sometimes occurring with dramatic results, as with the collapse of the Holbeck Hall Hotel at Scarborough in 1993.

South of the narrow rocky promontory of Filey Brigg, the Upper Jurassic Corallian rocks produce a small vertical cliff at the foot of high, easily eroded cliffs of glacial deposits. Gullying and rotational slips are common and a gently curving bay with a wide sand beach has been formed. At Speeton, cliffs of Lower Cretaceous Speeton Clay are unstable and extensively slipped.

Southwards, the Upper Cretaceous Chalk forms cliffs overlain by till at Selwicks Bay and Flamborough Head. There are small coves with sandy beaches and narrow wave cut platforms between the rock headlands.

2.6.3 Further sources of information

A. Further reading

Carruthers, R.G., Burnett, G.A., & Anderson, W. 1930. The geology of the Alnwick district. *Memoir of the Geological Survey of Great Britain.* London, HMSO.

Fowler, A. 1926. The geology of Berwick-on-Tweed, Norham and Scremerston. *Memoir of the Geological Survey of Great Britain.* London, HMSO.

Kent, P., Gaunt, G.D., & Wood, C.J. 1980. *British regional geology: eastern England from the Tees to the Wash.* 2nd ed. London, HMSO.

Land, D.H. 1974. The geology of the Tynemouth district. *Memoir of the Geological Survey of Great Britain.* London, HMSO.

Robson, D.A., *ed.* 1980. *The geology of North East England.* Newcastle upon Tyne, Special publication of the Natural History Society of Northumbria.

Smith, D.B., & Francis, E.A. 1967. Geology of the country between Durham and West Hartlepool. *Memoir of the Geological Survey of Great Britain.* London, HMSO.

Steers, J.A. 1964. *The coastline of England and Wales.* 2nd ed. Cambridge, Cambridge University Press.

Steers, J.A. 1981. *Coastal features of England and Wales.* Cambridge, Cambridge University Press.

Taylor, B.J., Burgess, I.C., Land, D.H., Mills, D.A.C., Smith, D.B., & Warren, P.T. 1971. *British regional geology: northern England.* 4th ed. London, HMSO.

B. Contact names and addresses

Type of information	*Contact address and telephone no.*
Coastal protection	Ministry of Agriculture, Fisheries and Food (MAFF), Flood and Coastal Defence Division, Eastbury House, 30/34 Albert Embankment, London SE1 7TL, tel: 0171 238 3000
Geomorphological information for region	Coastal Geology Group, British Geological Survey, Keyworth, Nottingham NG12 5GG, tel: 0115 936 3100

Lindisfarne National Nature Reserve. Lindisfarne and Budle Bay together form the largest estuary in the region, with over 3,000 ha of intertidal saltmarsh, mud and sand flats fringed by extensive sand dunes. Nationally and internationally important numbers of many wildfowl and wader species use this sheltered haven in winter or during migration. Holy Island, with its historic priory and castle, is a popular tourist attraction. Photo: R. Holt, JNCC.

Chapter 3 Terrestrial coastal habitats

3.1 Cliffs and cliff-top vegetation

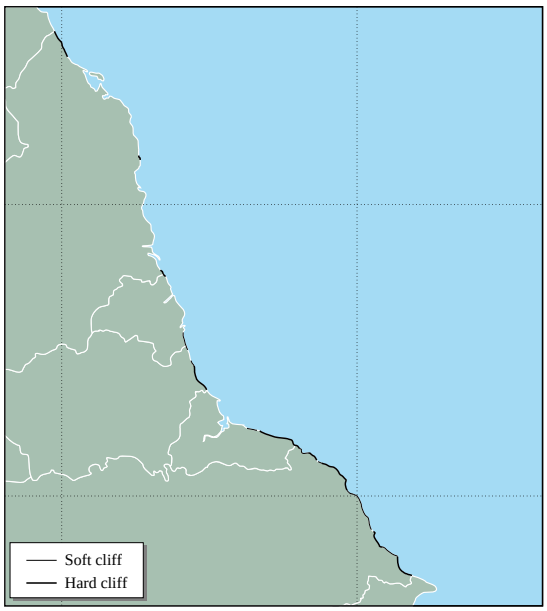
Dr T.C.D. Dargie

3.1.1 Introduction

The region contains a good variety of cliff and cliff-top habitat (Doody *et al*. 1993). Its total recorded cliff length of 112 km (see Table 3.1.1 and Map 3.1.1) represents 3% of the British resource (JNCC Cliffs database).

The scenic contribution of cliffs within the region is outstanding and is reflected in the protected status of much of the coast. A 52-kilometre length of the Northumberland coast south of Berwick is an Area of Outstanding Natural Beauty, with cliffs as a major feature. An even larger proportion in Northumberland (including cliffs north of Berwick) is Heritage Coast (93 km, the largest continuous Heritage Coast stretch in England and Wales), as is a further 55 km of the North Yorkshire and Cleveland coast, where cliffed scenery is predominant (Heritage Coast Forum 1993). The North York Moors National Park has a coastal frontage of 42 km, most of it cliffed (Gubbay 1988). Much of the region's cliffed coast is owned by the National Trust.

A glacial till capping to cliffs is extensive throughout the region; most cliffs are non-vertical and lower than 50 m in height. Their vegetation, and that of the cliff tops, varies with slope angle, soil type and salt spray deposition and, locally around headlands, degree of exposure. Soft cliffs on sheltered coasts can develop an undercliff vegetation of scrub, tall herbs and rank grassland, often very close to the sea. This vegetation type is extensive around Robin Hood's Bay in North Yorkshire (Cooper 1988)). The full regional extent of true cliff-top habitat has not been surveyed, but because the coast here is only infrequently exposed to very strong winds and heavy spray deposition, probably only



Map 3.1.1 Cliffs and clifftop habitat. Marked sectors have >90% cliffed coast. Source: JNCC Cliffs Database.

maritime grassland occurs in quantity, with much non-maritime rank grassland, tall herb, scrub and woodland developing on steep slopes immediately adjacent to the sea. The Durham coast is important for areas of lime-rich grassland, a habitat much reduced by agriculture elswhere.

No nationally rare or scarce cliff or cliff-top plants occur in the region, although one nationally scarce species not typical of cliffs, sea kale *Crambe maritima*, is present on cliffs

Table 3.1.1 Table of maritime cliff grassland area (ha) and lengths (km) of cliff types

Cliff type	*Northumber -land*	*Tyne and Wear*	*Durham*	*Cleve- land*	*North Yorkshire*	*Region 5*	*England*	*East Coast*	*Great Britain*
Maritime cliff grassland area (ha)	16.3	2.3	15.7	24.7	143.4	202.4	1,894.8	unknown	unknown
% in Region 5	-	-	-	-	-	-	11	unknown	unknown
Cliffs									
Vertical >20 m height	3.5	4.5	0.5	6.5	8.5	23.5	320	600.5	1,325
Vertical <20 m height	1	0	0	0	0.5	1.5	49	379.5	818
Non-vertical >20 m height	4	1	10.5	4	50	69.5	628.5	558.5	1,371
Non-vertical <20 m height	10.5	5.5	0.5	0	1	17.5	167	261	545
Total	***19***	***11***	***11.5***	***10.5***	***60***	***112***	***1,164.5***	***1,799.5***	***4,059***
% in Region 5	***-***	***-***	***-***	***-***	***-***	***-***	***10***	***6***	***3***
Soft cliff	2.1	0	8	3.4	33.1	46.6	256	unknown	unknown
Estimated hard cliff*	16.9	11	3.5	7.1	26.9	65.4	908.5	unknown	unknown

Source: Pye & French 1993 (coastal maritime grassland), JNCC Coastal Resources Database (cliff height and angle categories); Pye & French 1993 (soft cliff lengths); * estimated hard cliff lengths derived by subtraction.

here. Maritime heath is probably rare in the region but is found in the Castle Point to Cullernose Point SSSI. The cliff vegetation of the Burnworth coast (Northumberland), the Durham coast, and Beast Cliff to Robin Hood's Bay is regarded as being of national importance (Doody *et al.* 1993).

3.1.2 Important locations and species

Spectacular near-vertical hard cliffs are present north of Berwick in Carboniferous limestone with Whin Sill, and there are smaller stretches of lower hard cliff at Beadnell, Dunstanburgh Castle, Cullernose Point, Holy Rock and Blackhall Rocks. Resistant cliff features such as stacks (Marsden Rock, Blackhall Rocks) and caves (Holy Rock) occur on the Durham coast. A mix of high soft and hard non-vertical cliffs is very extensive in east Cleveland and North Yorkshire, forming a major landscape type. Cliffs at Boulby, west of Staithes, rise to 200 m in height, making them some of the highest cliffs on the British mainland, and other outstanding cliffs developed in till and Jurassic rocks are found at Robin Hood's Bay, The Doodles and Filey. Cliffed headland promontories, such as around Scarborough Castle and Filey Brigg, are rare in the region. Island cliffs are restricted to low features on the Farne Islands and Coquet Island (both in Northumberland).

Three maritime grassland National Vegetation Classification (NVC) (Rodwell in prep.) types are recorded for hard cliffs in Northumberland: MC8 red fescue *Festuca rubra* - thrift *Armeria maritima*, MC9 red fescue *Festuca rubra* - Yorkshire-fog *Holcus lanatus* and MC10 red fescue *Festuca rubra* - plantain *Plantago* spp. communities. On limestone cliffs in Durham there is a variant of magnesian limestone grassland with an unusual species-rich sward. In Durham this variant shows rare transitions to more inland grasslands. Wet flushes on cliffs are important on the Durham coast and between Castlepoint and Cullernose (Northumberland).

The fauna of the region's cliffs is notable, especially on islands. The Farne Islands and Coquet Island harbour important seabird colonies warranting Special Protection Area status (Stroud *et al.* 1990). These populations are dominated by both inshore (cormorant, shag, black-headed gull, herring gull, common tern and arctic tern) and offshore (fulmar, kittiwake, guillemot, razorbill, puffin) species (see section 5.10). No systematic survey has been carried out of the region's invertebrates in cliff and cliff-top habitats, but these environments have a rich habitat diversity and so typically support large numbers of species (Mitchley & Malloch 1991). Moderate invertebrate lists, with some notable and rare (Red Data Book) species, exist for several sites: Robin Hood's Bay, Ravenscar and Beast Cliff, Scalby Mills, and Blackhall Cliffs are regionally important cliff locations on the JNCC's Invertebrate Site Register (see section 5.3).

3.1.3 Human activities

The region's cliffs are amongst its most natural habitats, although the cliff-top zone, especially to landward, has been affected by a variety of human impacts. Footpaths (notably the Cleveland Way long distance path) are heavily used in some parts of the region and locally erosion is present. Much of the cliffed coast is largely undeveloped, the major exceptions being housing close to coastal towns (e.g. Whitby, Scarborough, Seaham, Seaton Sluice) and caravan park development (Filey). Long stretches of the Durham coast have been used for tipping colliery waste for many years, and this has probably altered sediment patterns to other habitats downdrift. Small areas are also used for military activity. In general, these activities have caused only local habitat loss and vegetation disturbance.

Arable agriculture and stock grazing on improved pasture are both extensive in the region and often extend to the cliff edge, restricting the area of cliff-top vegetation. On the other hand, lack of grazing can lead to invasion by gorse. On steeper slopes little management is practised, allowing extensive scrub and tall herb vegetation to develop. This is composed of relatively few species, in contrast (usually) to grazed semi-natural grasslands.

Relatively little of the base of the region's cliffs has been protected by coastal defences and so natural coastal erosion prevails. Slumped material is extensive on the North Yorkshire coast and is possibly protecting the cliff foot on this relatively sheltered coast. This partly explains the extensive tracts of scrub and rank grassland that are present in the undercliff zone (Cooper 1988). Present rates of erosion will pose a threat in the future to cliff property and six sectors of the regional soft cliff resource could be faced with protection in the next 50 years, modifying cliff habitat and beach sediment supply (Pye & French 1993).

3.1.4 Information sources used

Detailed National Vegetation Classification survey is confined to one study at Robin Hood's Bay (Cooper 1988). This work covered a total coastal length of 8 km (7% of the region's cliffs) and was part of a pilot study involving thirteen surveys to assess the feasibility of mapping all cliff habitat in Britain. These surveys, all carried out in the summer of 1987, are detailed and use a consistent methodology. The data provide a sound baseline for future cliff vegetation studies and local management of the cliff resource.

Other data sources (e.g. JNCC's Cliffs and Coastal Resources databases) do not have information on cliff vegetation but give details of cliff geology and size. No other detailed surveys have been carried out for the region and existing information is insufficient to assess the extent of individual cliff and cliff-top habitats in the region, apart from maritime cliff grassland.

3.1.5 Further sources of information

A. References cited

Cooper, E.A. 1988. *Survey of sea-cliff vegetation of Great Britain. 8. Robin Hood's Bay, North Yorkshire.* Peterborough, Nature Conservancy Council.

Doody, J.P., Johnston, C., & Smith, B. 1993. *Directory of the North Sea coastal margin.* Peterborough, Joint Nature Conservation Committee.

Gubbay, S. 1988. *Coastal directory for marine nature conservation.* Ross-on-Wye, Marine Conservation Society.

Heritage Coast Forum. 1993. *Heritage coasts in England and Wales: a gazetteer*. Manchester, Manchester Metropolitan University.
Mitchley, J., & Malloch, A.J.C. 1991. *Sea cliff management handbook for Great Britain*. Lancaster, University of Lancaster.
Pye, K., & French, P.W. 1993. *Targets for coastal habitat re-creation.* Peterborough, English Nature. (English Nature Science, No. 13.)
Rodwell, J.S., *ed*. In prep. *British plant communities. Volume 5: maritime and weed communities.* Cambridge, Cambridge University Press.
Stroud, D.A., Mudge, G.P., & Pienkowski, M.W. 1990. *Protecting internationally important bird sites*. Peterborough, Nature Conservancy Council.

B. Further reading

Agar, R. 1960. Postglacial erosion of the North Yorkshire coast from the Tees estuary to Ravenscar. *Proceedings of the Yorkshire Geological Society, 32*: 408-25.
Davidson, N.C., Laffoley, D.d'A., Doody, J.P., Way, L.S., Gordon, J., Key, R., Drake, C.M., Pienkowski, M.W., Mitchell, R., & Duff, K.L. 1991. *Nature conservation and estuaries in Great Britain.* Peterborough, Nature Conservancy Council.
Fletcher, A., Coppins, B.J., Gilbert, O.L., James, P.W., & Lambley, P.W. 1984. Survey and assessment of lowland heathland lichen habitats. (Contractor: British Lichen Society.) *Nature Conservancy Council, CSD Report,* No. 522.
Liddle, M.J. 1975. A selective review of the ecological effects of human trampling on natural ecosystems. *Biological Conservation, 7*: 17-36.
Mitchell, D.N., Davison, A.W., & Cooke, J.A. 1994. The flora and vegetation of Magnesian Limestone sea cliffs, County Durham. *Trans. Nat. Hist. Soc. Northumb. 57*: 153-175.
Mitchley, J. 1989. *A sea cliff bibliography*. Peterborough, Nature Conservancy Council. (Research & survey in nature conservation, No. 18.)
Robinson, L.A. 1977. Erosive processes on the shore platform of Northeast Yorkshire, England. *Marine Geology, 23*: 339-61.
Steers, J.A. 1964. *The coastline of England and Wales*. Cambridge, Cambridge University Press.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Flora, fauna, habitat information, site reports, site management	*Coastal Ecologist, English Nature HQ, Peterborough, tel: 01733 340345
Advice on national and international policy and cliff conservation; national databases	*Head of Coastal Conservation Branch, JNCC, Peterborough, tel: 01733 62626
Invertebrate fauna	*Invertebrate Site Register, Species Conservation Branch, JNCC, Peterborough, tel: 01733 62626

* Starred contact addresses are given in full in the Appendix

3.1.6 Acknowledgements

Assistance with sources was kindly provided by JNCC Species Conservation Branch.

3.2 Sand dunes

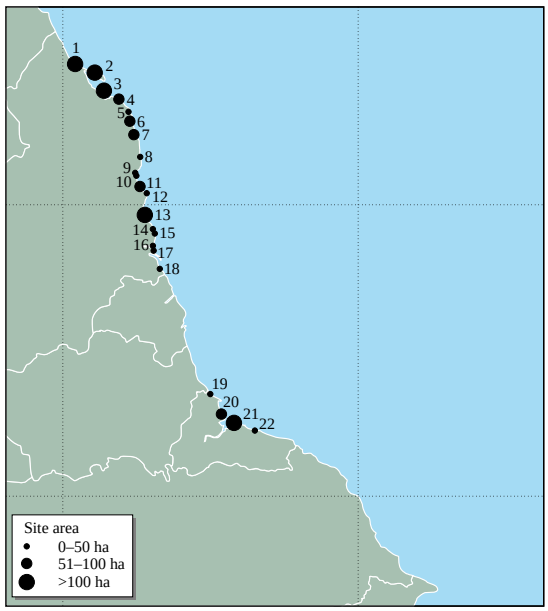
Dr. T.C.D. Dargie

3.2.1 Introduction

The region contains a moderate number of sand dune systems associated with bays and estuaries. It has 22 dune sites (listed in Table 3.2.1 and shown on Map 3.2.1), with 1,411 ha of vegetated and other land cover on blown sand. This represents 15% of the England dune resource and 3% of the British resource (Table 3.2.2).

Although not extensive, the region's vegetated dunes are of great interest for the diversity of their habitats. In the region there are nine SSSIs notified and one NNR designated for their sand-dune habitats (Table 3.2.1). The National Trust owns two dune sites and eleven occur in an Area of Outstanding Natural Beauty and Heritage Coast. Dune vegetation types (according to the National Vegetation Classification (Rodwell in prep.b)) found in the region and their importance in the region and in England are listed in Table 3.2.2.

The region has a large proportion of the 156 National Vegetation Classification (NVC) communities and sub-communities (Rodwell in prep.) recorded for all English dunes. It has the largest extents in England of two types of mobile dune (SD5 lyme-grass *Leymus arenarius* community and SD6f marram *Ammophila arenaria* mobile dune, smooth meadow-grass *Poa pratensis* sub-community) and rank neutral grassland types (SD9 marram - false oat-grass *Arrhenatherum elatius* community, especially the SD9b bloody crane's-bill *Geranium sanguineum* sub-community;



Map 3.2.1 Sand dune sites. Numbers refer to Table 3.2.1. Source: JNCC Sand Dune Database.

MG1 false oat-grass community). The total area of dune slacks is not large, but most slack types are present (SD13 creeping willow *Salix repens* - moss *Bryum pseudotriquetrum*, SD14 creeping willow - moss *Campylium stellatum*, SD15 creeping willow - moss *Calliergon cuspidatum*, SD16 creeping

Table 3.2.1 Sand dune sites in the region

Code	*Name*	*Grid ref*	*Area (ha)*	*Dune type*	*Conservation status*
1	Cheswick Sands	NU050465	160	bay, spit, climbing	AONB, SSSI, HC, NWT
2	Lindisfarne	NU115434	207	spit	AONB, NNR, NT, RS, SSSI, HC, SPA
3	Ross Links and Budle Bay	NU145375	348	offshore island, bay, climbing	AONB, NNR, SSSI, HC
4	Bamburgh to Seahouses	NU194347	92	bay	AONB, SSSI, HC
5	Annstead Rocks	NU226305	16	bay, spit, climbing	AONB, NWT, HC
6	Beadnell Bay	NU230273	62	bay, spit, climbing	AONB, NT, HC
7	Embleton Bay	NU242230	61	bay, spit, climbing	AONB, NT, HC
8	Howdiemount and Sugar Sands	NU263156	9	bay	AONB, HC
9	Alnmouth Town Dunes	NU246102	5	bay	AONB, HC, SSSI
10	Alnmouth Dunes	NU249092	35	spit	AONB, HC, NT, SSSI
11	Warkworth Dunes	NU260056	76	bay	AONB, HC, SSSI
12	Amble	NU284035	25	bay	
13	Druridge Bay	NZ278960	135	bay	NT
14	Lynemouth	NZ303913	19	bay	
15	Lyne Sands	NZ309897	69	bay	
16	North Seaton	NZ304856	3	bay	
17	Cambois	NZ306841	16	bay	
18	Seaton Sluice	NZ327781	37	bay	
19	Hart Warren Dunes	NZ494362	35	bay	
20	Seaton Dunes and North Gare	NZ530292	77	bay	SSSI, NNR
21	South Gare and Coatham Sands	NZ572262	217*	bay	SSSI
22	Redcar and Marske Sands	NZ640228	*	bay, climbing	

Source: Radley (1994). Code refers to site location on Map 3.2.1. Key: * Combined area of sites 21 and 22 is 217 ha; AONB - Area of Outstanding Natural Beauty; HC - Heritage Coast; NNR - National Nature Reserve; NT - National Trust; RS - Ramsar site; SSSI - (Biological) Site of Special Scientific Interest; NWT - Northumberland Wildlife Trust reserve.

Table 3.2.2 Table of areas (ha) of dune vegetation types

Dune vegetation type	*Northumberland*	*Durham*	*Cleveland*	*Region 5*	*England*	*East Coast*	*Great Britain***
Strand and embryo dune	8	0	27	35	179	*	340
Mobile and semi-fixed dune	307	0	60	367	2,484	*	8,504
Acidic fixed dune grassland	41	0	0	41	671	*	4,953
Neutral and calcareous fixed dune grassland	517	0	90	607	2,710	*	15,228
Dune heath and bracken	2	0	0	2	197	*	2,615
Dune slack	89	0	1	89	487	*	2,175
Other dune wetland	8	0	2	10	150	*	4,114
Dune woodland and scrub	60	0	5	65	1,189	*	8,965
Transitions to saltmarsh	7	0	12	19	141	*	836
Transitions to maritime cliff	1	0	0	1	30	*	64
Other land cover	123	0	51	174	1,044	*	2,406
TOTAL	***1,164***	***0***	***247***	***1,411***	***9,282***	***25,356***	***50,200***
% in Region 5	***-***	***-***	***-***	***-***	***15***	***6***	***3***

Sources: Dargie (1993), Dargie (1995), Radley (1994), JNCC Coastal Resources Database. Key: *not available; **GB figures include estimates for Scotland.

willow - Yorkshire-fog *Holcus lanatus* and SD17 silverweed *Potentilla anserina* - common sedge *Carex nigra* types). The slack diversity is particularly important in the context of English east coast dunes, where there is very little of this habitat type.

3.2.2 Important locations and species

Northumberland has much more dune habitat than Cleveland (see Table 3.2.2), especially in terms of slack area and ground planted under conifers. Most of the dunes are fully stabilised, with only 26% bearing mobile or semi-fixed vegetation types.

Bay dunes (e.g. in Druridge Bay) are very widespread in the region and develop upon sand trapped within the shelter of rock headlands. Climbing dunes (e.g. at Annstead Rocks, Beadnell Bay, Embleton Bay, Redcar and Marske Sands) are formed of sand blown onto steeply rising land behind the main dune system, in some cases covering areas of steep cliff. Spit dunes (e.g. those at Alnmouth Dunes and Lindisfarne/Holy Island) develop either at the mouths of rivers or in areas of strong sediment-bearing currents, as in the case of Lindisfarne. An offshore island dune (Ross Law) has developed close to Ross Links. This is a rare feature on British dunes and is the only case in the region (Table 3.2.1). Other types of dune (e.g. hindshore, prograding, tombolo, machair) do not occur in the region.

The larger dune systems in the region develop a fresh (rarely brackish) watertable, which influences the vegetation of depressions, allowing the formation of a distinct and nationally rare type of wetland, termed dune slack. This habitat is commonest and most extensive in Britain on hindshore, ness/foreland and large spit dunes and is rare in the region, where the only large expanses occur at Lindisfarne and Ross Links.

Four of the nationally scarce higher plant species (or varieties) found mainly or exclusively on dunes - dune helleborine *Epipactis leptochila var. dunensis*, variegated horsetail *Equisetum variegatum*, seaside centaury *Centaurium littorale* and curved sedge *Carex maritima* - are present in the region. Other nationally scarce species more typical of other habitats also occur on dunes in the region: Ray's knotgrass *Polygonum raii*, coralroot orchid *Corallorhiza trifida* and long-stalked orache *Atriplex praecox* (see section 5.2). Rare bryophytes (e.g. the liverwort *Petalophyllum ralfsii*) are also present, but the lichen assemblage of dunes is unremarkable (Fletcher *et al*. 1984) (see also section 5.1). Most dune site reports contain details of notable species.

Dunes in several places have breeding populations of seabirds (notably little tern) and waterfowl (notably ringed plover, oystercatcher and shelduck (see section 5.11). The dunes of Lindisfarne have been part of a Ramsar site (a wetland of international importance designated for waterfowl) since 1976; the Northumberland Coast, with Teesmouth and the Cleveland Coast, is also of international importance for birds. Holy Island and Embleton Links have moderate numbers of rare and Red Data Book invertebrate species.

3.2.3 Human activities

In general sand dunes are among the least modified of terrestrial habitats. However, the inner edge of many sand dune sites in the region has been strongly affected by a variety of human impacts, sometimes leading to major habitat loss or conversion to other common vegetation types (Doody 1989). The most notable case is the loss of dune to industrial development around Teesmouth, although the construction here of two breakwaters in the 19th century has aided accretion of dunes at Seaton and Coatham. Agriculture poses an important threat to several dune systems in the region. Winter stock grazing is widespread in Northumberland, together with stock feeding and improvement of the dune grassland sward. Druridge Bay and Ross Links show the worst effects, and at Ross Links comparisons (Dargie 1992) between maps drawn in different years (Robertson 1955; Dargie 1973; Woolven & Radley 1989) show that the area of slacks had almost halved over a 30-35 year period. Improved grassland made up 48% of the site on 1986 air photos, compared with 6% in 1964 and only 1% in 1952. Much of the nature conservation interest of this key east coast site has clearly been lost. Elsewhere, at

Newton Links for example, management aims to reduce stock wintering. Residential and recreational development has encroached on many sites. Car parks, caravan and camp sites and golf courses are very common on and alongside many sites. Severe, widespread erosion due to trampling is present at Seaton Sluice, and more localised severe trampling damage is present in almost all sites. Military use and structures are present on several sites but the total area of impact and damage is slight. The dunes of Lindisfarne have become infested with the alien pirri-pirri burr *Acaena novae-zealandiae*, after its accidental introduction (Culwick 1982), and it is slowly spreading into other Northumberland dunes (Loring 1982).

Conservation is now a major activity at many locations, with many sites having one or more conservation designation or form of planning control (Table 3.2.1). Details of the current use and future development of each site are given in Radley (1994). Management is now practised on several sites. Most Northumberland dunes show evidence of retreat due to coastal erosion, and coastal protection is used close to major settlements to arrest losses. Recreational use is often controlled by car parking and the provision of hardened paths and boardwalks to reduce path erosion. Several sites have required scrub removal (notably of sea buckthorn *Hippophae rhamnoides*).

3.2.4 Information sources used

Until the 1980s interest focused mainly on the largest dunes, at Ross Links and Lindisfarne (e.g. Robertson 1955; Dargie 1973). A review of vegetation change based on vegetation maps of three different dates has also been produced for Ross Links - see section 3.2.3 (Dargie 1992). The vegetation of other dunes along the Northumberland coast has since been surveyed (Loring 1982). In recent years all areas of vegetated sand dune in the region have been surveyed using the NVC (Rodwell in prep.). This work was part of the sand dune survey of Great Britain initiated by the NCC in 1987 and continued after 1991 by the JNCC on behalf of country conservation agencies. All 22 of the region's dune sites were surveyed in 1988 using the NVC, a reliable, consistent methodology yielding very detailed information (Rodwell in prep.). The vegetation is mapped and described, and information on coastal erosion and accretion, atypical vegetation and adjoining land use is also recorded. Individual site reports are available from the JNCC, as well as a national report for England (Radley 1994). The data represent a sound baseline for future dune vegetation studies and both strategic and local management of the dune resource. Most data discussed here are derived from the national report.

No other comprehensive surveys exist for the region. However, Drake & Denman (1993) surveyed invertebrates on five dunes in Northumberland.

3.2.5 Further sources of information

A. References cited

Culwick, E. 1982. *The biology of* Acaena novae-zelandiae *Kirk. on Lindisfarne*. PhD Thesis, University of Newcastle on Tyne.

Dargie, T.C.D. 1973. *Ross Links, Northumberland: vegetation survey 1972*. Newcastle, Nature Conservancy, England (North-East Region). (Unpublished report.)

Dargie, T.C.D. 1992. *Changes in the vegetation of Ross Links since 1955 and their relation to management*. Peterborough, English Nature. (Unpublished report to English Nature.)

Dargie, T.C.D. 1993. *Sand dune vegetation survey of Great Britain. Part 2 - Scotland*. Peterborough, Joint Nature Conservation Committee.

Dargie, T.C.D. 1995. *Sand dune vegetation survey of Great Britain. Part 3 - Wales*. Peterborough, Joint Nature Conservation Committee.

Drake, C.M., & Denman, D.J. 1993. *A survey of the invertebrates of five dunes in Northumberland*. English Nature Research Reports No. 46. English Nature, Peterborough.

Doody, J.P. 1989. Conservation and development of the coastal dunes in Great Britain. *In: Perspectives in coastal dune management*, ed. by F. van der Meulen, P.D. Jungerius & J. Visser, 53-67. The Hague, SPB Academic Publishing.

Fletcher, A., Coppins, B.J., Gilbert, O.L., James, P.W., & Lambley, P.W. 1984. Survey and assessment of lowland heathland lichen habitats. *Nature Conservancy Council, CSD Report*, No. 522.

Loring, J. 1982. *A survey of sand dunes and dune grasslands of the Northumberland coast*. Newcastle, Northumberland Wildlife Trust. (Unpublished report.)

Radley, G.P. 1994. *Sand dune vegetation survey of Great Britain. Part 1 - England*. Peterborough, Joint Nature Conservation Committee.

Robertson, J.S. 1955. *The ecology of the sand dune vegetation at Ross Links, Northumberland, with special reference to secondary succession in the blow outs*. PhD Thesis, University of Durham.

Rodwell, J.S., *ed*. In prep. *British plant communities. Volume 5: maritime and weed communities*. Cambridge, Cambridge University Press.

Woolven, S.C., & Radley, G.P. 1989. *National sand dune vegetation survey site report No. 21. Ross Links 1988*. Peterborough, Nature Conservancy Council. (Contract Surveys No. 45.)

B. Further reading

Atkinson, D.,& Houston, J., *eds*. 1993. *The sand dunes of the Sefton coast*. Liverpool, National Museums & Galleries on Merseyside.

Brooks, A., & Agate, E. 1986. *Sand dunes: a practical conservation handbook*. Wallingford, British Trust for Conservation Volunteers.

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

Doody, J.P., *ed*. 1985. *Sand dunes and their management*. Peterborough, Nature Conservancy Council. (Focus on nature conservation, No. 13.)

Doody, J.P., *ed*. 1991. *Sand dune inventory of Europe*. Peterborough, Joint Nature Conservation Committee.

Doody, J.P., Johnston, C., & Smith, B., *eds*. 1992. *Directory of the North Sea coastal margin*. Peterborough, Joint Nature Conservation Committee.

Pye, K., & French, P.W. 1993. *Targets for coastal habitat recreation*. Peterborough, English Nature. (English Nature Science, No. 13.)

Radley, G.P., & Woolven, S.C. 1990. *A sand dune bibliography*. Peterborough, Nature Conservancy Council. (Contract Surveys, No. 122.)

Ranwell, D.S. 1972. *Ecology of salt marshes and sand dunes*. London, Chapman & Hall.

Ranwell, D.S., & Boar, R. 1986. *Coast dune management guide*. Huntingdon, Institute of Terrestrial Ecology.

Ritchie, W., & Mather, A.S. 1984. *The beaches of Scotland*. Perth, Countryside Commission for Scotland.

Stroud, D.A., Mudge, G.P., & Pienkowski, M.W. 1990. *Protecting internationally important bird sites*. Peterborough, Nature Conservancy Council.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Flora, fauna, habitat information, location of site reports, site management	*Coastal Ecologist, English Nature HQ, Peterborough, tel. 01733 340345
Invertebrate data (Invertebrate Site Register)	*Species Conservation Branch, JNCC, Peterborough, tel: 01733 62626
Advice on national and international policy and dune conservation, sand dune survey reports, Sand Dune database	*Coastal Conservation Branch, JNCC, Peterborough, tel: 01733 62626

* Starred contact addresses are given in full in the Appendix

3.2.6 Acknowledgements

Assistance with sources was kindly provided by JNCC Coastal Conservation and Species Conservation Branches.

3.3 Vegetated shingle structures and shorelines

Dr R.E. Randall

3.3.1 Introduction

Shingle is the term applied to sediments larger in diameter than sand but smaller than boulders: that is, between 2 mm - 200 mm diameter. Where the coast features shingle, it is often mixed with large amounts of sand, or else sand dunes (see section 3.2) have developed on it. Shingle sites include both simple fringing beaches and also more complex structures where the shingle is vegetated yet not buried by more than 20 cm of sand. However this region has no vegetated shingle structures and only small lengths of shingle shoreline, shown on Map 3.3.1.

3.3.2 Important locations and species

In this region the shingle vegetation is limited to a sparse cover of pioneer species at the rear of the fringing beach or spit (Table 3.3.1). The igneous intrusion of Whin Sill gives sandy shingle at Bamburgh and Newton, with a flora of marram *Ammophila arenaria*, sea sandwort *Honkenya peploides* and lovage *Ligusticum scoticum*. At Newton there is also limestone shingle, with nitrogen-tolerant plants (because of the droppings of nesting eider, oystercatcher, plover and tern). Species present include scurvy grass *Cochlearia officinalis*, sea mayweed *Tripleurospermum maritimum*, bittersweet *Solanum dulcamara*, dock *Rumex crispus* and bloody crane's-bill *Geranium sanguineum*. There are sandy shingle spits at Lynemouth and at the mouth of the River Blyth, with sparse pioneer vegetation. At Whitburn Steel there is a raised beach (at least partly man-made) with cobbles and sand, which supports carline thistle *Carlina vulgaris*. The small sandy shingle beach at Roker, Sunderland, supports little vegetation. The beach at Seaham has an unusual coaly shingle and sand composition.

Table 3.3.1 Fringing shingle beaches in region

Location	*Grid ref.*	*Length of shoreline (km)*	*Description*
Bamburgh	NU 1934	3.0	sandy, little vegetation
Newton	NU 2425	3.5	sandy, bird-rich
Lynemouth	NZ 3091	2.0	sandy, spit
Blyth	NZ 3283	0.5	sandy, spit, little vegetation
Whitburn	NZ 4061	0.5	large shingle and sand
Roker, Sunderland	NZ 4259	0.5	little vegetation
Seaham	NZ 4061	0.5	'coal' shingle, little vegetation

3.3.3 Information sources used

Vegetated shingle structures of Britain were surveyed during the NCC's national shingle structures survey carried out between May and August 1989. This survey used the National Vegetation Classification (NVC), applying a standard methodology (Sneddon & Randall 1993a & b). No sites were in this region. JNCC's Coastal Resources database records lengths of shingle shoreline by 10 kilometre square.

Map 3.3.1 Fringing shingle beaches.

3.3.4 Further sources of information

A. *References cited*

Sneddon, P., & Randall, R.E. 1993a. *Coastal vegetated shingle structures of Great Britain: main report.* Peterborough, Joint Nature Conservation Committee.

Sneddon, P., & Randall, R.E. 1993b. *Coastal vegetated shingle structures of Great Britain: Appendix I Wales.* Peterborough, Joint Nature Conservation Committee.

B. *Further reading*

Further details of Britain's vegetated shingle sites may be found on the *Coastal & Marine UKDMAP datasets module,* available from JNCC Coastal Conservation Branch, Peterborough.

Barne, J., Davidson, N.C., Hill, T.O., & Jones, M. 1994. *Coastal and Marine UKDMAP datasets: a user manual.* Peterborough, Joint Nature Conservation Committee.

Chapman, V.J. 1976. *Coastal vegetation.* Oxford, Pergamon Press.

Ferry, B., *et al.* 1990. *Dungeness: a vegetation survey of a shingle beach.* Peterborough, Nature Conservancy Council. (Research & survey in nature conservation, No.26.)

Fuller, R.M. 1987 Vegetation establishment on shingle beaches. *Journal of Ecology, 75:* 1077-1089.

Randall, R.E. 1989. Geographical variation in British shingle vegetation. *Botanical Journal of the Linnean Society, 101:* 3-18.

Scott, G.A.M. 1963. The ecology of shingle beach plants. *Journal of Ecology, 51:* 517-527.

Sneddon, P., & Randall, R.E. 1989. *Vegetated shingle structures survey of Great Britain: Bibliography.* Peterborough, Nature Conservancy Council. (Research & survey in nature conservation, No.20.)

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Flora, fauna, habitat information, site management	*Coastal Ecologist, English Nature HQ, Peterborough, tel. 01733 340345
Advice on national and international policy, Shingle and Coastal Resources databases	*Coastal Conservation Branch, JNCC, Peterborough, tel: 01733 62626

* Starred contact addresses are given in full in the Appendix

3.4 Coastal lagoons

Dr R.N. Bamber & Dr R.S.K. Barnes

3.4.1 Introduction

Coastal lagoons are pond- or lake-like, virtually tideless bodies of saline water either wholly or partially separated from the adjacent sea, but with some influx of sea water. The term is used here to include true lagoons, i.e. those separated from the sea by a natural sedimentary barrier, and also artificial brackish ponds and coastal pools, of a similarly restricted tidal range and often containing a comparable lagoonal biota. Lagoons are commonly shallow, and their salinity can be either above or below normal sea-water levels (35‰); freshwater systems are not normally considered. Lagoons are a nationally rare habitat and a 'priority habitat type' under Annex 1 of the EC Habitats Directive.

Table 3.4.1 Total lagoonal areas in the region

	Lagoonal area (ha)	*Overall % of GB total*	*% of GB total excl. The Fleet*
Northumberland	10	1	1
Cleveland	9	1	1
Other counties	0	0	0
Region 5	19	1	3
North Sea coast	1,163	92	87
West Coast	98	8	13
Great Britain	1,261		

The coastal lagoons of the region are mainly restricted to the Northumberland Coast around Druridge Bay and to Teesmouth, Cleveland. The two 'natural' lagoons, Cresswell Ponds (a subsidence pool), Northumberland, and Cattersty Sands, Cleveland, total 9.5 hectares, amounting to <1.5% of Britain's total natural lagoonal resource and 4% of that resource excluding The Fleet, Dorset (by far Britain's largest lagoon, comprising nearly 70% of the total natural resource). Neither is included in the lagoonal resource that was regarded by Barnes (1989) as being 'especially noteworthy in the national context'. The region's lagoons are therefore insignificant in the national context. The contribution of the region's lagoons to the size of the British resource as a whole is shown in Table 3.4.1.

3.4.2 Important locations and species

Map 3.4.1 shows the location of the natural lagoons and other notable saline pools mentioned; Table 3.4.2 lists their areas and that of the habitat as a whole. Other lagoons in the region are individually small and total around 1 ha in area.

Map 3.4.1 Coastal lagoons and sites mentioned in the text

True lagoons support only three types of aquatic vegetation, namely stands of green algae (*Chaetomorpha*, *Ulva* and *Enteromorpha* spp.), of sea-grasses and similar plants (predominantly tasselweeds *Ruppia* spp.) and, much more rarely, of stoneworts (especially *Lamprothamnium*). Much of the area of their beds, however, is bare sediment, devoid of vegetation cover. Fringing stands of reeds *Phragmites* spp., saltmarsh plants and/or sedge *Scirpus maritimus* are usual. No significant vegetation types occur in the region, although tasselweed *Ruppia* spp. is present at Chevington Burn, Northumberland.

Lagoons possess a characteristic invertebrate fauna that shows little regional variation, even within Europe. In Britain, several of the invertebrate species are very rare and are protected under the Wildlife & Countryside Act 1981. None of these protected species occurs in the region, although the presence of the lagoonal snail *Hydrobia ventrosa* at Cresswell Ponds is notable. This lagoon (a Site of Special Scientific Interest (SSSI)) is a locally important feeding and roosting area for waders and waterfowl and a resting site for migrating birds. The Cattersty lagoon is without fauna.

Table 3.4.2 Lagoons surveyed in region

Location	*Grid ref.*	*Area (ha)*	*Surveyed ?*	*Description*
Warkworth Harbour, Northumberland	NU257062	2.0	Y	Dammed estuarine
Chevington Burn, Northumberland	NZ273982	0.4	Incidental	Dune-retained pool
Cresswell Ponds, Northumberland	NZ283944	7.5	Y	Natural
Snab Point, Northumberland	NZ302928	0.3	Incidental	Small saline pool
North Burn (Brinefield Creek), Teesmouth, Cleveland	NZ513254	7.0	Y	Reclamation
Cattersty Sands, Cleveland	NZ713202	2.0	Y	Natural, percolation pool

Source: Sheader & Sheader (1985, 1986)

The other saline ponds support low diversity estuarine assemblages with no species of conservation importance.

3.4.3 Human activities

Northumberland Wildlife Trust manages Cresswell Ponds under English Nature's Reserves Enhancement Scheme, which requires studies on the invertebrate fauna to be carried out.

3.4.4 Information sources used

All candidate lagoons in the region were surveyed as part of the national lagoon survey undertaken on behalf of the NCC between 1980 and 1988 (Barnes 1989). Only Cresswell Ponds SSSI has been the subject of specific and detailed lagoonal survey. Small saline pools at Chevington Burn and Snab Point, Northumberland, have experienced only incidental sampling (Sheader & Sheader 1985, 1986). Other small pools, predominantly of very low salinity, occur at Cocklawburn, Hadston Links, Saltholme and Cloughton Wyke Point. Sheader & Sheader's detailed survey reports (1985, 1986) include habitat maps and species lists (see also Collins *et al.* (1987)). The data are summarised by Barnes (1989) and Smith & Laffoley (1992), from which the data given here are derived. No other significant data are available.

3.4.5 Further sources of information

A. References cited

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

Collins, P., Dacombe, P.A., & Evans, P.R. 1987. Survey of Cresswell Ponds SSSI. *Nature Conservancy Council, CSD Report,* No.849.

Sheader, M., & Sheader, A. 1985. A survey of coastal saline lagoons, North Humberside to Tyneside, 1985. *Nature Conservancy Council, CSD Report,* No.753.

Sheader, M., & Sheader, A. 1986. A survey of coastal saline lagoons, Newcastle-upon-Tyne to Berwick-upon-Tweed. *Nature Conservancy Council, CSD Report,* No.750.

Smith, B.P., & Laffoley, D. 1992. *A directory of saline lagoons and lagoon-like habitats in England*. Peterborough, English Nature.

B. Further reading

Bamber, R.N., Batten, S.D., & Bridgwater, N.D. 1992. On the ecology of brackish water lagoons in Great Britain. *Aquatic Conservation: Marine and Freshwater Ecosystems,* 2: 65-94.

Barne, J., Davidson, N.C., Hill, T.O., & Jones, M. 1994. *Coastal and Marine UKDMAP datasets: a user manual.* Peterborough, Joint Nature Conservation Committee.

British Oceanographic Data Centre. 1992. *United Kingdom Digital Marine Atlas. User Guide. Version 2.0*. Birkenhead, Natural Environment Research Council, British Oceanographic Data Centre.

Frid, C.L.J., Evans, S.M., & Clark, R.B. 1991. *The north-east coast of England: environmental appraisal*. (Contractor: University of Newcastle-upon-Tyne, Dove Marine Laboratory, Cullercoats.) Unpublished Report to Shell UK Exploration and Production.

Hilton, V. 1993. *Survey of Cresswell Ponds*. Durham, University of Durham.

Sheader, M., & Sheader, A. 1989. The coastal saline ponds of England and Wales: an overview. *Nature Conservancy Council, CSD Report,* No. 1009.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Brackish lagoons of the region	Dr R.S.K. Barnes, St Catherine's College, Cambridge CB2 1RL, tel: 01223 336606
Cresswell Ponds, Hauxley, Chevington	*Reserve Manager, Northumberland Wildlife Trust, Newcastle-upon-Tyne, tel: 0191 284 6884

* Starred contact addresses are given in full in the Appendix

3.5 Coastal grazing marsh

Dr H.T. Gee

3.5.1 Introduction

Coastal grazing marsh, taken here to include non-grazed low-lying coastal grassland, is a distinctive habitat that is drained by a series of ditches that may be either brackish or freshwater. It is not one of the major features of conservation interest along this coast, being virtually absent (Doody *et al.* 1993). The region holds only a small proportion of the English coastal wet grassland north of the Humber Estuary (Dargie 1993). Coastal grazing marsh in the region is concentrated along the lower-lying areas of the north Northumberland coast and the Tees Estuary. There are areas of grazing marsh adjacent to five of the coastal SSSIs in Northumberland, although it is not noted as a valuable habitat in the SSSIs themselves (EN pers. comm.). However, many of these areas are associated with saltmarsh, coastal dune and heath habitats and so form part of a valuable and varied matrix of coastal habitats, thereby augmenting the conservation interest of the SSSIs. The coastline of County Durham, North Yorkshire and significant proportions of Northumberland is rocky, with cliffs, and so none of the wet grassland identified by Dargie *et al.* (1994) in these areas is coastal grazing marsh.

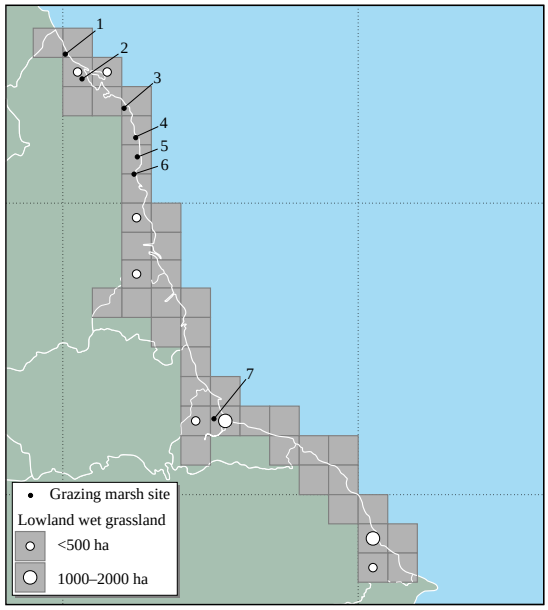
Cowpen Marsh SSSI on the Tees Estuary includes significant areas of grazing marsh. It is recognised as part of a complex of estuarine habitats that supports internationally and nationally important passage/wintering populations of waders and wildfowl, notably teal, widgeon and redshank.

3.5.2 Important locations and species

Most of the coastal grazing marsh resource in Cleveland is coastal, but there are no figures for coastal wet grassland in the other counties. Grazing marsh sites in the region are listed in Table 3.5.1 and shown on Map 3.5.1.

Table 3.5.1 Grazing marsh sites identified in Region 5 and shown in Map 3.5.1

Number	*Site*	*Grid ref.*	*Status of grazing marsh*
	Northumberland		
1	River Tweed	NT975523	Adjacent to SSSI
2	Lindisfarne	NU070437 NU082415 NU121377 NU135360	Grazing marsh adjacent to SSSI and NNR
3	Newton Links	NU225270	Grazing marsh both within and adjacent to the SSSI
4	River Aln	NU245115	Adjacent to Alnmouth SSSI
5	Coquet Estuary	NU256049	Adjacent to Warkworth Dunes and Saltmarsh SSSI
6	Druridge Pools	NZ273965	Part of Cresswell Ponds SSSI
	Cleveland		
7	Tees Estuary	NZ500250	SSSI



Map 3.5.1 Coastal grazing marsh sites (numbers refer to Table 3.5.1) and areas of lowland wet grassland in coastal 10 km squares, after Dargie (1994).

Typically, the botanical interest of grazing marsh in the region is associated with the ditch systems rather than the fields between. Cowpen Marsh is unusual because it retains both the saltmarsh creek system and, in places, saltmarsh vegetation. The fields support semi-improved grassland dominated by common bent *Agrostis capillaris*, Yorkshire-fog *Holcus lanatus* and red fescue *Festuca rubra*. The former saltmarsh creeks (called fleets in this area) are either shallow and seasonally damp, supporting tufted hair-grass *Deschampsia cespitosa*, creeping bent *Agrostis stolonifera* and marsh foxtail *Alopecurus geniculatus*, or deep and sometimes brackish. The flora of the deeper brackish fleets includes typical brackish species such as sea club-rush *Scirpus maritimus*, grey club-rush *Schoenoplectus tabernaemontani*, wild celery *Apium graveolens*, reed sweet-grass *Glyceria maxima* and brackish water-crowfoot *Ranunculus baudotii*. Marginal flora on the grazed margins of these fleets include celery-leaved buttercup *Ranunculus sceleratus*, sea rush *Juncus maritimus* and mare's tail *Hippuris vulgaris*. A number of typical grazing marsh plant species, such as grey club-rush and wild celery, reach the northern limit of their distribution along the east coast of England around the Tees Estuary.

As well as migrating and over-wintering waders and wildfowl, Cowpen Marsh SSSI supports populations of breeding waders and wildfowl, including teal, redshank, lapwing and snipe. These are decreasing as breeding species in Britain (Gibbons *et al.* 1993) and so the presence of any breeding populations is of conservation value.

3.5.3 Human activities

There has been extensive tipping on the western sector of Cowpen Marsh, resulting in a significant loss of habitat. The remaining grazing marsh has been drying out over a number of years, thus increasing the threat to the nature conservation value of this site. It is owned by ICI and has been managed as a nature reserve since 1969. This management will continue, but over the next fifteen years it will also be used as a brine field for the extraction of salt from the salt and anhydrite layer present 1,200 feet below the surface. Other areas of grazing marsh around the Tees Estuary are used for this purpose.

Elsewhere in the Tees Estuary, much former coastal wetland, including grazing marsh, has been lost to industrial use, as have large intertidal areas of the estuary. Much of the grazing marsh was created by the embankment of former saltmarsh in the 18th century.

3.5.4 Information sources used

There is no national survey of the grazing marsh resource in Britain as a whole. In England, however, the extent of lowland wet grasslands is summarised in Dargie (1993), whose survey included areas of coastal grazing marsh. A fuller breakdown of information and listings of sites by county are presented in Dargie *et al.* (in press).

Information on the flora and bird fauna of Cowpen Marsh, including species lists for plants and birds, is contained in English Nature's management plan for the site (Weeks 1993).

3.5.5 Further sources of information

A. References

Dargie, T.C. 1993. The distribution of lowland wet grassland in England. Peterborough, *English Nature Research Reports*, No. 49.

Dargie,T.C., Dargie, M., & Tantram, D. In press. *Lowland wet grassland in England - module 2. Resource distribution and biota reference inventory*. A report to English Nature. (Contract No. F72- 08-18.)

Doody, J.P., Johnston, C., & Smith, B. 1993. *Directory of the North Sea coastal margin*. Peterborough, Joint Nature Conservation Committee.

Gibbons, D.W., Reid, J., & Chapman, R.A. 1993. *The new atlas of breeding birds in Britain and Ireland: 1988 - 1991*. Calton, T. & A.D. Poyser.

Weeks, L. 1993. Cowpen Marsh / ICI No. 7 Brinefield Management Plan. Cleveland, ICI.

B. Further reading

Coleshaw, T. 1995. Rising to the water levels challenge. *Enact*, Vol. 3 No. 1: 7-9.

Davidson, N.C. 1991. Breeding waders on British estuarine grasslands. *Wader Study Group Bulletin, 61: Supplement*, 36-41.

Harold, R. 1995. Creating wetlands at Holkham. *Enact*, Vol. 3 No. 1: 12-15.

Scholey, G. 1995. Return of the "drowners", *Enact*, Vol. 3 No. 1: 10-11.

Thomas G. José, P., & Hirons, G. 1995. Wet grassland in the millenium. *Enact*, Vol. 3 No. 1: 4-6.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Coastal grazing marsh in North Yorkshire	*English Nature, North and East Yorkshire Local Team, York, tel: 01904 432700
Coastal grazing marsh elsewhere in Region 5	*English Nature, Northumbria Local Team, Newcastle, tel: 0191 281 6316

* Starred contact addresses are given in full in the Appendix

3.5.6 Acknowledgements

Thanks are due to the staff of English Nature Northumbria and North and East Yorkshire Local Teams for providing information on coastal grazing marsh in their districts.

3.6 Saltmarsh

Dr M.I. Hill

3.6.1 Introduction

The total amount of saltmarsh recorded in the region during the national survey was 312 ha, representing 1.4% of the total resource on the North Sea coast and only 1% of that in England (Table 3.6.1). The majority (86%) is in Northumberland, although the Coastal Resources Database held by JNCC shows that only 2.5% of the coastline of Northumberland (at Mean High Water) supports saltmarsh. The national survey did not record any saltmarsh in Durham or North Yorkshire (Map 3.6.1).

The limited extent of saltmarsh in the region is due to the limited supply of sediment, lack of suitable sites for fine sediment to accumulate and the land claim of extensive former saltmarshes on several estuaries. The coastline in this region is one of headlands and bays. Sediment is limited because wave action produces strong seasonal onshore/offshore sediment movement, while the tidal currents reinforce southerly sediment transport along the shore and nearshore sea bed (see section 2.3.2). The few saltmarshes in the region are fringing and back-barrier types. As can be seen from Table 3.6.1, a high proportion of their area (44%) is cord-grass *Spartina* marsh, a much higher figure than for Britain or the North Sea coast as a whole, where it averages 16%. The percentage of low to mid marsh and other pioneer communities is correspondingly low. Areas of swamp, driftline and transitional communities are also small.

Map 3.6.1 Saltmarsh sites. Source: JNCC Saltmarsh Database.

3.6.2 Important sites and species

Most of the saltmarsh in the region is within SSSIs (Table 3.6.2), with only small sites such as Seaton Sluice not having SSSI status. Saltmarsh at Lindisfarne is within an NNR, designated Ramsar site and Special Protection Area (SPA).

The largest areas of saltmarsh - more than 200 ha in total - are at Lindisfarne, Holy Island and Budle Bay (Table 3.6.3). Before the industrial revolution, there were extensive saltmarshes in the estuaries of the Tyne, Wear and Tees, but these have been claimed. Now on the tidal reaches of the Wear and at Cowpen Marsh around Greatham Creek on the Tees, saltmarsh is reduced to a fragment. Other small saltmarshes are present in the mouths of small rivers and in harbours and embayments. At several sites, the saltmarsh at the mouth of the river has been formed in the shelter of a dune ridge. Relict areas of saltmarsh vegetation are also present in sites that are no longer tidal. Examples include parts of Cowpen Marsh, and Seaton Dunes and Common SSSIs on the Tees. The saltmarsh at Lindisfarne has increased greatly in area in the last 50 years, owing to the spread of common cord-grass *Spartina anglica*, planted there in 1929. Elsewhere the marshes are generally stable. The remaining small marshes in the Tyne and Wear estuaries have cliffed edges and appear to be experiencing slow retreat (Pye & French 1993).

In the region, a typical vegetation zonation is from a pioneer zone of common cord-grass to a low/mid marsh of sea aster *Aster tripolium* and common saltmarsh-grass *Puccinellia maritima*, often with high cover of common sea lavender *Limonium vulgare* in the sward. The upper marsh tends to be a red fescue *Festuca rubra* or common saltmarsh-grass saltmarsh, with associated species including thrift *Armeria maritima*, sea plantain *Plantago maritima* and common sea-lavender. At some sites, such as Cowpen Marsh, the pioneer vegetation is glasswort *Salicornia* spp. and sea blite *Suaeda maritima*. In ungrazed sites, sea purslane *Halimione portulacoides* is more abundant, as at

Table 3.6.1 Areas (ha) of saltmarsh communities for region and compared to national totals

County	**Spartina**	*Pioneer*	*Low-mid*	*Mid-upper*	*Driftline*	*Upper swamp*	*Transition*	*Wet depression*	*Total*	*% of region total*
Northumberland	136	0	29	86	1	5	13	0	269	86
Tyne and Wear	0	1	1	5	<1	1	1	0	9	3
Cleveland	0	6	14	6	8	0	0	0	34	11
Region 5	**136**	**7**	**44**	**97**	**9**	**5**	**14**	**0**	**312**	**-**
North Sea	3,461	2,130	8,194	4,772	1,350	1,066	342	2	21,788	1
England	5,166	2,641	10,299	9,948	1,493	686	833	0	31,533	1
GB	6,948	3,470	12,353	16,042	1,824	1,475	1,670	2	44,370	<1

Source: Burd (1989a)

Table 3.6.2 SSSIs containing saltmarsh in Region 5

Northumberland
Lindisfarne
Newton Links
Alnmouth Saltmarsh and Dunes
Warkworth Saltmarsh and Dunes
Cresswell Ponds
Tyne and Wear
Willington Gut
Wear River Bank
Durham
Durham Coast
Seaton Dunes and Common
Cleveland
Cowpen Marsh
South Gare and Coatham Sands

Source: JNCC Protected Sites dataset

Alnmouth where there is also a high cover of fucoid algae in the saltmarsh. Transitions between saltmarsh and dunes, although not extensive, are of interest in this region. Examples are at Warkworth (mouth of river Coquet) and Alnmouth. The dune/marsh transition has a distinctive plant community containing reflexed saltmarsh-grass *Puccinellia distans*, sea-milkwort *Glaux maritima* and hard grass *Parapholis strigosa*. All three species of seagrasses (*Zostera spp.)* are present in intertidal and subtidal zones in the region: at Lindisfarne, the Blyth estuary and possibly also the Coquet estuary.

The region contains several saltmarsh plants at or near the northern edge of their range on the east coast, including sea couch *Elymus pycnanthus*, sea wormwood *Artemisia maritima* and sea-purslane *Halimione portulacoides*. There are also occasional records for species that are predominantly southern (i.e. occur mainly south of line from the Wash to Bristol Channel) in their distribution on saltmarshes: for example, slender hare's-ear *Bupleurum tenuissimum*, stiff saltmarsh-grass *Puccinellia rupestris* and curved hard-grass *Parapholis incurva* (Adam 1990); these three species are all nationally scarce. Warkworth is thought to be the most northerly site in Europe for the nationally scarce curved hard-grass. Saltmarsh flat-sedge *Blysmus rufus* occurs at a few sites, notably Lindisfarne and Warkworth. Saltmarsh flat-sedge is one of the few 'northern' elements in the British saltmarsh flora and is elsewhere present as small stands, mainly on the west coast. The nationally scarce long-stalked orache *Atriplex longipes* is present on Alnmouth and Lindisfarne saltmarshes.

As elsewhere, saltmarshes in this region provide roosting sites for shorebirds and food for wildfowl. At Lindisfarne, the eelgrass *Zostera* spp. beds are feeding areas for internationally important populations of light-bellied brent geese *Branta bernicla hrota* and wigeon *Anas penelope*. The seeds of saltmarsh plants attract feeding flocks of wintering twite and snow buntings. Small numbers of shelduck *Tadorna tadorna* and redshank *Tringa totanus* breed on the marshes.

3.6.3 Human activities

Saltmarshes in the region are now mainly used for grazing and wildfowling. There has been a problem at Lindisfarne NNR, where spreading common cord-grass has reduced the area of intertidal mudflats and threatens to replace the eelgrass beds. This could decrease the numbers of feeding waders and wildfowl that the site supports (Millard & Evans 1984). Cord-grass control has been carried out by spraying with herbicide (Corkhill 1984).

Although the pressure to claim saltmarsh for industry is now less, adjacent industrial activities may still affect the saltmarshes, particularly by disturbance of their bird populations.

3.6.4 Information sources used

Saltmarshes in this region were surveyed in 1985-7 as part of the national saltmarsh survey by the NCC (Table 3.6.3, Map 3.6.1). Detailed reports are available and results are summarised in Burd (1989a, b). Data presented here are derived from that database. The national saltmarsh survey provided a intermediate level of detail between Phase 1 habitat survey and the National Vegetation Classification (NVC) (Rodwell in prep.). It did not include all areas of transition to other habitats such as sand dune, shingle and freshwater marsh. Areas of eelgrass were not recorded. There are few detailed saltmarsh surveys, with the exception of studies at Lindisfarne in connection with the spread and control of common cord-grass (Corkhill 1984; Millard & Evans 1984). Graham (1988) gives examples of NVC communities for Cowpen Marsh on the Tees and Timber Beach on the river Wear. A description and species list for the saltmarsh at Cowpen Marsh is also available from English Nature.

Several sites known to contain saltmarsh vegetation were not included in the national survey in this region. These saltmarshes include a fringe around the brackish lagoon at Cresswell Ponds in Northumberland; a small area of saltmarsh/grassland transition in the Blyth estuary; an area at the mouth of Castle Eden Dene in Durham; relict areas at Seaton Dunes at the mouth of the Tees; and saltmarsh in the shelter of the breakwater at South Gare.

Table 3.6.3 Saltmarsh sites surveyed

Name	*Grid ref.*	*Area (ha)*
Lindisfarne	NU087412	176
Holy Island	NU107433	33
Budle Bay	NU144352	9
Long Nanny	NU227269	9
Alnmouth	NU243102	24
Warkworth	NU258057	15
Seaton Sluice	NZ334763	4
Willington Gut	NZ313668	3
Castletown Marshes	NZ360576	6
Cowpen Marsh	NZ500259	34

Source: Burd (1989b)

3.6.5 Further sources of information

A. References cited

Adam, P. 1990. *Saltmarsh ecology*. Cambrige, Cambridge University Press.

Burd, F. 1989a. *The saltmarsh survey of Great Britain.* Peterborough, Nature Conservancy Council. (Research & survey in nature conservation, No. 17.)

Burd, F. 1989b. *Saltmarsh survey of Great Britain. Regional supplement No.8. North-east England.* Peterborough, Nature Conservancy Council.

Corkhill, P. 1984. *Spartina* at Lindisfarne NNR and details of recent attempts to control its spread. *In:* Spartina anglica *in Great Britain*, ed. by P. Doody, 60-63. Peterborough, Nature Conservancy Council. (Focus on nature conservation No. 5.)

Graham, G.G. 1988. *The flora and vegetation of County Durham. Watsonian vice-county 66.* The Durham Flora Committee and Durham County Conservation Trust.

Millard, A.V., & Evans, P.R. 1984. Colonisation of mudflats by *Spartina anglica*: some effects on invertebrate and shorebird populations. *In:* Spartina anglica *in Great Britain*, ed. by P. Doody, 41-48. Peterborough, Nature Conservancy Council. (Focus on nature conservation No. 5.)

Pye, K., & French, P.W. 1993. *Erosion and accretion processes on British saltmarshes.* London, Ministry of Agriculture, Fisheries and Food. Unpublished report. Contract No. CSA 1976. (Contractor: Cambridge Environmental Research Consultants Ltd.)

Rodwell, J.S., *ed*. In prep. *British plant communities. Volume 5: maritime and weed communities.* Cambridge, Cambridge University Press.

B. Contact names and addresses

Type of information	*Contact address and telephone no.*
Data from National Saltmarsh Survey	*Coastal Conservation Branch, Peterborough, tel: 01733 62626

* Starred contact addresses are given in full in the Appendix

Chapter 4 Marine and estuarine environments

4.1 Estuaries

Dr N.C. Davidson

4.1.1 Introduction

Estuaries are "partially enclosed tidal areas at least partly composed of soft tidal shores, open to saline water from the sea, and receiving fresh water from rivers, land run-off or seepage" (Davidson *et al*. 1991; Davidson & Buck in prep.). They comprise both aquatic (marine, brackish and fresh water) and terrestrial habitats, including adjacent sand dunes, coastal grasslands and maritime heaths. All the estuaries discussed here are covered by the NCC Estuaries Review (Davidson *et al*. 1991) and have at least 2 km of tidal channel or 2 km of shoreline over 0.5 km wide at low tide, either now or historically. This section gives an overview of the main features of the estuarine resource in Region 5; for further details of habitats, species and human uses refer to the relevant chapter sections.

The ten estuaries on the coast of north-east England are mostly small, with seven each having a total area of 200 ha or less, but they are one of the most varied parts of the UK resource, in both their form and natural resources and the extent and impact of their human exploitation. Most are long and narrow, with only narrow strips of saltmarsh and tidal flats bordering the tidal channels. Estuaries in southern Northumberland, Tyne & Wear and Cleveland have been greatly modified by past and present industrial use and have largely urban and industrial shorelines. In contrast, estuaries in north Northumberland are predominantly rural, and their largely natural shorelines, at Lindisfarne and Budle Bay in particular, contribute to their great nature conservation importance.

The contribution of Region 5 estuaries to the wider resource is shown in Table 4.1.1. Within Region 5 much of the resource is in Northumberland - over 62% of the region's total estuary area lies here, as does 97% of the intertidal area and 86% of estuarine saltmarshes. Elsewhere, only the Tees in Co. Cleveland makes a major contribution (21%) to the total estuary area. Overall the ten estuaries in Region 5 form 1.1% by area of the total UK estuarine resource and 2.4% of the British North Sea coast resource. Many have only small intertidal areas and the region has only a small part (1.5%) of the British North Sea coast estuarine saltmarsh area. Since many Region 5 estuaries are long and narrow, total lengths of estuarine shoreline and main tidal channels form larger parts (4.2% and 7.9% respectively) of

Map 4.1.1 Estuaries. Source: JNCC Estuaries Database.

Table 4.1.1 The percentage contributions of Region 5 estuaries to the wider resource

Geographical unit	*Total area*			*Intertidal area*			*Saltmarsh area*	
	% North Sea	*% GB*	*% UK*	*% North Sea*	*% GB*	*% UK*	*% North Sea*	*% GB*
Northumberland	1.5	0.7	0.7	2.3	1.0	1.0	1.2	0.6
Tyne & Wear	0.4	0.2	0.2	0.1	<0.1	<0.1	<0.1	<0.1
Cleveland	0.5	0.3	0.2	0.3	0.1	0.1	0.2	0.1
N Yorkshire	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Region 5	***2.4***	***1.2***	***1.1***	***2.4***	***1.0***	***1.0***	***1.5***	***0.7***

Sources: Buck (in prep.); Davidson & Buck (in prep.). Note: Since each estuary is treated as a single site, percentages are given for all estuaries falling wholly or partly in each geographical unit. Where estuaries cross unit boundaries, regional percentages are therefore less than the sum of the county percentages. Areas of saltmarsh were not available for Northern Ireland and so estuarine saltmarsh area comparisons are not made for the UK.

Table 4.1.2 The size of Region 5 estuaries

Geographical unit	*Total area (ha)*	*Intertidal area (ha)*	*Saltmarsh (ha)*	*Shoreline length (km)*	*Longest channel (km)*
Northumberland	3,898	3,201	257	110.4	25.4
Tyne & Wear	992	89	9	120.6	49.7
Cleveland	1,347	471	34	121.4	38.3
N Yorkshire	30	9	0	8.5	3.8
Region 5	***6,267***	***3,299***	***300***	***239.5***	***117.2***

Notes. Since each estuary is treated as a single site, totals are given for all estuaries falling wholly or partly in each geographical unit. Where estuaries cross unit boundaries, regional totals are therefore less than the sum of the county totals. Approximately 2 km at the upper limit of the Wear Estuary is in Co. Durham; around 1 km at the upper limit of the Tweed Estuary is in Scotland (Borders Region).

the British North Sea coast totals. The over 6,200 ha of estuarine intertidal and subtidal habitat in Region 5 form only a very small part (<0.01%) of the estuarine habitat of north-west Europe (Davidson *et al.* 1991).

4.1.2 Important locations and species

Map 4.1.1 shows the locations of estuaries in Region 5. The largest estuary in the region is Lindisfarne and Budle Bay, with a total area of over 3,000 ha, including extensive intertidal flats deposited in the shelter of the limestone and sand dune barrier island of Holy Island. Lindisfarne has the only extensive saltmarshes in the region. Although almost 60% is cord-grass *Spartina anglica* marsh, originally planted in 1929, the Lindisfarne saltmarshes have natural grassland transitions and are the northern limit of distribution in Britain of sea purslane *Halimione portulacoides*. Further south on the Northumberland coast are four small narrow estuaries, mostly formed behind sand dune spits. Although each has lost some intertidal flats and marshes to land-claim (see Collins (1993) for Alnmouth land-claim history), industrialisation is most extensive on the Blyth. Several estuaries around the region are of complex geomorphological origin: the Tweed, Tyne, Wear and Esk are mostly narrow and steep-sided - incised into hard rock for much of their tidal length and with over two-thirds of their area being permanently inundated at low water. Except on the Tweed, the former small areas of tidal flats at the estuary mouths have largely disappeared through harbour development and industrial land-claim. Table 4.1.2 gives the size of estuarine features in the region.

Most estuaries in the region are macrotidal (i.e. their spring tidal range exceeds 4 m), with eight of the ten estuaries having tidal ranges between 4-5 m. Alnmouth and Warkworth Habour are, however, mesotidal (i.e. 2-4 m tidal range). Physical characteristics of each estuary are summarised in Table 4.1.3.

4.1.3 Human activities

Table 4.1.4 summarises the current major human influences and water quality data for estuaries in the region.

Many estuaries in north-east England have been very extensively modified by land claim and other human activities, and in several, e.g. Wansbeck, Tyne and Tees, very little intertidal area remains. In particular the Tees estuary has lost almost 90% of its intertidal flats and saltmarshes to land-claim during the last 250 years. 80% of the former tidal part of the Wansbeck became largely non-tidal in the early 1970s through construction of a weir designed to create a

Table 4.1.3 Physical characteristics of Region 5 estuaries

Location	*Centre grid ref.*	*Geomorph-ological type*	*Total area (ha)*	*Inter-tidal (ha)*	*Salt-marsh (ha)*	*Shoreline length (km)*	*Main channel (km)*	*Spring tidal (m)*	*Sub-tidal (%)*
Northumberland									
90. Tweed Estuary	NT9853	Complex	199	68	0	27.7	9.9	4.1	65.8
91. Lindisfarne & Budle Bay	NU1141	Barrier beach	3,364	2,931	218	36.3	8.5	4.2	12.9
92. Alnmouth	NU2410	Bar-built	52	30	24	8.8	3.7	3.3	42.3
93. Warkworth Harbour	NU2605	Bar-built	75	45	15	12.9	5.0	3.3	40.0
94. Wansbeck Estuary	NZ3085	Coastal plain	40	37	0	3.2	1.6	4.2	7.5
95. Blyth (Northumberland)	NZ3082	Bar-built	168	90	<0.5**	21.5	6.6	4.2	46.4
Tyne & Wear									
96. Tyne Estuary	NZ3466	Complex	792	60	3	83.1	32.7	4.3	92.4
97. Wear Estuary	NZ3958	Complex	200	29	6	37.5	17.0	4.4	85.5
Cleveland									
98. Tees Estuary	NZ5326	Coastal plain*	1,347	471	34	121.4	38.3	4.8	65.0
N Yorkshire									
99. Esk Estuary (Yorks)	NZ9010	Complex	30	9	0	8.5	3.8	4.6	70.0

Sources: Buck (in prep.); JNCC Integrated Coastal database. Estuary numbers are those used in *An inventory of UK estuaries*. 'Geomorphological type' classifies estuaries into nine categories, described further in Chapter 5.7 of Davidson *et al.* (1991) and Chapter 4.5 of Davidson & Buck (in prep.). 'Spring tidal ranges' are for the closest station to the mouth of the estuary. 'Subtidal' includes tidal channels remaining water-filled at mean low water. Key: * now functions as an artificial bar-built estuary; ** a small saltmarsh area, not covered by Burd (1989), occurs in the upper reaches.

Table 4.1.4 Human influences and water quality on Region 5 estuaries

Estuary	*Centre grid ref.*	*Human use type*				*Water quality*
		urban	*industrial*	*rural**	*recreational*	
90. Tweed Estuary	NT9853	•	○	•	•	A
91. Lindisfarne & Budle Bay	NU1141			•	•	A
92. Alnmouth	NU2410	○		•	•	A
93. Warkworth Harbour	NU2605	•		•	•	A
94. Wansbeck Estuary	NZ3085	○		•	•	A
95. Blyth (Northumberland)	NZ3082	•	•			B,(A)
96. Tyne Estuary	NZ3466	•	•	○	•	(A),D,C,B,(A)
97. Wear Estuary	NZ3958	•	•	○	○	A,B
98. Tees Estuary	NZ5326	•	•	○	•	(A),C,D
99. Esk Estuary (Yorks)	NZ9010	•		○	○	A

Sources: Buck (in prep.), National Rivers Authority (1991). Key: * includes natural resource exploitation. 'Human use types' are coded as major (•) or minor (○). Where more than one 'Water quality' code is shown these are in downstream sequence, with brackets indicating a water quality found in a small part of the estuary.

recreational lake. The industrialised estuaries, and especially the Tees Estuary, have major chemical, oil and other manufacturing complexes on their shores and extensive port and dock facilities, although other major industrial uses, notably coal export and shipbuilding, have now largely ceased. Estuaries in the north of the region are used extensively for recreation but there is less recreational use of the more industrialised estuaries. Exploitation of natural resources is limited mostly to stock grazing (on sand-dunes and saltmarshes), wildfowling and bait-collection, mostly on the more northerly estuaries.

In the mid 19th century the Tees estuary was a large coastal plain estuary with over 2,500 ha of intertidal flats and fringing saltmarshes, although the upper reaches had by then been largely canalised and industrialised. Since then large sand dunes have developed around the two artificial breakwaters constructed in the second half of the 19th century at the estuary mouth, effectively changing the geomorphological functioning to a bar-built type. Within the estuary progressive land-claim for port and industry has reduced the intertidal area to only 470 ha. Although there have been no further industrial land-claims since the mid-1970s, recent amenity barrage construction has removed the upper tidal reaches of the estuary. The sequence of land-claim is described in detail in Davidson *et al.* (1991), Chapter 10.5.

Estuarine water quality is good in the largely rural estuaries in the north of the region and in the Esk estuary but is much poorer in the industrial estuaries and is particularly poor in the mid-reaches of the Tyne and at the mouth of the Tees, although some improvements have been made recently. The water quality of freshwater input is now threatened by pollution from redundant mine workings, particularly in the Blyth and Wear estuaries.

4.1.4 Information sources used

This chapter is summarised chiefly from JNCC's *An inventory of UK estuaries*, being published in six regional volumes along with an introductory and methods volume. All estuaries in Region 5 are included in *Volume 5. Eastern England* (Buck in prep.). Data presented in the inventory are drawn largely from material collected during 1989-90 (updated to 1993/4 where appropriate) for the NCC's Estuaries Review (Davidson *et al.* 1991). Saltmarsh data come originally from Burd (1989a,b), whose surveys covered mostly saltmarshes of <0.5 ha.

Hydrological data (e.g. catchment areas and river flows) for some but not all estuaries as defined here are available from sources including National Rivers Authority Catchment Management Plans. For other estuaries, information is readily available for only some parts of the catchment, often those upstream of tidal limits.

4.1.5 Further sources of information

A. References cited

Buck, A.L. In prep. *An inventory of UK estuaries. 5. Eastern England.* Peterborough, Joint Nature Conservation Committee.

Burd, F. 1989a. *The saltmarsh survey of Great Britain.* Peterborough, Nature Conservancy Council. (Research & survey in nature conservation, No. 17.)

Burd, F. 1989b. *Saltmarsh survey of Great Britain. Regional supplement No.8. North-east England.* Peterborough, Nature Conservancy Council.

Collins, K. 1993. Alnmouth: unravelling of an estuary's history. *Geographical, Dec. 1993:* 53-56.

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

Davidson, N.C., & Buck, A.L. In prep. *An inventory of UK estuaries. 1. Introduction and methods.* Peterborough, Joint Nature Conservation Committee.

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

B. Further reading

Further details of estuaries are in the *Coastal & Marine UKDMAP datasets* module (Barne *et al.* 1994), available from JNCC Coastal Conservation Branch, Peterborough. A list of selected further reading for each estuary discussed in section 4.1 is given in Buck (in prep.) (above).

Barne, J., Davidson, N.C., Hill, T.O., & Jones, M. 1994. *Coastal and Marine UKDMAP datasets: a user manual.* Peterborough, Joint Nature Conservation Committee.

Brazier, D.P., & Murray, E. 1994. Littoral survey of the estuaries of south-east Scotland and north-east England. *JNCC Report*, No. 159. (Marine Nature Conservation Review Report No. 5 MNCR/SR/26.)

British Oceanographic Data Centre. 1992. *United Kingdom Digital Marine Atlas. User Guide. Version 2.0*. Birkenhead, Natural Environment Research Council, British Oceanographic Data Centre.

Davidson, N.C. 1991. *Estuaries, wildlife and man*. Peterborough, Nature Conservancy Council.

Noble, L., *ed*. 1993. *Estuaries and coastal waters of the British Isles. An annual bibliography of recent scientific papers. Number 17*. Plymouth, Plymouth Marine Laboratory and Marine Biological Association.

Marsh, T.J., & Lees, M.L., *eds*. 1993. *Hydrometric register and statistics 1986-90.* Wallingford, Institute of Hydrology.

Peck, K. 1993. Estuaries inventory - research towards a better understanding of the interactions between birds and human activities on UK estuaries. *RSPB Conservation Review, 7*: 42-46.

C. Contact names and addresses

Type of information	*Contact address and telephone no*
Integrated coastal database: national database of estuaries, coastal habitats, statutory and non-statutorily protected sites. Summary data available also in Coastal Directories UKDMAP display version.	*Coastal Conservation Branch, JNCC, Peterborough, tel: 01733 62626
Statutorily protected sites; detailed wildlife site information; coastal geomorphology. Estuaries Initiative and estuary management plans. Numerical and some digitised data.	*Estuarine Ecologist/ Estuaries Initiative Officer/ Marine Ecologist, English Nature HQ, Peterborough, tel: 01733 340345
RSPB Estuaries Inventory: mapped and numerical information on land use and selected human activities for 57 major UK estuaries . In region 5 covers Tweed Estuary and Tees Estuary.	*Estuaries Inventory project officer, RSPB, Sandy, tel: 01767 680551
Catchment Management Plans	*NRA Northumbria Region, Eldon House, Regent Centre, Gosforth, Newcastle upon Tyne NE3 3UD, tel: 0191 213 0266 *NRA Yorkshire Region, 21 Park Square South, Leeds LS1 2QG, tel: 01132 440191
National River Flow Archive: catchments and river flows from upstream gauging stations; interpreted analyses for whole estuaries.	National Water Archive Manager, Institute of Hydrology, Maclean Building, Crowmarsh Gifford, Wallingford, Oxfordshire OX10 8BB, tel: 01491 838800

* Starred contact addresses are given in full in the Appendix

4.1.6 Acknowledgements

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4.2 The sea bed

R.A. Irving

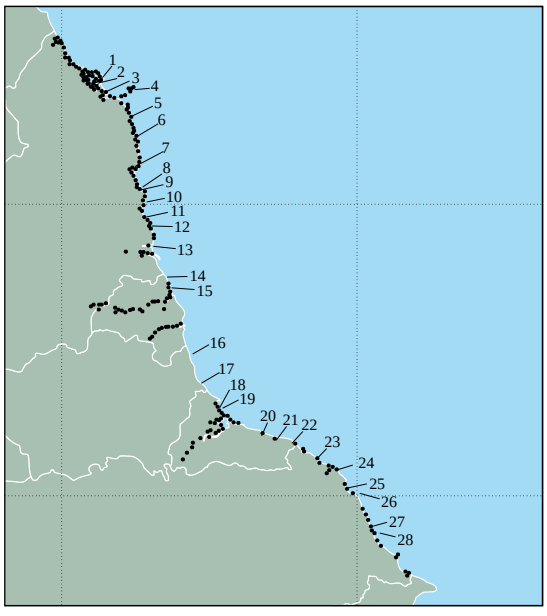
4.2.1 Introduction

This section covers the occurrence and distribution of groups of species that live on the sea bed (benthic communities, collectively called the benthos); the distribution and occurrence of indivually rare and scarce species in covered in section 5.4.

Information on the precise extent of shore and sea bed types in a national context is not yet available, although within the region, areas of several habitat types are known. Rocky shores are generally infrequent. In Northumberland, limestone promontories with occasional boulders continue south to Hartlepool, interspersed with broad sandy bays, incorporating the extensive intertidal sand and mudflats around Lindisfarne. The shores of Tyne & Wear comprise sandy bays separated by rocky headlands, whilst those of County Durham are predominantly of mixed sediments (including colliery waste). Sandstones and mudstones occur from Hartlepool to Saltburn; and soft clays and shales from Saltburn eastwards into North Yorkshire. Off headlands of the Northumberland coast in particular, limestone reefs extend into the sublittoral as bedrock platforms. Around the Farne Islands, igneous rock extends into deeper water, forming discrete bedrock outcrops, with tide-swept communities present, especially on underwater cliffs. Dense kelp forests occur on shallow rock, which is grazed by sea urchins. Sublittoral sediment is extensive, often as coarse sand, which may be mixed with varying amounts of larger sediments such as gravel, pebbles or cobbles.

Cleveland also has several long sandy beaches with a few areas of intertidal rock, whereas North Yorkshire's coast is dominated by high cliffs, rocky and boulder shores, with only a few sandy bays. There is extensive muddy sand at the mouths of estuaries. The two major estuaries, the Tyne and the Tees, have been adversely affected by pollution in the past, though clean-up measures appear to be alleviating this. In the sublittoral, sand and mixed sediments predominate, though important outcrops of hard substrata are provided by the limestone exposures of Northumberland, the igneous rock of the Farne Islands and the softer shales of Cleveland and North Yorkshire. Wrecks (ships, aircraft and other solid material) (see section 6.2), where they occur off the coast of this region, offer hard substrata in otherwise largely sedimentary areas, thus providing new habitats for opportunistic colonising species, which otherwise would not be present.

There are two Sensitive Marine Areas (SMAs, otherwise known as Important Areas for Marine Wildlife - see section 7.4.4) identified by English Nature (1994) within this region. The Holy Island and Farne Islands SMA extends from south of Berwick-upon-Tweed to south of Alnmouth on the coast, and up to 15 km offshore to include the waters surrounding the Farne Islands. The area has an unusually high marine habitat diversity in comparison with the majority of the English North Sea coast. The Holy Island area contains one of the largest intertidal areas in north-east England, with extensive seagrass *Zostera* spp. beds. The second SMA, at Robin Hood's Bay, also incorporates a short length of the coastline either side of the Bay. The rocky shore of the Bay



Map 4.2.1 Littoral surveys recorded on the MNCR database (source: JNCC) and locations of particular marine interest (Table 4.2.1).

Table 4.2.1 Locations (1 km squares) of marine interest mentioned in the text

No. on Map 4.2.1	*Location*	*Grid ref.*
1	Holy Island	NU1443
2	Fenham Flats	NU1140
3	Budle Bay	NU1536
4	Farne Islands	NU2337
5	Beadnell	NU2329
6	Newton Haven	NU2424
7	Dunstanburgh Castle	NU2522
8	Warkworth Harbour	NU2604
9	Amble	NU2705
10	Hadston Carrs	NU2800
11	Druridge Bay (between Amble & Newbiggin)	NZ 2797
12	Cresswell Skeres	NZ2993
13	Wansbeck estuary	NZ3085
14	St Mary's Island	NZ3575
15	Cullercoats	NZ3671
16	Seaham	NZ4349
17	Blackhall	NZ4639
18	South of Hartlepool	NZ5231
19	Long Scar	NZ5331
20	Saltburn	NZ6621
21	Skinningrove	NZ7120
22	Boulby	NZ7619
23	Deepgrove Wyke	NZ8514
24	Saltwick Bay	NZ9110
25	Robin Hood's Bay	NZ9504
26	Ravenscar	NZ9802
27	Scalby Ness	TA0391
28	Scarborough	TA0589

itself is moderately exposed and features organisms typical of this habitat, including fucoid algae, mussels, limpets and barnacles. A number of sublittoral species reach the southern limits of their geographical distribution in this region.

A large proportion of the Northumberland coast is designated as a Site of Special Scientific Interest (SSSI) (renotified as the Northumberland Shore SSSI in 1993) on account of its biological and geological importance; as Heritage Coast; and as an Area of Outstanding Natural Beauty (AONB).

4.2.2 Important locations and communities

Map 4.2.1 shows littoral surveys recorded on the JNCC's Marine Nature Conservation Review (MNCR) database and key locations of marine biological importance mentioned in the text; the latter are listed in Table 4.2.1. English Nature's Sensitive Marine Areas are shown on Map 7.4.1.

Berwick-upon-Tweed to Seaton Sluice (Northumberland)

From Cheswick south to Seahouses, the shores are predominantly of sand, with the other main sandy areas being at Beadnell Bay, Embleton Bay, Alnmouth Bay and Druridge Bay. There is extensive muddy sand at Lindisfarne and Budle Bay, supporting large populations of the lugworm *Arenicola marina,* fed on by large numbers of waders (see section 5.12). Large, dense beds of the seagrasses *Zostera noltii* and *Z. angustifolia* occur on Fenham Flats, and unusually *Zostera* ?*marina* in rockpools on Holy Island (Connor 1989); these seagrasses provide food for several important wintering and migrant wildfowl populations (see section 5.12).

Rocky shores are dominated by fucoid algae, or barnacles and mussels. Rich communities are found on vertical limestone on the lower shore (Connor 1989). The majority of habitats and species are widespread on the north-east coast of England, but several rare habitats for the area have also been described. In particular, a protective near-shore reef at Newton Haven provides additional shelter for the near-shore sediment community, which includes the burrowing urchin *Echinocardium cordatum* and the razor shells *Ensis ensis* and *E. arcuatus* (Foster-Smith & Foster-Smith 1987). The presence of *Echinocardium cordatum* in the littoral infauna at Newton Haven makes this beach unique in north-east England (Olive 1984). The survey area was considered to have a wide range of habitats and a high species diversity, with records of over 460 species.

The Farne Islands comprise a scattering of rocky outcrops between 3 km and 7 km from the mainland. Owned by the National Trust, they were declared a National Nature Reserve in 1993. There are up to 28 islets, but at high tide almost half of them are submerged. The intertidal rock extends beyond the low water mark, supporting extensive kelp forests in the clear water. The rock beneath the kelp is extensively grazed by the sea urchin *Echinus esculentus* and is covered with encrusting calcareous algae. Vertical rock is covered by the tubeworm *Pomatoceros triqueter*, and in areas of tidal movement the soft coral *Alcyonium digitatum* is abundant. Further offshore, to the south of the Farnes, extensive areas of tide-swept gravels and pebbles support a community of high nature conservation importance, which includes hydroids, bryozoans and crustaceans. Off the mainland coast of this sector, tilted limestone rock strata give rise to finger-like reefs in the sublittoral, extending out at right angles from the shore. These can form extensive areas of horizontal bedrock or shelve into sand. Bedrock terraces and current-swept flat bedrock areas, with surge gullies and tunnels, add to the diversity of sublittoral habitats. Several northern species (e.g. the bottlebrush hydroid *Thuiaria thuja* and the anemone *Bolocera tuediae*) are near their known southern limits of distribution here.

From Warkworth Harbour (at the mouth of the River Coquet) to just south of the River Tyne, the coastline consists of a series of sandy bays between rocky headlands fronted mainly by rock shore platforms. The tidal flats at Warkworth Harbour have dense growths of the green alga *Enteromorpha* spp., with small amounts of seagrass *Zostera* spp., both fed on by wildfowl (Brazier & Murray 1994). Interesting records for Druridge Bay, with its extensive sandy beach continuing into the shallow sublittoral, include a new southern limit of the North Sea distribution of the Devonshire cup coral *Caryophyllia smithii* and the first record for Britain's east coast of the sponge *Axinella infundibuliformis*. One shore site on the north side of the Wansbeck estuary was surveyed by Brazier & Murray (1994), revealing communities typical of sheltered muddy sand. Between the Wansbeck estuary and Blyth, the 3 km stretch of sand and shingle shore is speckled with coal dust. The sandy shoreline continues south a further 3 km to Seaton Sluice, where rock reappears.

Seaton Sluice to Staithes (Tyne & Wear; Durham; Cleveland)

St Mary's Island is a sandstone promontory extending into surprisingly clean water, with many reefs. Between the shore and a depth of 40 m, rocks are present as outcrops surrounded by areas of clean, fine sand (Buchanan 1963, 1964, 1965, in Bennet & Foster-Smith in prep.). Communities appear poorly correlated with sediment type. The burrowing heart urchin *Echinocardium cordatum* is present within a brittlestar *Amphiura filiformis* community to a depth of 60 m.

The bed of the river Tyne consists largely of a mixture of mud, muddy sand and gravel. Studies undertaken within the estuary have been mainly in relation to pollution. At seventeen sites within the estuary, Sinton (1979, in Bennett & Foster-Smith in prep.) found the fauna to consist predominantly of capitellids, oligochaetes, nematodes and the polychaete *Polydora* sp. The diversity and quantity of species present was related primarily to salinity and water quality (i.e. organic pollution loading). Studies by Evans *et al.* (1994) comparing the macrofauna from Black Middens in the Tyne estuary and Cullercoats Bay in 1991 with records from the same sites in 1931 revealed very few differences.

The coast from the Tyne south to Hartlepool typically consists of high limestone cliffs (up to 45 m high) backing rocky shore platforms, shingle and sandy bays. The estuary of the River Wear, which flows through the heart of Sunderland, was surveyed by Brazier & Murray (1994), who found a general paucity of littoral species. The Durham coastline is well known for the amount of colliery waste that is present on the shore, with an associated reduction in species numbers considered to be due to the turbidity, abrasive particles in the water and accumulation of fine

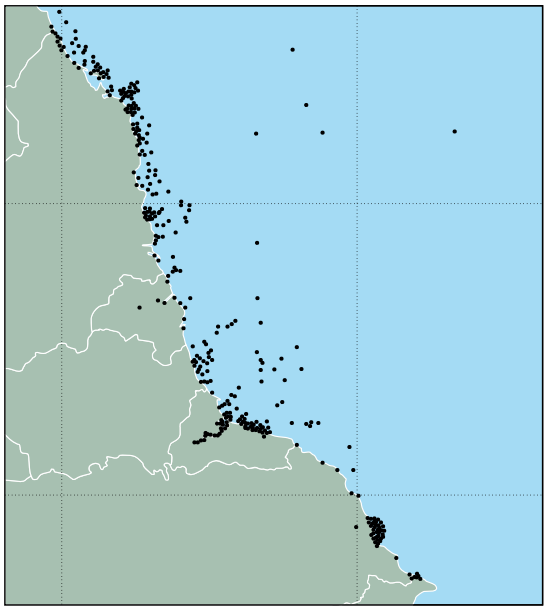
sediments in crevices (Nelson-Smith 1988, in Bennet & Foster-Smith in prep.). The sea bed off much of the Durham coastline is predominantly sedimentary. Evidence of smothering of the sea bed by colliery waste and dredge spoil was apparent inshore, with low species diversity (Loretto 1992). Exposed sublittoral rock in the north of a 'Seasearch' survey area (off Seaham), was reported to be depleted of life. Further offshore, the sea bed is muddy, with boulders and mixed sediments, hard substrata being dominated by the soft coral *Alcyonium digitatum*, hydroids and bryozoans. The water in these areas is turbid and a dark, fine silt covers all sites investigated.

Hartlepool is situated on a rocky limestone headland with sandy beaches to the north and in Tees Bay to the south. Just south of Hartlepool, an area of the foreshore is notified as SSSI on account of exposures of a submerged forest. Most marine biological studies of the Tees estuary have been as part of pollution (e.g. Gray 1976; Kendall 1976; Newell 1984 and Tapp *et al.* 1992 in Bennet & Foster-Smith in prep.) land claim or waterfowl ecology (e.g. Evans *et al.* 1979) studies. Within the estuary the softest muds of Seal Sands support only fifteen species but numbers of individuals are high, particularly of the polychaete *Manayunkia aestuarina*. The sandier Bran Sands supports a wider variety of less abundant polychates. Around the estuary mouth Seaton, North Gare and Coatham Sands are mostly well-graded sand exposed to wave action. Here there is a sparse fauna of amphipods, isopods and the polychaete *Scolelepis squamata* (Davidson & Evans 1981). Rees (1983) undertook grab sampling off the coast at Blackhall, Long Scar and Saltburn, checking how benthic communities are affected by pollution effects. The dominant species there in terms of mass were the polychaetes *Spiophanes bombyx*, *Magelona* spp. and *Nephtys* spp. A sandy shore stretches south from Redcar to Saltburn-by-the-Sea, backed by sand dunes. From Saltburn to the county border at Staithes, the shore consists of extensive rock platforms backed by high, sheer cliffs. The small sandy bay at Skinningrove was identified by Foster-Smith (1988) as having interesting intertidal communities.

Staithes to Filey (North Yorkshire)

Two important shore habitats present along this sector of coast are the intertidal rock platforms and boulders (Foster-Smith 1988). The communities of the bedrock platforms vary according to degree of exposure to wave action; they can be dominated by mussels *Mytilus edulis*, barnacles or fucoid seaweeds. Boulder beaches provide overhangs, and in deeper channels between boulders where sand and silt accumulates the tube-worm *Sabellaria spinulosa* is commonly found. Exposed sandy beaches support low numbers of lugworm *Arenicola marina*. A subjective assessment of biological diversity showed Deepgrove Wyke, Saltwick Bay and Ravenscar to support the greatest number of interesting communities (Foster-Smith 1988). A survey of the intertidal invertebrate fauna of Yorkshire's bathing beaches was carried out in 1991 (National Rivers Authority, Yorkshire Region 1992, in Bennet & Foster-Smith in prep.), revealing a dominance of amphipods and polychaete worms, as would be expected on this type of shore.

The shore communities present in Robin Hood's Bay are typical of moderately exposed sites on the North Yorkshire coast, featuring mussels, limpets, winkles and fucoid algae



Map 4.2.2 Near-shore sublittoral surveys recorded on the MNCR database. Source: JNCC.

(Bennett & Foster-Smith in prep.). The dominant species in terms of biomass are the polychaetes *Spiophanes bombyx*, *Magelona* spp. and *Nephtys* spp. The shore and near-shore sublittoral area to the south of Filey Brigg is of sand.

Offshore (defined as beyond 3 km or 50 m depth)

Off much of the Northumberland coast, between 40-60 m depth, there is a plain of fine sand being divided by a band of medium sand and gravel running parallel to the shore (Buchanan 1963, 1965, in Bennet & Foster-Smith in prep.). Deeper than 60 m, the sediments consisted of very fine sand with varying proportions of silt. Three principal communities have been identified, though these were found to be poorly correlated with sediment type: (1) a burrowing brittlestar *Amphiura filiformis-Amphiura chiajei* community; (2) an amphipod *Haploops tubicola* community; and (3) a bivalve *Chamelea gallina* community. Long-term monitoring of benthic communities off Blyth has shown periods of stability interspersed with periods of change caused by fluctuating winter temperatures and the flux of phytoplankton to the bottom (Buchanan & Moore 1986). From Redcar and Flamborough Head, between 3-10 km offshore, Edwards (1967, in Bennet & Foster-Smith in prep.) reported the sea bed to be sandy with outcrops of rocks and stones.

4.2.3 Human activities

St Mary's Island, Northumberland, is often used by students for field studies and may become a Voluntary Marine Nature Reserve in 1995.

A number of activities that affect marine habitats and communities take place within this region. There are several centres of fishing, involved mainly in potting, gill netting, salmon drift netting and demersal trawling, together with limited scallop gathering (see sections 5.5, 5.7, 5.8, 8.3, 9.1 and 9.2). Pollution and enrichment, especially of

the more industrialised estuaries in the region, has affected sea-bed communities. Sewage enrichment may affect parts of Budle Bay (Lindisfarne) and the Tyne, and there may be a general eutrophication effect over much of the coast from the Tees northwards (Evans *et al.* 1994) leading to high numerical densities but sometimes reduced diversity of organisms. Reductions in pollution loadings in the most polluted estuaries (e.g. the Tees) are now leading to improved sea-bed faunas (Shillabeer & Tapp 1989). Intensive bait-digging has affected densities of target and non-target species in some places, notably around the mouth of the Tyne and at Lindisfarne (Budle Bay) (Olive 1993).

The effect of dumping colliery waste, dredgings and fly-ash off the coast between Lynemouth and Seaham was investigated by Eagle *et al*. (1979, in Bennet & Foster-Smith in prep.) (see also section 9.4), who found that dumping of fly-ash and colliery waste caused severe depletion of the benthic fauna, in both species and abundance, in the areas where waste was tipped with greatest intensity. Some recovery appeared to take place on older, weathered waste deposits. Lynemouth Bay is excluded from the Northumberland Coast SSSI because of the presence of colliery waste and the practice of digging on the foreshore to recover waste coal. Dumping of colliery waste on the shore between Seaham and Easington in Co. Durham has been studied by Nelson-Smith (1988, in Bennet & Foster-Smith in prep.), with evidence of smothering in near-shore areas being reported by Loretto (1992). The effects of fly-ash dumping on benthic fauna were examined by Bamber (1984) at a fly-ash dumping ground off Blyth. The density, diversity and biomass of benthic species were all reduced at the centre of the dumping ground as compared with the surrounding natural sediments. Several studies have also been undertaken on the effects of sewage sludge dumping at a site off the mouth of the Tyne (e.g. Pomfret & McHugh 1983; Rees *et al*. 1992, in Bennet & Foster-Smith in prep.). The effects of the disposal operations on the benthos appeared minimal, as prevailing water movements had adequately dispersed the sludge. Benthic communities close to an outfall site 1.25 km off Boulby have been monitored over a number of years by Craig *et al*. (1993), who found that the discharge of fine inorganic potash mine waste had led to a change in sediment characteristics and a decline in the benthic fauna. Around the Tees estuary, analysis of benthic communities from grab samples by Rees (1983) indicated that the coastal waters had a sufficient capacity to dilute and disperse effluents emanating from the Tees.

4.2.4 Information sources used

The marine life and habitats of much of the coast have been well studied and documented. JNCC's Marine Nature Conservation Review (MNCR) team (and their contractors) use a standard recording methodology for both littoral and sublittoral surveys, which describe both habitats and their associated communities (see Hiscock 1990). Survey information from other sources may vary considerably in its methodology and coverage. An initial marine biological sublittoral survey of the Farne Islands was undertaken in 1982 (Edwards 1983). An MNCR littoral and sublittoral survey from Berwick to Beadnell (including the Farne Islands) was undertaken in 1987 (Connor 1989), with the section from Beadnell to Dunstanburgh Castle being surveyed by Foster-Smith & Foster-Smith (1987). Thereafter, an outposted MNCR team, based at Cullercoats from 1991-94, undertook a series of littoral and sublittoral surveys between Dunbar and Flamborough Head. Reports deriving from this work and relevant to this region include Brazier & Murray (1994) and Holt (1994). The MNCR literature review *Dunbar to Bridlington - MNCR Sector 5* (Bennett & Foster-Smith in prep.) has been widely consulted. Further details of marine survey sites are in the *Coastal & Marine UKDMAP datasets* module (Barne *et al*. 1994), available from JNCC Coastal Conservation Branch, Peterborough. Table 4.2.2 shows the number of sites with marine benthic habitat and species information held on the MNCR database, and Maps 4.2.1 and 4.2.2 show, respectively, littoral and near-shore sublittoral surveys recorded on the JNCC's MNCR database.

Table 4.2.2 Number of sites with marine benthic habitat and species information held on the MNCR database

Littoral	*Near-shore sublittoral*	*Offshore*	*Total*
266	556	0	822

Note: See also Maps 4.2.1 and 4.2.2. Information in this table is not comprehensive: records additional to those cited here may exist in sources not consulted.

The near-shore sublittoral area off the Durham coast was investigated by volunteer sports divers in 1991 using 'Seasearch' recording techniques to describe sea bed types (Loretto 1992). A regional habitat manual for SE Scotland and NE England has been produced using the results of this work and other surveys (Foster-Smith 1992). A remote near-shore BioMar survey between Budle Bay and Craster led to an assessment of the nature conservation importance of marine biotopes in north Northumberland (Foster-Smith & Davies 1994). An intensive study of the shores and shallow sublittoral between Beadnell and Dunstanburgh Castle was undertaken in 1987 by Foster-Smith & Foster-Smith (1987). Populations of the lugworm *Arenicola marina* have been closely studied off the north Northumberland coast, particularly in relation to bait digging activity (Olive 1986, 1993, in Bennet & Foster-Smith in prep.). Foster-Smith (1987, in Bennet & Foster-Smith in prep.) provides an interpretation for visitors of the geology, ecology and marine biology of the coast from Amble to Hadston Carrs. The marine life of Druridge Bay has been documented by Bamber (1989). The sublittoral habitats and species of Cresswell Skeres, a rocky offshore outcrop at the southern end of the bay, were surveyed by Foster-Smith (1987, in Bennet & Foster-Smith in prep.). The presence of the Dove Marine Laboratory at Cullercoats and a University of Newcastle-upon-Tyne research vessel based at Blyth harbour has facilitated many marine studies within this sector (Bennett & Foster-Smith in prep.). The Blyth estuary was also surveyed by Brazier & Murray (1994). The sediments and their associated benthic communities present off the Northumberland and Tyne & Wear coast are described by Buchanan (1963, 1964, 1965, in Bennet & Foster-Smith in prep.). Further information on sediments and benthic communities in this area comes from monitoring studies at a sewage sludge dumping ground off the mouth of the Tyne (e.g. Pomfret & McHugh 1983; Rees *et al*. 1992, in Bennet & Foster-Smith in prep.), an activity

which began in 1980. The intertidal fauna of the Aln estuary was investigated by Howcroft (1983, in Bennet & Foster-Smith in prep.), with past and present algal data from the area being drawn together by Hardy (1989). A list of the shore fauna and flora of St Mary's Island was given by Moore (1989), together with a list of those species found on an area of hard ground off the island at a depth of 36 m.

The North Yorkshire coast was described by Foster-Smith (1988) in terms of habitats, fauna and flora and features of conservation importance. In a survey of the intertidal invertebrate fauna, commissioned by the NRA, seven rocky shores sites between Staithes and Flamborough Head were investigated (Bird & Morris 1992, in Bennet & Foster-Smith in prep.). The fauna and flora of Robin Hood's Bay has been well documented. The University of Leeds had a marine laboratory in the Bay until 1982, resulting in numerous studies being undertaken in the vicinity (see Bennett & Foster-Smith in prep. for further details). Lewis (1964, 1977, in Bennet & Foster-Smith in prep.) examined the local shores during investigations on the dynamics of rocky shore communities, and Perkins (1953) described rocky shores and littoral algae from Robin Hood's Bay to Flamborough. Grab sampling was undertaken off Robin Hood's Bay by Rees (1983), who assessed levels of benthic biomass production in relation to pollution effects. Off Scalby Ness and Scarborough further survey work using grab sampling and diving was undertaken in 1988 and 1990, as reported by Wimpey Environmental (1993, in Bennet & Foster-Smith in prep.). The shores and littoral species in the Scarborough area are described by Lewis (1987a) in a guide to the Scarborough shoreline, which includes reference to harbour walls, rocky shores and sandy beaches. A similar study was carried out in the production of a guide to Filey Brigg (Lewis 1987b).

There are a number of studies describing offshore seabed habitats and communities, prepared as part of environmental impact assessments prior to the construction of long sea outfalls or gas and oil exploration rigs or the extraction of marine aggregates. This information is held by English Nature, MAFF, the Crown Estate and the County Wildlife Trusts. A Porcupine Society field trip in July 1989 undertook several Agassiz trawls over the offshore area known as 'The Trink', 16 km NNE of Blyth Lighthouse, at the relatively shallow depth of 55 m. A full species list for the area was produced by Moore (1989).

A number of studies have looked at the effects of pollution on the distribution of marine algae along the Durham coastline and beyond (e.g. Edwards 1975; Mercer 1976; and Hardy *et al*. 1993). The effects of sewage pollution on Scarborough's rocky shores have been described and discussed by National Rivers Authority Yorkshire Region (1991).

4.2.5 Further sources of information

A. References cited

Bamber, R.N. 1984. The benthos of a marine fly-ash dumping ground. *Journal of the Marine Biological Association of the United Kingdom*, *64*: 211-226.

Bamber, R.N. 1989. The marine biota of Druridge Bay, Northumberland. *Porcupine Newsletter*, *4*: 161-168.

Barne, J., Davidson, N.C., Hill, T.O., & Jones, M. 1994. *Coastal and Marine UKDMAP datasets: a user manual.* Peterborough, Joint Nature Conservation Committee.

Bennett, T.L., & Foster-Smith, J.L. In prep. *Benthic marine ecosystems in Great Britain: a review of current knowledge. Chapter 6: south-east Scotland and north-east England (Dunbar to Bridlington) MNCR Sector 5*. Peterborough, Joint Nature Conservation Committee.

Brazier, D.P., & Murray, E. 1994. Littoral survey of the estuaries of south-east Scotland and north-east England. *JNCC Report*, No. 159. (Marine Nature Conservation Review Report No. 5 MNCR/SR/26.)

Buchanan, J.B., & Moore, J.J. 1986. A broad review of variability and persistence in the Northumberland benthic fauna 1971-85. *Journal of the Marine Biological Association of the United Kingdom*, *58*: 191-210.

Connor, D.W. 1989. Marine biological survey of Berwick to Beadnell, including the Farne Islands. *Nature Conservancy Council, CSD Report*, No. 902. (Marine Nature Conservation Review Report, No. MNCR/SR/1).

Craig, N.C.D., Shillabeer, N., & Parr, J.C.W. 1993. Long-term benthic monitoring of the effects of a dense effluent discharges to North Sea coastal waters. *Journal of the Institute of Water and Environmental Management*, *7*: 262-269.

Davidson, N.C., & Evans, P.R. 1981. *Seal Sands Feasibility Study.* Unpublished report to the Nature Conservancy Council.

Edwards, A.J. 1983. Farne Islands sublittoral survey 1982. (Contractor: Marine Biology North East). *Nature Conservancy Council, CSD Report*, No. 465.

English Nature. 1994. *Important areas for marine wildlife around England*. Peterborough, English Nature.

Evans, P.R., Herdson, D.M., Knights, P.J., & Pienkowski, M.W. 1979. Effects of short-term reclamation of part of Seal Sands, Teesmouth, on wintering waders and Shelduck. *Oecologia 41*: 183-256.

Evans, S.M., Arnott, S. & Wahju, R.I. 1994. Evidence of change in the macrofauna of tidal flats subject to anthropomorphic impacts in north-east England. *Aquatic Conservation. Marine and Freshwater Ecosystems 4*: 333-344.

Foster-Smith, R.L. 1988. Marine interpretation on the North York Moors National Park coastline. (Contractor: R.L. Foster-Smith). *Nature Conservancy Council, CSD Report*, No. 885.

Foster-Smith, R. 1992. The 'Seasearch' regional guide for north-east England and south-east Scotland. Unpublished, Marine Conservation Society.

Foster-Smith, R.L., & Davies, J. 1994. *Survey of the marine environment of north Northumberland: an assessment of the conservation interest of the marine biotopes*. Peterborough, English Nature. (Research Report, No. 92.)

Foster-Smith, R.L., & Foster-Smith, J.L. 1987. A marine biological survey of Beadnell to Dunstanburgh Castle, Northumberland. (Contractor: R.L. Foster-Smith & J.L. Foster-Smith.) *Nature Conservancy Council, CSD Report,* No. 798.

Gray, J.S. 1976. The fauna of the polluted River Tees Estuary. *Estuarine and Coastal Marine Science, 4*: 653-676.

Hardy, F.G. 1989. The marine algae of Alnmouth: a century of study. *History of the Berwickshire Naturalists' Club*, *44*: 18-23.

Hiscock, K. 1990. Marine Nature Conservation Review: Methods. *Nature Conservancy Council, CSD Report*, No. 1072. (Marine Nature Conservation Review Report, No. MNCR/OR/5). Nature Conservancy Council, Peterborough.

Holt, R.H.F. 1994. Marine biological survey of Eyemouth (Berwickshire) to Alnmouth (Northumberland). *Joint Nature Conservation Committee Report*, No. 157. (Marine Nature Conservation Review Report, No. MNCR/OR/12).

Kendall, M.A. 1976. The biological importance of a polluted estuary. *Effluent and Water Treatment Journal, 16*: 339-341.

Lewis, D.B. 1987a. *Scarborough shoreline*. University of Hull, Department of Adult Education.

Lewis, D.B. 1987b. *Filey Brigg. Its plants and animals*. University of Hull, Department of Adult Education.

Loretto, C.J. 1992. Seasearch survey of the Durham coast. (Contractor: Marine Biological Consultants Ltd., Ross-on-Wye). *Joint Nature Conservation Committee Report*, No. 29. Peterborough.

Mills, D.J.L., Hill, T.O., Thorpe, K., & Connor, D.W. 1993. Atlas of marine biological surveys in Britain. *Joint Nature Conservation Committee Report*, No. 167. (Marine Nature Conservation Review Report MNCR/OR/17.) Peterborough.

Moore, J.J. 1989. Complete species list from the Porcupine field meeting on 20-21 July 1989 to the 'Trink' and other sites on the Northumberland coast. *Porcupine Newsletter*, *4*: 143-149.

National Rivers Authority, Yorkshire Region. 1991. *A biological survey of the intertidal zone at Scarborough in relation to existing sewage discharges and the porposed new long sea outfall at Scalby Ness, June-July 1989*. Unpublished, National Rivers Authority, Yorkshire Region. (Biology Report, No. BN 13/91.)

Olive, P.J.W. 1984. A survey of the littoral infauna at Newton-on-Sea: its scientific and educational value and the likely effect of unrestricted bait digging. (Contractor: University of Newcastle-upon-Tyne, Dove Marine Laboratory.) *Nature Conservancy Council, CSD Report*, No. 533.

Olive, P.J.W. 1993. Management of the exploitation of the lugworm *Arenicola marina* and the ragworm *Nereis virens* (Polychaeta) in conservation areas. *Aquatic Conservation. Marine and Freshwater Ecosystems, 3*: 1-24.

Perkins, D. 1953. Marine algae - seaweeds. *In*: *The natural history of the Scarborough district*, ed. by G.B. Walsh & F.C. Rimington, 67-80.

Rees, H.L. 1983. Pollution investigations off the north-east coast of England: community structure, growth and production of benthic macrofauna. *Marine Environmental Research*, *9*: 61-110.

Shillabeer, N. & Tapp, J.F. 1989. Improvements in the benthic fauna of the Tees Estuary after a period of reduced pollution loadings. *Marine Pollution Bulletin, 20*: 119-123.

B. Further reading

Further details of sea bed communities in the region are in the *Coastal & Marine UKDMAP datasets* module (Barne *et al.* 1994), available from JNCC Coastal Conservation Branch, Peterborough.

Bull, H.O. 1933. A classified index to the literature of the Cullercoats marine fauna and flora (exclusive of birds and mammals) 1832-1932. *Report of the Dove Marine Laboratory*, *Third Series*.

Doody, J.P., Johnston, C., & Smith, B., *eds*. 1993. *Directory of the North Sea coastal margin*. Peterborough, Joint Nature Conservation Committee.

Foster-Smith, J.L. 1984. The marine fauna of the Cullercoats District, 14: Literature on the marine fauna of the Cullercoats District, 1933-1984. *Report of the Dove Marine Laboratory*, *Third Series*: *27*.

Foster-Smith, R.L. 1989. A survey of boulder habitats on the Northumberland coast, with a discussion on survey methods for boulder habitats. (Contractor: R.L. Foster-Smith). *Nature Conservancy Council, CSD Report*, No. 921.

Foster-Smith, R.L., Foster-Smith, J.L., & Gubbay, S. 1994. *Marine Conservation Management: a pilot study on the Northumberland coast*. English Nature Research Report No. 92.

Gubbay, S. 1988. *Coastal directory for marine nature conservation*. Ross-on-Wye, Marine Conservation Society.

Hardy, F.G., & Aspinall, R.J. 1988. *An atlas of seaweeds of Northumberland and Durham*. Newcastle-upon-Tyne, University of Newcastle-upon-Tyne, Hancock Museum, Northumberland Biological Records Centre. (Special Publication, No. 3.)

Thompson, J.W., & Hickling, G. 1973. A bibliography of the literature of the Farne Islands, Northumberland. *Transactions of the Natural History Society of Northumberland*, *15*: 197-225.

Wood, E., *ed*. 1988. *Sea life of Britain and Ireland*. Marine Conservation Society. London, Immel.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Marine nature conservation issues in England. MNCR database	*Marine Task Force, English Nature HQ, Peterborough, tel: 01733 340345
Littoral and sublittoral habitats and communities (NE England); seabed mapping (BioMar project); Coastal management (Farne Islands)	Dove Marine Laboratory, University of Newcastle-upon-Tyne, Cullercoats, North Shields, Tyne & Wear NE30 4PZ, tel: 0191 2524850
Marine ecology (estuaries and coastal waters); water quality	Marine scientist, National Rivers Authority, Skinnerburn Road, Newcastle Business Park, Newcastle-upon-Tyne, Tyne & Wear NE4 7YL
North Tyneside coast: ecology and management	Head Warden, St Mary's Island Lighthouse, St Mary's Island, Whitley Bay, Tyne & Wear NE26 4RS, tel: 0191 252 0853
Estuarine, coastal and sublittoral benthos and habitats, NE England	Senior marine ecologist, Entec (Aquatic Environment Group), Northumberland Dock Road, Wallsend, Tyne & Wear NE28 0QD, tel: 0191 263 8494
North-east estuarine and coastal benthic fauna identification	Dr Peter Garwood, 8 Lesbury Road, Heaton, Newcastle-upon-Tyne NE6 5LB, tel: 0191 2650567

* Starred contact addresses are given in full in the Appendix

4.2.6 Acknowledgements

The author acknowledges the considerable help of JNCC's Marine Nature Conservation Review team (particularly Dr Tim Hill) in compiling and presenting the information given here.

4.3 Plankton

M. Edwards & A.W.G. John

4.3.1 Introduction

Plankton include the bacteria (bacterio-), plant (phyto-) and animal (zoo-) plankton. In temperate continental shelf seas, as in this region, the phytoplankton assemblage is dominated by diatoms and dinoflagellates, and the zooplankton, although containing representatives of most animal phyla at some stage, is dominated by crustaceans, principally copepods. The plankton's abundance is strongly influenced by factors such as depth, tidal mixing and temperature stratification, which determine the vertical stability of the water column. The distribution of species, here and elsewhere, is influenced directly by salinity and temperature (section 2.3.5), by water flows into the area (section 2.3.5) and by the presence of local benthic (bottom-dwelling) communities (section 4.2.2). Many of the species of these communities, including commercially important fish and shellfish (sections 5.5 and 5.7), have temporary planktonic larval forms (meroplankton). Tidal fronts (boundary zones between stratified and well-mixed water masses) in the region are likely to be of significant biological importance, since they are usually rich in plankton, which attracts other marine life. Phytoplankton blooms are a normal feature in the seasonal development of plankton. Some blooms (transient, unsustainable growths, usually of single species and often associated with a visible discolouration of the water) may reach exceptional proportions (>10^6 cells/l) or contain species (principally dinoflagellates) that can be toxic to humans and possibly have an important economic impact on mariculture, fisheries and tourism. Figure 4.3.1 shows the seasonality of phytoplankton blooms and the numbers of copepods present in the region.

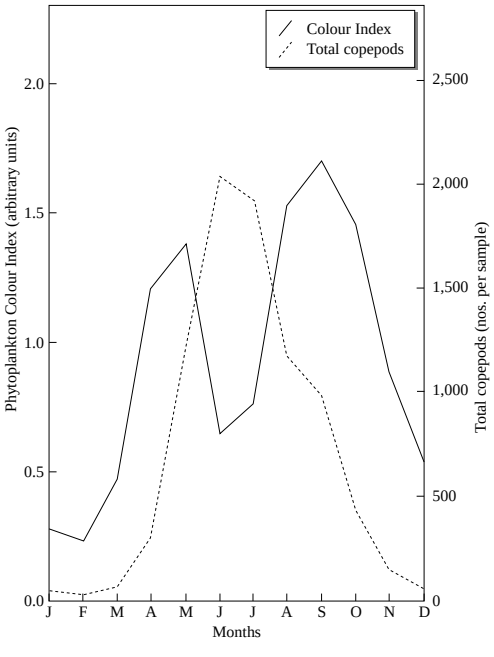
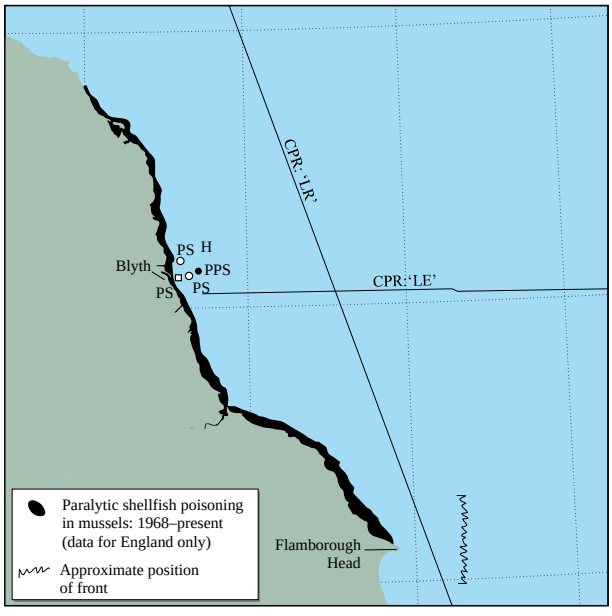


Fig 4.3.1 The seasonal cycles of an index of phytoplankton colour (a visual estimate of chlorophyll) and the numbers of copepods per sample (approximately 3 cubic metres of water filtered), derived from Continuous Plankton Recorder data for 1958-1992.



Map 4.3.1 Plankton surveys and 'fronts'. See Table 4.3.1 for details of surveys.

In Region 5, as elsewhere, the plankton has a fundamental role in the food chain of both benthic (sea-bed) (see sections 4.2 and 5.5) and pelagic (water column) (see section 5.7) wildlife. For both ecosystems, the availability of food and nutrients, larval survival, maintaining populations and timing of egg production are highly dependent on the amount of phyto/zooplankton available. Any environmental stress imposed on the plankton will have consequences throughout the food chain and may affect the amount of food available to fish, birds, marine mammals etc. In coastal management, plankton can also give early warning of adverse human impacts (for example the effects of eutrophication) and highlight different water masses.

The total primary production in this region (75-79 g C m^{-2} y^{-1}) is low compared with that in the central and eastern North Sea (120-260 g C m^{-2} y^{-1}; Joint & Pomroy 1992), whereas the production of small neritic (coastal water) copepods is high (560-2,400 KJ m^{-2} y^{-1}; North Sea Task Force 1993) compared with levels in other coastal regions.

4.3.2 Important locations and species

The Continuous Plankton Recorder (CPR) survey shows that the planktonic assemblage is made up mainly of northern intermediate (mixed water) and neritic species. The spring phytoplankton bloom off the north-east coast of England begins well offshore in March. The bloom is dominated by diatoms and spreads westward to cover most of the area by April. After the diatom peak, dinoflagellates (*Ceratium lineatum* and *Dinophysis norvegica*) become prominent during summer in near-shore production zones.

In autumn there is another phytoplankton peak which begins with the demise of the copepods, suggesting a release from grazing pressure (Roff *et al.* 1988). The main components of the zooplankton are small copepods, such as *Pseudocalanus, Paracalanus, Temora* and *Oithona*. Further offshore, larger species characteristic of the deeper central North Sea, such as *Calanus* and *Metridia*, are more frequent. Commonly found cladocerans, such as *Evadne* and *Podon*, occur in late spring and summer. In early summer ctenophores (sea gooseberries) can be expected, while the scyphozoans *Cyanea* and *Aurelia* are common for a short period in late August and September. The predatory zooplankton, including fish larvae (ichthyoplankton), decapods and medusae, peak between May and September. Other groups of zooplankton, including chaetognaths (an indicator species) and euphausiids (shrimps), peak between December and January (Roff *et al.* 1988). Within the zooplankton, copepods are the group with the highest diversity, with overall zooplankton biodiversity increasing towards the open sea.

Data from the CPR survey and the permanent plankton station off Blyth both indicate the general decline in the abundance of zooplankton along the English coast of the North Sea from 1960-1981. In particular, copepods and summer/autumn predators declined in abundance from 1974-1980. In contrast, euphausiids and chaetognaths increased in abundance during these years. After the initial decline, a substantial recovery to above average levels occurred.

4.3.3 Human activities

The phytoplankton are of particular importance to coastal management in this region due to the presence of Paralytic Shellfish Poisoning (PSP) (Map 4.3.1). PSP occurs in shellfish and is attributed to the dinoflagellate *Alexandrium tamarense*, which has occurred quite regularly in the area since 1968. Not only is this dinoflagellate a hazard to public health and economically detrimental to the shellfish industry, but it has also been associated with mass mortalities of seabirds and sandeels near Holy Island (Ayres & Cullum 1978).

Table 4.3.1 Details of surveys

Identification in Map 4.3.1	*Frequency*	*Period*	*Reference*
H	Occasional	1921-1922	Hardy (1923)
PS (○)	Occasional	1949-1957	Bossanyi (1957)
PS (■)	Monthly	1964-1965	Evans (1985)
PPS (•)	± Monthly	1968 to present	Evans (1985)
Whole region	Monthly	1976	Harding & Nichols (1987)
CPR: 'LR' route	Monthly	1959-1978, 1984 to present	
CPR: 'LE' route	Monthly	1978 to present	

Key: PS: Plankton stations; PPS: Permanent plankton station; CPR: Continuous Plankton Recorder

4.3.4 Information sources used

As is clear from the map and Table 4.3.1, survey data are concentrated in the area lying off Blyth, which has been sampled since the early 1920s at various stations (Hardy 1923 (H)). A permanent station was established in 1969 (Evans & Edwards 1993), situated at approximately 55° 07′ N 1° 20′W, about five nautical miles east of the port of Blyth, at a depth of 54 m. The Directorate of Fisheries Research at Lowestoft undertook intensive plankton surveys of this region in 1976, combining hydrographic and biological observations (Harding & Nichols 1987). The Continuous Plankton Recorder (CPR ('LE' & 'LR' route)) surveys in this region are of particular importance because they contain long-term plankton data which can be used to assess the effects of environmental variability and climatic changes on the marine biota.

4.3.5 Further sources of information

A. References cited

Ayres, P.A., & Cullum, M. 1978. Paralytic shellfish poisoning: an account of investigations into mussel toxicity in England, 1968-77. Lowestoft, MAFF. (*Fisheries Research Technical Report, 40*: 1-23.)

Bossanyi, J. 1957. A preliminary survey of the small natant fauna in the vicinity of the sea floor off Blyth, Northumberland. *Journal of Animal Ecology, 26*: 353-368.

Evans, F. 1985. The marine fauna of the Cullercoats district. 16. Zooplankton. *Report of the Dove Marine Laboratory, Series 3*: 1-113.

Evans, F., & Edwards, A. 1993. Changes in the zooplankton community off the coast of Northumberland between 1969 and 1988, with notes on changes in the phytoplankton and benthos. *Journal of Experimental Marine Biology and Ecology, 172*: 11-29.

Hardy, A.C. 1923. Notes on the Atlantic plankton taken off the east coast of England in 1921 and 1922. *Publications de Circonstance. Conseil Permanent International pour l'Exploration de la Mer, 78*: 5-10.

Harding, D., & Nichols, J.H. 1987. Plankton surveys off the north-east coast of England in 1976: an introductory report and summary of the results. Lowestoft, MAFF. (*Fisheries Research Technical Report, 86:* 1-56.)

Joint, I., & Pomroy, A. 1992. Phytoplankton biomass and production in the North Sea. Results from the NERC North Sea Project August 1988-October 1989. Plymouth Marine Laboratory.

North Sea Task Force. 1993. *North Sea subregion 3b, assessment report 1993.* London, Oslo and Paris Commissions/Fredensborg, Denmark, Olsen & Olsen.

Roff, J.C., Middlebrook, K., & Evans, F. 1988. Long-term variability in North Sea zooplankton off the Northumberland coast: productivity of small copepods and analysis of trophic interactions. *Journal of the Marine Biological Association of the United Kingdom, 68*: 143-164.

B. Further reading

Aebischer, N.J., Coulson, J.C., & Colebrook, J.M. 1990. Parallel long-term trends across four marine trophic levels and weather. *Nature, London, 347*: 753-755.

British Oceanographic Data Centre. 1992. *United Kingdom Digital Marine Atlas. User Guide. Version 2.0.* Birkenhead, Natural Environment Research Council, British Oceanographic Data Centre.

Colebrook, J.M. 1978. Continuous plankton records: zooplankton and environment, north-east Atlantic and North Sea, 1948-1975. *Oceanologica Acta, 1*: 9-23.

Colebrook, J.M. 1984. Continuous plankton records: relationship between species of phytoplankton and zooplankton in the seasonal cycle. *Marine Biology, 83*: 313-323.

Colebrook, J.M. 1985. Continuous plankton records: overwintering and annual fluctuations in the abundance of zooplankton. *Marine Biology, 84*: 261-265.

Colebrook, J.M. 1986. Environmental influences on long-term variability in marine plankton. *Hydrobiologia, 142*: 309-325.

Colebrook, J.M., & Robinson, G.A. 1965. Continuous plankton records: seasonal cycles of phytoplankton and copepods in the north-eastern Atlantic and the North Sea. *Bulletins of Marine Ecology, 6*: 123-139.

Coombs, S.H. 1980. Continuous plankton records: a plankton atlas of the North Atlantic and North Sea. Supplement 5 - young fish, 1948-1972. *Bulletins of Marine Ecology, 8*: 229-281.

Edinburgh Oceanographic Laboratory. 1973. Continuous plankton records: a plankton atlas of the North Atlantic and the North Sea. *Bulletins of Marine Ecology, 7*: 1-174.

Evans, F. 1977. Seasonal density and production estimates of the commoner planktonic copepods of Northumberland coastal water. *Estuarine and Coastal Marine Science, 5*: 223-224.

Fransz, H.G., Miquel, J.C., & Gonzalez, S.R. 1984. Mesozooplankton composition, biomass and vertical distribution and copepod production in the stratified central North Sea. *Netherlands Journal of Sea Research, 18*: 82-96.

Fransz, H.G., Colebrook, J.M., Gamble, J.C., & Krause, M. 1991. The zooplankton of the North Sea. *Netherlands Journal of Sea Research, 28*: 1-52.

North Sea Task Force. 1993. *North Sea quality status report 1993.* London,Oslo and Paris Commissions/Fredensborg, Denmark, Olsen & Olsen.

Pingree, R.D., & Griffiths, D.K. 1978. Tidal fronts on the shelf seas around the British Isles. *Journal of Geophysical Research, 83*: 4615-4622.

Radach, G. 1984. Variations in plankton in relation to climate. *Rapports et Proces-verbaux des Reunions. Conseil Permanent International pour I'Exploration de la Mer, 185*: 234-254.

Robertson, A. 1968. The continuous plankton recorder: a method for studying the biomass of calanoid copepods. *Bulletins of Marine Ecology, 6*: 185-223.

van-Beusekom, J., & Diel-Christiansen, S. 1994. *A Synthesis of Phyto- and Zooplankton Dynamics in the North Sea Environment.* Report to the World Wide Fund for Nature North Sea Programme. Godalming, World Wide Fund for Nature.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Continuous Plankton Recorder (CPR) survey data	Director, Sir Alister Hardy Foundation for Ocean Science, The Laboratory, Citadel Hill, Plymouth PL1 2PB, tel: 01752 222772
Plankton research	Head of Department, Department of Marine Sciences and Coastal Management, University of Newcastle upon Tyne, Newcastle upon Tyne NE1 7RU, tel: 0191 222 6000
Ichthyoplankton	*Director, MAFF Directorate of Fisheries Research, Fisheries Laboratory, Lowestoft, tel: 01502 562244
General	Director, Dove Marine Laboratory, University of Newcastle upon Tyne, Cullercoats, North Shields NE30 4PZ, tel: 0191 2524850

* Starred contact addresses are given in full in the Appendix

Nesting kittiwakes on the Farne Islands. The rocky outcrops of the Farnes have the largest colonies of breeding seabirds in the region, supporting several species in internationally important numbers, including nearly 6,000 pairs of kittiwakes. Photo: N.C. Davidson, JNCC.

Chapter 5 Important species

5.1 Terrestrial lower plants

N.G. Hodgetts

5.1.1 Introduction

The terrestrial lower plants covered in this section are lichens, bryophytes (mosses and liverworts), stoneworts (a group of freshwater and brackish water algae) and fungi, occurring in the coastal 10 km squares within the boundaries of the region.

Because of its geographical position and geomorphological characteristics, this region is not particularly rich in lower plants. Oceanic species and communities are scarce or absent. In most parts of the region, natural and semi-natural habitats have been reduced to fragments by a history of intensive agriculture. Indeed, there is frequently little or no space for what could have been good lower plant habitats between cultivated fields and coastal cliffs. However, there are some valuable sites, the most notable and extensive of which are the dune systems on the Northumberland coast and Holy Island, which are of outstanding importance in the region. Some of the hard rock coastline of Northumberland is likely to be important for lichens, but there has been little survey work in the area. Other interest is restricted to rather small sites such as quarries and ravine woodland.

The region is substantially under-recorded and the lower plant interest may be underestimated. Data for bryophytes and the larger lichens are generally good, but are less complete for fungi, algae and the smaller lichens. The area contains a relatively small number of threatened species, only one of which (the liverwort *Petalophyllum ralfsii*) is given special protection under national and international legislation. About 36% of the British bryophyte flora and about 7% of the stonewort flora occur in the region. Similar figures are not available for other groups.

5.1.2 Important locations and species

Like higher plants (see section 5.2), lower plant species tend to occur in characteristic assemblages that are found in particular habitats. In this region, dune systems are important for bryophytes, lichens and fungi. Some bryophytes and many fungi are dune specialists. Many of the fungi are mycorrhizal with higher plants, with willow and marram grass apparently being important associates: fungi are therefore probably instrumental in the process of dune stabilisation. Temporarily water-filled dune hollows can be important for stoneworts. Ravine woodlands may also be important for bryophytes, lichens and fungi. Some specialist aquatic species of all groups occur where there are streams and rivers.

The area of exposed rock between high water mark and the clifftops may be important for lichens. Many distinctive species and communities grow on different rock types. Some lichens are distinctive components of the saxicolous vegetation in cliff bird roosts, where the rocks are enriched by bird droppings. Coastal (usually cliff-top) grassland and heath are important areas, usually having thin turf with complex vegetation mosaics rich in bryophytes, lichens and higher plants. The often extensive unstable areas are important in maintaining bare ground for colonisation by some of the rare ephemeral lower plants of this habitat. Calcareous grassland is usually richer than neutral or acidic grassland. Exposed rocks in this habitat are often good for southern, warmth-loving species of bryophyte.

The eight Red Data Book species found in the region, excluding those with a status of Indeterminate, Insufficiently Known or Extinct (out of a total of 223 bryophytes, 17 stoneworts and 368 lichens on the British Red Lists) are listed in Table 5.1.1. Numbers of nationally scarce species occurring in the region, compared with total numbers nationally, are 24 bryophytes out of 313 and no stoneworts out of six. There is currently insufficient information to provide regional lists of nationally scarce species for fungi and lichens.

Table 5.1.2 shows all the sites in the region that are known to be important for lower plants, mostly bryophytes and lichens, and that have had at least some degree of survey work. All sites within coastal 10 km squares are included; site numbers are as shown on Map 5.1.1. Some of

Table 5.1.1 Red Data Book lower plant species

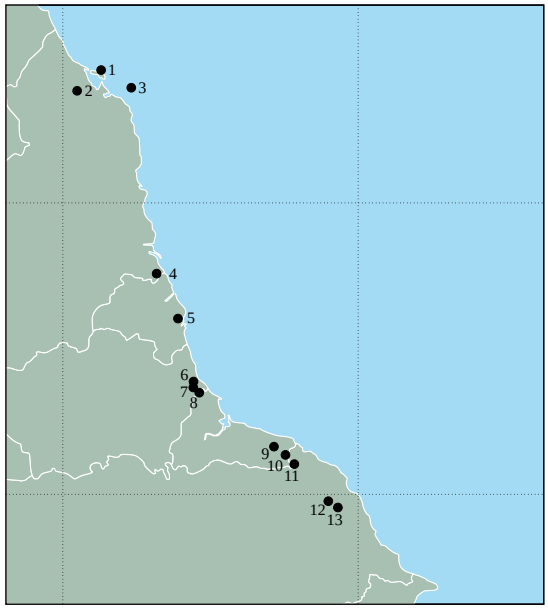
Species	*Habitat*
Liverworts	
Petalophyllum ralfsii[a]	Damp dune slacks, Holy Island, Northumberland; Ross Links, Northumberland[b]
Lichens	
Caloplaca flavorubescens	Parkland, Grinkle Park, Cleveland
Chaenotheca gracilenta	On elm, Kilton Beck Wood, Cleveland
Cliostomum corrugatum	Near Whitby, Yorks (unlocalised record)
Collema bachmanianum	Limestone rubble, Fulwell Quarry, Durham
Lecania chlorotiza	Basic bark, Houndean, Warkworth, Northumberland
Ramalina polymorpha	Whinstone outcrops, Farne Islands, Northumberland
Fungi[c]	
Hebeloma vaccinum	Coastal dune systems on Lindisfarne (Ing 1992)

Key: [a] Protected under Annex II of the EC Habitats & Species Directive, Appendix I of the Bern Convention and Schedule 8 of the Wildlife & Countryside Act 1981; [b] old records only; [c] for fungi there is insufficient information for a comprehensive listing.

Table 5.1.2 Lower plant sites in coastal 10 km squares

Site number	*Site name*	*Grid ref.*	*Status*
	Northumberland		
1	Lindisfarne (incl. Ross Links)	NU1343	NNR
2	Holburn Lake & Moss	NU0536	SSSI
3	Farne Islands	NU2337	SSSI
4	Holywell Pond	NZ3175	SSSI
	Tyne & Wear		
5	Fulwell Quarry	NZ3860	SSSI
	Durham		
6	Castle Eden Dene	NZ4339	NNR
7	Hulam Fen	NZ4337	SSSI
	Cleveland		
8	Hart Bog	NZ4535	SSSI
9	Kilton Beck Wood	NZ7017	not protected
10	Grinkle Park	NZ7414	not protected
	North Yorkshire		
11	Tranmire	NZ7711	SSSI
12	Fylingdales Moor	SE9199	SSSI
13	Castlebeck & Scar Woods	SE9497	SSSI

Note: site numbers refer to Map 5.1.1. Key: NNR = National Nature Reserve; SSSI = Site of Special Scientific Interest



Map 5.1.1 Sites known to be important for lower plants in coastal 10km squares. Site numbers refer to those in Table 5.1.2. Source: JNCC Red Data Book database.

the sites contain rare and scarce species and are Sites of Special Scientific Interest (SSSIs) at least partly because of their lower plant flora (Hodgetts 1992). In the case of large sites, the grid reference given refers to a reasonably central point. The sources used to compile this table were those listed in sections 5.1.4 and 5.1.5, along with data on protected sites held at JNCC.

5.1.3 Human activities

The impact of intensive agriculture on this region has been very extensive. In urban areas, particularly in Tyne & Wear, there are few sites that are even potentially interesting for lower plants. Current issues that may have a bearing on the lower plant flora of the region include road construction programmes and housing developments. Lowering of the water table may have an effect on wetland sites, particularly dune slacks. Some dune areas may be affected by holiday and leisure developments such as caravan sites and golf courses. Cliff-top grassland and heathland may be subject to erosion in some places. Pollution is a general problem but may be aggravated in some areas by oil spills, agricultural seepage etc. Some large sites are National Nature Reserves (NNRs) or SSSIs, so nature conservation is taken into consideration in their management.

5.1.4 Information sources used

The computerised database at the Biological Records Centre (BRC), Monks Wood, and the Red Data Book database at JNCC include recent records collected over decades by expert bryologists, as well as important historical records. Some important, or potentially important, coastal lichen sites have been identified in recent surveys (Fletcher 1984; James & Wolseley 1991), but as relatively few have been comprehensively surveyed, there may be more. Data collation for fungi is still at a relatively early stage. All British Mycological Society foray data are currently being put onto a computer database at the International Mycological Institute under a JNCC contract. A recent survey of dune fungi on Lindisfarne has taken place (Rotheroe 1992). With the exception of stoneworts, algae are poorly known. Computerised stonewort data are held at BRC and JNCC. More information on other freshwater algae may be available from the Freshwater Biological Association.

5.1.5 Further sources of information

A. References cited

Fletcher, A., *ed.* 1984. Survey and assessment of lowland heath lichen habitats. *Nature Conservancy Council, CSD Report,* No. 522.

Hodgetts, N.G. 1992. *Guidelines for selection of biological SSSIs: non-vascular plants.* Peterborough, Joint Nature Conservation Committee.

Ing, B. 1992. A provisional Red Data list of British fungi. *The Mycologist, 6:* 3.

James, P.W., & Wolseley, P.A. 1991. *A preliminary report of coastal lichen sites in England, Wales and Scotland.* Unpublished report to NCC.

Rotheroe, M. 1992. A survey of the mycoflora of British sand dunes 1991-1992. *JNCC Report,* No. 60. Peterborough, Joint Nature Conservation Committee.

B. Further reading

Hill, M.O., Preston, C.D., & Smith, A.J.E. 1991. *Atlas of the bryophytes of Britain and Ireland. Volume 1. Liverworts.* Colchester, Harley Books.

Hill, M.O., Preston, C.D., & Smith, A.J.E. 1992. *Atlas of the bryophytes of Britain and Ireland. Volume 2. Mosses (except Diplolepideae).* Colchester, Harley Books.

Hill, M.O., Preston, C.D., & Smith, A.J.E. 1994. *Atlas of the bryophytes of Britain and Ireland. Volume 3. Mosses (Diplolepideae).* Colchester, Harley Books.

Ratcliffe, D.A., *ed*. 1977. *A nature conservation review.* Cambridge, Cambridge University Press.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Lichens (hard rock coasts)	T. Duke, Sandrock, The Compa, Kinver, Staffs. DY7 6HS, tel: 01384 872798
Lichens (general coastal)	P.W. James, c/o Department of Botany, The Natural History Museum, Cromwell Road, London SW7 5BD, tel: 0171 9389123
Lichens (woodland and general: British Lichen Society database)	Dr. A. Fletcher, Leicester Museum, 96 New Walk, Leicester LE1 6TD, tel: 0116 9554100
Lichens (general; survey etc.)	A. Orange, Department of Botany, National Museum of Wales, Cardiff CF1 3NP, tel: 01222 397951
Fungi (general and sand dune)	M. Rotheroe, Fern Cottage, Falcondale, Lampeter, Dyfed SA48 7RX, tel: 01570 422041
Fungi (British Mycological Society database)	Dr. P. Cannon , International Institute of Mycology, Bakeham Lane, Englefield Green, Egham, Surrey TW20 9TY, tel: 01784 470111
Bryophytes (BRC database)	C.D. Preston, Biological Records Centre, Institute of Terrestrial Ecology, Monks Wood, Abbots Ripton, Huntingdon PE17 2LS, tel: 01487 773381
Bryophytes (British Bryological Society herbarium)	A.R. Perry, Department of Botany, National Museum of Wales, Cardiff CF1 3NP, tel. 01222 397951
Lower plants (species status; Red Data Book Database; site register etc.)	*N.G. Hodgetts, JNCC, Peterborough, tel: 01733 62626

* Starred contact addresses are given in full in the Appendix

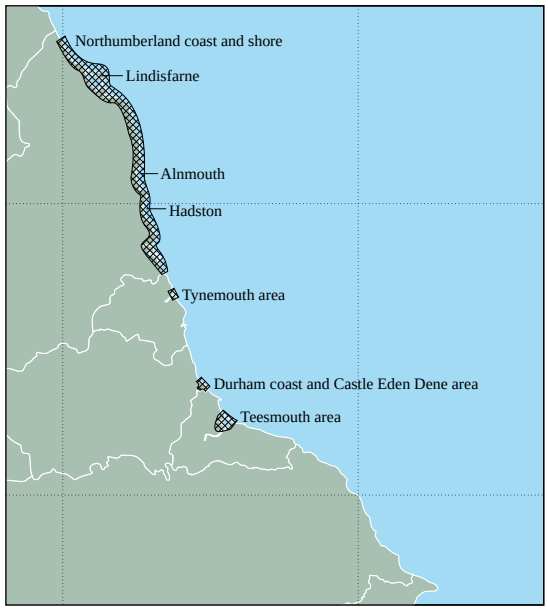
5.2 Flowering plants and ferns

V.M. Morgan

5.2.1 Introduction

This section describes the importance of the region for vascular plants (i.e. flowering plants and ferns) occurring in the coastal 10 km squares within the boundaries of the region, particularly species that are rare or scarce in Great Britain. The climate is generally colder and drier than correspondingly northern parts of the west coast as it lies in the rain shadow of the Pennine and Cheviot Hills and the North York Moors and because the North Sea lacks the warm currents of the Atlantic. It is also affected by 'haar' or 'frets' - coastal fog and low cloud - which are particularly common in spring and early summer.

The region contains no 'classic' botanical localities - centres of plant biodiversity - as are found in southern England and on the west coast of Britain and only one nationally rare species. There are no nationally or internationally protected species here. The May lily *Maianthemum bifolium*, the only nationally rare species, of 317 such species in the British Red Data Book of vascular plants (Perring & Farrell 1983), may have been introduced to its woodland site near Scarborough. It has been recorded in eight 10 km squares in Great Britain since 1970. 34 species in the region are nationally scarce, i.e. known from 16-100 ten km squares in Great Britain: there are 254 such species in Great Britain (Stewart, Pearman & Preston 1994). No species are known to be endemic (i.e. confined) to the region, but one subspecies of perennial flax, *Linum perenne* ssp. *anglicum*, is endemic to England and southern Scotland; the population in the region is important as the only remaining coastal occurrence of the subspecies. The hybrid grass x *Calamagrostis baltica* is a nationally scarce plant on the Northumberland dunes.



Map 5.2.1 Key localities for rare and scarce higher plants. Sites are listed in Table 5.2.2.

Table 5.2.1 Numbers of rare and scarce coastal plants

	Red data book (rare) species	*Scarce species*
Northumberland	0	26
Tyne & Wear	0	6
Durham	0	8
Cleveland	0	11
North Yorkshire	1	5
Region 5	**1**	**34**

Sources: JNCC Rare Plants database; Stewart *et al.* (1994; 1993 draft used); BRC database. Note: Excludes known introductions and records from before 1970.

5.2.2 Important locations and species

Rare and scarce plants grow in a wide range of habitats, but of particular importance in the region are saltmarshes,

Table 5.2.2 Key coastal localities for rare and scarce plants

Locality	*Status*	*Species*
Northumberland coast and shore, including Lindisfarne	part SSSI, part NNR, part undesignated	Blue moor-grass, Bithynian vetch, chives, coralroot orchid, creeping ladies-tresses, curved hard-grass, curved sedge, divided sedge, downy currant, dune fescue, early orache, fen pondweed, hairy stonecrop, long-stalked orache, maiden pink, narrow-lipped helleborine, purple ramping-fumitory, rush-leaved fescue, round-leaved wintergreen, sea buckthorn, sea pea, seaside centaury, tasteless waterpepper, variegated horsetail
Tynemouth area	part SSSI, part undesignated	Perennial flax, sea buckthorn
Durham coast and Castle Eden Dene area	SSSI, part NNR	Bird's-eye primrose, blue moorgrass, burnt orchid, downy currant, narrow-leaved marsh-orchid, rush-leaved fescue, round-leaved wintergreen, sea buckthorn, spring cinquefoil
Teesmouth area	SSSI	Long-stalked orache, rush-leaved fescue, sea buckthorn, seaside centaury, stiff saltmarsh-grass

Notes: Scarce plants may occur near to rather than within some localities. Key localities have been taken to be those with important populations of perennial flax or five or more scarce species. Key: SSSI - Site of Special Scientific Interest; NNR - National Nature Reserve. Scientific names are listed in tables opposite.

dunes and limestone grassland and cliffs. Table 5.2.1 gives the numbers of rare and scarce species found in the region's counties and the region as a whole. Table 5.2.2 summarises four of the more important areas for plants, shown in Map 5.2.1. Other scarce species in the region are listed in Tables 5.2.3 and 5.2.4, with notes on their habitat.

The geographical position and climatic history of the region mean that many species are here at the limits of their distribution in the British Isles. Some examples are listed in Table 5.2.5. This overlapping of disparate elements of the flora is particularly marked compared with other regions and results in some unique assemblages of species. The following combinations of species are unique to the particular area named. At Lindisfarne the northern elements predominate, with the only sites in the region for coralroot orchid *Corallorhiza trifida* and curved sedge *Carex maritima*, but still with some southern species, including divided sedge *Carex divisa* and possibly also tasteless water-pepper *Polygonum mite*. In Northumberland between Alnmouth and Hadston, the southern and eastern species sea pea *Lathyrus japonicus* and curved hard-grass *Parapholis incurva* as well as the northern and western seaside centaury *Centaurium littorale* grow. In the Durham coast/Castle Eden Dene area, species of northern limestone such as blue

Table 5.2.3 Scarce plants known from 16-30 10 km squares in Britain and found in the region's coastal 10 km squares

Species	*No. of 10 km squares in GB where sp. present*	*10 km squares in region where sp. present*	*Habitat*
Chives *Allium schoenoprasum*	20	NU13	Rocky ground, usually calcareous
Long-stalked orache *Atriplex longipes*	26	NU20 & 04; NZ42	Saltmarshes, in taller vegetation
Perennial flax *Linum perenne*	25	TA17; NZ35, 36 & 46	Calcareous grassland

Source: BRC database, Stewart *et al.* (1994. 1993 draft used). Figures show the numbers of 10 km squares in which the species have been recorded since 1970.

Table 5.2.4 Scarce plants known from >30 10 km squares in Britain and found in the region's coastal 10 km squares

Species	*No. of 10 km squares in GB where sp. present*	*Habitat*
Alpine pennycress *Thlaspi alpestre*	52	Stony places on limestone or where concentrations of lead or zinc are high
Bird's-eye primrose *Primula farinosa*	66	Damp ground on limestone
Bithynian vetch *Vicia bithynica*	36	Scrub, rough grassland & hedges
Blue moor-grass *Sesleria albicans*	53	Calcareous grassland & rocky places
Burnt orchid *Orchis ustulata*	67	Short calcareous grassland
Coralroot orchid *Corallorhiza trifida*	62	Dunes & damp woods
Cornflower *Centaurea cyanus*	139	Arable fields & wasteland
Creeping ladies-tresses *Goodyera repens*	88	Pine/birch woods & dunes
Curved hard-grass *Parapholis incurva*	67	Salt marshes, clifftops & waste ground
Curved sedge *Carex maritima*	41	Dunes
Divided sedge *Carex divisa*	80	Marshes, pastures & ditches
Downy currant *Ribes spicatum*	57	Woods on limestone
Dune fescue *Vulpia fasciculata*	68	Open parts of dunes
Early orache *Atriplex praecox*	41	Sea inlets, just above high tide mark
Fen pondweed *Potamogeton coloratus*	70	Shallow, nutrient-poor water
Hairy stonecrop *Sedum villosum*	92	Streamsides & stony flushes
Maiden pink *Dianthus deltoides*	84	Dry grassland
Narrow-leaved marsh-orchid *Dactylorhiza traunsteineri*	45	Calcareous fens & grassland
Narrow-lipped helleborine *Epipactis leptochila dunensis*	51	Woods & dunes, usually calcareous
Purple ramping-fumitory *Fumaria purpurea*	43	Cultivated land, waste ground & hedges
Rush-leaved fescue *Festuca juncifolia*	44	Coastal sands
Round-leaved wintergreen *Pyrola rotundifolia* ssp *rotundifolia*	44	Damp ledges, woods & mires
Sea buckthorn *Hippophae rhamnoides*	43	Dunes
Sea pea *Lathyrus japonicus*	33	Shingle & sand
Seaside centaury *Centaurium littorale*	54	Dunes
Spring cinquefoil *Potentilla tabernaemontani*	62	Dry basic grassland & rocky slopes
Stiff saltmarsh-grass *Puccinellia rupestris*	65	Bare rocky & muddy places
Tasteless water-pepper *Polygonum mite*	80	Damp places & shallow water
Variegated horsetail *Equisetum variegatum*	94	Dune slacks & other wet places
Whorled water-milfoil *Myriophyllum verticillatum*	100	Ponds, ditches and lakes
Wood barley *Hordelymus europaeus*	90	Woods & copses

Source: BRC database; Stewart *et al.* (1994; 1993 draft used) Figures show the number of 10 km squares in which the species have been recorded since 1970. Scarce species are defined as in Stewart *et al.* (1994).

Table 5.2.5 Examples of plants at or near the limit of their British distribution in the region

Species	*European distribution (taken from Matthews 1955)*
Northern limit	
Bithynian vetch *Vicia bithynica*	Oceanic southern
Burnt orchid *Orchis ustulata*	Continental
Chives *Allium schoenoprasum*	
Curved hard-grass *Parapholis incurva*	Oceanic southern
Divided sedge *Carex divisa*	Continental southern
Dune fescue *Vulpia fasciculata*	Oceanic southern
Field maple *Acer campestre*	Continental southern
Fly orchid *Ophrys insectifera*	Continental
Perennial flax *Linum perenne*	
Sea buckthorn *Hippophae rhamnoides*	
Stiff saltmarsh-grass *Puccinellia rupestris*	Oceanic west European
Tasteless water-pepper *Polygonum mite*	Continental
Wood barley *Hordelymus europaeus*	
Southern limit on east coast	
Coralroot orchid *Corallorhiza trifida*	Continental northern
Curved sedge *Carex maritima*	Arctic-alpine
Early orache *Atriplex praecox*	
Scots lovage *Ligusticum scoticum*	Arctic-subarctic
Seaside centaury *Centaurium littorale*	Oceanic northern
Spring squill *Scilla verna*	Oceanic west European
Variegated horsetail *Equisetum variegatum*	
Species of limestone, also found inland	
Blue moor-grass *Sesleria albicans*	
Bird's-eye primrose *Primula farinosa*	Northern montane
Downy currant *Ribes spicatum*	

moorgrass *Sesleria albicans* and bird's-eye primrose *Primula farinosa* coexist with the southern burnt orchid *Orchis ustulata*. Around Teesmouth, stiff saltmarsh-grass *Puccinellia rupestris* and native populations of sea buckthorn *Hippophae rhamnoides*, both south-eastern species, are found near seaside centaury.

In addition to the effect of location on plant biogeography, geological features have produced unusual plant communities, particularly where magnesian limestone, which typically carries a diverse flora, is exposed at the coast and has also been colonised by maritime species. In Durham the glacial periods resulted in the formation of steep-sided gorges, known as denes, in the calcareous boulder clay. Castle Eden Dene NNR is the classic example and carries the most diverse flora (Doody 1981).

5.2.3 Human activities

As the region includes urban, industrial and holiday areas, it is subject to pressures of recreation, pollution and development. The long dune systems, which are particularly characteristic of Northumberland, have been affected and their species-richness reduced by recreation as well as military training and agricultural change, including a cessation of sheep-grazing (Swan 1993). The collieries of Durham have caused the loss of some vegetation by spoil tipping and pollution. Saltmarshes typically occur in the large estuaries, which are also the sites of important ports and industries. As a result, many are now fragmented, as in Teesside (Lawrence 1994). Other pressures on the habitats of scarce species include forestry and agricultural land-claim.

5.2.4 Information sources used

All the counties were covered by rare plant surveys between 1979 and 1981 and a series of detailed confidential reports was produced, now held by EN and the JNCC. Further work has been carried out by EN as part of their programme of monitoring. JNCC maintains a database of nationally rare plant species, which includes site records. Members of the Botanical Society of the British Isles (BSBI) have recently finished collecting up-to-date records of scarce species; these data are held at the Biological Records Centre and have been summarised in *Scarce plants in Britain* (Stewart, Pearman & Preston 1994).

5.2.5 Further sources of information

A. References cited

Doody, J.P. 1981. The conservation of the semi-natural vegetation of the Magnesian Limestone, 3, the Durham coast. *The Vasculum, 66:* 17-28.

Ellis, R.G. 1983. *Flowering plants of Wales.* Cardiff, National Museum of Wales.

Graham, G.G. 1988. *The flora and vegetation of County Durham.* Durham Flora Committee/Durham County Conservation Trust.

Lawrence, I. 1994. *A guide to the wildflowers of Cleveland.* Middlesbrough, Cleveland County Council.

Perring, F.H., & Farrell, L. 1983. *British red data books: 1 Vascular plants.* 2nd ed. Lincoln, Royal Society for Nature Conservation.

Stewart, A., Pearman, D.A., & Preston, C.D. 1994. *Scarce plants in Britain*. Peterborough, Joint Nature Conservation Committee/Institute of Terrestrial Ecology/Botanical Society of the British Isles.

Swan, G.A. 1993. *Flora of Northumberland*. Newcastle upon Tyne, The Natural History Society of Northumbria.

B. Further reading

Matthews, J.R. 1955. *Origin and distribution of the British flora*. London, Hutchinson's University Library.

Stace, C. 1991. *New flora of the British Isles.* Cambridge, Cambridge University Press.

Sykes, N. 1993. *Wild plants and their habitats in the North York Moors*. Helmesley, North York Moors National Park.

C. Contact names and addresses

Type of information	*Contact name and telephone no.*
Species on SSSIs and NNRs, other protected areas, rare and scarce species, rare plant surveys, licensing and protected species.	Coastal Land Management and Conservation Adviser, Maritime Team, English Nature, Roughmoor, Bishop's Hull, Taunton, Somerset TA1 5AA, tel: 01823 283211
Database of rare and protected species	*Species Conservation Branch, JNCC, Peterborough, tel: 01733 62626
Northumberland and Tyne & Wear biological database	Northumberland and Tyne & Wear Biological Records Centre, The Hancock Museum, Barras Bridge, Newcastle-upon-Tyne NE2 4PT, tel: 0191 222 7418
Biological Records Centre for part of Tyne & Wear, County Durham & part of Cleveland (old county of Durham)	Environmental Records Centre, Sunderland Museum & Art Gallery, Borough Road, Sunderland SR1 1PP, tel: 0191 5141235
Yorkshire biological database	Yorkshire Museum Biological Records Centre, The Yorkshire Museum, Museum Gardens, York, North Yorkshire YO1 2DR, tel: 01904 629745
Local BSBI vice-county records	Mr C.D. Preston, c/o Biological Records Centre, Monk's Wood, Abbots Ripton, Huntingdon, PE17 2LS, tel: 01487 773381

* Starred contact addresses are given in full in the Appendix

5.2.6 Acknowledgements

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5.3 Land and freshwater invertebrates

A.P. Foster & M.S. Parsons

5.3.1 Introduction

There are over 28,000 species in the better-known groups of invertebrates in Great Britain (Kirby 1992). This chapter deals with most orders (although not all families) of insects, together with some non-insect invertebrates, occurring within the coastal 10 km Ordnance Survey grid squares of the region.

The region is of national conservation importance for a number of invertebrate species, for example the least minor moth *Photedes captiuncula expolita* (a subspecies not known outside Great Britain), which is restricted to limestone grasslands in northern England and has significant populations on the Durham coast. Red Data Book (RDB) and nationally scarce species are found along the length of the region's coast. Most have exacting habitat requirements in one or more stages of their life histories. They are often restricted in range, in some cases occurring in only one or a few localities; some scarce species are confined to particular habitat types, for example coastal limestone grasslands, sand dune systems or soft rock cliffs.

The Invertebrate Site Register (ISR) records one protected species (the medicinal leech *Hirudo medicinalis)* from the region, although not in this century. Holdich & Reeve (1991) record the freshwater crayfish *Austropotamobius pallipes.* Both species are protected by the Wildlife & Countryside Act 1981 (Variation of Schedule 1988), the EC Habitats Directive and the Bern Convention. The medicinal leech is also listed on Appendix III of CITES.

5.3.2 Important locations and species

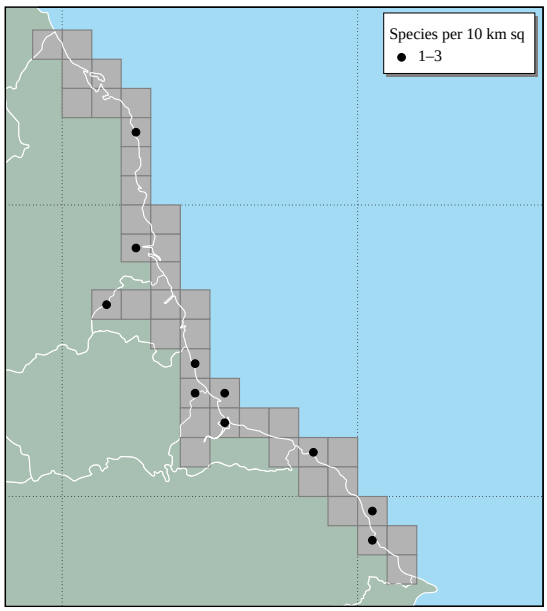
According to the JNCC's Invertebrate Site Register, there are 61 Red Data Book (RDB) species and 350 nationally scarce species recorded in the coastal 10 km squares of the region. As defined by Kirby (1994a, b), there are eight coastal RDB (natioanlly rare) species and 73 coastal scarce species recorded in the region; the RDB species are listed in Table 5.3.1. Other coastal species of equivalent rank, but not covered by Kirby (1994a, b), are also known to occur in the region. Additionally, scarce and threatened species that are not strictly coastal in terms of their national distribution, but which have populations on coastal localities, are also represented. Map 5.3.1 shows the numbers of nationally rare (RDB) invertebrate species recorded in coastal 10 km squares in the region; Map 5.3.2 shows those of nationally scarce invertebrates. Note that survey effort has not been equivalent throughout the region, so actual occurrence may differ from recorded distribution.

The ISR has records from 126 sites in the region (a few of these are subsites of larger statutorily protected areas), from Holy Island in the north to Hunmanby in the south. RDB and nationally scarce species have been recorded at many of these ISR sites. Table 5.3.2 lists sites of major importance for the conservation of invertebrates. Site selection was based on the range and/or scarcity of species present, the species/habitat associations and the amount of available habitat. Many of these sites are either National Nature Reserves (NNRs) or Sites of Special Scientific Interest

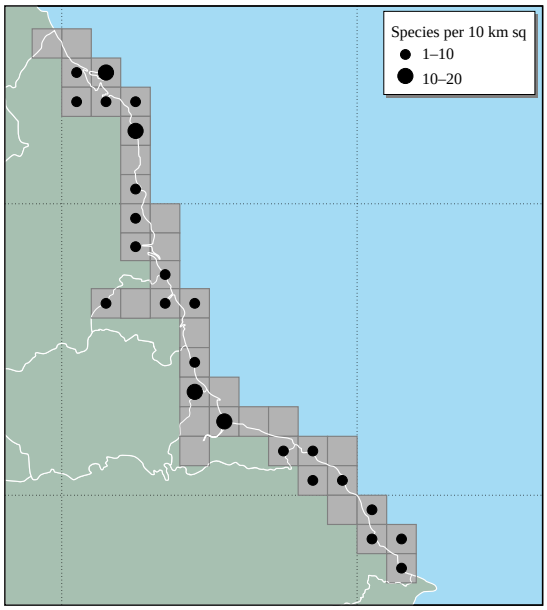
Table 5.3.1 Coastal Red Data Book (RDB) species in Region 5

Species	*Description and notes on recorded occurrence in the region*
RDB 1	
Anthophora retusa	Solitary bee of light sandy soils e.g. coastal cliffs and dunes. Once widespread in England but now known from only very few southern localities. Unconfirmed record from Axwell Park*, Tyne & Wear.
Osmia xanthomelana	Solitary bee; quite widespread in England in the last century; now known from only a single locality in southern England. Axwell Park*, Tyne & Wear.
Psylliodes hyoscyami	Small flea beetle; disturbed ground on sandy soils, especially near the coast. Larvae mine stems, roots and leaf bases of henbane. Very rare, last recorded in 1930s in Oxon.
RDB 2	
Psen bicolor	Small black and red solitary wasp nesting in moist sandy soil; predatory on planthoppers. Axwell Park*, Tyne & Wear.
RDB 3	
Eubria palustris	Small black beetle; dead grass and other plant remains, either in water or in very wet conditions e.g. seepages on coastal cliffs. Most records from southern England. Castle Eden Dene* - Durham; Sandsend Cliffs*, Cayton Bay* - North Yorks.
Photedes captiuncula	Least minor moth; carboniferous limestone areas in extreme south of Cumbria, N.Yorks. and coastal Northumberland and Magnesian Limestone of Durham coast. Larvae feed in the stems of *Carex flacca*. Blackhall Cliffs, Crimdon Dene*, Seaham Bay - Durham; Embleton Links, Bedlington, Northumberland.
Proposed RDB K	
Trichohydnobius suturalis	Small beetle; sandy places on coast. Coatham Sands, Cleveland.
Trimium brevicorne	Small brown beetle (approx. 1 mm long); deciduous woodland and coastal undercliff, although habitat preferences uncertain: usually recorded from moss. Ravenscar and Beast Cliff, North Yorks.

Key: Red Data Book categories: RDB 1 = endangered; RDB 2 = vulnerable; RDB 3 = rare; RDB K = insufficiently known; Proposed species as categorised in e.g. Hyman & Parsons (1992); * = old records (before approx. 1970). Some records are doubtful (identified as 'unconfirmed'). For further description of RDB categories, see Shirt (1987) and Bratton (1991).



Map 5.3.1 Numbers of nationally rare (i.e. RDB) species of invertebrates recorded in coastal 10 km squares (all dates). Distribution may reflect differences in recording effort. Source: Invertebrate Site Register, JNCC.



Map 5.3.2 Numbers of nationally scarce species of invertebrates recorded in coastal 10 km squares (all dates). Distribution may reflect differences in recording effort. Source: Invertebrate Site Register, JNCC.

Table 5.3.2 Sites of importance for the conservation of invertebrates in this region

Site	*Grid ref.*	*Status*
Northumberland		
Lindisfarne	NU1043	NNR/SSSI/NT (in part)/Ramsar
Bamburgh Dunes	NU1934	SSSI
Newton Links - Embleton Links	NU2326	SSSI/NT
Castle Point to Cullnerose Point	NU2520	SSSI/NT (in part)
Alnmouth Saltmarsh & Dunes	NU2409	SSSI/NT
Warkworth Dunes & Saltmarsh	NU2605	SSSI
Blyth Dunes	NZ3377	
Wylam River bank	NZ1164	
Whitburn Beach	NZ4162	
Tyne & Wear		
Ryton Willows	NZ1564	SSSI
Shibdon Pond	NZ1962	SSSI/LNR/County Trust reserve
Paddock Hill Wood	NZ1760	
Timber Beach	NZ3658	SSSI/County Trust reserve
Durham		
Durham Coast	NZ4347	SSSI
Hawthorn Dene	NZ4245	SSSI/County Trust reserve
Castle Eden Dene	NZ4238	NNR/SSSI/LNR
Cleveland		
Hart Warren Dunes	NZ4936	SSSI/County Trust reserve
Hart Bog	NZ4535	SSSI
Seaton Dunes & Common	NZ5328	SSSI
South Gare & Coatham Sands	NZ5626	SSSI
Cowpen Marsh	NZ5025	SSSI/County Trust reserve
Kilton Woods	NZ7018	SSSI
North Yorkshire		
Runswick Bay	NZ8115	SSSI
Sandsend Cliffs	NZ8413	
Maw Wyke to Miller's Nab	NZ9408	SSSI/NT
Beast Cliff Miller's Nab	TA0099	SSSI
Hayburn Wyke	TA0197	SSSI/County Trust reserve
Cayton & Cornelian Bays	TA0685	SSSI/NT (in part)
Filey Cliffs	TA1281	SSSI

Key: LNR - Local Nature Reserve; NNR - National Nature Reserve; NT - National Trust; SSSI - Site of Special Scientific Interest

(SSSIs), other currently under-recorded unprotected sites may warrant similar status on the basis of their invertebrate interest. There may also be other equally good though as yet unrecorded sites.

Sand dune invertebrate communities are well represented in the region and include many scarce species. Among them are a wide variety of moths, including the Portland moth *Ochropleura praecox* and coast dart *Euxoa cursoria*. Both are recorded from a range of localities and are associated with the more stable inner dunes. Scarce species more characteristic of the fore dunes are the sand dart moth *Agrotis ripae* and the lyme-grass moth *Photedes elymi*. Other nationally scarce dune specialists include the crab spider *Philodromus fallax,* found at Coatham Sands.

Unstable soft-rock cliffs, such as those at Cayton Bay, are of considerable importance for their invertebrate communities. Relatively dry cliff faces are as important as faces flushed with seepages. The former are inhabited by many scarce beetles, for example *Nebria livida*, and the latter are important for species having semi-aquatic larvae, for example the beetle *Eubria palustris* and the soldierfly *Oxycera pygmaea*.

Limestone grassland habitats on and near the coast are particularly rich in species and have populations of many rarities, most notably including the least minor moth *Photedes captiuncula expolita,* which occurs at, for example, Hart Warren SSSI. Other rarities include the mining bee *Andrena ruficrus* at Castle Eden Dene. There are important populations of Durham argus *Aricia artaxerxes* on the magnesian limestone grasslands of the Durham coast.

Wetland sites in the region also contain rarities. Hart Bog, for instance, has two scarce water beetles: *Hydroporus scalesianus* and *Laccornis oblongus*.

5.3.3 Human activities

As for other nature conservation interests, the main threats to invertebrate communities in the region include inappropriate management of sites and direct habitat loss or degradation, for example through coastal defence and stabilisation schemes. Appropriate site management may be vital for maintaining invertebrate interest. Most invertebrates have life cycles lasting one year or less and require specific conditions in which to complete development, and many of the rarest species have poor powers of dispersal and are thus unable to colonise suitable habitat from afar. It is therefore vital that suitable breeding conditions are retained at sites year after year. The fundamentals of managing coastal habitats for invertebrates are covered by Kirby (1992).

5.3.4 Information sources used

Data are scattered over a wide range of sources, including local records centres and literature. This report has largely been prepared from data from the Invertebrate Site Register (ISR). The ISR is a computerised database that, although not comprehensive, includes data from many of the sources, specialists and surveys mentioned, as well as from the literature and local biological records centres.

The level of recording around the region varies considerably, although many areas have been well studied in both historic and modern times. Only a few ISR sites have been studied in detail. Most of the better known invertebrate groups have been recorded along this section of coast, although some much more so than others. There is a good historical and modern base of records, particularly for Lepidoptera (larger moths especially) and Coleoptera (beetles). Publications such as Dunn & Parrack (1988), Sutton & Beaumont (1989), Eyre, Ball & Foster (1985) and Eyre, Luff & Ball (1985) reflect the level of attention that such groups have received. Diptera (flies) and micro-lepidoptera (smaller moths) are fairly well recorded, unlike many of the more obscure invertebrate groups, though Smith (1982) provides coverage of spiders in Yorkshire.

5.3.5 Further sources of information

A. References cited

Colvin, M., & Reavey, D. 1993. *A directory for entomologists*. 2nd ed. The Amateur Entomologists' Society, Middlesex (Pamphlet No. 14).

Dunn, T.C., & Parrack, J.D. 1986. The moths and butterflies of Northumberland and Durham. Houghton-le-Spring, Northern Naturalists' Union. *The Vasculum*, Supplement No. 2.

Eyre, M.D., Ball, S.G., & Foster, G.N. 1985. *An atlas of the water beetles of Northumberland and Durham.* Newcastle, Northumberland Biological Records Centre. (Special Publication No. 1.)

Eyre, M.D., Luff, M.L., & Ball, S.G. 1985. *An atlas of the Carabidae of Northumberland and Durham.* Newcastle, Northumberland Biological Records Centre. (Special Publication No. 2.)

Holdich, D.M., & Reeve, I.D. 1991. Distribution of freshwater crayfish in the British Isles, with particular reference to crayfish plague, alien introductions and water quality. *Aquatic conservation: marine and freshwater ecosystems, 1:* 139-158.

Kirby, P. 1992. *Habitat management for invertebrates: a practical handbook.* Peterborough, Joint Nature Conservation Committee.

Kirby, P. 1994a. *Habitat fragmentation; species at risk*. Peterborough, English Nature. (English Nature Research Reports, No. 89.)

Kirby, P. 1994b. *Habitat tabulations for rare and scarce invertebrates. Coleoptera (part); Dolichopodidae & Empididae; macro-moths; Ethmiinae, Stathmopodinae and Gelechiidae.* Peterborough, unpublished report to Species Conservation Branch, JNCC.

Smith, C. 1982. *An atlas of Yorkshire spiders.* York, Smith.

Sutton, S.L., & Beaumont, H.E. 1989. *Butterflies and moths of Yorkshire. Distribution and conservation*. Leeds, Yorkshire Naturalists' Union.

B. Further reading

Bratton, J.H., *ed.* 1991. *British Red Data Books: 3. Invertebrates other than insects.* Peterborough, Joint Nature Conservation Committee.

Chalmers-Hunt, J.M. 1989. *Local lists of Lepidoptera.* Uffington, Hedera Press.

Cook, N.J. 1990. *An atlas of the butterflies of Northumberland & Durham.* Newcastle, Northumberland Biological Records Centre. (Special Publication No. 5.)

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

Drake, C.M., & Denman, D.J. 1993. *A survey of the invertebrates of five dunes in Northumberland*. Peterborough, English Nature. (English Nature Research Reports, No. 46.)

Dunn, T.C., & Parrack, J.D. 1992. The moths and butterflies of Northumberland and Durham. Part 2: micro-lepidoptera. Houghton-le-spring, Northern Naturalists' Union. *The Vasculum*, Supplement No. 3.)
Falk, S. 1991. *A review of the scarce and threatened bees, wasps and ants of Great Britain*. Peterborough, Nature Conservancy Council. (Research & survey in nature conservation, No. 35.)
Falk, S. 1991. *A review of the scarce and threatened flies of Great Britain.* Peterborough, Nature Conservancy Council. (Research & survey in nature conservation, No. 39.)
Fryer, G. 1993. *The freshwater Crustacea of Yorkshire. A faunistic and ecological survey*. Kendal, Yorkshire Naturalists' Union & Leeds Philosophical and Literary Society.
Heath, J., & Emmet, A.M., *eds.* 1983. *The moths and butterflies of Great Britain and Ireland.* Volume 10. Colchester, Harley Books.
Hyman, P.S., & Parsons, M.S. 1992. *A review of the scarce and threatened Coleoptera of Great Britain. Part 1*. Peterborough, Joint Nature Conservation Committee. (UK Nature Conservation, No. 3.)
Hyman, P.S., & Parsons, M.S. 1994. *A review of the scarce and threatened Coleoptera of Great Britain. Part 2*. Peterborough, Joint Nature Conservation Committee. (UK Nature Conservation, No. 12.)
Kirby, P. 1992. *A review of the scarce and threatened Hemiptera of Great Britain.* Peterborough, Joint Nature Conservation Committee. (UK Nature Conservation, No. 2.)
Lowe, R. 1989. *An atlas of the land and freshwater mollusca of Northumberland and Durham*. Newcastle, Northumberland Biological Records Centre. (Special Publication No. 4.)
Luff, M.L., & Selman, B.J. 1977. The Diptera of Castle Eden Dene. *Vasculum*, *62:* 32-29.
Luff, M.L., Selman, B.J., & Foster, G.N. 1974. The Coleoptera of Castle Eden Dene. *Transactions of the Natural History Society of Northumberland and Durham*, *41:* 179-193.
Luff, M.L., & Sheppard, D.A. 1980. The Coleoptera of Castle Eden Dene: a supplement. *Vasculum*, *65*: 53-60.
Merrett, P. 1990. *A review of the nationally notable spiders of Great Britain.* Peterborough, Nature Conservancy Council. (Contract surveys, No. 127.)
Parsons, M.S. 1993. *A review of the scarce and threatened pyralid moths of Great Britain*. Peterborough, Joint Nature Conservation Committee. (UK Nature Conservation, No. 11.)
Sheppard, D.A., & Eyre, M.D. 1983. The insects of Castle Eden Dene: minor orders. *Vasculum*, *68:* 17-27.
Shirt, D.B., *ed.* 1987. *British Red Data Books: 2. Insects.* Peterborough, Nature Conservancy Council.
Smith A.E., *ed.* 1988. *Endangered wildlife in Lincolnshire and south Humberside: a red data report*. Alford, Lincolnshire & South Humberside Trust for Nature Conservation.
Smith J.K., & Smith, H. 1984. *Butterflies in Cleveland*. Stockton-on-Tees, Cleveland Nature Conservation Trust Report.
Smith, K.G.V., & Smith, V. 1983. *A bibliography of the entomology of the smaller British offshore islands.* Faringdon, Classey.
Wallace, I.D. 1991. *A review of the Trichoptera of Great Britain.* Peterborough, Nature Conservancy Council. (Research & survey in nature conservation, No. 32.)
Waring, P. In prep. *A review of the scarce and threatened macrolepidoptera of Great Britain.* Peterborough, Joint Nature Conservation Committee.

C. Contact names and addresses

Colvin & Reavey (1993) provides a more comprehensive list of addresses for societies, individuals, and national and local recording schemes.

Type of information	*Contact address and telephone no.*
Occurrence of invertebrates in the region	Biological Records Centre, Institute of Terrestrial Ecology, Monks Wood Experimental Station, Abbots Ripton, Huntingdon, Cambridgeshire PE17 2LS, tel. 01487 773381
Records of local, scarce and threatened species of all groups of non-marine invertebrate	*Invertebrate Site Register, JNCC, Peterborough, tel: 01733 62626
Conservation of invertebrates in England	*Invertebrate zoologists, English Nature HQ, Peterborough, tel: 01733 340345
Invertebrate interest of National Trust holdings	Biological Survey Team, National Trust, 33 Sheep Street, Cirencester, Gloucestershire GL7 1QW, tel. 01285 651818
County Durham biological database	North Eastern Biological Records Centre, Curator of Natural Sciences, Sunderland Museum, Borough Road, Sunderland, Tyne & Wear SR1 1PP, tel. 0191 514 1235
Northumberland and Tyne & Wear biological database	Northumberland and Tyne & Wear Biological Records Centre, The Hancock Museum, Barras Bridge, Newcastle-upon-Tyne N4E2 4PT, tel. 0191 222 7418
Yorkshire biological database	Yorkshire Museum Biological Records Centre, The Yorkshire Museum, Museum Gardens, York, North Yorkshire YO1 2DR, tel. 01904 629745

* Starred contact addresses are given in full in the Appendix

5.3.6 Acknowledgements

Thanks are due to D.A. Procter (JNCC) and Dr S.G. Ball (JNCC) for providing raw data from the ISR and for assistance in producing maps.

5.4 Rare sea-bed species

Dr W.G. Sanderson

5.4.1 Introduction

This section considers rare and scarce marine benthic (sea-bed) species, excluding fish. The occurrence and distribution of benthic communities is discussed in section 4.2. 'Nationally rare' marine benthic species in this section are those native organisms known to occur in eight or fewer of the 10 x 10 km squares (of the Ordnance Survey national grid) containing sea within the three-mile territorial limit for Great Britain. 'Nationally scarce' are those known to occur in 55 or fewer. This methodology and these criteria are analogous to those used for other groups of organisms in British Red Data Books (e.g. Bratton 1991) and by the International Union for Conservation of Nature and Natural Resources (IUCN) (see Mace *et al.* 1993). The development of the current criteria and the choice of study area for rarity assessment in the marine benthos of Great Britain are discussed in detail by Sanderson (in prep.). Species considered in this chapter are those conspicuous and readily identifiable in the field by the Marine Nature Conservation Review (MNCR) and similar techniques or for which taxonomic or biogeographic experts consider that sufficient data exist on a national basis to warrant their inclusion. Some species classed here as rare or scarce may be present also in deeper water beyond the study area. In addition, species at the limit of their global distribution (e.g. 'northern' or 'southern' species) may be rare only within Great Britain's territorial seas. A species described here as 'nationally rare' or 'nationally scarce' is therefore not necessarily endangered and the conservation importance of these species may need to be carefully considered. The analysis in this section represents the first attempt to quantify the rarity of marine benthic species and to summarise the known occurrence of rare and scarce species. As either more data become available or populations change, the status of species listed in this chapter will require re-evaluation.

Four rare and three scarce marine benthic species have been recorded from Region 5. Maps 5.4.1 and 5.4.2 summarise the current known occurrence of rare and scarce marine benthic species in the region.

5.4.2 Important locations and species

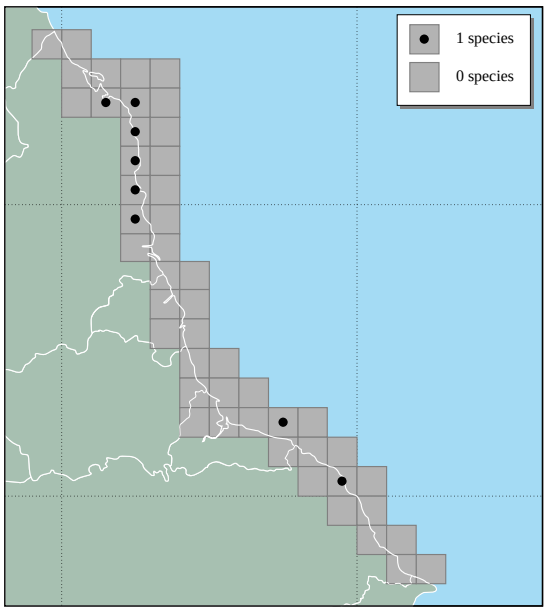
Table 5.4.1 lists the rare and scarce marine benthic species that have been recorded in the region, together with their known areas of occurrence. The codes given (after Howson 1987) are often used in marine conservation and survey work.

Within this region of Great Britain certain species are 'nationally rare' or 'scarce' because they are north Atlantic/sub-Arctic species at the margins of their distribution in Great Britain. It has been argued that populations of many sessile (non-mobile) southern species have a poor capacity for recovery and recruit (^{2} reproduce) slowly at the margins of their distribution and are therefore particularly vulnerable to even the most minor, infrequent damage. Communities of southern species have therefore been considered important as reference sites for monitoring the

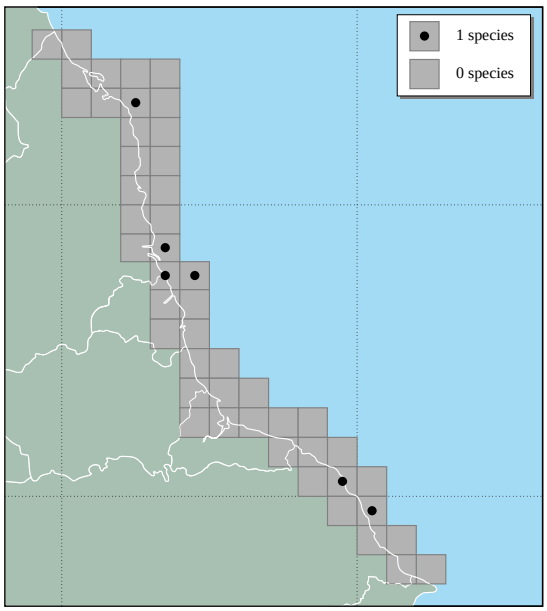
Table 5.4.1 Nationally rare (*) and scarce marine benthic species found in Region 5

Code	*Species*	*Common name/group*	*Area(s) of occurrence*	*Habitat/associations*	*Comments*	*Useful reference*
D0689	*Tamarisca tamarisca*	Hydroid	Off Robin Hood's Bay/Ness Point	Sublittoral. Substrate apparently unrecorded.	Occurs around GB and north to Arctic. Local.	Hayward & Ryland (1990)
P1535	*Baldia johnstoni* (*)	Worm	Fenham Flats, by Shoreston Rocks (St Aidan's Dunes), Druridge Bay	Clean sand of the low shore	Currently known only from north-east England.	Garwood & Bamber (1988)
W1072	*Stelliger bellulus* (*)	Sea slug	Robin Hood's Bay	Shallow water, sometimes amongst eel grass	Norway to the Mediterranean. Thompson regarded it as exceedingly rare.	Thompson (1988)
Y0315	*Escharoides mamillata*(*)	Bryozoan	Off Druridge Bay	On shells and other calcareous material (?) Offshore (?)	May be only rarely recorded because it is an offshore species.	Hayward & Ryland (1979)
Y0876	*Bugula purpurotincta* (*)	Bryozoan	Off Dunstanburgh and Staithes	Low water to shallow sublittoral on shells and hydroids	A northern species. Occurs north through Norway to Spitzbergen.	Ryland & Hayward (1977)
ZD0258	*Molgula oculata*	Sea squirt	Off Seaton Sluice, Tynemouth	Sublittoral sediments, partially protruding	Also occurs south of GB to the Bay of Biscay.	Millar (1970)
ZM0322	*Callophyllis cristata*	Red alga	Farne Islands	Sublittoral, epiphytic on laminarian algae. Sheltered and moderately wave-exposed coasts.	Northern species at margin of distribution in GB.	Irvine (1983)

Species codes are after Howson (1987); in the absence of a specific common name the nearest available group names have been used. None of these species currently has protected status.



Map 5.4.1 Numbers of rare marine benthic species recorded in 10 km squares within the 3 mile limit



Map 5.4.2 Numbers of scarce marine benthic species recorded in 10 km squares within the 3 mile limit

marine environment (Fowler & Laffoley 1993). This argument may also be applicable to northern species at the limit of their distribution in Great Britain. Other genetic, ecological and pragmatic arguments for the conservation of species that are rare because they are at the margins of wider distributions have been put forward (see Hunter & Hutchinson 1994). Some rare or scarce species in this region are thought to occur also offshore, and so may only be scarce in the near-shore sea area that is the focus of this study. Although rare or scarce on a national basis, records of sea slugs are often sporadic and populations may fluctuate from year to year.

5.4.3 Information sources used

The sites of littoral (shore) and sublittoral benthic survey data used for this report have been mapped in section 4.2. Some data are derived from the research activities of the Dove and the Wellcome Marine Laboratories (the latter now closed) as well as various commercial impact assessment studies. A large proportion of the recent data originates from MNCR survey work and earlier NCC-funded surveys, many of them available as JNCC reports. Further species records have been considered following personal communications with experts in many taxonomic fields. It has not been possible in this chapter to list all the available literature on which this analysis has been based, but the information reviews and recent papers listed below should allow access to the majority of the available information.

Although the available data for this region show comparatively good coverage, survey effort is uneven. Some areas and groups of organisms found within Region 5 have a long history of study; for example, studies on the marine algae of the coast of Northumberland and Durham go back over nearly 200 years (Hardy & Aspinall 1988). Although every effort has been made to obtain biogeographic data for rarity assessment in the present study, data from reports more than 30 years old have not been used. Species that are likely to be very under-recorded or overlooked on a national scale have been avoided.

MNCR survey work uses a consistent methodology to record conspicuous species (Hiscock 1990). Not all the data available from other surveys in this region are as broad in scope, and sometimes they have not included less common species or those less familiar to a specialist worker. Inconsistent recording has not, however, seriously reduced the quality of available information for rarity assessment in Region 5. The MNCR of Great Britain is at present incomplete, but in future it will substantially increase the quality and evenness of distribution of the available data from around Great Britain. This will almost certainly expand our knowledge of species that are 'nationally rare' and 'scarce' and may therefore cause the species discussed here to require re-evaluation in future. Species with short life histories may require more regular re-evaluation of their occurrence than others. Furthermore, rare or scarce species may also be added to the list as, inevitably, more data become available in Region 5.

5.4.4 Further sources of information

A. References cited

Bratton, J.H., *ed.* 1991. *British Red Data Books: 3. Invertebrates other than insects*. Peterborough, Joint Nature Conservation Committee.

Fowler, S., & Laffoley, D. 1993. Stability in Mediterranean-Atlantic sessile epifaunal communities at the northern limits of their range. *Journal of Experimental Marine Biology & Ecology*, *172*: 109-127.

Garwood, P.R., & Bamber, R.N. 1988. A new genus and species of capitellid polychaete from north east England. *Ophelia*, *29*: 119-126.

Hardy, F.G., & Aspinall, R.J. 1988. *An atlas of the seaweeds of Northumberland and Durham*. Newcastle-upon-Tyne, University of Newcastle-upon-Tyne, Hancock Museum, Northumberland Biological Records Centre (Special Publication, No. 3).

Hayward, P.J., & Ryland, J.S., *eds*. 1990. *The marine fauna of the British Isles and north-west Europe.* 2 Vols. Oxford, Clarendon Press.

Hayward, P.J., & Ryland, J.S. 1979. *British ascophoran bryozoans. Keys and notes for the identification of the species*. London, Academic Press for Linnean Society of London/Estuarine and Brackish-Water Sciences Association. (Synopses of the British Fauna (New Series), No. 14.)

Hiscock, K. 1990. Marine Nature Conservation Review: methods. *Nature Conservancy Council*, *CSD Report*, No. 1072. (Marine Nature Conservation Review Report, No. MNCR/OR/5.)

Howson, C.M., *ed*. 1987. *Directory of the British marine fauna and flora. A coded checklist of the marine fauna and flora of the British Isles and its surrounding seas.* 1st ed. Ross-on-Wye, Marine Conservation Society.

Irvine, L.M. 1983. *Seaweeds of the British Isles. Vol. 1. Rhodophyta. Part 2A. Cryptonemiales*, *Palmariales*, *Rhodymeniales*. London, British Museum (Natural History).

Mace, G., Collar, N., Cooke, J., Gaston, K., Ginsberg, J., Leader-Williams, N., Maunder, M., & Milner-Gulland, E.J. 1993. *The development of new criteria for listing species on the IUCN Red List.* Unpublished IUCN article.

Millar, R.H. 1970. *British Ascidians. Tunicata: Ascidiacea. Keys and notes for the identification of the species*. 1st ed. London, Academic Press for Linnean Society of London. (Synopses of the British Fauna (New Series), No. 1.)

Ryland, J.S., & Hayward, P.J. 1977. *British anascan bryozoans. Cheilostomata: Anasca. Keys and notes for the identification of the species.* 1st ed. London, Academic Press for Linnean Society of London. (Synopses of the British Fauna (New series), No. 10.)

Sanderson, W.G. In prep. Rare marine benthic flora and fauna in Great Britain: the development of criteria. *Joint Nature Conservation Committee Report*, No. 240.

Thompson, T.E. 1988. *Molluscs: benthic opisthobranchs (Mollusca: Gastropoda). Keys and notes for the identification of the species.* 2nd ed. Leiden, E.J. Brill/Dr W. Backhuys for Linnean Society of London/Estuarine and Brackish-Water Sciences Association. (Synopses of the British Fauna (New Series), No. 8.)

B. Further reading

Bennett, T.L. 1991. Benthic marine ecosystems in Great Britain: a review of current knowledge. Orkney, north Scotland, east Scotland and north-east England (MNCR Coastal sectors 2 to 5). *Nature Conservancy Council*, *CSD Report*, No. 1171. (Marine Nature Conservation Review Report, No. MNCR/OR/7.)

Bird, G.J., & Morris, E. 1992. *Summary report on the rocky-shore survey carried out on Yorkshire NRA Region's coastline during 1991*. National Rivers Authority, Yorkshire Region. (Unpublished Biology Report, No. BN 9/92.)

Brazier, D.P., Davies, J., Holt, R.H.F., & Murray, E. In prep. *Classification of benthic marine biotopes for MNCR Sector 5: Dunbar*, *south-east Scotland*, *to Bridlington*, *north-east England*. Peterborough, Joint Nature Conservation Committee (unpublished).

Craig, N.C.D., Shillabeer, N., & Parr, J.C.W. 1993. Long-term benthic monitoring of the effects of a dense effluent discharged to North Sea coastal waters. *Journal of the Institute of Water and Environmental Management*, *7*: 262-269.

Hardy, F.G. 1992. The marine algae of Berwickshire: a description of the shore and the history of its study. *Botanical Journal of Scotland*, *46*: 89-96.

Hardy, F.G. 1993. The marine algae of Berwickshire: a detailed check-list. *Botanical Journal of Scotland*, *46*: 199-232.

Hardy, F.G., Evans, S.M., & Tremayne, M.A. 1993. Long-term changes in the marine macroalgae of three polluted estuaries in the north-east England. *Journal of Experimental Marine Biology and Ecology*, *172*: 81-92.

Holt, R.H.F. 1994. Marine biological survey of Eyemouth (Berwickshire) to Alnmouth (Northumberland). *Joint Nature Conservation Committee Report*, No. 157. (Marine Nature Conservation Review Report, No. MNCR/SR/24.).

Wimpey Environmental Ltd. 1993. *Benthic survey data. Scarborough 1988 and 1990*. (Contractor: Wimpey Environmental Ltd, Swindon.) York, Unpublished report to Yorkshire Water.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Baldia	Dr R. Bamber, Fawley Aquatic Research Laboratories Ltd, Marine and Freshwater Biology Unit, Fawley, Southampton SO4 1TW, tel: 01703 893513
Rhodophycean algae	Dr J. Brodie, Bath College of Higher Education, Newton Park, Newton Street, Loe, Bath BA2 9BN, tel: 01225 873701
Tunicates	* Head of Marine Nature Conservation Review, Marine Conservation Branch, JNCC, Peterborough, tel: 01733 62626
General	Director, Dove Marine Laboratory (University of Newcastle-upon-Tyne), Cullercoats, North Shields, Tyne & Wear NE30 4PZ, tel: 0191 252 4850
Bryozoans	Dr P.J. Hayward, School of Biological Sciences, University College Swansea, Singleton Park, Swansea, West Glamorgan SA2 8PP, tel: 01792 205678
Molluscs	Mrs J. Light, 88 Peperharow Road, Godalming, Surrey GU7 2PN, tel: 01483 417782
Rhodophycean algae	Dr C. Maggs, School of Biology & Biochemistry, Queen's University of Belfast, Belfast BT7 1NN, tel: 01232 245133
Sea slugs, hydroids	Mr B.E. Picton, BioMar, Environmental Science Unit, University of Dublin, Trinity College, Dublin 2, Republic of Ireland, tel: 010 353167 72941

* Starred contact addresses are given in full in the Appendix

5.4.5 Acknowledgements

The author is grateful for the assistance of the JNCC Marine Conservation and Coastal Conservation Branches, as well as for the expert advice of Dr J.M. Baxter, Dr J. Brodie, P.F. Clark, D.W. Connor, Dr M.J. Costello, Dr R.L. Fletcher, Dr J.D. Fish, Dr J. Hall-Spencer, Dr T. Harris, Dr P.J. Hayward, Dr K. Hiscock, J. Light, Dr C.A. Maggs, Prof. P.G. Moore, D. Moss, Prof. T.A. Norton, Dr J.D. Nunn, B.E. Picton, Dr S.M. Smith and Dr R. Williams.

5.5 Exploited sea-bed species

Dr M.G. Pawson & C.F. Robson

5.5.1 Introduction

This section describes the distribution of large populations of species that live on, near, or in the bottom sediments of the sea bed (collectively called 'the benthos') and that are routinely exploited, mainly for human food. The exploitation itself is described in sections 9.1 and 9.2. Many of these species also provide an essential food source for other species, such as fish and birds, for example migrant and wintering waders and wildfowl. Most of the species discussed have planktonic larvae; the dispersal of planktonic larvae and the interrelation between populations of the same species can only be inferred from studies on movements of water masses. Their distributions are determined by factors such as water temperature (see section 2.3) and available habitat/substrate type (see section 4.3). The species described may also be found elsewhere in the region, but in smaller numbers.

All species apart from *Nephrops* are referred to by their common names in the text; their scientific names are given in Table 5.5.1.

This region is characterised by the generally inshore distributions of exploited marine benthic fauna such as lobster, edible crab, velvet crab and mussels and offshore distributions of *Nephrops*, deep water prawns, scallops, queen scallops and whelks. The other commonly-exploited species, spider crab *Maja squinado* and crawfish *Palinurus elephas*, are western species and so are unlikely to be found in this region. Lobster, queen scallops and *Nephrops* are present in nationally significant quantities in the region. There are also exploitable populations of deep water prawns, mussels, periwinkle, whelk, lugworm and ragworm in the region. Although brown shrimp, pink prawns, cockles and native oyster may also be present, compared with other areas there are no large exploitable quantities.

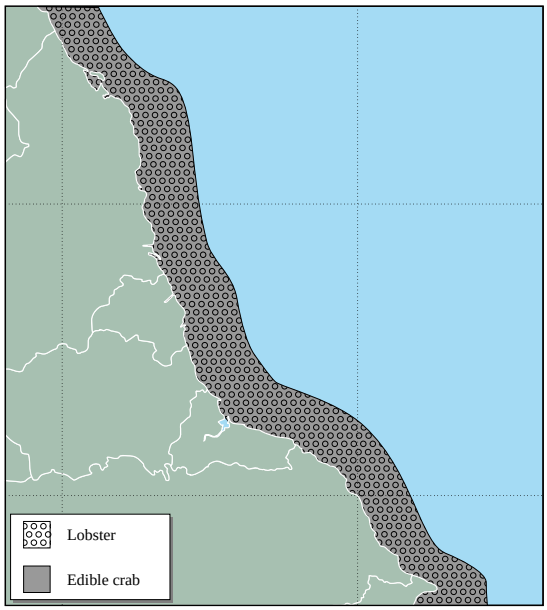
Table 5.5.1 Species names

Common name	*Scientific name*
Lobster	*Homarus gammarus*
Edible crab	*Cancer pagurus*
Velvet crab	*Liocarcinus puber*
Dublin Bay prawn, scampi, Norway lobster or langoustine	*Nephrops norvegicus*
Deep water prawn (or shrimp - referred to as both)	*Pandalus borealis*
Brown shrimp	*Crangon crangon*
Pink prawn (or shrimp - referred to as both)	*Pandalus montagui*
Cockle	*Cerastoderma edule*
Mussel	*Mytilus edulis*
Native oyster	*Ostrea edulis*
Periwinkle	*Littorina littorina*
Scallop	*Pecten maximus*
Queen scallop	*Chlamys opercularis*
Whelk	*Buccinum undatum*
Lugworm	*Arenicola marina*
Ragworm	*Nereis* spp.

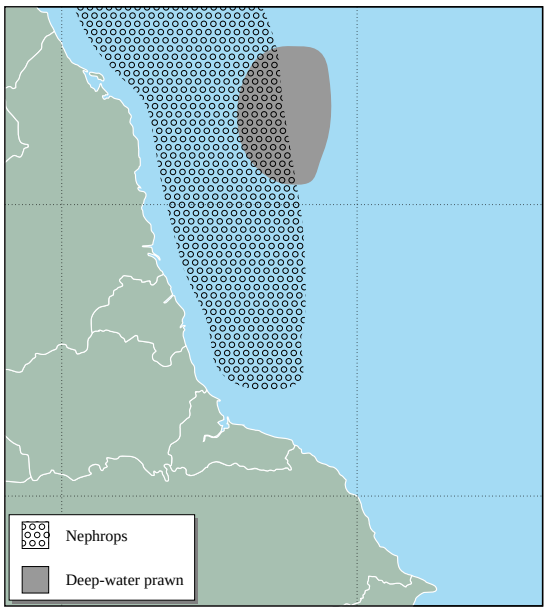
5.5.2 Important locations and species

Crustacea

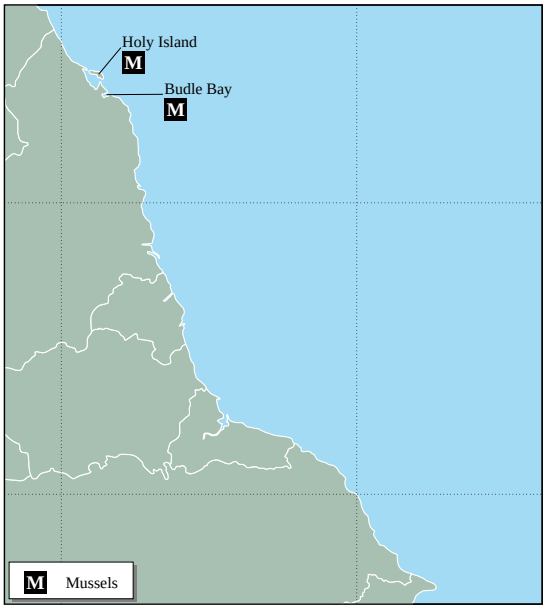
Lobster and velvet crabs are distributed throughout the region wherever there is suitable habitat, such as rocky reefs with crevices for protection. Edible crab are found along



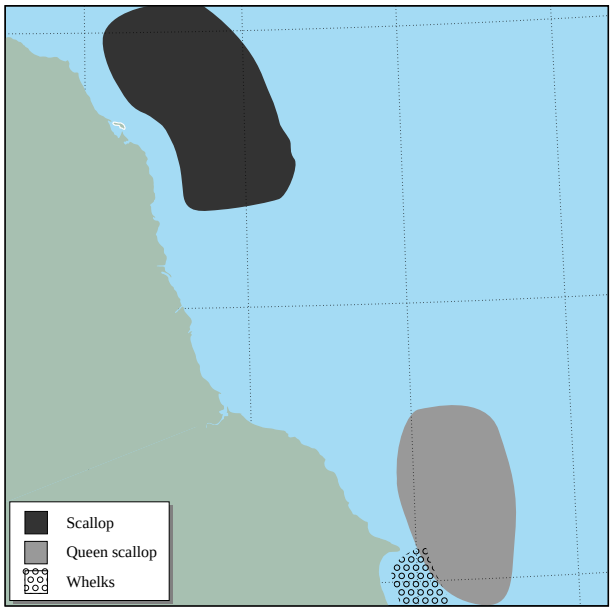
Map 5.5.1 Distribution of exploited crustacea: lobster and edible crab. Copyright of the Shellfish Resource Group, MAFF Directorate of Fisheries Research (Lowestoft).



Map 5.5.2 Distribution of exploited crustacea: *Nephrops* and deep-water prawn. Copyright of the Shellfish Resource Group, MAFF Directorate of Fisheries Research Lowestoft).



Map 5.5.3 Main locations of exploited mollusc species: inshore and estuarine. Copyright of the Shellfish Resource Group, MAFF Directorate of Fisheries Research (Lowestoft).



Map 5.5.4 Main locations of exploited mollusc species: offshore. Copyright of the Shellfish Resource Group, MAFF Directorate of Fisheries Research (Lowestoft).

exposed or rocky shorelines throughout most of the region, often on softer sediments (ranging from sand/gravel to rock) than lobsters. Juveniles tend to be found inshore and adults further offshore (Rees & Dare 1993). The broad-scale distributions of lobster and edible crab in the region are shown on Map 5.5.1. *Nephrops* is abundant in areas with a sea bed of muddy sand, into which it burrows. In this region there is a well defined stock off the coast of Northumberland and Tyne & Wear, in an area known as the Farne Deeps. Within and to the east of this area, deep-water prawns are also found. The broad-scale distributions of *Nephrops* and deep-water prawns in the region are shown on Map 5.5.2.

Molluscs - inshore and estuarine

Cockles are found in the intertidal zones of many sandy estuaries and other sheltered sites in this region, but there are no sites of commercial significance. Mussels are found from the mid shore to the subtidal zone in water of normal or variable salinity and in areas exposed to water currents. They attach themselves using 'byssus threads' to sand, gravel or pebble substrata or other mussels and empty shells, effectively binding the substratum. Small mussel stocks are distributed around coastal sites in the region, with the main area being concentrated around Holy Island and in Budle Bay in Northumberland (Map 5.5.3). Periwinkles live on algae growing on rocky shorelines throughout the region, wherever suitable habitat is present.

Molluscs - offshore

Scallops and queen scallops live on sandy/gravel areas of the sea bed. Scallops are found in an area east of Holy Island; queen scallops are found off the Yorkshire coast. Whelks are widely distributed throughout the region but are present mainly south of Flamborough Head. The broad-scale distributions of scallops, queen scallops and whelks in the region are shown in Map 5.5.4.

Polychaetes

The intertidal and subtidal zones in the region's estuaries support populations of polychaetes, such as lugworm and ragworm, which are commonly collected by anglers for bait (see section 5.5.5 and 9.1.2). Lugworms are common in less exposed areas where there is a higher organic content in the substratum. They occur elsewhere in a wide range of sediment types from almost pure mud to clean sand (Davidson *et al.* 1991). Ragworms are usually found in slightly estuarine conditions in the intertidal and sublittoral. They live in burrows in muddy sediments or under rocks and stones.

5.5.3 Human activities

The exploitation by fisheries of the species covered in this section is described in Section 9.1, and by mariculture in Section 9.2. The major human activity issues relating to the marine benthic species in the region are the levels of their exploitation and the possible effects of harvesting on the benthos, feeding birds and the fluctuations in stocks.

The exploitation of *Nephrops* has increased in the region but is regulated by the application of management measures such as catch quota management with an annual Total Allowable Catch (see section 9.1.3).

Bait collection, especially digging, can have major localised effects on intertidal habitats and communities and can also cause disturbance to birds when they are concentrated in estuaries and embayments. Problems have occurred at Budle Bay and Boulmer Haven in the region, where local byelaws have now been introduced to control bait digging; this is reviewed in Huggett (undated). The potential of bait digging and shellfish collection to disturb feeding waterfowl is discussed in section 5.11. Significant detrimental effects have been found at Lindisfarne and nearby Budle Bay (Townshend & O'Connor 1993), and at the latter the effects have been worsened by the intensity of

wildfowling at Lindisfarne. These issues are explored in the references given in Section 5.5.5.

5.5.4 Information sources used

The four maps in this section show schematically the known broad-scale distribution of the main species of interest, based on current knowledge from MAFF scientists and fishery officers on the location of the species and their fisheries. There is supporting information in the form of commercial landings statistics and biological samples of crustacea collected at the ports. These data provide some information about the location of spawning and nursery areas, but to establish the links between individual areas for spawning, nursery and adults would require specific research vessel investigations on the planktonic stages, the hydrography and the movement (or otherwise) of juveniles and adults. Barring substantial climate change or over-exploitation, these distributions and relationships are likely to remain stable over several decades. The seaward boundaries on the maps are only indicative, and because only large, exploitable populations are described, the species may also be found elsewhere in the region, but in smaller numbers.

5.5.5 Further sources of information

A. References cited

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

Huggett, D. Undated. *Coastal zone management and bait digging. A review of potential conflicts with nature conservation interests, legal issues and some available regulatory mechanisms.* Sandy, Royal Society for the Protection of Birds (unpublished).

Rees, H.L., & Dare, P.J. 1993. *Sources of mortality and associated life-cycle traits of selected benthic species: a review.* Lowestoft, Directorate of Fisheries Research. (MAFF Fisheries Research Data Report No. 33.)

Townshend, D.J., & O'Connor, D.A. 1993. Some effects of disturbance to waterfowl from bait-digging and wildfowling at Lindisfarne National Nature Reserve, north-east England. *Wader Study Group Bulletin, 68:* 47-52.

B. Further reading

Blake, R.W. 1979. Exploitation of a natural population of *Arenicola marina* (l.) from the north-east coast of England. *Journal of Applied Ecology, 16:* 663-670.

Clark, P.F. 1986. *North-east Atlantic crabs; an atlas of distribution.* Ross-on-Wye, Marine Conservation Society.

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

Doody, J.P., Johnston, C., & Smith, B. 1993. *Directory of the North Sea coastal margin.* Peterborough, Joint Nature Conservation Committee.

Eno, N.C., *ed.* 1991. *Marine conservation handbook.* 2nd ed. Peterborough, English Nature.

Ferns, P.N., & Siman, H.Y. 1993. Effects of mechanised cockle harvesting on bird feeding activity in the Burry Inlet. *Countryside Council for Wales, Science Report*, No. 34.

Franklin, A., Pickett, G.D., & Connor, P.M. 1980. *The scallop and its fishery in England and Wales.* MAFF Directorate of Fisheries Research Laboratory Leaflet No. 51.

Frid, C.L.J., Evans, S.M., & Clark, R.B. 1991. *The north-east coast of England: environmental appraisal.* (Contractor: University of Newcastle-upon-Tyne, Dove Marine Laboratory, Cullercoats.) Unpublished report to Shell UK Exploration and Production.

Gubbay, S. 1988. *A coastal directory for marine nature conservation.* Ross-on Wye, Marine Conservation Society.

Hancock, D.A. 1971. The role of predators and parasites in a fishery for the mollusc *Cardium edule* L. *In: Dynamics of populations,* ed. by P.J. den Boer & G.R. Gradwell. (Proceedings of the Advanced Studies Institute, Oosterbeck, 1970.) Wageningen, Centre for Agricultural Publication and Documentation.

Huggett, D. 1992. *Foreshore fishing for shellfish and bait.* Sandy, Royal Society for the Protection of Birds.

McLusky, D.S., Anderson, F.E., & Wolfe-Murphy, S. 1983. Distribution and population recovery of *Arenicola marina* and other benthic fauna after bait digging. *Marine Ecology Progress Series*, Vol. 11: 173 - 179.

Moore, J. 1991. *Studies on the impact of hydraulic cockle dredging on intertidal sediment flat communities.* Final report to NCC from the Field Studies Council Research Centre. (FSC/RC/4/91.)

Olive, P.J.W. 1993. Management of the exploitation of the lugworm *Arenicola marina* and the ragworm *Nereis virens* (Polychaeta) in conservation areas. *Aquatic Conservation: Marine and Freshwater Ecosytems*, Vol. 3, 1-24.

Seaward, D.R. 1990. *Distribution of the marine molluscs of north-west Europe.* Peterborough, NCC for Conchological Society of Great Britain and Ireland.

Seaward, D.R. 1993. Additions and amendments to the distribution of the marine molluscs of north-west Europe (1990). *JNCC Report*, No. 165. Peterborough, Joint Nature Conservation Committee.

C. Contact names and addresses

Type of information held	*Contact address and telephone no.*
Fish stocks and fisheries advice to assist with management and policy decisions for the coastal zone	Head of Laboratory, MAFF Directorate of Fisheries Research, Fisheries Laboratory (Conwy), Benarth Road, Conwy, Gwynedd LL32 8UB, tel: 01492 593883
Assessment and provision of advice on the conservation of commercial fish and shellfish stocks. Publications leaflet.	Director, MAFF Directorate of Fisheries Research, Fisheries Laboratory (Lowestoft), Pakefield Road, Lowestoft, Suffolk NR33 OHT, tel: 01502 562244
Benthic surveys: (Marine Nature Conservation Review Database)	*Marine Conservation Branch, JNCC, Peterborough, tel: 01733 62626
Library and scientific advice	Director/Librarian, Dove Marine Laboratory, University of Newcastle upon Tyne, Cullercoats, North Shields NE30 4P2, tel: 0191 252 4850
Information and advice on marine conservation issues and fisheries	*Marine Fisheries Officer, English Nature HQ, Peterborough, tel: 01733 340345
Marine Fisheries Task Group papers and advice on marine conservation issues	*Marine Advisory Officer, Marine Conservation Branch, JNCC, Peterborough, tel: 01733 62626
Information and advice on marine conservation issues	*Conservation Officer, RSPB Sandy, tel: 01767 680551
Information and advice on marine conservation issues	*Fisheries Officer, Marine section, WWF-UK, Panda House, Weyside Park, Catteshall Lane, Godalming, Surrey GU7 1XR, tel: 01483 426444
Information and advice on marine conservation issues	Conservation Officer, Marine Conservation Society, 9 Gloucester Road, Ross-on-Wye, Herefordshire HR9 5BU, tel: 01989 566017
Information and advice on marine conservation issues	Administrator, The Marine Forum for Environmental Issues, Department of Zoology, Natural History Museum, Cromwell Road, London SW7 5BD, tel: 0171 938 9114

* Starred contact addresses are given in full in the Appendix

5.5.6 Acknowledgements

The authors thank R.C.A. Bannister (Shellfish Resource Group, MAFF Directorate of Fisheries Research, Lowestoft) for his helpful comments and additional written sections. Additional thanks go to Sir Derek Bradbeer and A.J. Flett (Northumberland Sea Fisheries Committee), P. Smith and M.D. Wilkinson (North Eastern Sea Fisheries Committee) and P. Knapman (English Nature) for reviewing draft maps and text.

5.6 Amphibians and reptiles

Dr M.J.S. Swan

5.6.1 Introduction

All nine of the widespread species of amphibians and terrestrial reptiles and one species of marine turtle have been recorded in this region. They are the amphibians: common frog *Rana temporaria*, common toad *Bufo bufo*, smooth newt *Triturus vulgaris*, palmate newt *T. helveticus* and great crested newt *T. cristatus*; the terrestrial reptiles: slow-worm *Anguis fragilis*, common lizard *Lacerta vivipara*, grass snake *Natrix natrix* and adder *Vipera berus*; and the leatherback turtle *Dermochelys coriacea*. Breeding populations of the alpine newt *T. alpestris* were reported in Sunderland in the early 1980s (Banks 1989), but no records exist post-1987, by which time both recorded breeding ponds had been destroyed. All amphibian and reptile species have some national and international protection, and two, the great crested newt and the leatherback turtle, are of international significance.

Amphibian species have been found throughout the region, largely because recording effort has been thorough (Table 5.6.1). The region supports areas of high local diversity of amphibians. 42% of surveyed 10 km squares in the region contain all five species (Map 5.6.1), comparing favourably with the entire British east coast (25%) and the coast of Great Britain as a whole (18%). This region contains ten of the 126 most important amphibian species assemblage sites in Britain and three nationally important great crested newt breeding sites. Reptile distribution is, however, more patchy (Map 5.6.2). A lower percentage (32%) of surveyed 10 km squares in this region supports at least three reptile species than in the east coast of Britain (81%) and the coast of the country as a whole (45%). Reptile diversity is greatest in North Yorkshire, where the coast is backed by the North York Moors National Park.

Table 5.6.1 gives the total numbers of records of amphibians and reptiles and the mean numbers per surveyed 10 km square, in the region and nationally.

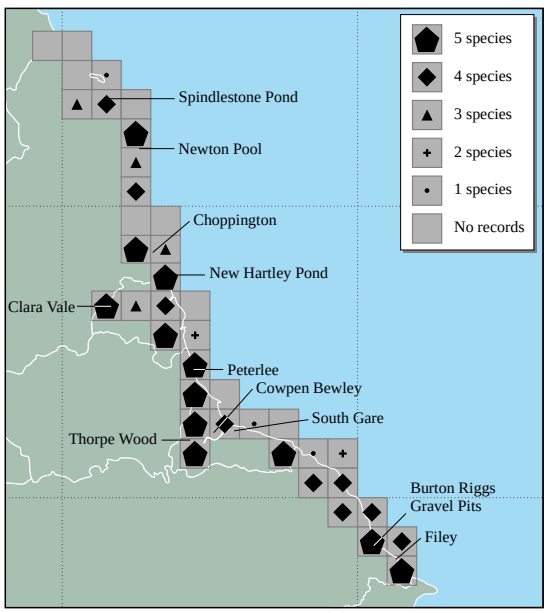
Table 5.6.1 Amphibian and reptile numbers recorded in Region 5

Coast	*Total no. of individual records*		*Mean no. of individual records per 10 km sq.*	
	amphibians	*reptiles*	*amphibians*	**reptiles**
Northumberland	165	16	18.3	3.2
Tyne & Wear	158	13	26.3	4.3
Durham	45	11	15.0	5.5
Cleveland	216	24	36.0	6.0
N Yorkshire	290	112	22.3	14.0
Region 5	**874**	**176**	**24.3**	**8.0**
East coast of GB	4,141	1,602	12.5	6.5
Whole coast of GB	7,524	3,138	11.3	5.7
Great Britain	**27,182**	**8,803**	**12.1**	**4.7**

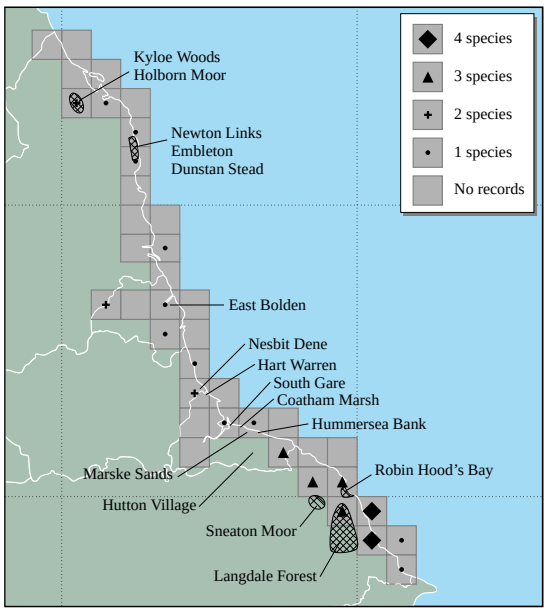
Source: Biological Records Centre, Monks Wood.

5.6.2 Important locations and species

Amphibians are found in ponds within grazing areas on low-lying parts of the coast, e.g. in Cleveland and Northumberland, but can also be abundant in industrial and mineral extraction sites within, or close to, built-up areas. This latter type of site comprises some of the best amphibian and reptile habitat in this region. Examples include Burton Riggs gravel pits, which support five amphibian species,



Map 5.6.1 Numbers of amphibian species recorded in coastal 10 km squares and key localities for amphibians. Source: Biological Records Centre, ITE Monks Wood.



Map 5.6.2 Numbers of reptile species recorded in coastal 10 km squares and key localities for reptiles (large localities shown cross-hatched). Source: Biological Records Centre, ITE Monks Wood.

Table 5.6.2 Important sites for amphibians in Region 5

Site name	*Grid ref.*	*Status*
Northumberland		
Spindlestone Pond	NU156334	GCN, SA
Newton Pool	NU233242	SA
Choppington	NZ250835	SA
New Hartley Pond	NZ304764	SA
Tyne & Wear		
Clara Vale	NZ137652	SA
Durham		
The Newty, Peterlee	NZ428401	SA
Cleveland		
Thorpe Wood	NZ404247	SA
Cowpen Bewley	NZ485258	GCN
South Gare	NZ576253	SA
North Yorkshire		
Burton Riggs Gravel Pits	TA030834	SA
The Dams, Filey	TA107808	GCN, SA

Source: Swan & Oldham (1993a). Key: 'Status' denotes the reason(s) for each site's importance: GCN - nationally important great crested newt population; SA - nationally or regionally important species assemblage. Note: The assemblage sites have been evaluated using the 'community score' devised by NCC and described in Swan & Oldham (1989).

and the lakes and reed-beds formed as a result of anhydrite extraction in the Teesmouth area and around the British Steel plant at Redcar, which each support large populations of common toads and lizards. Table 5.6.2 lists important amphibian sites in the region. Named localities are shown on Map 5.6.1. Great crested newts have also been recorded from the slacks in dunes in Druridge Bay.

The available reptile information for the region is mainly qualitative. Table 5.6.3 lists areas where reptile sightings have been relatively frequent. The locations of these sites are indicated in Map 5.6.2. Reptiles are associated with coastal areas backed by moorland or coastal woodland, but, like the amphibians, they can also be abundant in derelict industrial sites. Shale or slag heaps provide good habitat for adders and slow-worms. Slow-worms have been recorded in fewer than one third of the region's surveyed 10 km squares. They are most frequent in North Yorkshire but appear to be virtually absent from Durham and Tyne & Wear. The data suggest that adders too, although present throughout the region, are relatively common only in North Yorkshire. Common lizards, the most frequently recorded reptile species on this coast, are found in every county, although there are few records (only 12) from the industrial areas between Blyth and Hartlepool. In Cleveland, however, the coastal strip is probably the species' last refuge within the county. The region straddles the north-eastern limit of the UK range of the grass snake, a fact reflected in the small number of records (seven) in the region, from Tyne & Wear and North Yorkshire only.

Since 1990, two leatherback turtles *Dermochelys coriacea*, both dead, have been found stranded on the North Yorkshire coast (McCarthy pers. comm.).

5.6.3 Human activities

A particular problem for both amphibians and reptiles in this region has been the reclamation and 'improvement' of derelict land, which has led to a reduction in the extent and quality of important aquatic and terrestrial habitats. Also, in common with much of agricultural Britain, lack of conservation management has led to significant losses of small water-bodies from coastal farmland. In order to maintain the status of the reptiles of this region, the existing contiguity of coastal and hinterland habitats needs to be conserved.

5.6.4 Information sources used

The coast of this region has been well recorded, especially for amphibians, in terms of both the percentages of 10 km squares sampled (Table 5.6.4) and the numbers of individual records returned per 10 km square (Table 5.6.1).

National distribution data for amphibians and terrestrial reptiles were provided by the Biological Records Centre

Table 5.6.3 Important areas for reptiles

Site/area name	*Grid ref*	*Habitat*	*Species present*
Northumberland			
Kyloe Woods, Holborn Moor	NU0438	Woodland	Slow-worm, adder
Newton Links, Embleton, Dunstan Stead	NU2326	Sand dune	Common lizard
Tyne & Wear			
East Bolden	NZ3661	Grassland	Adder
Cleveland			
Nesbit Dene	NZ4737		Slow-worm
Hart Warren	NZ4936	Sand dune	Common lizard
South Gare	NZ5627	Sand dune	Common lizard
Coatham Marsh	NZ5824	Marsh	Common lizard
Hutton Village	NZ6013		Slow-worm, common lizard, adder
Marske Sands	NZ6522	Sand dune	Common lizard
Hummersea Bank	NZ7319		Slow-worm
North Yorkshire			
Sneaton Moor	NZ8701	Moorland, woodland	Common lizard, adder
Robin Hood's Bay	NZ9504	Associated with railway line	Adder
Broxa Moor, Langdale Forest	SE9491	Moorland, woodland	Common lizard, adder

Sources: Cleveland Wildlife Trust, Swan & Oldham (1993b). Named localities are shown on Map 5.6.2.

Table 5.6.4 Percentage of 10 km squares surveyed for amphibians and reptiles

Coast	*Total no. of 10 km squares*	*% of 10 km squares surveyed for All herpetofauna*	*Amphibians*	*Reptiles*
Northumberland	15	60	60	33
Tyne & Wear	7	86	86	43
Durham	3	100	100	67
Cleveland	8	75	75	50
N. Yorkshire	13	100	100	62
Region 5	***42***	***86***	***86***	***52***
East coast of GB	504	76	66	49
Whole coast of GB	1,124	69	59	49
Great Britain	***2,862***	***84***	***79***	***66***

Source: Biological Records Centre, Monks Wood.

(BRC) at Monk's Wood (Arnold 1983, Arnold in prep.). These comprise post-1970 species records held by BRC and include all the data collected during the National Amphibian and Reptile Surveys (NARS) undertaken by De Montfort University for English Nature. The NARS formed the focus of national amphibian and reptile recording during the 1980s and early 1990s (Oldham & Nicholson 1986; Swan & Oldham 1989, 1993a & b). Most of the quantitative data presented have been collected through a volunteer, mainly amateur, recorder network. Qualitative information was provided by the county Wildlife Trusts, and turtle data were supplied by the Natural History Museum and Southampton University. English Nature and the county Wildlife Trusts hold lists of recorded great crested newt and other amphibian breeding sites.

5.6.5 Further sources of information

A. References cited

Arnold, H.R., *ed.* 1983. *Distribution maps of the amphibians and reptiles of the British Isles.* Biological Records Centre, Monks Wood, Huntingdon.

Arnold, H.R., *ed.* In prep. *Atlas of amphibians and reptiles in Britain and Ireland.* Biological Records Centre, Monks Wood, Huntingdon.

Banks, B. 1989. Alpine newts in north-east England. *British Herpetological Society Bulletin*, *30*: 4-5.

Oldham, R.S., & Nicholson, M. 1986. *Status and ecology of the warty newt* Triturus cristatus. *Final Report.* Peterborough, Nature Conservancy Council (unpublished). (Contractor: Leicester Polytechnic.)

Swan, M.J.S., & Oldham, R.S. 1989. *Amphibian communities. Final report.* Peterborough, Nature Conservancy Council (unpublished report). (Contractor: Leicester Polytechnic.)

Swan, M.J.S, & Oldham, R.S. 1993a. Herptile sites Volume 1: National amphibian survey. *English Nature Research Report*, No. 38. (Contractor: De Montfort University.)

Swan, M.J.S & Oldham, R.S. 1993b. Herptile Sites Volume 2: National reptile survey. *English Nature Research Report*, No. 39. (Contractor: De Montfort University.)

B. Further reading

Nature Conservancy Council. 1990. *The turtle code.* Peterborough. (Advice sheet.)

British Herpetological Society. 1990. *Save our reptiles.* London. (Advice leaflet.)

British Herpetological Society. 1990. *Surveying for amphibians.* London. (Advice leaflet.)

British Herpetological Society. 1990. *Garden ponds as amphibian sanctuaries.* London. (Advice sheet.)

Corbett, K. 1990. *Conservation of European reptiles and amphibians.* London, Christopher Helm.

Green, D. 1984. *A study of the great crested newt* Triturus cristatus *in Durham and Tyne & Wear South.* Durham County Wildlife Trust.

Mallinson, J.J. 1990. Turtle rescue. *Marine Conservation, Winter 1990/91*: 8-9.

Mallinson, J.J. 1991. Stranded juvenile loggerheads in the United Kingdom. *Marine Turtle Newsletter, 54:* 14-16.

Penhallurick, R.D. 1990. *Turtles off Cornwall, the Isles of Scilly and Devonshire.* Truro, Dyllansow Pengwella.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Distribution of amphibians and reptiles	The British Herpetological Society, c/o The Zoological Society of London, Regent's Park, London NW1 4RY, tel: 0181 452 9578
Conservation of threatened reptiles and amphibians in Britain and priority species in Europe	Conservation Officer, The Herpetological Conservation Trust, 655A Christchurch Road, Boscombe, Bournemouth, Dorset BH1 4AP, tel: 01202 391319
National secretariat to local amphibian and reptile groups	Common Species Co-ordinator, Herpetofauna Groups of Britain and Ireland, c/o HCIL, Triton House, Bramfield, Halesworth, Suffolk IP19 9AE, tel: 0198 684 518
Coordinates national recording schemes and collates biological data from throughout UK	Environmental Information Centre, Institute of Terrestrial Ecology, Monks Wood, Abbots Ripton, Huntingdon, Cambridgeshire PE17 2LS, tel: 01487 773381
Turtles	Dr Colin McCarthy, Natural History Museum, Cromwell Road, London SW7 5BD, tel: 0171 938 9123
Turtles	Dept of Oceanography, Southampton University, Highfield, Southampton SO9 5NH, tel: 01703 595000
Conservation in Northumberland	The Conservation Officer, Northumberland Wildlife Trust, Hancock Museum, Barras Bridge, Newcastle upon Tyne NE2 4PT, tel: 0191 222 7418
Conservation in Durham	The Conservation Officer, Durham Wildlife Trust, Low Barnes Nature Reserve, Witton-le-Wear, Bishop Auckland, Co. Durham DL14 0AG, tel: 01388 488728
Conservation in Cleveland	The Conservation Officer, Cleveland Wildlife Trust, Bellamy Pavilion, Kirkleatham Old Hall, Kirkleatham, Redcar, Cleveland TS10 5NW, tel: 01642 480033
Conservation in Yorkshire	Yorkshire Wildlife Trust, 10 Toft Green, York YO1 1JT, tel: 01904 659570
Conservation in England	*English Nature, North East Region, Newcastle upon Tyne, tel: 0191 281 6316

* Starred contact addresses are given in full in the Appendix

5.6.6 Acknowledgements

The author thanks the following people for information and for useful comments on the draft: Henry Arnold, Alec Coles, Keith Corbett, Phil Gates, Steve Lowe, Graham Moon and Rob Scaife.

5.7 Fish: exploited sea fish

Dr M.G. Pawson & C.F. Robson

5.7.1 Introduction

This section describes the distributions of sea fish species that are of interest because they are exploited by people, mainly for food. Their exploitation by fisheries is described in section 9.1. Sea fish described as pelagic (Table 5.7.1) are most commonly found in shoals swimming in midwater; they typically make extensive seasonal movements or migrations between sea areas. 'Demersal' fish (Table 5.7.1) are those found living at or near the bottom of the sea. For this report, all sea fish that are not 'pelagic' are termed 'demersal', the latter term thus including bass and grey mullet. Demersal species are here divided into four groups: elasmobranchs (sharks, skates and rays), gadoids (the cod family), flatfish, and other demersal fish. Most demersal species gather in late winter or spring on persistent and recognisable spawning grounds, to release millions of minute free-floating eggs. From these hatch larvae, which feed on and move with the plankton, often for a hundred miles or more, before metamorphosing into tiny fish, which recruit to inshore nursery grounds.

The distribution of all exploited sea fish species can be mapped from expert analysis of catch data, but this is outside the scope of this report. This description of their distribution covers only their occurrence at identifiable locations during particular phases of their life history, and the three maps are restricted to showing the known spawning areas and nursery areas (Maps 5.7.1, 5.7.2 and 5.7.3) of key species in the region. Barring substantial climate change, or complete over-exploitation, these distributions and relationships will remain stable over several decades.

Tables 5.7.1 and 5.7.2 list the important pelagic and demersal species occurring in the region and show their protected status.

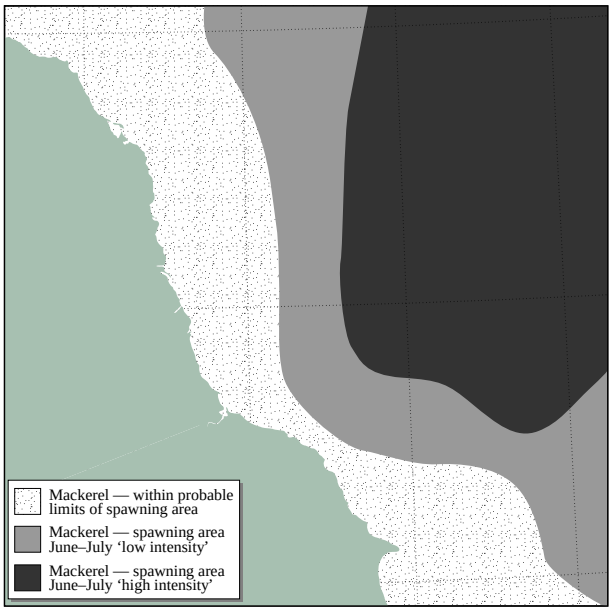
Table 5.7.1 Pelagic species and their protected status

Species	*Protected status*
Mackerel *Scomber scombrus*	QM/MLS
Horse mackerel *Trachurus trachurus*	QM
Herring *Clupea harengus*	QM/MLS & mesh regulations on pelagic trawls and gill nets
Sprat *Sprattus sprattus*	None

Key: MLS = minimum landing size; QM = catch quota management.

5.7.2 Important locations and species

Of the pelagic species, mackerel is widely distributed around Britain and is present in the region. Two stocks of mackerel are found in north-west European waters: the western stock, which spawns along the shelf edge west of Britain, and the North Sea stock, which feeds and spawns in June and July in the central North Sea, including offshore areas of this region (Map 5.7.1). Seasonal immigrants from



Map 5.7.1 Mackerel spawning areas. Source: Lee & Ramster (1981). © Crown copyright.

the western stock also occur in the northern North Sea. The population spawning in the North Sea is very small at present and has shown no signs of recovery since its decline in the 1970s. Overwintering concentrations of mackerel are found west of Scotland, west of Ireland and off Cornwall (outside this region).

Herring are locally abundant in the summer and autumn in feeding areas throughout the region. There are two distinct autumn/winter spawning areas in the northern and southern areas of the region; the timing of spawning depends on the locality and rate of drift of the herring larvae to shallow nursery areas (Map 5.7.2). Sprat are widely dispersed throughout the shallower areas of the region; they migrate to the offshore spawning areas, indicated by the main areas of egg and larvae distribution. Spawning mainly peaks from April to June and is temperature-dependent. Sprat migrate inshore to overwinter and no clearly defined nursery areas have been identified.

All elasmobranch species produce relatively small numbers of live young (10 - 100 per year, but can be fewer in big sharks) or lay large eggs on the sea bed close to their nursery areas. Several species of shark occur sporadically in the region, but only the spurdog and lesser spotted dogfish are found regularly. The thornback ray is also important, especially *en route* to its spring spawning grounds in shallow bays around the region.

Cod is one of the most important commercial fish species in the North Atlantic. The North Sea population of cod is self sustaining; in general the fish migrate south to the spawning areas in winter and in summer are spread out over a wider area. In an area offshore of Flamborough Head there is a pronounced aggregation of spawning cod whose numbers peak during February (Map 5.7.2). Whiting are widely distributed around Britain and are extremely common in the North Sea, especially in inshore waters.

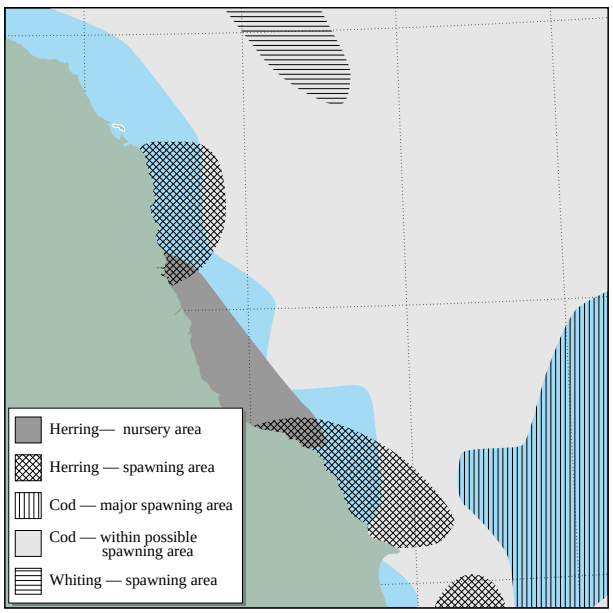
Table 5.7.2 Demersal species and their protected status

Species	*Protected status*
Elasmobranchs	
Spurdog *Squalus acanthias*	None
Thornback ray *Raja clavata*	None
Lesser spotted dogfish *Scyliorhinus canicula*	None
Gadoids	
Cod *Gadus morhua*	MLS/QM
Haddock *Melanogrammus aeglefinus*	MLS/QM
Whiting *Merlangius merlangus*	MLS/QM
Ling *Molva molva*	None
Pollack *Pollachius pollachius*	MLS
Saithe *Pollachius virens*	MLS/QM
Flatfish	
Plaice *Pleuronectes platessa*	MLS/QM
Dab *Limanda limanda*	MLS
Sole (Dover) *Solea solea*	MLS/QM
Lemon sole *Microstomus kitt*	MLS
Turbot *Scophthalmus maximus*	MLS
Brill *Scophthalmus rhombus*	MLS
Megrim *Lepidorhombus whiffiagonis*	MLS/QM
Flounder *Platichthys flesus*	MLS
Other demersal fish	
Bass *Dicentrarchus labrax*	MLS
Grey mullet *Chelon labrosus*	*MLS* (mesh size in gill nets)
Monkfish (angler) *Lophius piscatorius*	QM
Sandeels *Ammodytes spp.*	None
Conger eel *Conger conger*	MLS
Gurnards *Triglidae spp.*	None

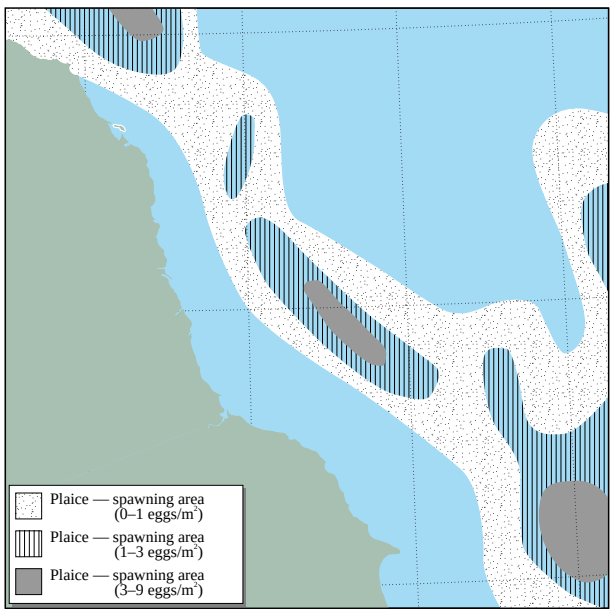
Key: MLS = minimum landing size; QM = catch quota management.

There is one recognisable whiting spawning area in the region, the southern part of an area which extends north up to the Moray Firth. The spawning season is prolonged - lasting from January to July, depending on the latitude - and all over the North Sea there are likely to be other spawning areas and nursery areas that have not been identified. Haddock spawns between February and June and the main spawning areas are outside the region (east of Shetland). Nursery areas are widely distributed and juveniles are common in the region throughout the year. Ling, pollack and saithe are less abundant than other gadoids and more locally distributed, being found particularly around areas of stony sea bed, reefs and wrecks. Saithe spawn in early spring (mainly between January and April) in areas of deep water outside the region. The juvenile saithe then move to inshore nursery areas, which extend from the Humber northwards to Cape Wrath.

Plaice and dab are the most abundant flatfish species, though much more is known about the life history of the exploited plaice. These species occur on areas of sandy sea bed throughout the region, with juveniles living close to the shore, gradually moving to deeper water as they grow. The knowledge of plaice spawning areas (Map 5.7.3) is obtained from the distribution of newly spawned eggs, and has been determined from plankton surveys over 20 years (Lee & Ramster 1981). Dab spawn from January to June throughout the North Sea, and local concentrations of eggs occur off Flamborough Head; the juveniles move to coastal nurseries in the autumn and migrate to deeper water as they grow. Dover sole are present in the south of the region and have a similar lifestyle to plaice and dab, though they are more confined to areas with higher bottom temperatures. Dover sole spawn in the early summer (April to June) but there are no identified spawning areas in the region. Young Dover sole may spend up to two years in the same inshore nursery areas used by plaice. Mature lemon sole occur in small numbers throughout the region but are more common further north. It is assumed that the adults spawn where they are found. Turbot and brill are much less abundant than plaice, dab and sole but have a similar lifestyle. None of these flatfish species exhibits extensive migrations, though their larvae can drift for 100 miles or more from offshore spawning grounds to inshore nursery areas which are located on coasts with sandy or muddy bays. Megrim



Map 5.7.2 Whiting, cod and herring spawning areas and herring nursery area. Source: Lee & Ramster (1981). © Crown copyright.



Map 5.7.3 Plaice spawning areas. Source: Lee & Ramster (1981). © Crown copyright.

tend to be found only in the deepest water of this region, and there are no separate megrim nursery or spawning areas recognised in the North Sea. All along the coast of the region, flounders migrate in late winter between inshore, estuarine and even riverine nursery areas and spawning areas up to 20 or 30 miles offshore; however, there appears to be little longshore coastal movement other than in the egg or larval phase.

Bass occur only occasionally in the region, which is to the north of their normal range (Pawson 1992); thick-lipped grey mullet are more likely to be found. Spawning grey mullet have been recorded in the North Sea, but they also have a generally more southerly distribution.

Monkfish (angler) is present in low densities in the region and spawns mainly between March and June in deeper waters offshore, but juveniles and non-spawning adults can be found throughout coastal areas. Sandeels *Ammodytes tobianus* are present in the region and burrow in coarse sand at night and during the winter; their distribution is therefore linked to that of coarse sand. Druridge Bay is believed to be a spawning ground for the sandeel. Other exploited demersal species of minor importance are conger eel and various gurnards.

5.7.3 Human activities

A feature of all fish stocks, and the primary reason for their fluctuation, is the variability of recruitment of juvenile fish to the exploited populations. This variability, the causes of which are not fully understood, is determined largely by environmental conditions at the time of spawning and in the subsequent larval survival. Exploitation of fish stocks may increase the extent of these fluctuations.

Efforts are made to conserve stocks of pelagic and demersal species by giving them categories of protected status (see Tables 5.7.1 and 5.7.2) reflecting their commercial importance or state of exploitation. Management measures are applied, including minimum landing sizes (MLS), closed fishing areas and seasons, mesh size regulations and quantitative controls on catches (catch quota management (QM)) or fishing effort (further explained in section 9.1.3). Their implementation means that species caught below minimum landing size or for which the quota is exhausted may be discarded at sea, and this may affect the exploited species fish stocks, as well as other fish species, birds and species that live on the sea bed. In order to reduce the by-catch of juvenile fish when *Nephops* nets with a mesh size of 70 mm are used, in June 1992 MAFF made it compulsory for a section of 80 mm square mesh panelling to be incorporated into the net, near to the cod end.

Spawning and nursery areas may be vulnerable to activities such as sewage sludge dumping, dredging and dredge spoil dumping, and to the development of infrastructure such as barrages and pipelines. MAFF is a statutory consultee for activities such as these, in which the distributions of exploited fish populations and their identifiable spawning and nursery areas have to be taken into account.

The elasmobranch species do not have any protected status and are potentially vulnerable because they take a relatively long time taken to reach reproductive maturity and produce only small numbers of young.

5.7.4 Information sources used

Whereas the life history of the exploited crustacean and mollusc species can be observed at or near the sites at which they are harvested, the distributions of fish populations can change considerably between juvenile and adult phases and with seasonal migrations. Therefore the information used in this section is based on the distribution and relative abundance of fish species revealed by fisheries catch statistics obtained from recorded commercial landing figures. In addition, information is used from research vessel catch data and data from biological sampling during fishing surveys. Data from these surveys on the occurrence of spawning fish and juveniles can be used to identify spawning and nursery areas. However, this information is sometimes limited, and there may be other areas in addition to those described or shown on the maps where the species might also occur. Research surveys involving plankton sampling, hydrographic studies, fishing and tagging are required to establish the links between spawning groups and specific nursery areas, and between growing juveniles there and the adult populations to which they eventually recruit. Lee & Ramster (1981) has been used extensively as a source for the maps. Pawson (1995) shows distribution maps of selected fish and shellfish species around the north-east Atlantic and the British Isles and has a species-specific bibliography.

5.7.5 Further sources of information

A. References cited

Lee, A.J., & Ramster, J.W. 1981. *Atlas of the seas around the British Isles*. Lowestoft, MAFF.

Pawson, M.G. 1992. Climatic influences on the spawning success, growth and recruitment of bass (*Dicentrarchus labrax* L.) in British waters. *ICES Marine Science Symposium, 195*: 388-392.

Pawson, M.G. 1995. *Biogeographical identification of English Channel fish and shellfish stocks*. Lowestoft, Ministry of Agriculture, Fisheries & Food, Fisheries Laboratory. (Fisheries Research Technical Report No. 99.)

B. Further reading

Doody, J.P., Johnston, C., & Smith, B. 1993. *Directory of the North Sea coastal margin*. Peterborough, Joint Nature Conservation Committee.

Earll, R.C., *ed.* 1992. *Shark, skate and ray workshop.* Ross-on-Wye, Marine Conservation Society, for Joint Nature Conservation Committee.

Frid, C.L.J., Evans, S.M., & Clark, R.B. 1991. *The north-east coast of England: environmental appraisal*. (Contractor: University of Newcastle-upon-Tyne, Dove Marine Laboratory, Cullercoats.) Unpublished report to Shell UK Exploration and Production.

Knijn, R.J., Boon, T.W., Heessen, H.J.L., & Hislop, J.R.G. 1993. Atlas of North Sea fishes. *ICES, Cooperative Research Report, No. 194.* Copenhagen, ICES.

Nichols, J.H., & Brander, K.M. 1989. Herring larval studies in the west-central North Sea. *ICES, Cooperative Research Report, No. 191:* 160-168. Copenhagen, ICES.

North Sea Task Force UK. 1993. *Quality status report of the North Sea 1993. Report on sub-region 3a.* Aberdeen, Scottish Office Agriculture and Fisheries Department, Marine Laboratory.

North Sea Task Force UK. 1993. *Quality status report of the North Sea 1993. Report on sub-region 3b.* Lowestoft, Ministry of Agriculture, Fisheries & Food, Fisheries Laboratory.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Advice to assist with management and policy for the coastal zone	Head of Laboratory, MAFF Directorate of Fisheries Research, Fisheries Laboratory (Conwy), Benarth Road, Conwy, Gwynedd LL32 8UB, tel: 01492 593883
Assessment and provision of advice on the conservation of commercial fish stocks. MAFF Databases e.g. young fish and ground fish surveys, commercial landing statistics. Publications leaflet.	Director, MAFF Directorate of Fisheries Research, Fisheries Laboratory (Lowestoft), Pakefield Road, Lowestoft, Suffolk NR33 OHT, tel: 01502 562244
UKDMAP software with maps showing distributions of selected sea fish species and spawning areas	Project Manager, British Oceanographic Data Centre, Proudman Oceanographic Laboratory, Bidston Observatory, Birkenhead, Merseyside L43 7RA, tel: 0151 652 3950
Library and scientific advice	Director/Librarian, University of Newcastle upon Tyne, Dove Marine Laboratory, Cullercoats, North Shields NE30 4PZ, tel: 0191 252 4850
Information and advice on marine conservation issues and fisheries	*Marine Fisheries Officer, English Nature HQ, Peterborough, tel: 01733 340345
Marine Fisheries Task Group papers and advice on marine conservation issues	*Marine Advisory Officer, Marine Fisheries Task Group, c/o JNCC, Peterborough, tel: 01733 62626
Information and advice on marine conservation issues	*Conservation Officer, RSPB, Sandy, tel: 01767 680551
Information and advice on marine conservation issues	*Fisheries Officer, Marine Section, WWF-UK, Godalming, tel: 01483 426444
Information and advice on marine conservation issues	Conservation Officer, Marine Conservation Society, 9 Gloucester Road, Ross-on-Wye, Herefordshire HR9 5BU, tel: 01989 566017
Information and advice on marine conservation issues.	Administrator, The Marine Forum for Environmental Issues, Department of Zoology, Natural History Museum, Cromwell Road, London SW7 5BD, tel: 0171 938 9114

* Starred contact addresses are given in full in the Appendix

5.8 Fish: salmon, sea trout and eels

Dr M. Aprahamian & C.F. Robson

5.8.1 Introduction

Diadromous fish migrate between fresh water and the sea. The three diadromous fish species covered in this section because they are exploited for human consumption - the Atlantic salmon, sea trout and eel - are widespread in British waters and have been recorded in six rivers in this region. (Twaite shad are also diadromous but are included in section 5.9, as they are not routinely exploited.) The salmonids (salmon and sea trout) spawn in fresh water and then migrate out to sea to mature, while the eel matures in fresh water and reproduces at sea. Sea trout and brown trout are the same species, but the latter is a freshwater form and is therefore not covered in this section. Information on the life-cycles of these fish can be found in Jones (1959), Mills (1971, 1989), Moriarty (1978), Shearer (1992), Sinha & Jones (1975) and Tesch (1977). Table 5.8.1 gives the protected status of salmon, sea trout and eels in the region.

Table 5.8.1 Species and their protected status

Species	*Protected status*
Atlantic salmon *Salmo salar*	EC Habitats and Species Directive Annexes IIa, Va (freshwater only), close season
Sea trout *Salmo trutta*	Minimum landing size, close season
Eel *Anguilla anguilla*	None

5.8.2 Important locations

Salmon, sea trout and eel have a widespread distribution in rivers and the coastal seas of British waters, and the majority of the rivers within the region are likely to support populations of these species.

Salmon and sea trout are known to occur in six rivers and the coastal seas of this region. These six rivers, which are the principal rivers for which the National Rivers Authority (NRA) publishes catch statistics and which are therefore known to contain salmon and sea trout, are shown in Map 5.8.1. Salmon migrate close to the coast as they return to spawn in their home rivers on the east coast of Scotland and the north-east coast of England; they are believed to enter the North Sea from the north. Many are thought to migrate past their home rivers, moving south either along the coast or further out before turning back. The distribution of salmon and sea trout in rivers is controlled by natural factors, such as river levels and man-made barriers that may limit the extent to which they can go upstream. Eels are probably found in all river systems in the region, as elsewhere in Britain.

5.8.3 Human activities

Under the 1991 Water Resources Act, the Northumbria and Yorkshire Region of the NRA has a responsibility to regulate, protect and monitor salmon, sea trout and eel

Map 5.8.1 Salmon and sea trout rivers. Source: NRA.

fisheries from rivers to coastal waters out to the 6 nautical mile limit. The two Sea Fisheries Committees (see section 9.1.3) in the region have powers to support the conservation of salmonid fisheries while exercising their responsibilities towards the regulation of sea fisheries. The NRA uses a variety of techniques, such as netting, electric fishing and monitoring of angling catches, to assess stocks of salmon and sea trout. They are currently working to produce a 'Fisheries Classification Scheme', under which fisheries will be allocated a quality class on the basis of fish and river habitat data. The NRA construct fish passes around natural barriers, or make them passable by fish in other ways. The NRA also undertakes physical habitat improvement by, for example, creating pools and adding spawning gravels, riffles and trees for cover.

The effects of exploitation, especially by different catch methods (rod and line or nets) is an issue for salmon and sea trout stocks (MAFF/SO 1991). A large percentage of the salmonids caught by net fishing in England and Wales are taken from the coast in this region (see section 9.1). Catch statistics of salmon and sea trout from the region's rivers compared with those from the rest of Great Britain are presented in section 9.1.1. Maitland & Campbell (1992) describe the possible effects of a variety of factors on freshwater fish. Issues mentioned that are of relevance in the region include the possible effect of industrial and domestic pollution in the rivers and estuaries on the populations of diadromous fish and the effects of obstructing rivers with land-claim and amenity and tidal barrages, for example the recent amenity barrage constructed in the Tees Estuary.

5.8.4 Information sources used

The rivers shown in Map 5.8.1 include both those that support net fisheries or have mean annual rod catches in

excess of 30 salmon or 100 sea trout (NRA 1994), and some small rivers selected by the Northumbria and Yorkshire Region of the NRA. Tributaries and minor rivers with a shared estuary are included under the main river and any remaining rivers in each NRA region are recorded separately in the 'others' category in NRA (1994). Diadromous fish are therefore probably present in rivers not shown on the map.

5.8.5 Further sources of information

A. References cited

Jones, J.W. 1959. *The salmon*. London, Collins. (New Naturalist series.)

Maitland, P.S., & Campbell, R.N. 1992. *Freshwater fishes of the British Isles*. London, Harper Collins (New Naturalist Series).

Mills, D.H. 1971. *Salmon and trout: a resource, its ecology, conservation and management*. Edinburgh, Oliver & Boyd.

Mills, D.H. 1989. *Ecology and management of Atlantic salmon*. London, Chapman & Hall.

Ministry of Agriculture, Fisheries and Food/Scottish Office. 1991. *Salmon net fisheries.* London, HMSO. (Report of a review of salmon net fishing in the areas of the Yorkshire and Northumbria regions of the National Rivers Authority and the salmon fishery districts from the River Tweed to the River Ugie. Presented to Parliament by the Minister of Agriculture, Fisheries and Food, and the Secretary of State for Scotland, pursuant to section 39 of the Salmon Act 1986.)

Moriarty, C. 1978. *Eels*. Newton Abbot, David & Charles.

National Rivers Authority. 1994. *Salmonid and freshwater fisheries statistics for England and Wales, 1992*. London, HMSO and NRA.

Shearer, W.M. 1992. *The Atlantic salmon natural history, exploitation and future management*. Oxford, Blackwell Scientific.

Sinha, V.R.P., & Jones, J.W. 1975. *The European freshwater eel*. Liverpool, University of Liverpool Press.

Tesch, F.W. 1977. *The eel: biology and management of Anguillid eels*. London, Chapman & Hall.

B. Further reading

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

National Rivers Authority. 1992. *Sea trout in England and Wales*. Bristol, National Rivers Authority. (Fisheries Technical Report No. 1.)

National Rivers Authority. 1992. *Sea trout literature review*. Bristol, National Rivers Authority. (Fisheries Technical Report No. 3.)

National Rivers Authority. 1992. *The feasibility of developing and utilising gene banks for sea trout* (Salmo trutta*) conservation*. Bristol, National Rivers Authority (Fisheries Technical Report No. 4).

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Regional scientific information and advice	*Regional Fisheries Manager, National Rivers Authority - Northumbria and Yorkshire Regional Office, Leeds, tel: 01532 440191
Scientific advice and policy. Information on Fisheries Classification Scheme	*Head of Department, National Rivers Authority - Fisheries Department, Bristol, tel: 01454 624400
General enquiries including publications.	*Public Relations Officer, National Rivers Authority - Public Relations Department, Bristol, tel: 01454 624400
Advice on its programme of research into freshwater habitats and species	Director, Institute of Freshwater Ecology - Head Office, Windermere Laboratory, Far Sawrey, Ambleside, Cumbria, LA21 0LP, tel: 01539 442468
Conservation of wild salmon; salmonid research.	Director, The Atlantic Salmon Trust, Moulin, Pitlochry PH16 5JQ, tel: 01796 473439

* Starred contact addresses are given in full in the Appendix

5.8.6 Acknowledgements

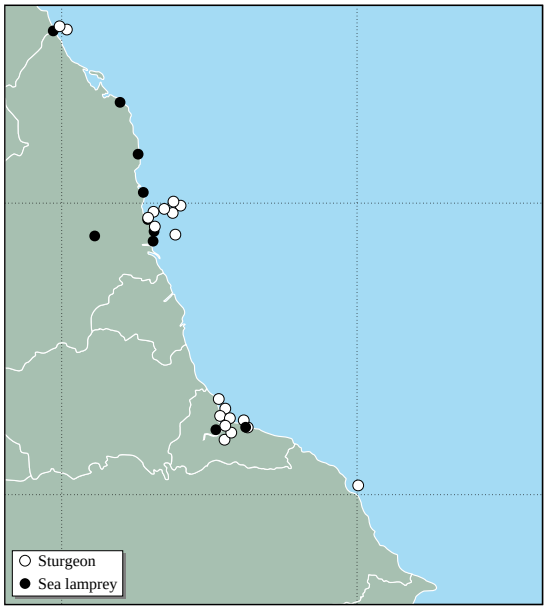
Thanks to S. Bailey (NRA Northumbria and Yorkshire Region) for his comments on the draft, and to Catherine Smith (JNCC) for helping to prepare the map.

5.9 Fish: other species

Dr G.W. Potts & S.E. Swaby

5.9.1 Introduction

This region has a rich fish fauna and many well studied estuaries and coastal seas. 167 species of fish (of a national total of 336) have been recorded, comprising three jawless fishes (Agnatha), 26 sharks and rays (elasmobranchs) and 138 bony fishes (teleosts) (Davis 1983). The region has records of all seven British marine and estuarine species protected under national, European and international legislation. These have mostly been individual records of the allis and twaite shads *Alosa alosa* and *A. fallax*, the lampern *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* and the occasional sturgeon *Acipenser sturio.* These species are considered threatened in UK and European waters (Potts & Swaby 1993a). The occurrence of shad in this area during autumn is noteworthy in that for the most of the UK shad are recorded in spring, mostly during late April and May. Both the common and sand goby *Pomatoschistus microps* and *Pomatoschistus minutus* have been recorded in this region, but as they are both very abundant in the UK they are not discussed further.



Map 5.9.1 Distribution records on the British Marine Fishes Database of sea lamprey *Petromyzon marinus* and sturgeon *Acipenser sturio*. After Potts & Swaby (1993a).

5.9.2 Important locations and species

Of the protected fish, the lampern has been recorded only singly between 1832 and 1982, from the Tweed, Tyne, Tees and Blyth. The only recent records are from the Blyth in 1982 (Davis 1983). The sea lamprey was once considered 'not uncommon' in this area, but since the early 19th century it has mostly been recorded singly from Redcar, Tees, Tyne, Aln, Cullercoats, Tweed, New Water Haugh, Tynemouth Pier, Bamburgh, Newburn, Blyth, South Shields and the North Sea (Davis 1983). A record exists of a sea lamprey in the River Blyth in 1984 and they have been recorded from the rivers Coquet and Tees by recent NRA fish surveys. Map 5.9.1 shows the recorded distribution of the sea lamprey and sturgeon in this region. Some sturgeon were landed at North and South Shields early this century, but this fish was already considered rare by the 1940s. Twaite shad were recorded at the turn of the century ascending rivers and were occasionally captured, but there are no records of viable populations. However, the allis shad is regularly captured in the River Tweed (Campbell pers. comm.) and frequents the estuaries of most of the north-east's rivers in the autumn months (Davis 1983). Its distribution has been restricted by both pollution and the erection of physical barriers and it must now be considered rare (Davis 1983).

Many fish have complex life cycles and habitat requirements, occupying several habitats during the different phases (Potts & Swaby 1993c). *The atlas of North Sea fishes* (Knijn *et al*. 1993) gives details of the distribution of fish in this region between 1985-1987. However, sampling did not occur in inshore and coastal areas, so those species not routinely caught by otter trawls are likely to have been missed. A small number of fish have been recorded between Berwick and Beadnell, the most common being the butterfish *Pholis gunnellus* and the less common Yarrell's blenny *Chirolophis ascanii*. The waters around Holy Island have been beam trawled for fish by the NRA and twelve species have been recorded. The fish in the Farne Islands were listed, and information on habitats and impacts was included as part of the larger work by Potts & Swaby (1993b). The study on the coast between Beadnell and Dunstanburgh Castle recorded common littoral and sublittoral fish, including the butterfish, shanny *Lipophrys pholis* and saithe *Pollachius virens*, amongst others. Druridge Bay is a typical sandy bay and the unusual opah or moonfish *Lampris guttatus* has been stranded there. The fish in the Blyth river and estuary have been well studied, using the power station's intake screen data (Henderson 1989). Both lampern and sea lamprey have been recorded here, but neither is believed to form resident populations.

Some more unusual fish include the starry ray *Raja radiata*, which is on the southern limit of its distribution and appears to be a visitor in the winter. The tadpole fish *Raniceps raninus* is another that is often under-recorded because of its solitary and obscure life style, as is the northern rockling *Ciliata septentrionalis*, which has only relatively recently been recorded on the Northumberland coast. Ray's bream *Brama brama* is an unusual fish and a rare catch in most parts of the UK, although this area is known for migrations down the east coast, in autumn and winter, during which specimens are regularly stranded. Blyth is also a commercial fishing port and many unusual fish caught in local waters are landed here. Further down the coast at Cullercoats, fish were surveyed in winter between 1971 and 1980. Rockpool and shore fish were common, although not all those known to occur there, such as Yarrell's blenny, were recorded. In contrast to references to its abundance in earlier years, smelt *Osmerus eperlanus* in the Tyne is now considered rare, owing to pollution levels,

although recent sightings may show an increase and the possible return of this fish. Other unusual fish in this region include the redband fish *Cepola rubescens*, of which only three specimens have been recorded, and one specimen of the frigate mackerel or bullet tuna *Auxis rochei,* found 16 miles NNE of the River Tyne. Basking sharks *Cetorhinus maximus* have been caught off the River Wear and sighted off Whitley Bay, and one was caught south of the River Tyne. Some of those caught were landed at North Shields, which as a fishing port has yielded other unusual fish records going back to before the 1890s, when a trawlerman brought in a swordfish *Xiphias gladius*.

There is excellent sea angling off piers at Sunderland and Seaham. A range of species is regularly fished for here, including mackerel *Scomber scombrus,* flounder *Platichthys flesus* and plaice *Pleuronectes platessa*. Redcar has five miles of good angling off rock and sand, with various species featuring in catches. Float fishing from Saltburn pier provides good sport angling, with flatfish, whiting *Merlangius merlangus* and good cod *Gadus morhua* angling from October to March (Orton 1992). Whitby is becoming increasingly popular with sea anglers; Scarborough provides good angling from boats and piers most of the year; and Filey Brigg rocks are famous for deep water casting (Orton 1992).

5.9.3 Human activities

Human activities summarised in Davidson *et al*. (1991) will affect the abundance and distribution of fish. In this region, human activities that have been found to affect fish populations include power generation on the Blyth (Henderson 1989); other activities also have the potential to be damaging. Many of the region's estuaries have been very extensively modified by land-claim and other human activities, and in several, e.g. Wansbeck, Tyne and Tees, very little intertidal area remains. 80% of the former tidal part of the Wansbeck became largely non-tidal in the early 1970s through construction of a weir designed to create a recreational lake. Urban and industrial development and agricultural pollution have been shown to have a detrimental effect on the estuarine environment, and dams, weirs and barrages can impede the passage of migratory fish. While salmon passes allow some selected species to migrate up or down rivers and estuaries, they provide obstacles to the majority of fish, which are unable to reach spawning and feeding grounds. Urbanisation and the disposal of untreated sewage in estuaries result in a reduction in dissolved oxygen, to which fish are particularly sensitive. The result is that fish leave the area and do not return until treatment plants reduce the amount of sewage and oxygen levels increase (Potts & Swaby 1993b).

5.9.4 Information sources used

The fish of the Northumberland, Tyne & Wear, Durham, Cleveland and Yorkshire coast have been studied on an area or site-by-site-basis, rather than as a larger unit. The fish fauna of some areas, for example the Cullercoats district, are well studied, but fish in other areas are only studied as part of other surveys and these lists cannot be considered complete. Other surveys of different parts of this region have been carried out by the National Rivers Authority (NRA), universities (Newcastle, Dove Marine Laboratory) and other research institutes (Hancock Museum, Sunderland Museum). The shore fish of Robin Hood's Bay on the Yorkshire coast have been studied by Wheeler (1971).

The associations of fish with habitats are given in Potts & Swaby (1993c). The review of estuarine fish in England (Potts & Swaby 1993b), carried out for English Nature, is included in the British Marine Fishes Database and covers UK fish and individual records for this area. A network is being established of those with a professional or informal interest in fish around the UK, forming the core of the recording scheme that reports to the British Marine Fishes Database. Information for the region is being gathered from a variety of sources including universities (Newcastle), NRA, the Sea Fisheries Committees (North Eastern), anglers and fishermen. The data include published literature, unpublished reports and personal communications from fish biologists.

5.9.5 Further sources of information

A. References cited

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

Davis, P. 1983. *The marine fauna of the Cullercoats district, 11: Fishes.* Newcastle upon Tyne, Report of the Dove Marine Laboratory, 3rd Series (No. 24).

Henderson, P. A. 1989. On the structure of the inshore fish community of England and Wales. *Journal of the Marine Biological Association of the United Kingdom, 69:* 145-163.

Knijn, R.J., Boon, T.W., Heessen, H.J.L., & Hislop, J.R.G. 1993. *Atlas of North Sea fishes*. Copenhagen, International Council for the Exploration of the Sea. (Cooperative Research Report, No. 194.)

Orton, D.A. *ed.* 1992. *Where to fish*, *1992-1993.* Beaminster, Thomas Harmsworth.

Potts, G.W., & Swaby, S.E. 1993a. *Marine fishes on the EC Habitats and Species Directive.* Peterborough, Joint Nature Conservation Committee. (Confidential Report to the Joint Nature Conservation Committee.)

Potts, G.W., & Swaby, S.E. 1993b. Review of the status of estuarine fishes. *English Nature Research Reports*, No. 34.

Potts, G.W., & Swaby, S.E. 1993c. *Marine and estuarine fishes of Wales. The development of the British marine fishes database and monitoring programme for Wales.* Bangor, Countryside Council for Wales.

Wheeler, A. 1971. Notes on a collection of shore fishes from Yorkshire. *Naturalist, 918:* 105-107.

B. Further reading

Bamber, R.N., & Coughlan, J. 1989. *The marine fauna and flora of Druridge Bay.* Central Electricity Generating Board, Research Report No. RD/L/3470/R89.

Bolam, G. 1879. The occurrence of the vaagmaer or deal-fish (*Gymnetrus arcticus*) at Spittal. *History of the Berwickshire Naturalists' Club, 8*: 509.

Bolam, G. 1919. The fishes of Northumberland and the Eastern Borders. *History of the Berwickshire Naturalists' Club, 23(1):* 153-197, and *23(2):* 250-304.

Clarke, W.J. 1934. Uncommon marine fishes near Scarborough. *Naturalist, 4-5.*

Connor, D.W. 1989. *Marine biological survey of Berwick to Beadnell including the Farne Islands.* Peterborough, Nature Conservancy Council. (Marine Nature Conservation Review Report MNCR/SR/01/89.)

Davis, P.S. 1981. First records for the northern rockling from the Northumberland coast. *Transactions of the Natural History Society of Northumbria, 43:* 62.

Davis, P.S. 1982. Rare fish caught off Amble. *Transactions of the Natural History Society of Northumbria, 49:* 23-24.

Davis, P.S. 1984. A note on the occurrence of a swordfish *Xiphias gladius* L. on the Northumberland coast. *Transactions of the Natural History Society of Northumbria, 52:* 35.

Davis, P.S. 1988. Two occurrences of the gilthead *Sparus aurata* (Linnaeus 1758), on the coast of Northumberland, England. *Journal of Fish Biology, 33:* 951.

Davis, P.S. 1990. The first occurrence of torsk *Brosme brosme* (Ascanius, 1772) for the coast of Northumberland, and additional records of the swordfish *Xiphias gladius* Linnaeus, 1758. *Transactions of the Natural History Society of Northumbria, 55:* 149.

Davis, P.S., & Dunn, J.L. 1980. Notes on a collection of marine fish at the Dove Marine Laboratory, Cullercoats. *Vasculum, 65:* 39-44.

Davis, P.S., & Dunn, J.L. 1982. The fish fauna of the estuary of the River Blyth. *Transactions of the Natural History Society of Northumbria, 49:* 1-13.

Davis, P.S., & Edwards A.J. 1988. New records of fishes from the north east coast of England, with notes on the rediscovery of part of the 'type collection' of marine fishes from the Dove Marine Laboratory, Cullercoats. *Transactions of the Natural History Society of Northumbria, 55:* 39-46.

Evans, F. 1981. Winter survey of shore fish at Cullercoats, North Shields. *Porcupine Newsletter, 2:* 38-42.

Foster-Smith, J. 1984. *A checklist of the marine flora and fauna of Newton Haven, Newton-by-the-Sea, with notes on species abundance and distribution.* (Unpublished report to the Nature Conservancy Council.)

Foster-Smith, R.L., & Foster-Smith, J.L. 1987. A marine biological survey of Beadnell to Dunstanburgh Castle, Northumberland. *Nature Conservancy Council, CSD Report*, No. 798.

Johnson, G. 1841. A history of the fishes of Berwickshire, exclusive of the salmones. *History of the Berwickshire Naturalists' Club, 1:* 170-176.

Kelley, D. 1988. The importance of estuaries for sea bass *Dicentrarchus labrax* (L.). *Journal of Fish Biology, 33, (Supplement A):* 25-33.

Johnson, G. 1838. Fishes of Berwickshire. *History of the Berwickshire Naturalists' Club, Volume 1 Alnwick.*

Pawson, M.G., & Rogers, S.I. 1989. *The coastal fisheries of England and Wales. Part II: A review of their status in 1988.* Lowestoft, Ministry of Agriculture Fisheries and Food. (Directorate of Fisheries Research, Internal Report, No. 19.)

Pomfret, J.R., Turner, G.S., & Phillips, S. 1988. Beam trawl surveys as a monitoring tool in polluted estuaries in north-east England. *Journal of Fish Biology, 33 (Supplement A):* 71-77.

Turner, S. 1974. Sunfish and moonfish. *Transactions of the Natural History Society of Northumbria, 41:* 241-242.

Turner, S., & Bamber, R. 1977. A rare fish in the North Sea. *Transactions of the Natural History Society of Northumbria, 42:* 136.

Walker, P. 1984. Fish recorded in Druridge Bay, Northumberland. 1975-80. *Porcupine Newsletter, 3:* 47-50.

Wood, E. 1988. Flamborough Headland sublittoral survey. *Nature Conservancy Council, CSD Report,* No. 832.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Marine and coastal fish data (British Marine Fishes Database)	Dr Geoffrey W.Potts; Miss Silja E.Swaby, British Marine Fishes Database, Marine Biological Association UK, Citadel Hill, Plymouth PL1 2PB, tel: 01752 222772
Marine conservation	*Marine Ecologist, English Nature, Peterborough, tel: 01733 340345
Library and scientific advice	Director/Librarian, University of Newcastle upon Tyne, Dove Marine Laboratory, Cullercoats, North Shields NE30 4PZ, tel: 0191 252 4850

* Starred contact addresses are given in full in the Appendix

5.10 Seabirds

M.L. Tasker

5.10.1 Introduction

This section deals with seabirds both at their colonies on land and while at sea. It covers not only those species usually regarded as seabirds (see list in Table 5.10.1), but also divers, grebes and seaduck: in other words, those species reliant for an important part of their life on the marine environment.

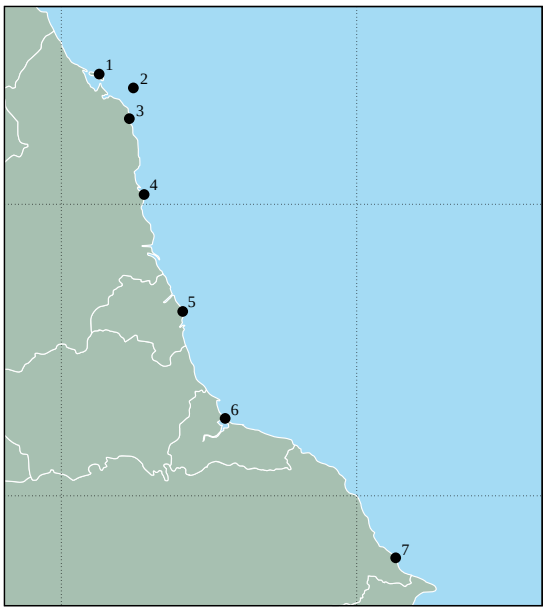
This region is important for seabirds in both national and international contexts. Three breeding sites - Farne Islands, Coquet Island and Marsden Bay - support the most important seabird colonies in the region (Map 5.10.1). The greatest concentrations of birds at sea in this region are near the colonies during the breeding season, and these waters are also important outside this period. The nearshore waters off Northumberland and northern Durham hold highly vulnerable concentrations of seabirds for much of the year (Map 5.10.2). These areas are of certainly national and probably international importance. Waters further offshore are not of as great a general importance as those further to the north or just to the south. Seabird vulnerability is calculated from the abundance of birds in the rectangles shown on the map and a factor derived from the amount of time spent on the water, the overall population size and the rate at which the species recruits new individuals to the population (for discussion of vulnerability see Carter *et al.* (1993) and Webb *et al.* (in prep.)).

Total numbers of eight species breeding in the region all exceed 1% of their European population levels (Table 5.10.1). Numbers of a further five species exceed nationally important levels. The Sandwich tern population, which is usually centred on the Farne Islands, is of particular

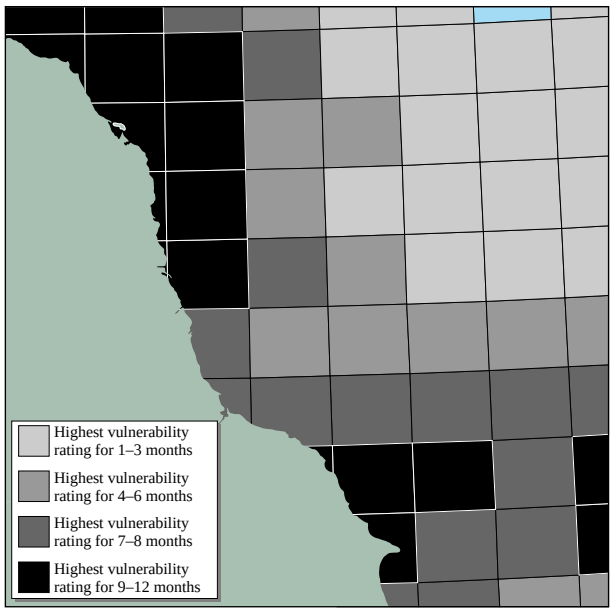
Table 5.10.1 Overall importance of seabirds breeding in the region

Species	*Total*	*% GB*	*% Europe*
Fulmar *Fulmarus glacialis*	2,270	<1.0	<1.0
Cormorant *Phalacrocorax carbo*	612	8.9	<1.0
Shag *Phalacrocorax aristotelis*	2,185	6.0	1.7
Black-headed gull *Larus ridibundus*	4,394	2.6	<1.0
Lesser black-backed gull *Larus fuscus*	1,000	1.2	<1.0
Herring gull *Larus argentatus*	1,956	1.3	<1.0
Kittiwake *Rissa tridactyla*	33,149	6.7	1.9
Sandwich tern *Sterna sandvicensis*	3,858	27.5	7.0
Roseate tern *Sterna dougalli*	43	53.7	5.7
Common tern *Sterna hirundo*	1,224	9.6	1.3
Arctic tern *Sterna paradisaea*	3,987	9.3	1.4
Little tern *Sterna albifrons*	109	4.5	<1.0
Guillemot *Uria aalge*	30,215	2.9	1.0
Razorbill *Alca torda*	350	<1.0	<1.0
Puffin *Fratercula arctica*	96,105	10.7	1.4

Notes: Counts are all of pairs, except for guillemot, razorbill and puffin, where they are of individuals. Figures for Britain from Walsh *et al.* (1994), for Europe from Lloyd *et al.* (1991). Regional totals are compiled from the most recent available good-quality counts up to 1993.



Map 5.10.1 Colonies holding at least 1% of the GB population of any seabird species. Numbers are those listed in Table 5.10.3. Source: JNCC Seabird Colony Register.



Map 5.10.2 Relative importance of region and adjacent seas for seabirds. The grid is of 15'N x 30'W rectangles; see text for explanation of vulnerability ratings. Source: JNCC Seabirds at Sea Team.

Table 5.10.2 Numbers of offshore wintering waterfowl at five sites, in relation to British and north-west European populations

Species	*Peak numbers*	*1% GB*	*1% NW Europe*
Tweed Estuary			
Goldeneye			
Bucephala clangula	408	170	3,000
Lindisfarne			
Cormorant *Phalacrocorax carbo*	189	130	1,200
Eider *Somateria mollissima*	2,206	750	20,000
Long-tailed duck			
Clangula hyemalis	399	230	20,000
Common scoter *Melanitta nigra*	727	230	8,000
Red-breasted merganser			
Mergus serrator	125	100	1,000
Seahouses to Budle Point			
Eider *Somateria mollissima*	1,717	750	20,000
Blyth to Newbiggin			
Eider *Somateria mollissima*	900	750	20,000
Tees Estuary			
Cormorant *Phalacrocorax carbo*	297	130	1,200

Note: Peak numbers from Waters & Cranswick (1993); 1% GB from Waters & Cranswick (1993); 1% NW Europe from Rose & Scott (1994)

importance. Numbers of Sandwich tern and roseate tern are both especially important in a European context. Numbers of offshore waterfowl do not reach international importance, but the eider population, which probably derives from that breeding in the region, is of national importance.

There are no sites of international importance for seaduck or other offshore waterfowl in the region, but five species exceed nationally important levels at Lindisfarne (Table 5.10.2). Numbers of eider, both those breeding on the Farne Isles and Coquet Island and those wintering off the coasts, are of particular national signiificance. The waters to the north-east of the Farnes are important for much of the year (Stone *et al*. in prep.). There are, at present, no protected sites at sea in the region.

5.10.2 Important locations and species

Most breeding seabirds require habitat that is free from predatory mammals, so nearly all colonies in the region are on offshore islands or cliffs. The large gulls appear to be able to tolerate more disturbance by mammals than the smaller seabird species. The little tern colonies in the region are mostly on beach sites and are liable to desertion if disturbed, so most are in protected areas on nature reserves. Four colonies hold numbers of breeding seabirds at or above 1% of the total population of the European Union for that species (Table 5.10.3). A further three colonies are important at the Great Britain level. The Farne Islands, Coquet Island and Marsden Bay colonies all hold more than one population of international importance, with the Farnes being especially important, with seven species at this level. The feeding areas of birds from these colonies are of equal importance to the breeding areas themselves as colonies cannot survive without food. Some research has been carried out in the area to determine feeding areas or general ranges; Pearson (1968) researched generalised feeding ranges from the Farne Islands. More recent work has shown that the seabirds from the islands use waters to the north-east of the islands, and waters close to the shore.

At sea, seabird food sources range from zooplankton to small fish and waste from fishing fleets. Habitats that concentrate any of these foods are preferred. Zooplankton

Table 5.10.3 Recent counts of seabird colonies in the region holding more than 1% of the EU or the Great Britain total for particular species. Numbers are those shown on Map 5.10.1.

No.	*Colony*	*OS ref.*	*Species*	*Year*	*Count*	*1%*
1	Holy Island	NU130430	Little tern	89	42	*
2	Farne Islands	NU240380	Cormorant	93	268	**
			Shag	93	1,948	**
			Kittiwake	93	5,889	**
			Sandwich tern	89	3,445	**
			Common tern	89	313	*
			Arctic tern	89	3,710	**
			Guillemot	93	25,309	**
			Puffin	93	34,710	**
3	Long Nanny	NU231272	Little tern	92	51	*
4	Coquet Island	NU293046	Black-headed gull	93	3,996	*
			Sandwich tern	92	2,131	**
			Roseate tern	92	29	**
			Common tern	92	842	**
			Arctic tern	93	672	*
			Puffin	93	13,273	**
5	Marsden Bay	NZ410643	Cormorant	93	225	**
			Kittiwake	86	7,700	**
6	South Gare	NZ557284	Little tern	93	45	*
7	Filey North Cliffs	TA115824	Kittiwake	90	5,666	**

Source: JNCC/Seabird Group Seabird Colony Register. Note: a single asterisk in the 1% column indicates count >1% of the GB total (nationally important population), while two asterisks indicate a count >1% of the EU total (internationally important). For most species the most recent available good-quality count is presented. For terns (whose numbers may fluctuate markedly from year to year, reflecting inter-colony movements), the highest count from the period 1989-93 is presented. Counts are of pairs, except for guillemots, which are counted individually.

can be concentrated in zones where water masses meet, or where tides converge around islands or over some sea-bed features. Such areas are found around and to the north of the Farnes.

5.10.3 Human activities

Seabirds can be particularly affected by marine oil pollution, and spills near the main colonies during the breeding season could have serious consequences for populations. There have been no major recent oil spill events in this region. Spills may occur from non-tanker shipping movements: the shipping routes into Teesmouth and the Tyne pass through the region, and there is substantial offshore traffic passing the region. Some birds may become entangled in fishing nets in the region, but the scale at which this occurs is not believed to be great overall. It is important to avoid the introduction of mammalian predators onto the Farne Islands and Coquet Island. There is tourist pressure on Holy Island and habitat change in several places due to agriculture, forestry and residential development.

5.10.4 Information sources used

All seabird colonies in the region were counted between 1984 and 1987. These counts, and all those made since 1969, are held on the JNCC/Seabird Group Seabird Colony Register. Numbers and breeding performance of several species are evaluated annually at the Farnes and Coquet, with numbers and breeding performance of terns assessed at several further sites. Surveys of birds at sea have been carried out by JNCC's Seabirds at Sea Team (SAST), whose survey effort from ships has been greatest in the nearshore zone off Newcastle and to the north, but has been reasonable in most months of the year in most areas. Waters at 2 km and 5 km from the shore have been surveyed from the air by SAST on a bi-monthly basis over one year.

5.10.5 Further sources of information

A. References cited

Lloyd, C.S., Tasker, M.L., & Partridge, K. 1991. *The status of seabirds in Britain and Ireland.* London, Poyser.

Pearson, T.H. 1968. The feeding biology of seabird species breeding on the Farne Islands, Northumberland. *Journal of Animal Ecology, 37:* 521-552.

Rose, P.M., & Scott, D.A. 1994. *Waterfowl population estimates.* Slimbridge, International Waterfowl and Wetlands Research Bureau. (IWRB publication No.29.)

Stone, C.J., Webb, A., Barton, C., Ratcliffe, N., Reed, T.C., Tasker, M.L., & Pienkowski, M.W. In prep. *An atlas of seabird distribution in north-west European waters.* Peterborough, Joint Nature Conservation Committee.

Walsh, P.M., Brindley, E., & Heubeck, M. 1994. *Seabird numbers and breeding success in Britain and Ireland, 1993.* Peterborough, Joint Nature Conservation Committee. (UK Nature Conservation, No. 17.)

Waters, R.J., & Cranswick, P.A. 1993. *The wetland bird survey 1992-93: wildfowl and wader counts.* Slimbridge, British Trust for Ornithology/ Wildfowl and Wetlands Trust/ Royal Society for the Protection of Birds/Joint Nature Conservation Committee.

B. Further reading

Carter, I.C., Williams, J.M., Webb, A., & Tasker, M.L. 1993. *Seabird concentrations in the North Sea: an atlas of vulnerability to surface pollutants*. Aberdeen, Joint Nature Conservation Committee.

Frid, C.L.J., Evans, S.M., & Clark, R.B. 1991. *The north-east coast of England: environmental appraisal*. (Contractor: University of Newcastle-upon-Tyne, Dove Marine Laboratory, Cullercoats.) Unpublished Report to Shell UK Exploration and Production.

Kirby, J.S., Evans, R.J., & Fox, A.D. 1993. Wintering seaducks in Britain and Ireland: populations, threats, conservation and research priorities. *Aquatic Conservation: Marine and Freshwater Ecosystems, 3:* 105-137.

Owen, M, Atkinson-Willes, G.L., & Salmon, D.G. 1986. *Wildfowl in Great Britain*. 2nd ed. Cambridge, Cambridge University Press.

Prater, A.J. 1981. *Estuary birds of Britain and Ireland*. Calton, Poyser.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Seabird colonies	*Co-ordinator, Seabird Colony Register, JNCC, Aberdeen, tel: 01224 642863
Seabirds at sea	*Head, Seabirds at Sea Team, JNCC, Aberdeen, tel: 01224 642863
Birds database	*Head, Vertebrate Ecology and Conservation Branch, JNCC, Peterborough, tel: 01733 62626
Nearshore waterfowl	*Wildfowl and Wetlands Trust, Slimbridge, tel: 01453 890333

* Starred contact addresses are given in full in the Appendix

5.11 Other breeding birds

D.M. Craddock & D.A. Stroud

5.11.1 Introduction

This section outlines the importance of the region to breeding birds other than seabirds. Because of their distinctive ecology and mixed-species breeding colonies, seabirds are described separately in section 5.10.

Most of the region's coastline is either rocky shore or cliff, and its character determines the distribution of breeding bird assemblages. The maps show the incidence in coastal 10 km squares of confirmed breeding of selected species characteristic of wet grassland (Map 5.11.1) and shingle, sand dunes and other dry grassland (Map 5.11.2). In a national context the region is notable for moderate numbers of breeding ringed plover *Charadrius hiaticula*, although only small populations occur, restricted to stretches of soft coastline (Pienkowski & Pienkowski 1989). Compared with other coastal regions, numbers and densities of other breeding waterfowl are generally low. The most notable stretch of soft coastline is that surrounding Holy Island in Northumberland, which is of national importance (Pritchard *et al.* 1992): here there are significant areas of saltmarsh and sand dune and the largest extent of inter-tidal mud and sand-flats in north-east England - important feeding areas for breeding waterfowl. The overall species diversity of breeding waders on the limited areas of saltmarsh and coastal wet grassland on estuaries in the region is low in a national context. However, wet grassland in parts of the region such as at Lindisfarne contains small but significant numbers of breeding waders (section 3.5; Davidson 1991; Davidson *et al.* 1991). Nationally and internationally, numbers of lowland breeding waders have been declining, especially those associated with wet grassland areas and saltmarshes (Hötker 1991), so the region's populations are likely to increase in importance.

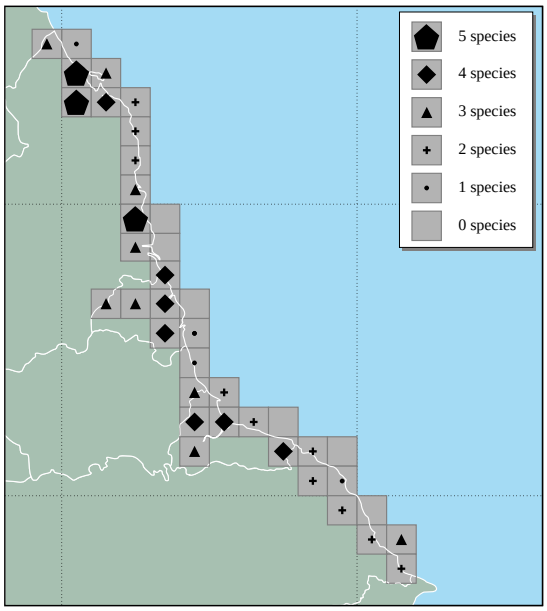
5.11.2 Important locations and species

Breeding waders occurring on the region's saltmarshes and wet coastal grasslands include redshank *Tringa totanus*, oystercatcher *Haematopus ostralegus* and lapwing *Vanellus vanellus*. Several areas of the coast, such as near the Tees

Table 5.11.1 Numbers of pairs of territorial (presumed breeding) ringed plovers in the region in 1984

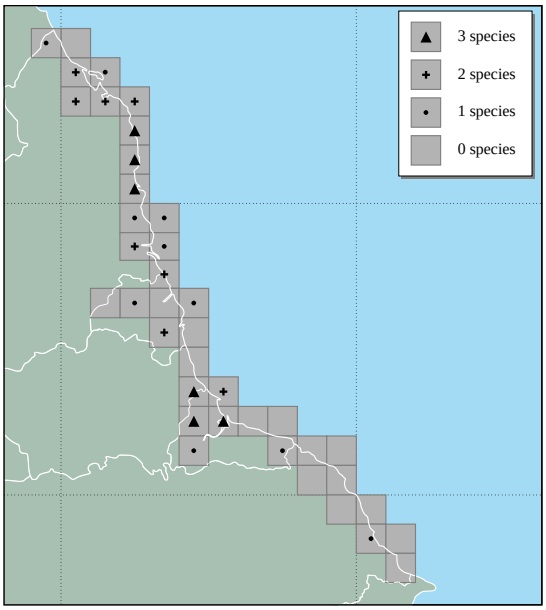
	Pairs (coastal) counted in survey	*% GB total counted in survey*
Northumberland	70	1.0
Tyne & Wear	2	0.0
Durham	3	0.0
Cleveland	41	0.6
North Yorkshire	0	0.0
Region 5	116	1.6
England	1,984	27.5
GB total	***7,207***	

Source: Prater (1989). Note that coverage varied between counties.



Map 5.11.1 Number of confirmed breeding species characteristic of wet grassland (mallard, redshank, snipe, lapwing, teal and pintail) in coastal 10 km squares. Based on Gibbons, Reid & Chapman (1993).

Estuary and at Holy Island, are significant breeding areas for low densities of ringed plover (Table 5.11.1; Prater 1989; Davidson *et al.* 1991). Other waterfowl, such as mute swan *Cygnus olor* and teal *Anas crecca*, also breed in small numbers. A national survey of shelduck *Tadorna tadorna* in 1992 located 47 pairs in the north Tees Estuary (Delany pers. comm.) and a further study showed that shelduck breed along much of the Northumberland coast (Hodgson 1992).



Map 5.11.2 Number of confirmed breeding species characteristic of shingle, sand dunes and other dry grasslands (ringed plover, oystercatcher and shelduck) in coastal 10 km squares. Based on Gibbons, Reid & Chapman (1993).

Many parts of the important breeding bird habitat in the region lie within designated sites (for example Sites of Special Scientific Interest (SSSIs), Special Protection Areas (SPAs) and Ramsar sites), although the sites were not always chosen principally for their breeding bird interest. Of note are a Royal Society for the Protection of Birds (RSPB) reserve at Coquet Island, although this was acquired principally for breeding seabirds, and three Northumberland Wildlife Trust reserves on Druridge Bay.

5.11.3 Human activities

In this region any incremental land claim along the soft coasts of estuarine and sand dune systems has the potential to affect breeding waterfowl populations through loss of nesting and feeding habitat, although at important sites SSSI designation can limit such activity. Oil pollution is well known as a serious potential threat to waterfowl where high densities of birds occur. Human disturbance during the breeding season may have significant effects on breeding success (Pienkowski 1992), although for the birds discussed in this section there are few good assessments of the scale of the problem for this region. The appropriate agricultural and other management of wet grassland in the region (see e.g. Coleshaw 1995; Harold 1995; Scholey 1995; Thomas *et al.* 1995) is of crucial importance for their wader populations (see papers in Hötker 1991); for example at Druridge Marsh wader-rich grassland has been enhanced by management. Likewise, different grazing regimes on saltmarshes can significantly alter the density and nesting success of breeding waders through effects on vegetation composition and structure (Cadbury, Green & Allport 1987). There are proposals for the creation of reedbeds at Chevington. Sand extraction at Druridge Bay and tourist pressure at Lindisfarne and along the North York Moors National Park coastline may lead to habitat change (Pritchard *et al.* 1992).

5.11.4 Information sources used

The most recent and comprehensive overview of the status of breeding birds throughout Britain and Ireland is provided by Gibbons, Reid & Chapman (1993). This summarises the results of a national breeding bird census undertaken between 1988 and 1991 and compares distributions at the 10 x 10 km square level with those recorded in the first breeding bird atlas of 1968-1972 (Sharrock 1976). Whilst these data are one of the best sources for comparisons at county, regional or national scales, care should be taken with their use to assess individual sites or 10 km squares. This is because the tetrad coverage of each 10 km square was not always the same, and since the atlas survey period (1988-1991) distributions of some breeding species may have changed. Between- and within-region comparisons of precise distributions and densities based on coastal 10 x 10 km should be undertaken with caution, as there may be greatly varying amounts of land within each square.

For a number of species, extensive survey work has also been undertaken by volunteers. Usually these surveys have been organised as part of wider British surveys (e.g. for ringed plover (Prater 1989) and shelduck (Delany pers. comm.)).

5.11.5 Further sources of information

A. References cited

Cadbury, C.J., Green, R.E., & Allport, G. 1987. Redshanks and other breeding waders of British saltmarshes. *RSPB Conservation Review*, *1*: 37-40.

Davidson, N.C. 1991. Breeding waders on British estuarine wet grasslands. *Wader Study Group Bulletin, 61*, Supplement: 36-41.

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

Gibbons, D.W., Reid, J.B., & Chapman, R. 1993. *The new atlas of breeding birds in Britain and Ireland 1988-1991.* T. & A.D. Poyser, London.

Hodgson, S. 1992. Breeding survey of shelduck in Northumbria. *In: Birds in Northumbria,* ed. by I Kerr, 99-101. Newcastle-upon-Tyne, Northumberland and Tyneside Bird Club.

Hötker, H., *ed.* 1991. Waders breeding on wet grassland. *Wader Study Group Bulletin, 61*, Supplement.

Pienkowski, M.W. 1992. The impact of tourism on coastal breeding waders in western and southern Europe: an overview. *Wader Study Group Bulletin*, *68*: 92-96.

Pienkowski, M.W., & Pienkowski, A.E. 1989. Limitation by nesting habitat of the density of breeding ringed plovers *Charadrius hiaticula*: a natural experiment. *Wildfowl*, *40*: 115-126.

Prater, A.J. 1989. Ringed plover *Charadrius hiaticula* breeding population of the United Kingdom in 1984. *Bird Study, 36*: 154-159.

Pritchard, D.E., Housden, S.D., Mudge, G.P., Galbraith, C.A., & Pienkowski, M.W., *eds*. 1992. *Important bird areas in the UK including the Channel Islands and the Isle of Man.* Sandy, RSPB.

Sharrock J.T. 1976. *The atlas for breeding birds in Britain and Ireland*. British Trust for Ornithology and Irish Wildbird Conservancy. Bath, T. & A.D. Poyser.

B. Further reading

Allport, G., O'Brien, M., & Cadbury, C.J. 1986. Survey of redshank and other breeding birds on saltmarshes in Britain 1985. *Nature Conservancy Council, CSD Report,* No. 649.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Breeding atlas data	Head of Development Unit, British Trust for Ornithology, The Nunnery, Nunnery Place, Thetford, Norfolk IP24 2PU, tel: 01842 750050
Coastal breeding wildfowl data	*The Wildfowl & Wetlands Trust, Slimbridge, Gloucestershire GL2 7BT, tel: 01453 890333
Site designations	*Designations Team, EN HQ, Peterborough, tel: 01733 340345

* Starred contact addresses are given in full in the Appendix

5.11.6 Acknowledgements

Thanks are due to David Cole and George Boobyer (JNCC), and Simon Delany and WWT (for the use of unpublished shelduck data). We would also like to thank Colin Macduff-Duncan (Esso) for helpful comments, Tim Cleeves (RSPB) and Peter Cranswick (WWT).

5.12 Migrant and wintering waterfowl

D.A. Stroud & D.M. Craddock

5.12.1 Introduction

This section describes the importance of the region for waterfowl, defined as waders and wildfowl (divers, grebes, ducks, geese and swans together with coot *Fulica atra*). The importance of offshore areas for wintering divers, grebes, seaducks and cormorant *Phalacrocorax carbo* is outlined in section 5.10.

The wintering waterfowl species occurring vary from place to place and within sites, according to the types of habitat available. Much of the region's coastline is rocky, and most of the estuarine areas have been subject to extensive land claim. Sites in the region generally have little saltmarsh or grazing marsh close to intertidal areas, so numbers of grazing wildfowl are generally low compared with some other regions. Still, several of these areas have populations of national and international importance, and the region is important for wintering waterfowl in a UK and international context. Altogether this region holds in mid-winter about 62,000 waterfowl. Holy Island, Teesmouth and the Cleveland coast, and the Northumberland coast, are of international importance for their waterfowl populations.

For some non-breeding waterfowl species, sites in the region are amongst the most important in the UK, and for several the region holds a significant proportion of the total UK population, either in the migration periods or in winter. The rocky shoreline of the region is important for several wader species, although not all sections have been regularly monitored. Some stretches of the coastline are of international importance for a variety of waders. Densities of wintering shorebirds on non-estuarine coasts are among the highest on the east coast of Britain, and in Great Britain as a whole they are only exceeded in parts of east Scotland and Northern Ireland (Moser & Summers 1987). They are highest on the coasts of Cleveland and Tyne & Wear (Table 5.12.1).

Table 5.12.1 Overall densities of wintering waders on non-cliff, non-estuarine coasts in the region

	No. of species	*Total*	*Extent of habitat (km)*	*Extent of coast surveyed (km)*	*Birds/ km coast*
Northumberland	14	7,057	110.7	110.7	63.7
Tyne & Wear	10	2,290	27.7	25.7	89.1
Co. Durham	6	319	17.4	17.4	18.3
Cleveland	11	5,228	38.7	38.7	135.1
North Yorkshire	11	3,517	77.7	77.7	45.3

Source: Winter Shorebird Count (Moser & Summers 1987).

The coastline, especially of the estuaries, is important for migrant waterfowl in spring and autumn. The region lies on the major migratory flyway of the east Atlantic; many birds moving to and from wintering areas on the African, Mediterranean and south-west European coasts to arctic breeding grounds pass through and stage on the coast here, although species' use of the region differs. Conservation of these areas and their migrant waterfowl populations is therefore an international responsibility. The region can become more important in periods of severe cold weather elsewhere in Britain or Europe. Under these conditions, there may be major influxes of waterfowl, such as wigeon and teal, from other coastal regions or inland areas (Ridgill & Fox 1990). Locally, where parts of the estuarine systems freeze more slowly than other coastal and inland wetlands, some sites also act as cold weather refuges, providing open-water feeding when other sites are unavailable (Owen, Atkinson-Willes & Salmon 1986).

Table 5.12.2 gives the total January 1993 waterfowl count for this coastal region as a proportion of the totals (coastal) for England and Great Britain. Note that such comparisons can give only a rough approximation of relative regional importance, since the data are uncorrected for survey coverage - some areas and regions are better counted than others.

Table 5.12.2 Overall coastal waterfowl count of the region as a proportion of the total waterfowl count for England and Great Britain in January 1993

	Total count	*No. of sites*	*% of total in Region 5*
Coastal sites in Region 5	61,873	22	-
All counted English coastal sites	1,577,388	106	3.9%
All counted British coastal sites	2,060,961	214	3.0%

Data from Waters & Cranswick (1993) and Rose & Taylor (1993). Care should be taken in interpretation as count coverage varies from country to country and has not been corrected.

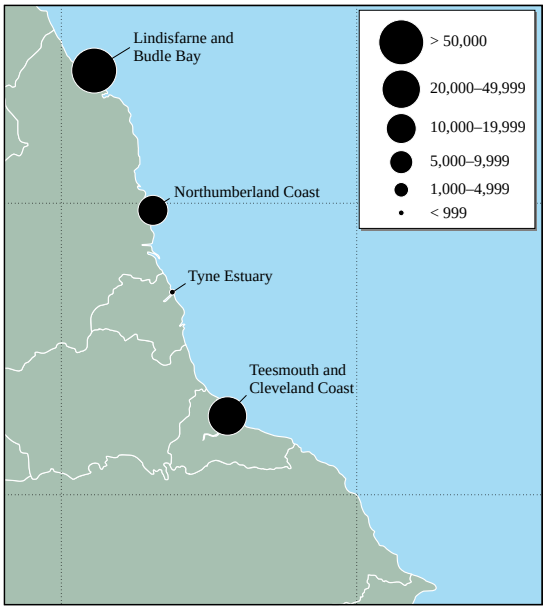
5.12.2 Important locations and species

The nature of the substrate determines which species occur on estuaries in the region. Sheltered muddy substrates (such as occur at Budle Bay) are especially attractive to dunlin, whilst sandier estuaries and embayments (such as at Holy Island) hold larger numbers of wigeon, brent geese, oystercatcher and curlew.

Those wader species occurring on non-estuarine coasts vary greatly with exposure and type of substrate (Moser & Summers 1987). These waders often roost on non-tidal areas at extreme high-tides, and the continued availability of such secure roosts close to the shore is important for them.

Ringing studies have shown that many wintering shorebird species (e.g. dunlin and grey plover *Pluvialis squatarola*) have complex patterns of movement within and between sites during the course of a winter, so individual sites cannot be considered in isolation (Davidson *et al.* 1991).

Overall, there are nine species that occur at levels of international importance on at least one estuary, and a further thirteen species (Table 5.12.3) that occur at levels of national (i.e. Great Britain) importance. Three coastal wetlands - Holy Island, Teesmouth/the Cleveland Coast, and the Northumberland Coast - are internationally important, both for their wintering waterfowl populations



Map 5.12.1 Distribution of main concentrations of wintering intertidal waterfowl. Size of circle proportional to 5-year mean of waterfowl numbers, from Waters & Cranswick (1993). Offshore sea-duck concentrations are not shown (see Fox & Roderick (1990); Kirby, Evans & Fox (1993) and section 5.10), nor are the distributions of those waterfowl, mainly waders, wintering on the non-estuarine coast (see Moser & Summers (1987)).

and because they hold over 20,000 waterfowl. Holy Island is particularly noteworthy for holding populations of six species at levels of international importance and nine at levels of national importance (Table 5.12.3). Of particular significance is the substantial proportion of the small and

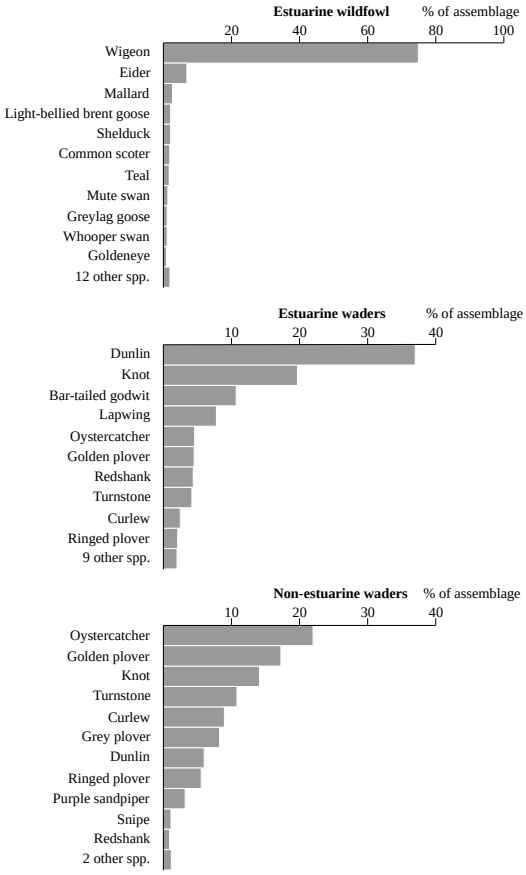


Fig 5.12.1 Relative species composition of non-breeding waterfowl assemblages on coastal areas of the region. Estuarine waterfowl data from Prater (1981), non-estuarine wader data from Moser & Summers (1987).

Table 5.12.3 Wintering waterfowl numbers on the region's estuaries and other coastal areas

	Protected status (SPA, (Ramsar)	*Five year mean numbers wintering waterfowl*	*1992/93 peak waterfowl numbers*	*1992/93 peak wildfowl numbers*	*1992/93 peak wader numbers*	*Species occurring at levels of national or international# importance*
Holy Island and Budle Bay	SPA & Ramsar	**50,710	45,283	14,873	30,410	Bar-tailed godwit#, redshank#, wigeon#, light-bellied brent goose#, ringed plover#, greylag goose#, cormorant, whooper swan, shelduck, grey plover, dunlin, eider, long-tailed duck, common scoter, red-breasted merganser
Teesmouth and Cleveland coast		**20,522	19,511	5,723	13,788	Knot#, redshank#, shelduck, teal, ringed plover, sanderling
Northumberland Coast (including the Tweed and Blyth Estuaries, Coquet and South Alnmouth)			19,993	800	11,993	Turnstone#, purple sandpiper#, goldeneye, sanderling. redshank, ringed plover, mute , swan, eider
Tyne Estuary		301	-	-	-	

Source: WeBS data from Waters & Cranswick (1993). See Waters & Cranswick (1993) for further detail on interpretation of counts and limitations of data. Protected status follows Pritchard *et al.* (1992). Key: ** - sites holding >20,000 waterfowl are of international importance by virtue of absolute numbers. Species occurring at levels of international importance are marked #. SPA = Special Protection Area, , Ramsar = site classified as internationally important under the Ramsar Convention. Notes: Estuaries are arranged in declining order of average waterfowl numbers for the period 1988/89 to 1992/93. Teesmouth and the Cleveland coast, and the Northumberland coast, are also of international importance for their birds but have not as yet been given SPA or Ramsar site status. The wildfowl and wader count figures include divers, grebes and cormorant. The winter season used by WeBS is November to March for waders, and September to March for wildfowl.

threatened population of Svalbard light-bellied brent goose *Branta bernicla hrota* that occurs at Holy Island, their only British wintering site. The precise numbers each year vary according to weather conditions in northern Denmark, the other major wintering area for this population (Madsen 1984; Madsen *et al.* in press).

Map 5.12.1 shows the main concentrations in the region of wintering intertidal waterfowl, and Figure 5.12.1 shows the relative proportions of species in non-breeding waterfowl assemblages in the region. At regularly counted estuaries, different wintering waterfowl assemblages occur, determined by habitat characteristics. Knot *Calidris canutus* are numerous on the Tees Estuary.

The rocky shoreline of Northumberland and Cleveland holds notable populations of turnstone *Arenaria interpres*, purple sandpiper *Calidris maritima*, ringed plover *Charadrius hiaticula*, redshank *Tringa totanus*, sanderling *Calidris alba* and golden plover *Pluvialis apricaria*. Large populations of grey plover and wigeon *Anas penelope* are found at Holy Island (the latter together with light-bellied brent geese feeding on extensive eel-grass *Zostera* spp. beds), although there has been a large decrease in the number of wigeon in recent years (Townshend & O'Connor 1993). Sandier estuaries and embayments (such as at Holy Island) hold larger numbers of wigeon, brent geese, oystercatcher *Haematopus ostralegus* and curlew *Numenius arquata*. Other regularly occurring non-breeding waterfowl include cormorant, teal *Anas crecca*, mallard *A. platyrhynchos*, shelduck *T. tadorna*, lapwing *V. vanellus* and bar-tailed godwit *Limosa lapponica*.

On non-estuarine shores oystercatcher is the most abundant wader species, followed in decreasing order of abundance by golden plover, knot, turnstone, curlew, grey plover, dunlin and ringed plover (Moser & Summers 1987).

5.12.3 Human activities

Wintering waterfowl are potentially affected, either directly or indirectly, by a wide range of human activities. Wildfowling occurs, especially in estuaries, although it is generally subject to good regulation. The impacts and regulation of wildfowling on NNRs have been reviewed by Owen (1992). Permit systems generally operate and there is close liaison in the regulation of wildfowling between local shooting clubs, the BASC and English Nature staff. Owen (1992) made a number of recommendations for the improvement of the operation of existing schemes to regulate shooting on NNRs. Townshend & O'Connor (1993) concluded that patterns of punt-gunning were having detrimental and disturbing effects on wintering wildfowl at Holy Island, in particular on the numbers of wigeon remaining on the site over-winter. They made practical recommendations for the modification of shooting practice, which have now been put into effect.

Cumulative loss of feeding habitat through incremental land claim (as has occurred on a large scale on the Tees estuary and elsewhere in the region) and barrage schemes has the potential to affect waterfowl populations further, although at important sites SSSI designation can limit land claim. Coastal windfarm developments in sensitive areas also have the potential to be highly disruptive to wintering waterfowl (as reviewed by Crockford 1992).

Bait digging and shellfish collection from intertidal sediments, as well as other recreational activities, are potentially disruptive and may prevent waterfowl using feeding areas. The significance of these activities varies not only from site to site (in relation to the intensity of the activity and the size/topography of the site) but also with the time of year. Especially in cold periods, wintering waterfowl need to feed almost continuously in order to survive (Davidson & Rothwell 1993 and papers therein). Research is needed on the extent of disturbance caused by these activities and its significance for waterfowl population, in order to ensure that coastal management planning can best minimise negative impacts. Townshend & O'Connor (1993) have reviewed the effects of disturbance by bait digging at Holy Island and nearby Budle Bay, demonstrating the significant detrimental effects it can have on populations of waterfowl. At Budle Bay, the effects of intensive bait-digging have been worsened by the patterns of wildfowling at Holy Island.

Oil pollution is well known as a serious potential threat to wintering waterfowl in areas where high densities of birds occur.

5.12.4 Information sources used

As with other areas of the UK, migrant and wintering waterfowl are well surveyed by the Wetland Bird Survey (WeBS - organised by the British Trust for Ornithology, the Wildfowl & Wetlands Trust, the Royal Society for the Protection of Birds and the JNCC). This volunteer-based survey collates monthly counts from coastal and inland wetlands through the UK. Coastal coverage is generally good for estuaries, although the open coast is not thoroughly surveyed on an annual basis (Waters & Cranswick 1993). The WeBS waterfowl count scheme publishes an extensive annual summary report, the most recent being Waters & Cranswick (1993), covering the winter season 1992/93. This report summarises species trends, based on counts at wetlands throughout the UK. It also tabulates counts of total waterfowl numbers at all counted estuaries. It is the primary source of information on wintering and migrant waterfowl in the UK. Copies are available from either of the WeBS National Organisers listed in section 5.12.5. The annual report can only summarise what are very detailed data, and in summary form such counts may be subject to misinterpretation for a number of reasons. Detailed count data for sites can be provided by WeBS, and inspection of these data is recommended for any planning-related activity. WeBS counts are generally undertaken at high tide, when waterfowl gather in high densities on traditional roosting areas. To complement this information, at selected estuaries WeBS organises low-tide counts to give information on the feeding distributions of waterfowl during the intertidal period. In this region counts are available for part of Lindisfarne and for the Blyth estuary.

The whole UK coastline was surveyed for wintering waders during the Winter Shorebird Count of 1984/85 (Moser & Summers 1987), and there are current WeBS plans for a repeat national survey, possibly in 1995/96. Such information on the wintering waterfowl of the non-estuarine shore is important to place annual estuaries counts into a wider perspective.

Although now becoming slightly dated, Owen,

Atkinson-Willes & Salmon (1986) give a thorough and comprehensive account of the wildfowl and wetlands of the region, summarising data available up to the mid-1980s. The volume is an invaluable source of initial information on sites and species, although this should now be supplemented by more recent count information available from WeBS and Davidson *et al.* (1991).

Prater (1981) gives useful descriptive accounts of the birds of British estuaries, as well as placing these in a wider national and international context, using data from the period 1969-1975. As in Owen, Atkinson-Willes & Salmon (1986), much of the numerical information is dated and the site accounts should be supplemented by the more recent reviews of Davidson *et al.* (1991).

For sites of international importance (either proposed or designated), *Important bird areas in the UK,* jointly published by RSPB and the country nature conservation agencies (Pritchard *et al.* 1992), provides further information. Data on the important bird populations of each site are summarised, together with summary information on location and habitats.

There have been a number of more detailed studies of the wintering waterfowl of Holy Island (e.g. Townshend & O'Connor 1993).

5.12.5 Further sources of information

A. References cited

Crockford, N.J. 1992. A review of the possible impacts of wind farms on birds and other wildlife. *JNCC Report,* No. 27. Peterborough, Joint Nature Conservation Committee.

Davidson, N.C., & Rothwell, P.I. 1993. Disturbance to waterfowl on estuaries: the conservation and coastal management implications of current knowledge. *Wader Study Group Bulletin, 68:* 97-105.

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

Kirby, J.S., Evans, R.J., & Fox, A.D. 1993. Wintering seaducks in Britain and Ireland: populations, threats, conservation and research priorities. *Aquatic conservation: marine and freshwater ecosystems, 3:* 105-137.

Madsen, J. 1984. Status of the Svalbard population of light-bellied brent goose *Branta bernicla hrota* wintering in Denmark 1980-1983. *Norsk Polarinstitut Skrifter, 181:* 119-124.

Madsen, J., Clausen, P., Percival, S & O'Connor, D. In press. Population development and changes in winter sites use by Svalbard light-bellied brent goose, 1982-1994. *Biological Conservation.*

Moser, M., & Summers, R.W. 1987. Wader populations on the non-estuarine coasts of Britain and Northern Ireland: results of the 1984-85 Winter Shorebird Count. *Bird Study, 34:* 71-81.

Owen, M. 1992. An analysis of permit systems and bag records on NNRs. *JNCC Report,* No. 68. Peterborough, Joint Nature Conservation Committee.

Owen, M., Atkinson-Willes, G.L., & Salmon, D.G. 1986. *Wildfowl in Great Britain.* 2nd ed. Cambridge University Press.

Prater, A.J. 1981. *Estuary birds in Britain and Ireland.* Calton, Poyser.

Pritchard, D.E., Housden, S.D., Mudge, G.P., Galbraith, C.A., & Pienkowski, M.W, *eds.* 1992. *Important bird areas in the UK including the Channel Islands and the Isle of Man.* Sandy, RSPB.

Ridgill, S.C., & Fox, A.D. 1990. *Cold weather movements of waterfowl in western Europe.* Slimbridge, IWRB. (IWRB Special Publication No. 13.)

Rose, P.M., & Taylor, V. 1993. *Western Palearctic and south west Asia waterfowl census 1993. Mid-winter waterfowl counts, January 1993.* Slimbridge, IWRB.

Townshend, D.J., & O'Connor, D.A. 1993. Some effects of disturbance to waterfowl from bait-digging and wildfowling at Lindisfarne National Nature Reserve, north-east England. *Wader Study Group Bulletin, 68:* 47-52.

Waters, R.J., & Cranswick, P.A. 1993. *The wetland bird survey 1992-1993: wildfowl and wader counts.* Slimbridge, BTO/WWT/RSPB/JNCC.

B. Further reading

Anderson, N. 1989. *A report on the numbers and distribution of waders and wildfowl on the Northumberland coast.* Peterborough, unpublished report to the Nature Conservancy Council.

Fox, A.D., Bell, M.C., Brown, R.A., Mackie, P., & Madsen, J. 1994. An analysis of the abundance and distribution of Brent Geese and Wigeon at Strangford Lough 1965/66 to 1988/89. *Irish Birds, 5:* 139-150.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
High tide and low tide counts of wintering and migrant wildfowl (WeBS)	*Peter Cranswick, WeBS National Organiser (Wildfowl), The Wildfowl & Wetlands Trust, Slimbridge, tel: 01453 890333
High tide counts of wintering and migrant waders (WeBS)	Ray Waters, WeBS National Organiser, (Waders), The British Trust for Ornithology, The Nunnery, Nunnery Place, Thetford, Norfolk IP24 2PU, tel: 01842 750050
Low tide counts of wintering and migrant waders (WeBS)	Julianne Evans, WeBS National Organiser (Low Tide Counts), The British Trust for Ornithology, as above
Local counts	*Reserves Manager, Northumberland Wildlife Trust, Newcastle upon Tyne, tel: 0191 2846884
Lindisfarne ecosystem studies	Dr Steven Percival, Northumbrian Water Ecology Centre, The Science Complex, University of Sunderland, Sunderland SR1 3SD, tel: 0191 515 2533
Teesmouth and Lindisfarne ecosystem studies	Prof. Peter Evans, Dept. of Biological Sciences, University of Durham, South Road, Durham DH1 3LE, tel: 0191 374 3357
Site designations	*Designations Team, EN HQ, Peterborough, tel: 01733 340345

* Starred contact addresses are given in full in the Appendix

5.12.6 Acknowledgements

Thanks to Simon Delany at WWT for providing unpublished shelduck data, and to Peter Cranswick (WWT) and Tim Cleeves (RSPB) for their comments.

5.13 Land mammals

Dr C.E. Turtle

5.13.1 Introduction

This section covers mammals that occur in the coastal 10 km squares in the region, concentrating on those that are truly coastal, such as otters *Lutra lutra*, and those that occur on the coast for reasons of shelter and foraging, such as the greater horseshoe bat *Rhinolophus ferrumequinum*. Other mammals - common and widespread throughout Britain, feral or recently introduced - have not been considered.

There are no reliable estimates of the numbers of mammals in the region or Britain that could be used to quantify the resource. However, existing data confirm the presence of several important species. Using data from Arnold (1993) (although these records are incidental rather than comprehensive), an estimate has been made of the frequency of their occurrence in the region. The region supports relatively few nationally important species, and those that do occur are absent from large areas of the region. The otter is associated with semi-aquatic areas, including rivers, lakes and coasts, and is the land mammal that uses coastal areas most frequently. The otter is classed as endangered and is absent from many areas of England (Morris 1993). The otter, red squirrel *Sciurus vulgaris* and five species of bats - Brandt's *Myotis brandtii*, Natterer's *M. nattereri*, noctule *Nyctalus noctula*, pipistrelle *Pipistrellus pipistrellus* and brown long-eared *Plecotus auritus* - are recorded from the coast, although there is little evidence that there are still significant numbers of otters in the area (Strachan *et al*. 1990). This may be due to the lack of coastal surveys.

All British bats, the otter and the red squirrel are listed under Schedule 5 of the Wildlife & Countryside Act and Annex II of the Bern Convention (except for the red squirrel, which is on Annex III). Table 5.13.1 lists records of distribution of protected species in the region.

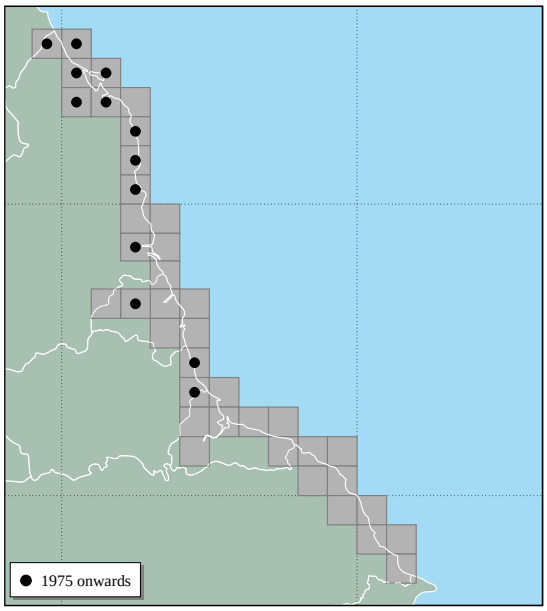
Table 5.13.1 Recorded distribution of protected species

Protected species	*Estimate of importance in region*
Brandt's bat	Rare
Natterer's bat	Rare
Noctule	Rare
Pipistrelle	Frequent
Brown long-eared bat	Rare
Red squirrel	Common in Northumberland; rare elsewhere
Otter	Occasional

Source: Arnold (1993)

5.13.2 Important locations and species

There were no coastal records of otters in this region during the 1984-1986 survey of England and Wales (Strachan *et al.* 1990). However, not all squares were covered, and Arnold (1993) reports several records since 1975 from north of Newcastle upon Tyne. Otters are thought to occur on all Northumberland's rivers and on most of the coastal streams



Map 5.13.1 Recorded coastal distribution of red squirrels by coastal 10 km square. Source: Arnold (1993).

and there is evidence that the coast may be important in their movement between sites. A recent survey (in November 1994) indicated that otters are using the coast between Berwick and Bamburgh, and signs have been found at Budle Bay and the mouth of the South Low. There are occasional anecdotal reports of otters on Holy Island, and streams in Northumberland may be used to some extent (Northumberland Wildlife Trust pers. comm.). County Durham has not been thoroughly surveyed.

All five species of bats recorded from this area are classed as vulnerable in Europe (Stebbings & Griffith 1986). Only the pipistrelle is recorded frequently, whilst the rest are rare. The record for Brandt's is the most northerly coastal record for Britain. The national bat habitat survey (Walsh & Harris in prep.) included coastal habitats and demonstrates that bats use the coast for foraging, where there is suitable habitat with shelter and flightlines to foraging areas. The Bat Sites Register, held by English Nature, may help locate important coastal sites.

The red squirrel is extinct over much of England and Wales and has a patchy distribution (Morris 1993). It is absent from much of the region (Map 5.13.1), although there are several records on the Northumberland coast, centred around Howick (Arnold 1993). The national survey of 1991 conducted by Timber Growers UK (TGUK) suggests that red squirrels are often associated with forestry plantations rather than coastal woodland. However red squirrels maintain populations in all the coastal denes (wooded valleys) in County Durham, and compete with grey squirrels in some places (Durham Wildlife Trust pers. comm.).

5.13.3 Human activities

Considerable stretches of the coast are heavily industrialised and tend to have poor water quality: this is reflected in the absence of mammal records, particularly of otters. The waters of the Wear and Tees are Class 2 at the coast and 3 and 4 in some stretches (NRA 1991). This would prevent otters recolonising as there would be few food resources and the water pollution can directly cause mortality. Any further declines in water quality would be detrimental. Any increasing loss of semi-natural habitat, such as by hedgerow removal or woodland clearance, will be detrimental to bats, and this may be significant on the coastline, where bats are recorded at present. The control of grey squirrels in coastal woodlands, where red squirrels occur at present, is necessary to prevent the decline in the red squirrel population.

5.13.4 Information sources used

There have been no specifically coastal mammal surveys within this region, and therefore even the nationally comprehensive surveys, such as for otters, do not cover all 10 km squares and so are of limited use for assessing the importance of the coastal areas. As a general observation (Morris 1993), mammal surveys are not recorded with the same intensity as botanical ones, and the occurrence of mammals within 10 km squares is not enough to establish the status of species.

There have been no comprehensive surveys for any of the bats, and there are currently insufficient data to establish the importance of bat species in the region. It is probable that more species than those listed in Table 5.13.1 do occur and that the absence of records is due to under-recording. There was a red squirrel survey in 1991 (TGUK 1992), which was based on questionnaires sent to all TGUK members.

5.13.5 Further sources of information

A. References cited

Arnold, H.R. 1993. *Atlas of mammals in Britain.* London, HMSO. (ITE Research Publication, No. 6.)

Morris, P.A. 1993. *A red data book for British mammals.* London, The Mammal Society.

National Rivers Authority. 1991. *The quality of rivers, canals and estuaries in England and Wales: report of the 1990 survey.* Bristol, National Rivers Authority. (Water Quality Series, No 4.)

Stebbings, R.E., & Griffith, F. 1986. *Distribution and status of bats in Europe*. Huntingdon, Institute of Terrestrial Ecology.

Strachan, R., Birks, J.D.S., Chanin, P.R.F., & Jefferies, D.J. 1990. *Otter survey of England, 1984-1986*. Peterborough, Nature Conservancy Council.

Timber Growers UK. 1992. *Survey of squirrels in Britain.* Farnham, Forestry Authority.

Walsh, A., & Harris, S. In prep. *Bat habitats survey.* Peterborough, Joint Nature Conservation Committee.

B. Further reading

Baker, J.R. 1981. Otter mortality and marine pollution. *Biological Conservation 20*: 311-321

Bright, P.W., Mitchell, P., & Morris, P.A. 1994. Dormouse distribution: survey techniques, insular ecology and selection of sites for conservation. *Journal of Applied Ecology, 31:* 329-339.

Chanin, P.R.F. 1985. *The natural history of otters.* London, Croom Helm.

Corbet, G.B., & Harris, S.H., *eds.* 1991. *The handbook of British Mammals*. 3rd ed. Oxford, Blackwell Scientific Publications.

Crawford, A.K., Evans, D., Jones, A., & McNulty, J. 1979. *Otter survey of Wales 1977-78.* Nettleham, Lincoln, Society for the Promotion of Nature Conservation.

Cresswell, P., Harris, S., & Jefferies, D.J. 1990. *The history, distribution, status and habitat requirements of the badger in Britain.* Peterborough, Nature Conservancy Council.

Hurrell, E., & McIntosh, G. 1984. Mammal Society dormouse survey, January 1975 - April 1979. *Mammal Review, 14:* 1-18.

Jefferies, D.J. 1989. The changing otter population of Britain 1700 -1989. *Linnean Society: Biological Journal, 38*: 61-69

MacDonald, S.M., & Mason, C.F. 1983. Some factors influencing the distribution of otters *Lutra lutra*. *Mammal Review, 13:* 1-10.

MacDonald, S. M. 1983. The status of the otter *Lutra lutra* in the British Isles. *Mammal Review, 13:* 11-23.

Neal, E. 1986. *The natural history of badgers*. London, Croom Helm.

Schober, W., & Grimmberger, E. 1987. *A guide to bats of Britain and Europe*. London, Hamlyn.

Strachan, R., & Jefferies, D.J. 1990. *The water vole* Arvicola terrestris *in Britain 1989-90: its distribution and changing status.* Peterborough, Vincent Wildlife Trust/Joint Nature Conservation Committee.

Stebbings, R.E. 1988. *Conservation of European bats*. London, Christopher Helm.

Velander, K. A. 1983. *Pine marten survey of Scotland, England and Wales 1980-1982.* London, The Vincent Wildlife Trust.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Local site and species information	*Mammal Ecologist, EN HQ, Peterborough, tel: 01733 340345
Local site and species information	*Conservation Officer, Northumberland Wildlife Trust, Newcastle upon Tyne, tel: 0191 284 6884
Bats	Northumberland Bat Group, 16 Manor Drive, Benton, Newcastle upon Tyne NE7 7XN, tel: 0191 266 2485
Bats	Durham Bat Group, 5 Rose Terrace, Waterhouses, Durham DH7 9BB, tel: 01388 730606
Otters	*National Rivers Authority, Newcastle-on-Tyne, tel: 0191 213 0266
General mammal information	The Mammal Society, Unit 15, Cloisters House, Cloisters Business Centre, 8 Battersea Park Road, London SW8 4BG, tel: 0171 498 4358
General mammal information	*Institute of Terrestrial Ecology, Monks Wood, tel: 01487 773381

* Starred contact addresses are given in full in the Appendix

5.13.6 Acknowledgements

The author thanks all those people cited in the text for contributing information and time.

5.14 Seals

C.D. Duck

5.14.1 Introduction

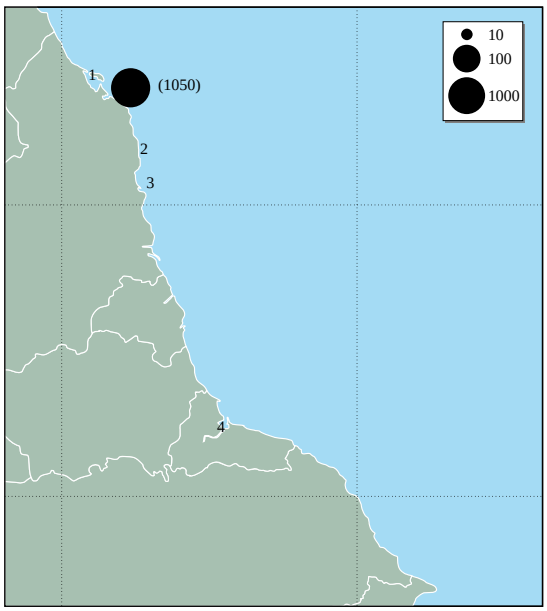
Grey seals *Halichoerus grypus* can be seen regularly throughout the region, and there is a major breeding colony on the Farne Islands. Outside the breeding season, the numbers of grey seals at haul-out sites are unpredictable and can vary greatly from day to day. For this reason and for comparability with regions elsewhere in GB, the information supplied here refers mainly to grey seal numbers and distribution during the breeding season. Common seals *Phoca vitulina* are not abundant in this region. There are only two established colonies: a very small one on Holy Island Sands and a slightly larger one in the mouth of the River Tees. Table 5.14.1 shows the importance of common and grey seals in the region and in Great Britain.

5.14.2 Important locations

The Farne Islands grey seal colony is the biggest in England. The distribution of grey seal breeding and haul-out sites in the region is shown on Map 5.14.1. Important non-breeding haul-out sites are indicated as numbers (see Table 5.14.2). Teesmouth NNR covers most of the haul-out sites in the vicinity presently designated as SSSIs.

Common seals have recently recolonised the highly industrialised Tees estuary site after an absence of approximately 100 years. Single pups were born here in 1989, 1991 and 1993, but all died within a few days of birth (Wilson 1994). However, in June 1994 two pups were born and both are known to have survived at least until after weaning (S. Wilson, J. Lacey & D. Muir pers. comm.). Common seals can occasionally be seen on the Farne Islands and less frequently elsewhere along the coast. The distribution of common seals in the region in August is shown on Map 5.14.2 (see Table 5.14.3).

Common and grey seals tend to haul-out on sandbanks at Holy Island, on rocky shores at the Farnes and other coastal sites, and on mudflats in the Tees Estuary. Up to 24 grey seals have been recorded hauled-out at the Tees Estuary at any one time.



Map 5.14.1 Grey seal pup production. Circle represents the numbers of pups born along the section of coast. Figures refer to locations in Table 5.14.2. Data from SMRU, National Trust, English Nature, Tees Seal Research Programme, RSPB.

5.14.3 Human activities

The Farne Islands grey seal colony is an important tourist attraction with numerous tour boats operating out of Seahouses. The region is very popular with sub-aqua divers, partly owing to the opportunities for swimming underwater with seals. The Sea Mammal Research Unit (SMRU) use seals at the Farne Islands to study aspects of grey seal diet, foraging ecology and movement of individuals between haul-out sites, and to estimate the size of the North Sea population. Grey seals are dissuaded from breeding on some of the Farne Islands in order to conserve important vegetation communities and seabird breeding habitat. In addition, during the breeding season, the National Trust are licensed to "humanely destroy any pup

Table 5.14.1 The importance of common and grey seals in the region in relation to the rest of GB

County	*Common seals*		*Grey seals*		
	No. of seals	*% of GB total*	*Pup production (to nearest 50)*	*% of GB total*	*Associated population > = 1 year old (to nearest 100)*
Northumberland	12	0.04	1,050	3.1	3,600
Tyne & Wear	0	0	0	0	0
Durham	0	0	0	0	0
Cleveland	35	0.2	0	0	0
North Yorkshire	0	0	0	0	0
Region 5	50*	0.2	1,050	3.1	3,600
England	1,900*	6.7	1,400	4.1	4,800
GB total	***28,350****		***33,850***		***115,000***

Sources: Sea Mammal Research Unit (SMRU), National Trust, Lincolnshire Trust for Nature Conservation, Tees Seal Research Programme, English Nature. Key: * indicates figure given to the nearest 50.

Table 5.14.2 Grey seal pup production and important haul-out sites in the region

	Grid ref.	*No. of pups born*	*% of region total*
Breeding site			
Farne Islands	NU240380	1,050	100
Other main haul-out sites			
1 Holy Island	NU105415	0	
2 Boulmer Steel	NU272154	0	
3 Coquet Island	NU293046	0	
4 Tees Estuary	NZ530260	0	

Sources: SMRU, National Trust, English Nature, Tees Seal Research Programme, RSPB.

Table 5.14.3 Common seals in Region 5

Location	*Grid ref.*	*No. of seals*	*% of region total*
Holy Island Sands	NU105415	12	26
Tees Estuary	NZ530260	35	74

Sources: SMRU, Tees Seal Research Programme, English Nature

so seriously diseased or in such a condition that to kill it would be an act of mercy". No adult seals have been taken under licence since 1984.

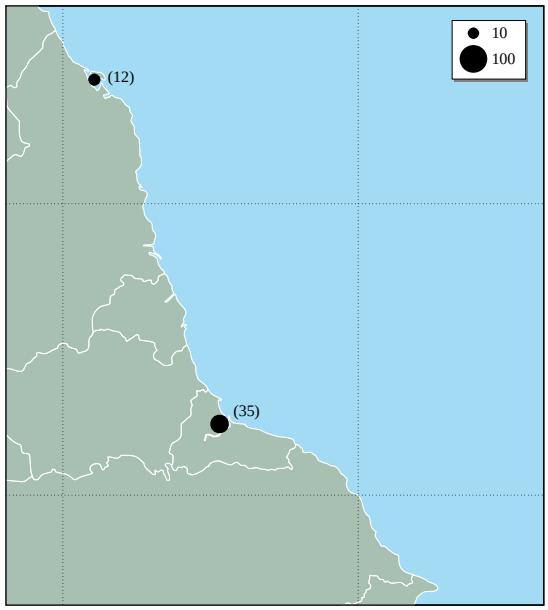
There are continuous interactions between seals and the inshore fixed salmon netting and river angling industries. Fishermen are entitled to shoot seals in the vicinity of fixed nets, and this right is frequently exercised.

The haul-out sites used by seals in the Tees estuary are adjacent to a major port and industrial centre. The Tees Seal Research Programme is examining factors, including pollution, that may be affecting the reproductive performance of common seals here and their recolonisation of the estuary.

Under the Conservation of Seals (England) Order 1993, the closed season for both species has been extended, within the territorial limits (12 nautical miles) of the region, throughout the year until 19 December 1996.

5.14.4 Information sources used

The seal colonies at the Farne Islands, Holy Island and the Tees estuary are regularly surveyed. At the Farne Islands, grey seal breeding biology and foraging ecology have been studied for approximately 40 years (Hickling 1962; Coulson & Hickling 1964; McConnell *et al.* 1992). Surveys are conducted during the autumn breeding season, and pup production figures are used to derive estimates of total population size. The National Trust annually monitor grey seal pup production by ground counting newborn pups throughout the breeding season (Hawkey 1991). Common seals are surveyed at the Farne Islands during their annual moult, in August, when the greatest and most consistent numbers haul-out, rather than during their June breeding season. On the Tees estuary, the Industry Nature Conservation Association (INCA) coordinates the continuous monitoring of numbers, behaviour and breeding performance of seals (Wilson 1994). The Holy Island and



Map 5.14.2 Distribution of common seals in the region in August. Circles represent the numbers of seals at each location (see Table 5.14.3). Data from SMRU, Tees Seal Research Programme, English Nature

Tees estuary sites were included in SMRU's common seal aerial survey programme in August 1994. The RSPB monitors the numbers of grey seals on Coquet Island during the summer months.

5.14.5 Further sources of information

A. References cited

Coulson, J.C., & Hickling, G. 1964. The breeding biology of the grey seal, *Halichoerus grypus* (Fab.), on the Farne Islands, Northumberland. *Journal of Animal Ecology, 33*: 485-512.

Hawkey, P. 1991. The grey seal, *Halichoerus grypus*, at the Farne Islands 1986-1989. *Transactions of the Natural History Society of Northumberland, 5*: 263-273.

Hickling, G. 1962. *Grey seals and the Farne Islands*. London, Routledge & Kegan Paul.

McConnell, B.J., Chambers, C., Nicholas, K.S., & Fedak, M. 1992. Satellite tracking of grey seals *Halichoerus grypus*. *Journal of Zoology, London, 226*: 271-282.

Wilson, S. 1994. *The Tees seals programme. Monitoring Report No. 5 (Jan 1989 - Nov 1993).* Unpublished report to Teesside Development Corporation and Cleveland INCA.

B. Further reading

McGillivray, D. 1995. Seal conservation legislation in the UK: past, present and future. *International Journal of Marine and Coastal Law, 10:* 19-52

Gubbay, S. 1988. *A coastal directory for marine nature conservation.* Ross-on-Wye, Marine Conservation Society.

Hickling, G. 1983. The grey seals of the Farnes. *Porcupine Newsletter, 2:* 222-224.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Seals around Holy Island	The Warden, English Nature, Beal Station, Beal, Berwick-upon Tweed TD15 2SP, tel: 01289 381470
Seals at the Farne Islands	The Warden, The National Trust, 8 St Aidans, Seahouses, Northumberland NE68 7SR, tel: 01670 774691
Seals in the Tees Estuary	Tees Seal Research Programme, c/o Industry Nature Conservation Association, 1 Belasis Court, Belasis Hall Technology Park, Billingham, Cleveland TS23 4AZ, tel: 01642 370319
General information	*Northumberland Wildlife Trust, Newcastle-upon-Tyne, tel: 0191 2846884
Seal rescue and rehabilitation	The Bird and Animal Sanctuary (Creature Care), North Farm Cottage, Throckley, Newcastle-upon-Tyne NE15 9RE
Information on seal numbers and distribution around GB	Sea Mammal Research Unit, High Cross, Madingley Road, Cambridge CB3 0ET, tel: 01223 311354
Licenses to kill seals	E Division, Home Office, Queen Anne's Gate, London SW1H 9AT, tel: 0171 273 3000

* Starred contact addresses are given in full in the Appendix

5.14.6 Acknowledgements

The information for this region was derived from data collected by the National Trust (Farne Islands), Tees Seal Research Programme and SMRU. Thanks for these data and for additional information to: John Walton (NT), Rob Lidstone-Scott (RSPB), Andrew Bielinski (Northumberland Wildlife Trust), Phil Davey (English Nature), Jane Lacey and Dave Muir (INCA), Ailsa Hall and Dave Thompson (SMRU), and Catriona Porteous and Sue Wilson (Tees Seal Research Programme).

5.15 Whales, dolphins and porpoises

Dr P.G.H. Evans

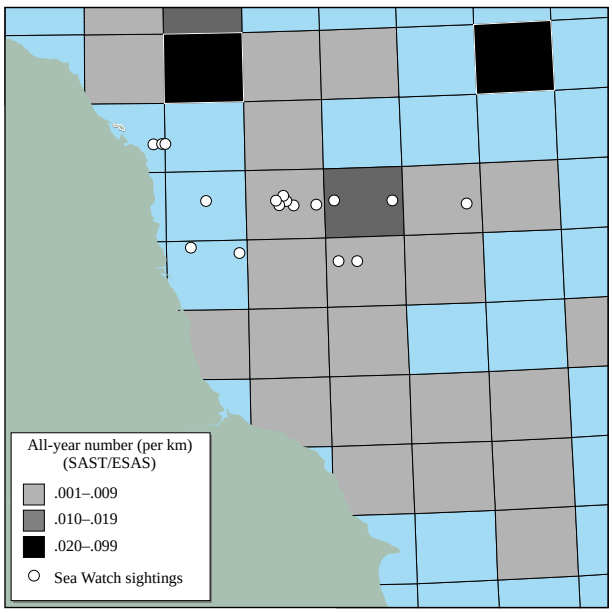
5.15.1 Introduction

The cetacean fauna increases progressively northwards in the North Sea both in numbers of animals and diversity of species. The coastal waters of the region, lying as they do adjacent to the central North Sea, are moderately rich. Twelve species of cetaceans (whales, dolphins and porpoises) have been recorded since 1980 along the coasts or in nearshore waters (within 60 km of the coast) of the region (see Table 5.15.1). Of these, five species (just under 20% of the 26 UK species) are either present throughout the year or are recorded annually as seasonal visitors to the region. One of these, the harbour porpoise, is listed in Annex II of the EC Habitats Directive as a species whose conservation requires the designation of Special Areas of Conservation.

5.15.2 Important locations

The commonest species in nearshore waters are the harbour porpoise *Phocoena phocoena* and white-beaked dolphin *Lagenorhynchus albirostris*, followed by minke whale *Balaenoptera acutorostrata*, with white-sided dolphins *Lagenorhynchus acutus* and killer whales *Orcinus orca* recorded occasionally, mainly further offshore. Other cetacean species recorded in the region include fin whale *Balaenoptera physalus*, humpback whale *Megaptera novaeangliae*, sperm whale *Physeter macrocephalus*, beluga *Delphinapterus leucas*, common dolphin *Delphinus delphis*, bottlenose dolphin *Tursiops truncatus*, and long-finned pilot whale *Globicephala melas*. Between 1986 and 1991, a sociable bottlenose dolphin, nick-named 'Freddie', was resident in the vicinity of Amble, Northumberland. Maps 5.15.1, 5.15.2 and 5.15.3 show the locations of sightings in the region in summer 1992 of, respectively, minke whale, harbour porpoise and white-beaked dolphin. For geographical comparisons of sightings rates for various cetacean species in UK waters, see Evans (1990, 1992) and Northridge *et al.* (1995).

In coastal waters around the Farnes and Holy Island (Northumberland), harbour porpoises are reported throughout the year, but with peak numbers in April and between July and November. Killer whales are occasionally



Map 5.15.1 Minke whales: all-year number sighted per kilometre of Seabirds at Sea survey (source: JNCC: SAST/ESAS); and sightings reported to the Sea Watch sighting system (source: Evans (1992)).

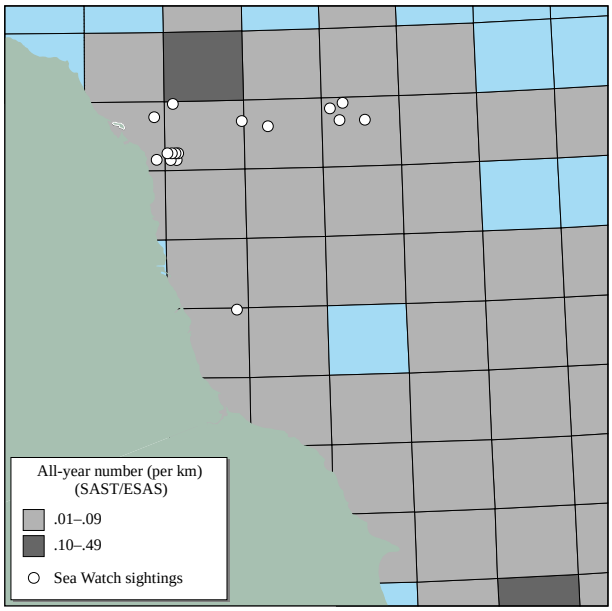
recorded here between June and August, and white-beaked dolphins between July and September. Minke whales, harbour porpoises, white-beaked dolphins and white-sided dolphins have all been recorded in offshore waters in the vicinity of the Farne Deeps, mainly between July and September. Harbour porpoises and white-beaked dolphins have been recorded regularly in the vicinity of the Dogger Bank, mainly between July and November.

5.15.3 Human activities

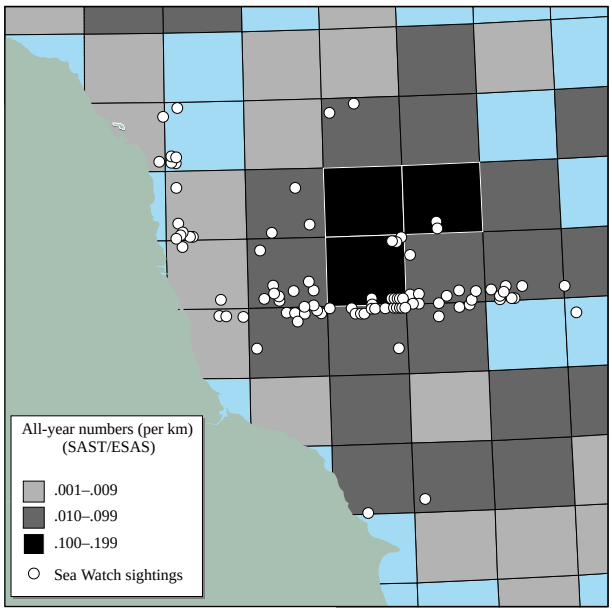
ASCOBANS (Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas) is an international agreement between countries bordering the North and Baltic Seas, with the aim of promoting the conservation of small cetaceans. It was ratified by the UK in 1993. Participating states agree to cooperate on issues including

Table 5.15.1 Table of cetacean species recorded in the region since 1980

Species	*Status, distribution and seasonal occurrence*
Minke whale *Balaenoptera acutorostrata*	Recorded in small numbers along the Northumberland coast and offshore, mainly between June and Sept.
Harbour porpoise *Phocoena phocoena*	Occurs in small numbers in nearshore waters mainly off the Northumberland coast, with peak numbers in April and July - Nov.
White-sided dolphin *Lagenorhynchus acutus*	Deep water species recorded mainly more than 10 km from the coast; most nearshore sightings NE of Flamborough Head, generally between July and September.
White-beaked dolphin *Lagenorhynchus albirostris*	The commonest dolphin in the region, but occurring mainly offshore. Peak numbers and frequency of sightings between June and September (particularly August).
Killer whale *Orcinus orca*	Recorded most years around the Farne Islands between June and September, and occasionally offshore.



Map 5.15.2 Harbour porpoises: all-year number sighted per kilometre of Seabirds at Sea survey (source: JNCC: SAST/ESAS); and sightings reported to the Sea Watch sighting system (source: Evans (1992)).



Map 5.15.3 White-beaked dolphins: all-year number sighted per kilometre of Seabirds at Sea survey (source: JNCC: SAST/ESAS); plus sightings reported to the Sea Watch sighting system (source: Evans (1992))

national legislation and research into, for example, cetacean population sizes and the effects of fishing (see below).

Cetaceans in the region face three potential pressures from human activities: conflicts with fisheries (either by competition for a common food resource, or accidental capture in fishing gear), habitat degradation (mainly by pollution) and disturbance (from underwater sounds). There have been several reports from the region of small cetaceans (harbour porpoises, white-beaked and white-sided dolphins) being killed accidentally in fishing gear, mainly involving salmon drift nets and Dutch midwater trawls for herring, but also purse seines and longliners, although actual figures on catch levels were not available (Northridge 1988).

Contaminant levels in cetaceans from the region are generally low. Mean total PCB (25 congeners) levels of 32 harbour porpoises sampled from the east coast of England (Kent to Northumberland) from 1988 to 1992 amounted to 19 ppm (Kuiken *et al.* 1994).

Recreational activities (speedboats, jet skis, etc.) near resorts such as Amble, Whitby and Scarborough pose threats of direct physical damage from collisions and disturbance from the high frequency (>1 kHz) noise they generate (Evans *et al.* 1992). Other underwater sounds from seismic activities (as part of oil and gas exploration in the North Sea) involve lower frequencies, and are therefore most likely to affect baleen whales, which communicate primarily at these frequencies (20-500 Hz), although it is possible that porpoises are also affected (Baines 1993), perhaps indirectly by changing the distribution of their fish prey (Evans, 1995). Heavy shipping may also disturb cetaceans. Most of the sound produced by vessels with large engines is at frequencies below 1 kHz, thus also overlapping more with baleen whales than with dolphins and porpoises (Evans 1987). However, even those vessels can generate high frequency sound that overlaps the frequencies (i.e. 1-150 kHz) used by small odontocetes (toothed whales), particularly if their propellors are damaged, and negative responses (vessel avoidance and increased dive times) to such sounds by both bottlenose dolphins and harbour porpoises have been reported by Evans *et al.* (1992, 1994). The sociable bottlenose dolphin, nicknamed Freddie, which resided in Amble Harbour for several years, was eventually badly injured by a boat's propellor, and this may have led to its subsequent death.

5.15.4 Information sources used

Information on cetacean status and distribution comes primarily from the national sightings database (1973 - present) maintained by the Sea Watch Foundation (SWF) (Evans 1992) and the strandings scheme organised by the Natural History Museum in London (1913 - present) (Sheldrick *et al.* 1994). Systematic land-based watches have been carried out by the wardens of the Farne Islands, Holy Island and Coquet Island. Offshore effort-related data have been collected as part of seabird surveys of the North Sea by JNCC's Seabirds at Sea team (see section 5.10.4), together with other vessels, mainly between 1979 and 1986 (Northridge *et al.* 1995). Coverage is generally better in nearshore waters than offshore. Regular watching along the ferry route from Newcastle east across the North Sea results in a concentration of sightings there. Effort generally has been highest between the months of April and September when sea conditions are also usually best. For map presentation, Sea Watch sightings (dots) are superimposed upon the effort-related (sightings per kilometre travelled) data from the Seabirds at Sea surveys, which are collated into 15'N by 30'W rectangles (Northridge *et al.* 1995).

A major international collaborative programme, the Small Cetacean Abundance in the North Sea (SCANS) project, has aimed to provide an authoritative baseline assessment of abundance from intensive survey work in summer 1994.

5.15.5 Further sources of information

A. References cited

Baines, M.E. 1993. *Marine mammal monitoring during the seismic exploration of block 107/21 in Cardigan Bay, Autumn 1993*. Haverfordwest, Dyfed Wildlife Trust.

Evans, P.G.H. 1987. *The natural history of whales and dolphins*. London, Christopher Helm.

Evans, P.G.H. 1990. Whales, dolphins and porpoises. The order Cetacea. *In: Handbook of British mammals,* ed. by G.B. Corbet & S. Harris, 299-350. Oxford, Blackwell.

Evans, P.G.H. 1992. *Status review of cetaceans in British and Irish waters.* Report to the UK Department of the Environment. Oxford, Sea Watch Foundation.

Evans, P.G.H. 1995 Human disturbance of cetaceans. *In: Exploitation of Mammals,* ed. by N. Dunstone & V. Taylor. London, Chapman & Hall.

Evans, P.G.H., Canwell, P.J., & Lewis, E.J. 1992. An experimental study of the effects of pleasure craft noise upon bottle-nosed dolphins in Cardigan Bay, West Wales. *In: European research on Cetaceans - 6,* ed. by P.G.H. Evans, 43-46. Cambridge, European Cetacean Society.

Evans, P.G.H., Carson, Q., Fisher, P. Jordan, W., Limer, R., & Rees, I. 1994. A study of the reactions of harbour porpoises to various boats in the coastal waters of SE Shetland. *In: European research on Cetaceans - 8,* ed. by P.G.H. Evans, 60-64. Cambridge, European Cetacean Society.

Kuiken, T., Bennett, P.M., Allchin, C.R., Kirkwood, J.K., Baker, J.R., Lockyer, C.H., Walton, M.J., & Sheldrick, M.C. 1994. PCBs, cause of death and body condition in harbour porpoises (*Phocoena phocoena*) from British waters. *Aquatic Toxicology, 28:* 13-28.

Northridge, S. 1988. *Marine mammals and fisheries*. London, Wildlife Link (unpublished report).

Northridge, S., Tasker, M.L., Webb, A., & Williams, J.M. 1995. Seasonal distribution and relative abundance of harbour porpoises *Phocoena phocoena* (L.), white-beaked dolphins *Lagenorhynchus albirostris* (Gray) and minke whales *Balaenoptera acutorostrata* (Lacepède) in the waters around the British Isles. *ICES Journal of Marine Science, 52* (1): 55-56.

Sheldrick, M.C. Chimonides, P.J., Muir, A.I., George, J.D., Reid, R.J., Kuiken, T., Iskjaer-Ackley, C., & Kitchener, A. 1994. Stranded cetacean records for England, Scotland and Wales, 1987-1992. *Investigations on Cetacea, 25:* 5-28.

B. Further reading

Evans, P.G.H. 1987. *The natural history of whales and dolphins*. London, Christopher Helm.

Evans, P.G.H. 1990. European cetaceans and seabirds in an oceanographic context. *Lutra, 33:* 95-125.

Lee, A.J., & Ramster, J.W. 1981. *Atlas of the seas around the British Isles*. London, Ministry of Agriculture, Fisheries and Food.

Natural History Museum. 1990-1994. *Annual Reports*. London, Natural History Museum.

Pingree, R.D., & Griffiths, D.K. 1978. Tidal fronts on the shelf seas around the British Isles. *Journal of Geophysical Research 83:* 4615-4622.

Tasker, M.L., Webb, A., Hall, A.J., Pienkowski, M.W., & Langslow, D.R. 1987. *Seabirds in the North Sea.* Peterborough, Nature Conservancy Council.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Cetacean strandings	Dr D. George & A. Muir, Natural History Museum, Cromwell Road, London SW7 5BD, tel: 0171 938 8861
Cetacean sightings & surveys	Dr P.G.H. Evans, Sea Watch Foundation, c/o Dept. of Zoology, University of Oxford, South Parks Road, Oxford OX1 3PS, tel: 01865 727984
Cetacean sightings & surveys	*Head, Seabirds & Cetaceans Branch, JNCC, Aberdeen, tel: 01224 642863
Cetacean organochlorine & heavy metal levels	*Dr R.J. Law, Directorate of Fisheries Research, MAFF Fisheries Laboratory, Burnham-on-Crouch, tel: 01621 782658

* Starred contact addresses are given in full in the Appendix

5.15.6 Acknowledgements

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Chapter 6 Archaeology

A.B. Gale

6.1 Overview

6.1.1 Introduction

This chapter tells of past human activity in the region, drawing on archaeological (the physical remains) and historical evidence, which is inevitably incomplete. Distribution of known sites is biased by the uneven spread of survey work: many missing details can only be found by the discovery and investigation of new sites. Archaeological sites are vulnerable and those not yet located can unwittingly be destroyed. The chapter gives information on the provisions for safeguarding known and unknown sites, and on the organisations that manage archaeology. Further sections set out the extent of survey work and describe how to report new discoveries.

Documents reveal a concentration of human activity on the rivers of this region since the Roman period. The Rivers Tweed, Tyne, Wear and Tees were ports of regional and national importance. The export of coal nurtured a shipbuilding industry which grew to dominate the world. The modern urban centres conceal much earlier settlements, and today discoveries from the prehistoric period come mostly from the undeveloped coast and intertidal area.

Map 6.1.1 shows some of the principal locations mentioned in the text.

Map 6.1.1 Archaeology: locations mentioned in the text

6.1.2 History and archaeology of the region

Hunters, gatherers and early farmers (Palaeolithic, Mesolithic and Neolithic)

From Ross Links, Whitburn and Hartlepool, flint tools, worked antler and a bone harpoon are evidence of Mesolithic hunters. At a time before sea-level rise created the present North Sea these people were able to roam over a vast area that is now submerged. Little is known of the earliest farmers who settled north-east England in the Neolithic period, beyond occasional finds of their characteristic polished stone axes. These have been dredged from the Tyne and the Wear. The intertidal zone, where the sea is revealing earlier land surfaces, has produced further evidence. Material has been found around Bamburgh and from a burial at Hartlepool.

Metal-working peoples (Bronze Age and Iron Age)

Apart from evidence of a settlement at Scarborough, the presence of Bronze Age communities can only be deduced from burials. In the north of the region, stone burial chambers, which can be assumed originally to have been beneath earth mounds, are located close to rivers, for example at Amble and Blyth. Dredging of the Blyth, Tyne, Wear and Tees has produced bronze weapons and tools, especially where shallow islands have been removed. In North Yorkshire the burials are found on eroding cliff tops, most notably on Brow Moor and Howdale Moor. The relationship of both groups to the Bronze Age coast is not clear. Evidence for the later Iron Age is similarly elusive. Some enclosed homesteads and a number of modest promontory forts have been located at strategic sites, such as Dunstanburgh, Craster and Tynemouth, and may have existed at others. Stray finds such as swords have also been dredged from the Tyne and a burial has been discovered on the open coast at Beadnell.

The Roman province

Herd Sand has always been a major hazard to shipping, causing the loss of hundreds of ships attempting to enter the Tyne. The numerous and diverse Roman coins from the area may be the sole evidence for Roman shipwrecks. The massive granaries at Arbeia, South Shields, which supplied the troops on Hadrian's Wall, can only have been filled by grain ships using the east coast sea route. The Tyne base was crucial for the fleet supporting the army campaigns into Scotland, although neither harbour nor ship remains have been found. South of the Tees lie a string of coastal signal stations, at Huntcliff, Goldsborough, Ravenscar, Scarborough and Filey. The fort of Dictis was probably sited at Wearmouth, but the conspicuous absence of other fortifications suggests a supportive native population.

Roman departure to Norman conquest

Little evidence survives for the region in the immediate post-Roman period, but the conversion to Christianity of the kingdoms of Northumbria and Deira in the 7th century coincided with new prosperity, which has left a record. A royal castle at Bamburgh overlooked the east coast sea route, and from here coastal sites were granted to early missionaries: St. Aiden received Holy Island (Lindisfarne), St Cuthbert exiled himself on the Farnes, and St Hilda founded Hartlepool and Whitby abbeys. The exposed position of abbeys at Tynemouth, Monkwearmouth and Whitby meant they were among the first to suffer Norse raids, beginning in 799 with the sacking of Holy Island. The successive waves of Norse settlers are difficult to trace in the north of the region, but some evidence has survived, for example at Scarborough (founded in 966).

The medieval period

In 1080 a new castle was built overlooking the lowest bridging point on the Tyne (Newcastle). Scarborough castle was built in 1086. For the next six centuries the fortunes of ports in the north of the region were dominated by internecine war and diplomacy. It was a period of great maritime activity, both naval and mercantile. Early trade was stimulated by the great monastic houses, such as Jarrow and Lindisfarne. Despite changing hands from Scotland to England or *vice versa* thirteen times between 1147 and 1482, Berwick-upon-Tweed still became a major port, as the nearest export point for wool from abbeys inland, such as at Jedburgh. Berwick's location prompted numerous fortification projects, culminating in the innovative Elizabethan works which still dominate the harbour. To the south, ships could shelter at Holy Island, and the strategic importance of the island is marked by an originally Henrician fort on the Heugh. The Prince Bishops of Durham and the Prior of Tynemouth had shipping interests: the latter was exporting coal as early as the 12th century. St Hilda's at Hartlepool stood over the medieval harbour, as did the abbey at Whitby. Detailed financial accounts show that Newcastle was building top-class vessels for kings in the 13th century. Remains of these ships, or the merchant vessels from which they developed, have yet to be found, as has archaeological evidence for the building sites. Scarborough was also a major port in medieval times. By the mid-14th century, many of the ports began to fail. Hartlepool and Berwick respectively suffered from silting and the decline in the wool trade. Newcastle, in contrast, was on the threshold of expansion based on her monopoly of coal export.

Modern times

By the early 17th century there were 200 ships trading coal from Newcastle to London. The port's monopoly was broken by Sunderland during the English Civil War but it retained a lead position in the region. Trinity House, Newcastle upon Tyne, with responsibility for pilots, lights and buoys, held jurisdiction from Holy Island to Whitby. The original high and low leading lights at North Shields, dating from 1536, were the first in the country. At the end of the century, the region was at the heart of a resurgence of English shipbuilding to provide capacity for shipment of bulk cargoes. By 1790 Newcastle and Sunderland together produced over 15% of English shipping tonnage. Shipbuilding demanded timber, iron, tar, hemp and flax from the Baltic. Many of the smaller ports, such as Stockton and upriver Yarm on the Tees, were engaged in the North Sea and coastal trade. The coal industry provided capital for harbour works on the barely navigable rivers. Protective piers were built at the mouths of the Tweed, Blyth, Tyne, Wear and Esk. At Seaton Sluice a harbour was cut from rock, and at Seaham the Marquis of Londonderry built a new port on a featureless coast. Smaller pier-ports were developed for fishing and for mineral extraction, as at Craster for granite chippings, Seahouses and Beadnell to service limekilns, Port Mulgrave for iron ore and Saltwick for alum. The alum (Loftus, Boulby, Sandsend, Saltwick, Ravenscar) and iron stone (Skinningrove, Robin Hood's Bay) industries characterise the coast south of the Tees, which lies outside the coalfield. After 1830 the railway enabled the Tees to export coal from County Durham through the newly created river ports of Middlesbrough, Hartlepool and West Hartlepool. The raw materials of Cleveland and the new ports enabled development of the iron, shipbuilding and, later, steel and chemical industries. The region's shipbuilders, especially in Tyne & Wear, dominated world production throughout the 19th century, in both tonnage and innovation of hull and engine design. Early wartime radar sites were developed at Boulby, Ravenscar and Bempton.

6.1.3 Archaeological evidence in the region

The archaeological resource does not consist entirely of discrete sites such as intact wrecks. Many sites are scattered, and palaeo-environments (the landscapes of history and prehistory) can be extensive, crossing between terrestrial, inter-tidal and sub-tidal zones. Palaeo-environments, surviving as waterlogged peat and forest, have been recorded on the foreshore at Hauxley, Cresswell, North Seaton Links, South Shields, Whitburn, Seaham, Hartlepool (the most extensive) and Redcar. There is no evidence of such deposits on the coast south of the Tees. Analysis of plant remains helps reconstruct environments, as changing plant populations reveal patterns of animal husbandry, cultivation or managing woodland. Artefacts within the peat provide direct evidence of man's presence. At Hartlepool, for example, where two layers of peat are dated *c.* 4,500 and 5,500 BP, a scatter of artefacts includes a wooden lid, possibly crafted from an old boat timber, and a wattle hurdle of late Mesolithic or Neolithic date (Fenwick 1993; Buglass 1994). Prehistoric land surfaces have also been preserved beneath sand dunes in the north of the region. They have been exposed in places, for example to the north of Jack's Linn (Northumberland County Council 1994).

The latest surveys have revealed a combination of prehistoric and industrial material. The location of *in situ* Mesolithic and Bronze Age finds often reveals past changes in sea level. Where sea level has risen, many types of site found on land or the foreshore may also survive on the sea bed. Shipwrecks are, however, expected to be the most numerous type of site remaining to be found there. The industrial material relates to past exploitation of the region's mineral resources and its transport by sea.

Shipwrecks in the intertidal zone are an integral part of the archaeological record of these trades. Written accounts show that the hazards of this region caused hundreds of shipwrecks, especially in the approaches to the Tyne, Wear and Tees and on Flamborough Head. Observation of intertidal sites shows that wrecks can survive on this hostile coast. For example, the English Rose was discovered embedded in a submerged forest off Redcar, Cleveland. Records of losses, which show the potential for ship sites to be found, are comprehensive for the 19th century, relatively complete for the 18th, and patchy for the 14th to 17th centuries. For earlier periods it is necessary to examine documentary evidence for sea-borne trade and extrapolate the extent of ship losses by considering the hazards to navigation. This process has then to be extended into the prehistoric period by looking at archaeological evidence for trade and seafaring.

Modern development has permitted excavation of waterfront areas in Newcastle (O'Brien *et al.* 1988) and on Hartlepool headland (Young 1987), showing the type of evidence that may lie beneath other modern ports. Scarborough provides a further example of waterfronts now on dry land, with a 16th century quay forming the back wall of an arcade. Similar finds may occur on rivers that have not seen much modern development, such as the Coquet. In contrast to this hidden resource, the demise of extractive and manufacturing industries has left visible yet often under-valued remains.

6.2 Important locations

6.2.1 Protected sites, monuments and wrecks

For England and Wales there is a published list of criteria for determining the national importance of a monument (DoE 1990), and the number of scheduled sites is expected to increase following current review programmes. Scheduled Ancient Monuments in the region include sites such as Tynemouth Priory and Bronze Age burial monuments on the cliffs of North Yorkshire. Listed Buildings in the region include maritime structures such as docks, dock gates, warehouses and lighthouses.

No shipwrecks have been designated under the Protection of Wrecks Act 1973. This, however, does not indicate an absence of shipwreck sites in the region. Since fewer than 45 wrecks have been designated for the whole of Britain, the lack of designations to date cannot be accepted as indicative of the total sea-bed resource. The number of wreck sites recorded by Cleveland Coastal Archaeology project (see section 6.4.2) is shown in Table 6.2.1, and Table 6.2.2 shows wreck sites recorded in the National Monuments Record (Maritime Section).

Table 6.2.1 Records created by the Cleveland Maritime Archaeology Project

	Known wreck sites[1]	*Historic records of ship losses*[2]	*Possible wreck sites*[3]	*Industrial/ defensive sites*
Durham	20	53	231	15
Cleveland	87	662	492	99
North Yorkshire	53	356	131	40
Totals	**160**	**1,071**	**854**	**154**

Source: Buglass (1994). Note: The industrial and defence sites were primarily recorded from a programme of beachwalking during the project. Key: [1]Hydrographic wreck index; [2]casualties documented; [3]net fastener (unidentified obstruction to fishing).

Table 6.2.2 Records entered in the National Monuments Record - Maritime Section

	Known wreck sites[1]	*Historic records of wreck*[2]	*Unidentified obstruction*
Northumberland	61	*	75
Tyne & Wear	48	*	19
Durham	23	53	231
Cleveland	93	662	492
North Yorkshire	56	356	131
Totals	***281***	***1,071***	***948***

Source: RCHME (October 1994). Key: * The casualty information for Northumberland and Tyne & Wear has not yet been entered onto the database. Northumberland County Council note some 600 casualties on their coast (Northumberland County Council 1994). [1]Hydrographic wreck index; [2]casualties documented.

6.3 Human activities

6.3.1 Activities and processes affecting the archaeological resource

Erosion is a major concern for archaeological remains, both on land and in the intertidal zone. Rapid exposure and destruction of sites allows little time to record their archaeological content. The greater part of Huntcliff Roman signal station, for example, has been lost. Alum works, and other sites associated with mineral extraction and shipping, are vulnerable to wave attack. The cessation of colliery tipping has left areas of the Durham coastline with reduced protection against the sea. Sites sealed within sand dunes are vulnerable to the action of the wind, which can strip away the protective covering. These areas, including coastal paths, are particularly sensitive to human erosion, including excessive use of motorbikes and the commercial extraction of sand. Tourism-based economic regeneration, such as at Hartlepool, has both beneficial and detrimental aspects, providing funds for restoration and interpretation of the built heritage, for example, but also necessitating the demolition of historic maritime structures such as docks and warehouses. At Blyth Harbour, wind-generators sited on the north pier provide a secondary use for a maritime installation. It is difficult to evaluate the influence of activities on the sub-tidal archaeological resource because few surveys have been carried out there. Clearly some activities could directly damage or destroy sites, for example salvage diving, dredging for navigation or the use of fishing gear that is in contact with the sea bed.

6.3.2 Development control

Terrestrial and intertidal development

To landward of low water mark, archaeology is considered within the unified system of development control provided by the planning system. The Department of the Environment has issued guidance notes (DoE 1990) explaining the requirements for planning authorities and developers to consider archaeological remains. In essence there is a presumption in favour of preserving *in situ* remains and their settings; it is therefore in the interest of developers, as part of their research into a potential project, "to make an initial assessment of whether the site is known or likely to contain such remains". The Sites and Monuments Records (SMRs - see 6.3.3 below) provide information on the location of archaeological sites and should be consulted at an early stage. More detailed policies appear in Development Plans of authorities in the Tyne & Wear area: the County Structure Plans, Local Plans of constituent districts and the Unitary Development Plans. In addition to these statutory plans, Northumberland County Council has a strategy for coastal archaeology which identifies areas of high archaeological potential and includes both general and site-specific recommendations (Northumberland County Council 1994). For certain types of development (listed in Schedules 1 and 2 of the Town & Country Planning (Assessment of Environmental Effects) Regulations 1988), formal Environmental Assessments (EA) may be necessary. The EA should include information on any effects on the cultural heritage.

Subtidal development

To seaward of low water mark there is a sectoral approach to development control (DoE 1993). Regulation, including requirement for EA, is divided between a range of government departments and agencies. Until recently, the lack of databases or a management structure for archaeology in the subtidal zone has precluded its consideration by many authorities. However, fresh awareness of marine archaeology is leading to voluntary consideration of the resource, and a Code of Practice for sea bed developers has been issued by the Joint Nautical Archaeology Committee of the Royal Commission on the Historical Monuments of England (RCHME).

6.3.3 Key organisations and their responsibilities

In this region, two statutory designations have been applied to protect remains of archaeological or historic importance *in situ*. The Ancient Monuments & Archaeological Areas Act 1979 (AMAA) provides for the scheduling of Ancient Monuments; the Town & Country Planning (Listed Buildings and Conservation Areas) Act 1990 provides for buildings considered of special architectural or historic importance to be Listed. English Heritage is responsible for Scheduled Ancient Monuments (see section 6.2), which can be sites on land or in UK territorial waters, including remains of vehicles, vessels and aircraft. In practice, however, scheduling has been applied only above low water mark (Firth 1993). Prior consent is necessary for any works that will destroy, damage, repair or remove a Scheduled Monument, and there is a presumption against destruction. English Heritage funds research projects and some rescue archaeology; it inspects monuments, assists owners by drawing up management agreements that are supported by grants and directly manages those monuments in Guardianship.

The Department of National Heritage (DNH) is responsible for sites protected under the Protection of Wrecks Act (1973), although there is currently none in this region.

The Royal Commission on the Historical Monuments of England (RCHME) has responsibility for survey and inventory of archaeological sites in England. It maintains a computerised database of archaeological sites, the National Monuments Record (NMR). In 1992 a new Royal Warrant extended the remit of RCHME to the territorial seas and a Maritime Section has since been added to the NMR. RCHME is the lead agency responsible for overseeing data standards in local archaeological databases, Sites and Monuments Records (SMRs), which are maintained at County level.

The role of Sites and Monuments Records (SMRs) as a source of information and advice for planning authorities was recently confirmed (DoE 1990). In this region, Northumberland, Durham, Cleveland and North Yorkshire County Councils maintain SMRs. The Tyne & Wear SMR covers the old Metropolitan County and thus serves the five unitary districts existing at the time of writing. The North York Moors National Park, a department of North Yorkshire County Council at the time of writing, acts as a local planning authority, and while not maintaining a separate SMR it holds detailed archives of sites and survey work within the Park. A number of SMRs in the region have received data to extend their cover to the limit of territorial waters.

Northumberland County Council's strategy for coastal archaeology is part of an integrated approach to coastal management. This addresses reconciliation of interests and identifies opportunities for practical site management. Opportunities for archaeology to be included exist in other structures for integrated management. Within the North Yorkshire & Cleveland Heritage Coast (NY&CHC), the North York Moors Advisory Group is pursuing consideration of archaeology through informal liaison, record enhancement and interpretation. The written objectives include integration of sea-bed and terrestrial archaeological databases (NY&CHC 1994).

English Heritage and the Royal Commission on the Historical Monuments of England (RCHME) have commissioned a project, England's Coastal Heritage, which will contribute to the development of a strategic approach to survey, recording and management. For this last element, the project is examining the relationship between archaeology and current developments in management of the coast. The survey aspects are described in section 6.4.

6.3.4 Reporting archaeological information

The Royal Commission on the Historical Monuments of England (RCHME) and the Sites and Monuments Records (SMRs) are the accepted reporting points for new

archaeological information, although there is a legal requirement to report archaeological and historical artefacts only when the objects fall within the laws on either Treasure Trove or Salvage. Objects of gold or silver found on land must be reported to the British Museum, the police or the coroner. The Merchant Shipping Act 1894 requires any recovered wreck to be reported to the Receiver of Wreck. Wreck is defined as any ship, aircraft, hovercraft or parts of these, their cargo, or equipment, found in or on the shores of the sea, or any tidal water. The Receiver advertises reported wreck, regardless of age, in order that owners may claim their property. After one year, unclaimed wreck becomes the property of the Crown and is disposed of in order to pay the expenses of the Receiver and any salvage awards. During the statutory year, such items may be lodged with an appropriate museum or conservation facility with suitable storage conditions. Finders are often allowed to keep unclaimed wreck in lieu of a salvage award.

There is a policy of offering unclaimed wreck of historic, archaeological or artistic interest to registered museums. The responsibility of the Receiver to the finder, with regard to salvage awards, remains regardless of the historic character of the wreck. The Receiver is preparing new forms for reporting wreck. These include a form which finders may use to volunteer to the RCHME information on the identity and condition of wreck sites.

Museums in the region hold a variety of artefacts brought up from the sea bed by dredging, diving and fishing, and a project to improve the reporting procedure and liasion between museums and the keepers of Sites and Monuments Records (SMRs) has been set up by Cleveland Archaeology Section, with funding from the North of England Museum Service.

The Department of National Heritage (DNH) can protect shipwrecks of artistic, archaeological or historical importance under the Protection of Wreck Act 1973. Sites should be reported to DNH.

6.4 Information sources

6.4.1 Terrestrial surveys

The Royal Commission on the Historical Monuments of England (RCHME) has undertaken an architectural survey of the Tyne & Wear area, including riverfront buildings and structures, and has also surveyed a number of coastal colliery sites. The Cleveland Industrial Archaeology Society is active in recording industrial sites, including those on the coast, in both Cleveland and North Yorkshire. The National Trust owns an alum works and has undertaken survey of this and other cliff-line industrial sites in the Ravenscar area, while RCHME has surveyed alum works on Boulby Cliffs.

6.4.2 Intertidal surveys

Two specifically coastal archaeological surveys covering much of the undeveloped coast of this region have identified general factors that influence archaeology and site-specific problems (Buglass 1994; Northumberland County Council 1994).

The Northumberland Coastal Archaeology Project, funded by English Heritage, involved fieldwalking of the intertidal and immediate terrestrial zones and gathering information on erosion and dune movement from aerial photographs and documents. It identified sites and assessed both the archaeological potential and the level of risk from erosion for the whole of the county's coast, excluding Berwick and upriver areas. In addition, information was collected from documentary sources on wrecks in the subtidal zone.

Cleveland Archaeology Section undertook a similar project in the south of the region, funded by the Royal Commission on the Historical Monuments of England (RCHME). This covered 43 miles from Seaham Harbour to Whitby, excluding the developed areas of the Tees and the Esk. The project involved fieldwalking the intertidal zone to identify and assess foreshore and cliff sites, and the use of documentary, oral and other sources to create a record of sea-bed sites to the territorial limit. The information for the Durham and North Yorkshire Coasts has been passed to the respective SMRs. Cleveland Archaeology Section have also undertaken survey and excavation of the peat deposits in the Hartlepool area. Scarborough Archaeological and Historical Society have carried out survey and excavation on alum works at Saltwick, where remains are being destroyed by tidal erosion. As part of the English Heritage and the Royal Commission on the Historical Monuments of England (RCHME) project England's Coastal Heritage, the Aerial Photographic Unit of RCHME are investigating the feasibilty of using aerial photographs for intertidal survey (see section 6.3.3); and Reading University is producing a synthesis of information within the National Monuments Record, SMRs and published sources.

6.4.3 Sub-tidal surveys

No survey work has been identified beyond the desk-top exercises carried out by Northumberland and Cleveland County Councils, described above, and the continuing work of RCHME in developing the National Monuments Record (NMR) Maritime Section.

6.4.4 Further sources of information

A. References cited

Breeze, D.J. 1993. Ancient monuments legislation. *In: Archaeological resource management in the UK an introduction*, ed. by J. Hunter & I. Ralston, 56-65. Stroud, Alan Sutton.

Buglass, J. 1994. *Lost at sea. Maritime archaeology of the north east of England.* (Contractor Cleveland County Council.) Middlesbrough, Cleveland County Council (unpublished report to RCHME).

Department of the Environment. 1990. *Planning policy guidance note 16: archaeology and planning.* London, HMSO.

Department of the Environment. 1993. *Development below low water mark. A review of regulations in England and Wales.* London, HMSO.

Fenwick, V. 1993. A winged cleat from Hartlepool. *In: A spirit of enquiry. Essays for Ted Wright*, ed. by J. Coles, V. Fenwick & G. Hutchinson, 49-51. Taunton, Wetlands Archaeology Research Group, National Maritime Museum & Nautical Archaeological Society.

Firth, A. 1993. The management of underwater archaeology. *In: Archaeological resource management in the UK, an introduction*, ed. by J. Hunter & I. Ralston, 65-76. Stroud, Alan Sutton.

North Yorkshire & Cleveland Heritage Coast. 1994. *Management plan second review. Draft strategy*.

Northumberland County Council. 1994. *A strategy for coastal archaeology in Northumberland*. Morpeth, Northumberland County Council.

O'Brien, C., Brown, L., Dixon, S., & Nicholson, R. 1988. *The origins of Newcastle quayside, excavations at Queen Street and Dog Bank*. Newcastle Upon Tyne, Society of Antiquaries of Newcastle Upon Tyne. (Monograph Series III.)

Young, G.A.B. 1987. Excavations at Southgate, Hartlepool, Cleveland, 1981-82. *Durham Archaeological Journal, 3:* 15-55.

B. Further reading

Department of the Environment and Department of National Heritage. 1994. *Planning policy guidance note 15: planning and the historic environment*. London, HMSO.

Gale, A. 1992. *Catching the tide. The status and future of maritime collections in north east museums.* Newcastle Upon Tyne, North of England Museum Service.

Longworth, I. 1993. Portable antiquities. *In: Archaeological resource management in the UK: an introduction*, ed. by J. Hunter & I. Ralston, 56-65. Stroud, Alan Sutton.

Marshall, G. 1990. The Ravenscar alum works. *Transactions of the Scarborough Archaeological and Historical Society*, No.28. Scarborough.

Northumberland County Council. 1991. *Northumberland coast management plan consultation draft.* Morpeth, Northumberland County Council.

Northumberland County Council. 1994. *The Northumberland coast project management report 1993-1994*. Morpeth, Northumberland County Council.

Royal Commission on the Historical Monuments of England. 1990. *An architectural survey of the Urban Development Corporation Area. Volume I Tyneside; Volume II Wearside.* Swindon, RCHME.

Tann, G. 1991. Research on Hartlepool submerged forest. *Archaeology North, 1:* 1-15.

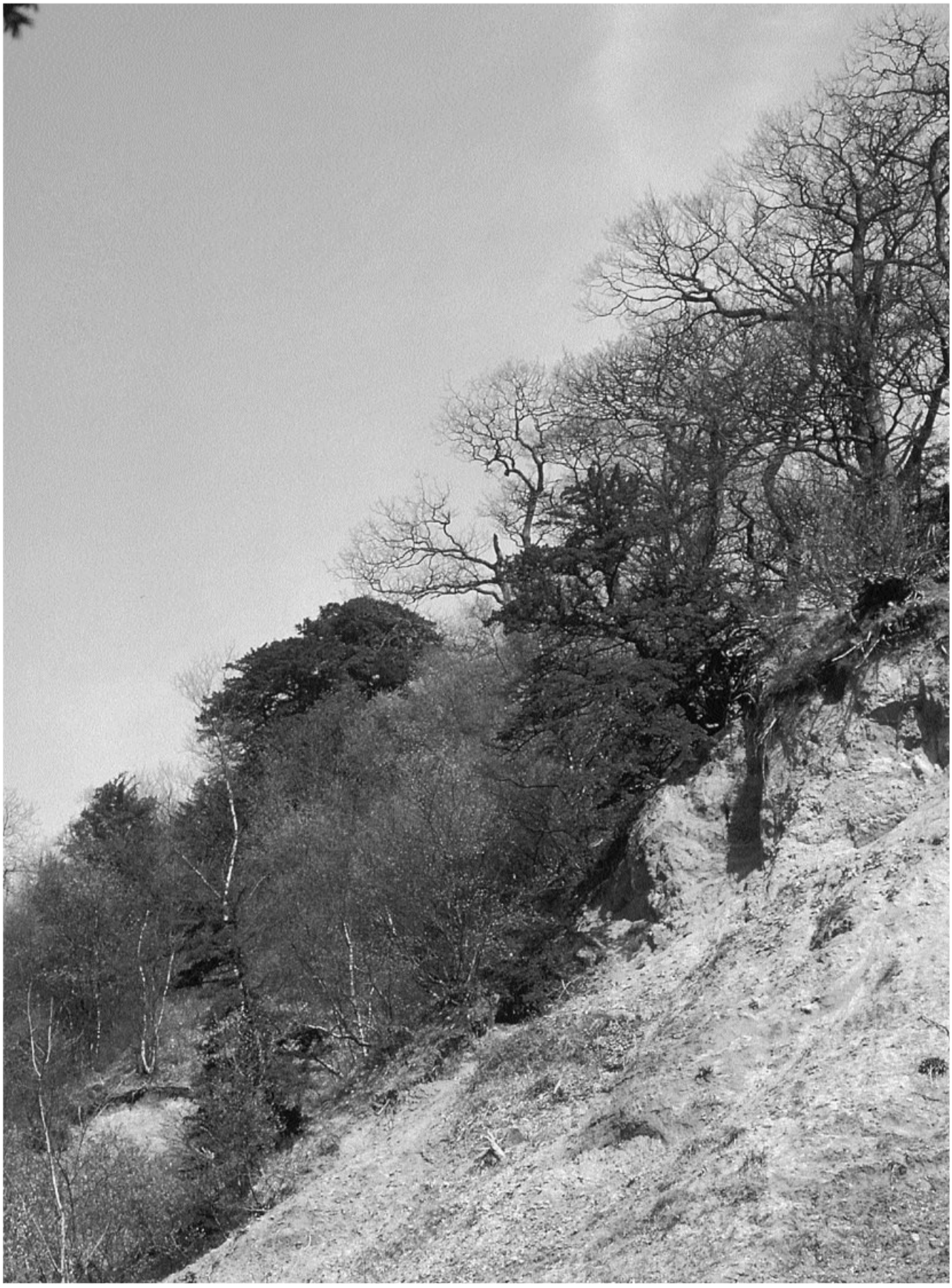
Thornes, R. 1994. *Images of industry: coal.* Swindon, Royal Commission on the Historical Monuments of England.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Scheduled Monuments and Listed Buildings	Chief Archaeologist, English Heritage, 23 Savile Row, London W1X 2HE, tel: 0171 9733000
Maritime historical monuments	National Monuments Record, Head of Recording (Maritime), Royal Commission on the Historical Monuments of England, National Monuments Record Centre, Kemble Drive, Swindon SN2 2GZ, tel: 01793 414600
Sites and Monuments Records, Northumberland	SMR Officer, County Archaeology Section, Northumberland County Council, Department of Planning & Economic Development, County Hall, Longdean, Morpeth, Northumberland NE61 2EF, tel: 01670 53300
Sites and Monuments Records, Tyne and Wear	SMR Officer, Planning Department, Newcastle City Council, Civic Centre, Barras Bridge, Newcastle Upon Tyne NE1 8PH, tel: 0191 232 8520
Sites and Monuments Records, Co. Durham	County Archaeological Officer, Department of Arts, Libraries & Museums, Durham County Council, County Hall, Durham DH1 5TY, tel: 0191 386 4411
Sites and Monuments Records, Cleveland	SMR Officer, Cleveland Archaeology Service, PO Box 41, Southlands Centre, Ormesby Road, Middlesbrough, Cleveland TS3 0YZ, tel: 01642 327583
Sites and Monuments Records, North Yorkshire	SMR Officer, Planning Department, North Yorkshire County Council, County Hall, Northallerton, North Yorkshire DL7 8AQ, tel: 01609 780780
Archaeology on the North York Moors	Archaeologist, North York Moors National Park Office, The Old Vicarage, Bondgate, Helmsley, York YO6 5BP, tel: 01439 770657
Code of practice for seabed developers (to be published by the Joint Nautical Archaeology Policy Committee)	Head of Recording (Maritime Section), National Monuments Record, Royal Commission on the Historical Monuments of England, National Monuments Record Centre, Kemble Drive, Swindon SN2 2GZ, tel: 01793 414713
Reporting of recovered wreck	Receiver of Wreck, Coastguard Agency, Spring Place, 105 Commercial Road, Southampton S015 1EG, tel: 01703 329474
Reporting of Treasure Trove	The British Musem, Bloomsbury, London W1, tel: 0171 323 8629 (Medieval to Present), or 0171 323 8454 (Prehistoric to Romano-British)
Reporting of wreck sites of artistic, archaeological or historical importance	The Secretary, The Advisory Committee on Historic Wreck, Department of National Heritage, Room 306, 2-4 Cockspur Street, London SW1Y 5DH, tel: 0171 211 6369 or 6367

6.4.5 Acknowledgments

Thanks are due, in particular, to Valerie Fenwick for help in compiling this chapter, and to the staff of all the organisations mentioned in the text who gave their time to provide information. The author is also indebted to J. Tyson, Reading University, who made available information from the England's Coastal Heritage project, and to Dr Ben Ferrari for his advice in developing the chapter.



Castle Eden Dene National Nature Reserve, County Durham. This wooded ravine, carved through boulder clay overlying limestone, is a warm, sheltered refuge for many rare and scarce invertebrates, ferns and flowering plants. It is the largest of several such denes on the Durham coast. Photo: J.P. Doody, JNCC.

Chapter 7 Coastal protected sites

R.G. Keddie

7.1 Introduction

7.1.1 Chapter structure

This chapter incorporates statutory and non-statutory site protection mechanisms operating at international, national and local level, including those administered by voluntary bodies and other organisations who own land. It covers only the various types of site protection mechanisms currently found within this region, giving a brief explanation for each category. For the purposes of this chapter, any site that is wholly or partly intertidal, and any terrestrial site at least partly within 1 km of the Mean High Water Mark, or any tidal channel as depicted on 1:50,000 Ordnance Survey maps, is included as 'coastal'. Where a site straddles the boundaries of two Coastal Directories Project regions and there is no easy way of calculating the percentage of the site lying in each, the site area has been halved, one half being included in each region. Data included in this section are correct as at April 1995, unless otherwise stated.

Statutory protected sites are those notified, designated or authorised under European Directives and/or implemented through British legislation (most notably the Wildlife and Countryside Act 1981) by a statutory body, thereby having recognised legal protection. 'Non-statutory sites' include a wide variety of sites that are not directly protected by legislation but which are recognised by statutory bodies or owned, managed or both by non-statutory organisations for their nature conservation or aesthetic value. Note that the categories of conservation protection (e.g. National Nature Reserve, RSPB Reserve) are not mutually exclusive. In many localities several different types of protected site overlap, since they have been identified for different wildlife and landscape conservation purposes. Patterns of overlap are often complex, since site boundaries for different categories of site are not always the same.

Further explanation of the various site protection mechanisms can be found in Davidson *et al.* (1991). Planning Policy Guidance Note (PPG) 9 - Nature Conservation (DOE 1994) also gives useful summaries of

Table 7.1.1 Summary of site protection in Region 5

	Number					*Area*				
	Total number in region	*North Sea coast*	*% of North Sea coast in region*	*GB coast*	*% of GB number in region*	*Region total (ha)*	*North Sea coast (ha)*	*% of North Sea coast*	*GB coast (ha)*	*% of GB area in region*
Ramsar sites	1	30	3.3	51	2.0	3,625	168,545	2.2	251,508	1.4
Special Protection Areas	3.5*	43	8.1	76	4.6	3,850*	175,263	2.2	263,740	1.5
Geological Conservation Review	52	508	10.2	1,059	4.9	n/a[a]	n/a[a]	n/a[a]	n/a[a]	n/a[a]
National Nature Reserves	4	41	9.8	80	5.0	4,134	34,426	12.0	85,964	4.8
Sites of Special Scientific Interest	55	549	10.0	1,182	4.7	10,303	330,211	3.1	700,517	1.5
Areas of Special Protection	2	14	14.3	23	8.7	n/a[b]	n/a[b]	n/a[b]	n/a[b]	n/a[b]
National Parks	1	2	50.0	6	16.7	143,600	173,900	82.6	745,000	19.3
Heritage Coasts	2	17.5	11.4	45	4.4	153[c]	661[c]	23.2[c]	1,525[c]	10.0[c]
Areas of Outstanding Natural Beauty	1	13.5	7.4	23	4.4	13,500	695,300	1.9	880,400	1.5
Local Nature Reserves	6	69	8.7	94	6.4	165	8,731	1.9	13,336	1.2
Country Parks	2	20	10.0	34	5.9	368	2,943	12.5	4,441	8.3
The National Trust & The National Trust for Scotland	35	190	18.4	446	7.9	1,450	17,387	8.3	62,648	2.3
Royal Society for the Protection of Birds	1	52	1.9	79	1.3	6	23,296	<0.1	37,142	<0.1
Wildfowl and Wetlands Trust	1	3	33.3	6	16.7	41	472	8.7	1,585	2.6
The Wildlife Trusts	15	122	12.3	218	6.9	461	10,411	4.4	23,398	2.0
Sensitive Marine Areas	2.5*	16.5	15.2	27	9.3	n/a[b]	n/a[b]	n/a[b]	n/a[b]	na[b]
Woodland Trust	7	35	20.0	64	10.9	25	1,095	2.3	1,458	1.7
Candidate coastal/marine SACs	3	33	9.1	71	4.2	n/a[b]	n/a[b]	n/a[b]	n/a[b]	n/a[b]
Candidate coastal terrestrial SACs	1	15	6.7	40	2.5	n/a[b]	n/a[b]	n/a[b]	n/a[b]	n/a[b]

Source: JNCC. Key: n/a[a] = not applicable; n/a[b] = not available; [c] = Heritage Coast data in these columns refer to lengths in kilometres. * Sites lie partly within Region 6 - half of area has been included in the total. Notes: Site types not currently found in the region: World Heritage (Natural) Sites, Biosphere Reserves, Biogenetic Reserves, Voluntary Marine Nature Reserves, Ministry of Defence sites. In this table any site that is wholly or partly intertidal, and any terrestrial site at least partly within 1 km of the Mean High Water Mark, or any tidal channel as depicted on 1:50,000 Ordnance Survey maps, is included as 'coastal'.

existing site protection mechanisms. It sets out the Government's objectives for nature conservation and provides a framework for safeguarding natural heritage under domestic/international law, emphasises the importance of both designated sites and undesignated areas for nature conservation, advises that potential Special Protection Areas (SPAs) and candidate Special Areas of Conservation (SACs) should be treated similarly to classified SPAs and designated SACs and deals with the treatment of nature conservation issues in development plans. It also includes copies of the Ramsar Convention, the Birds Directive and the Habitats Directive (including lists of important species and habitat types).

The following types of protected site have not been included in this chapter:

- Archaeological designations and protected sites (covered in Chapter 6);
- 'Sites of Importance for Nature Conservation' (SINCs): a general term for the variously-named non-statutory sites identified by local authorities and wildlife trusts as having special local value for nature conservation but not currently managed for nature conservation; the most common are Sites of Nature Conservation Importance. For more information, see Collis & Tyldesley (1993).

Non-site based measures contained in conventions and directives aimed at broad species and habitat protection, such as the Bonn Convention, CITES, parts of the EC Birds Directive and parts of the EC Habitats Directive, are also not covered. For further information, see references in section 7.1.3A.

This chapter is divided into five sections. A regional summary of all categories of site is given in Table 7.1.1. Section 7.2 covers those site-based protection measures falling under international conventions or European directives. Section 7.3 discusses sites identified under national statute; section 7.4 covers sites without statutory protection but which are identified, owned or managed by statutory bodies; and finally, section 7.5 describes other types of sites (i.e. those identified, owned or managed by charities, trusts etc.). For each category of protected site, a list of coastal sites is given (clockwise around the coast), showing their type, area/length and location, with an accompanying map. Each section concludes with further information sources and contact points relevant to the region.

7.1.2 Importance of the region

For its length of coastline, this region has relatively high proportions by area of coastal National Nature Reserves (NNRs) (4.9%) and Sites of Special Scientific Interest (SSSIs) (1.5%) and also 10% of all Heritage Coasts in Great Britain. Table 7.1.1 summarises site protection in the region, showing the numbers and areas of each type of site and comparing these with North Sea coast and British (whole country coast) totals.

7.1.3 Further sources of information

A. References cited

Collis, I., & Tyldesley, M. 1993. *Natural assets: non-statutory sites of importance for nature conservation,* Newbury, Local Government Nature Conservation Initiative.

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

Department of the Environment. 1994. *Planning Policy Guidance Note 9 - Nature Conservation*. London, HMSO

B. Further reading

Doody, J.P., Johnston, C., & Smith, B. 1993. *The directory of the North Sea coastal margin.* Peterborough, JNCC.

English Nature. 1994. *Natura 2000 - European Habitats Directive. European wildlife sites in England.* Peterborough, English Nature.

Gubbay, S. 1988. *A coastal directory for marine conservation.* Ross-on-Wye, Marine Conservation Society.

Hatton, C. 1992. *The Habitats Directive: time for action.* Godalming, WWF UK (World Wide Fund for Nature).

7.1.4 Acknowledgements

The author wishes to thank all the staff of JNCC Coastal Conservation Branch, and particularly Nick Davidson and John Barne, for help in compiling this chapter.

7.2 Sites designated under international conventions and directives

This section describes those types of site designated under international conventions to which the UK is a contracting party, and sites designated under UK statute to implement EC Directives concerning wildlife and landscape conservation. Sites protected by domestic legislation only are covered in section 7.3.

7.2.1 Wetlands of international importance (Ramsar sites)

Ramsar sites are statutory areas designated by the UK government on the advice of the conservation agencies under the Ramsar Convention (the Convention on wetlands of international importance especially as waterfowl habitat). Contracting parties (of which the UK is one) are required to designate wetlands of international importance and to promote their conservation and 'wise use'. Ramsar sites are thus designated for their waterfowl populations, their important plant and animal assemblages, their wetland interest or a combination of these. There is one coastal Ramsar site (3,625 ha) in Region 5 (see Table 7.2.1 and Map 7.2.1). This compares with a total of 51 coastal Ramsar sites (251,508 ha) in Great Britain, of which 30 (168,545 ha) are on the North Sea coast. There are currently 82 designated Ramsar sites (342,019 ha) in Great Britain, as at November 1994 (data provided by Vertebrate Ecology and Conservation Branch, JNCC). Sections 5.10, 5.11 and 5.12 describe the importance of these sites for the region's birds.

Table 7.2.1 Ramsar sites and SPAs

Site name	*Grid ref.*	*Area (ha)*	*Date designated*
Ramsar			
Lindisfarne, Northumberland	NU100430	3,625	1976-92
SPA			
Lindisfarne, Northumberland	NU100430	3,625	1992
Farne Islands, Northumberland	NU230370	97	1985
Coquet Island, Northumberland	NU294047	21	1985
Flamborough Head & Bempton Marshes, N. Yorkshire/ North Humberside[a]	TA258705	214	1993
Total SPA		*3,850*	

Source: JNCC. Key: [a]Flamborough Head & Bempton Marshes lies partly within Region 6 - half of its area has been included in the total. Note: In this table any site that is wholly or partly intertidal, and any terrestrial site at least partly within 1 km of the Mean High Water Mark, or any tidal channel as depicted on 1:50,000 Ordnance Survey maps, is included as 'coastal'.

Map 7.2.1 Coastal Ramsar sites and Special Protection Areas. Source: JNCC.

7.2.2 Special Protection Areas

The 1979 EC Directive on the Conservation of Wild Birds (the Birds Directive) requires member states to take conservation measures particularly for certain rare or vulnerable species and for regularly occurring migratory species of birds. In part this is achieved through the designation of statutory Special Protection Areas (SPAs) by the UK government on the advice of the statutory conservation agencies. This designation is implemented through the Wildlife and Countryside Act 1981; all SPAs must first be notified as SSSIs.

There are three whole and part of one other coastal SPAs totalling (3,849 ha) in Region 5 (see Table 7.2.1 and Map 7.2.1). This compares with a total of 76 coastal SPAs (263,740 ha) in Great Britain, of which 43 (175,263 ha) are on the North Sea Coast. There are currently 96 designated SPAs (292,878 ha) in Britain, as at November 1994 (data provided by Vertebrate Ecology and Conservation Branch, JNCC). Sections 5.10, 5.11 and 5.12 describe the importance of these sites for the region's birds.

7.2.3 Special Areas of Conservation

Special Areas of Conservation (SACs) are one of the tools to be used to implement the 1992 EC Habitats Directive. They are areas considered to be important for habitat and non-avian species of interest in a European context. The protection measures are based around a series of six annexes: Annexes I & II require the designation of SACs for certain habitats and species; Annex IV prohibits the taking of certain species; Annex V requires the taking of certain species to be monitored; and Annex VI prohibits some

Table 7.2.2 Possible SACs in Region 5

Interest	*County*	*Site name*	*Qualifying interest*
Coastal/Marine	Berwickshire, Northumberland	Berwickshire and North Northumberland Coast[a]	*Halichoerus grypus* (grey seal); mudflats and sandflats not covered by seawater at low tide; reefs; submerged or partly submerged sea caves.
Coastal/Marine	Northumberland	North Northumberland Dunes	*Petalophyllum ralfsii* (petalwort); dunes with creeping willow *Salix arenaria;* embryonic shifting dunes; fixed dunes with herbaceous vegetation (grey dunes); humid dune slacks
Terrestrial/Coastal*	North Yorkshire, Humberside	Lower Derwent Valley	Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*)
Coastal/Marine	North Yorkshire, Humberside	Flamborough Head[b]	Reefs; submerged or partly submerged sea caves; vegetated sea cliffs of the Atlantic and Baltic coasts.

Source: JNCC 1995. Key: [a] partly within Region 4; [b] partly within Region 6. * In this table any site that is wholly or partly intertidal, and any terrestrial site at least partly within 1 km of the Mean High Water Mark, or any tidal channel as depicted on 1:50,000 Ordnance Survey maps, is included as coastal.

means of capture or killing of mammals and fish. In the UK the Directive will be implemented through the Habitats etc. Regulations 1994. A list of candidate SACs was announced by the Government on 31 March 1995. There are three candidate SACs selected for their coastal/marine interest in Region 5, from a total of 71 in GB, and one proposed terrestrial coastal SAC from a total of 40 in GB (Table 7.2.2)(see JNCC (1995) for more information).

7.2.3 Further sources of information

A. Further reading

Pritchard, D.E., Housden, S.D., Mudge, G.P., Galbraith, C.A., & Pienkowski, M.W., *eds.* 1992. *Important bird areas in the UK including the Channel Islands and the Isle of Man.* Sandy, RSPB.

Gubbay, S. 1988. *A coastal directory for marine conservation.* Ross-on-Wye, Marine Conservation Society.

Joint Nature Conservation Committee. 1995. *Council Directive on the Conservation of natural habitats and wild fauna and flora (92/43/EEC) - the Habitats Directive: a list of possible Special Areas of Conservation in the UK. List for consultation (31 March 1995).* Peterborough (unpublished report to the Department of the Environment).

Nature Conservancy Council. 1988. *Internationally important wetlands and special protection area for birds.* Peterborough, Nature Conservancy Council.

Stroud, D.A., Mudge, G.P., & Pienkowski, M.W. 1990. *Protecting internationally important bird sites. A review of the EEC Special Protection Area network in Great Britain.* Peterborough, Nature Conservancy Council.

B. Contact names and addresses

Type of information	*Contact, address and telephone no.*
Special Protection Areas (North Yorkshire and Humberside)	*Dave Clayden, Conservation Officer, North Yorkshire (East)/Denice Leach, Conservation Officer North Humberside, English Nature (North and East Yorkshire Local Area Team), York, tel: 01904 432700
Ramsar sites, Special Protection Areas (Northumberland)	*Wesley Smyth, Conservation Officer East Northumberland, Northumbria Local Team, English Nature, Newcastle upon Tyne, tel: 0191 281 6316
Ramsar sites, Special Protection Areas	*Regional Officer, RSPB North of England Office, Newcastle upon Tyne, tel: 0191 232 4148

* Starred contact addresses are given in full in the Appendix.

7.2.4 Acknowledgements

Thanks are due to Alan Law and JNCC International Policy Branch.

7.3 Sites established under national statute

Included in this section are the eight types of site identification made under national legislation relating to wildlife, landscape and amenity value. Identifications are made by the statutory conservation agencies (in this region), English Nature local authorities or the government acting on advice from these bodies.

7.3.1 National Nature Reserves

National Nature Reserves (NNRs) contain examples of some of the most important natural and semi-natural ecosystems in Great Britain. They are managed to conserve their habitats, providing special opportunities for scientific study of the habitats, communities and species represented within them (Marren 1994). They are statutorily declared by the country agencies under section 19 of the National Parks and Access to the Countryside Act 1949, or section 35 of the Wildlife and Countryside Act 1981.

There are four coastal National Nature Reserves (NNRs) (4,134 ha) in Region 5 (see Table 7.3.1 and Map 7.3.1). This compares with a total of 80 (85,964 ha) coastal NNR sites in Great Britain, of which 41 sites (34,426 ha) are on the North Sea coast. The total number of NNRs in Britain is 288 (195,531 ha), as at March 1995 (data provided by CCW, EN, SNH and Biotopes Conservation Branch, JNCC).

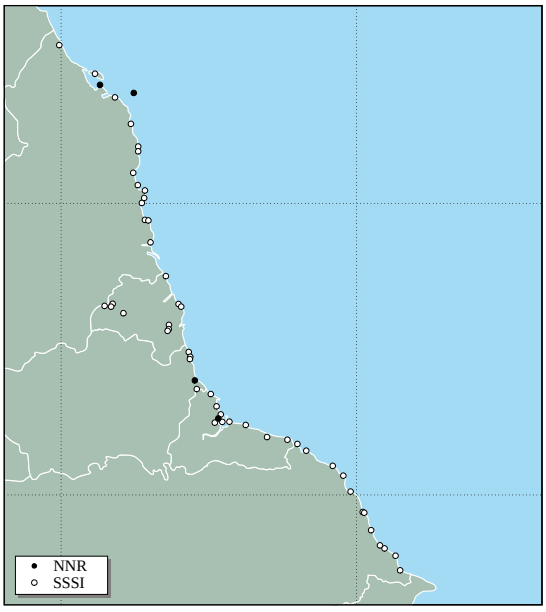
Table 7.3.1 National Nature Reserves

Site name	*Grid ref.*	*Area (ha)*	*Date declared*
Northumberland			
Lindisfarne	NU105420	3,541	1964
Farne Islands	NU230370	32	1993
Durham			
Castle Eden Dene	NZ434397	221	1985
Cleveland			
Teesmouth (North Gare and Seal Sands)	NZ540275 and NZ530260	340	1995
Total		***4,134***	

Source: EN, JNCC. Note: In this table any site that is wholly or partly intertidal, and any terrestrial site at least partly within 1 km of the Mean High Water Mark, or any tidal channel as depicted on 1:50,000 Ordnance Survey maps, is included as coastal.

7.3.2 Sites of Special Scientific Interest

Sites of Special Scientific Interest (SSSIs) are statutorily notified under the Wildlife and Countryside Act 1981. They are intended to form a national network of areas, representing in total the parts of Britain in which the natural features, especially those of greatest value to wildlife conservation or earth science conservation, are most highly concentrated or of highest quality. Each SSSI represents a significant fragment of the much-depleted resource of wild nature remaining in Britain. Within the area of an SSSI the provisions of the Wildlife & Countryside Act 1981 and its 1985 amendments aim to ensure that actions damaging to the conservation interest of the area are not carried out.



Map 7.3.1 Coastal National Nature Reserves and Sites of Special Scientific Interest. Source: English Nature, JNCC. Note: a single symbol may represent more than one site in close proximity.

There are 55 coastal SSSIs (10,303 ha) in Region 5, as at September 1994 (see Table 7.3.2 and Map 7.3.1). This compares with a total of 1,182 coastal SSSIs (700,517 ha) in Great Britain, of which 549 (330,211 ha) are on the North Sea coast. The total number of SSSIs in Britain as at June 1994 was 6,055 (1,920,527 ha), or 7.98% of the total land mass, with 3,794 (871,066 ha) in England, 1,371 (846,869 ha) in Scotland and 890 (202,592 ha) in Wales (data provided by CCW, EN, SNH and Biotopes Conservation Branch, JNCC).

Of the 55 coastal SSSIs in the region, over two-thirds include intertidal land to mean low water mark; with almost one quarter purely terrestrial. Almost two-thirds were selected at least partly for their biological interest and more than half at least partly for their geological or geomorphological interest. Of the total, nearly a quarter have both biological and earth science interest. Examples of a very wide range of habitats and species occur within the SSSIs in this region, the most frequently occurring habitats being dry grassland, woodland, tidal flats, shingle, sand dunes, swamp and open water, all of which occur in between 15% and 31% of sites. SSSIs in the region include many sites of interest for their lower and higher plants and terrestrial invertebrates.

7.3.3 Local Nature Reserves

Local Nature Reserves (LNRs) are statutorily designated by local authorities, under section 21 of the National Parks and Access to the Countryside Act 1949, for the same purposes as NNRs, but because of the local rather than the national interest of the site and its wildlife. Under this Act local authorities have the power to issues bylaws to protect the LNR. There are six LNRs (165 ha) in Region 5 (see Table 7.3.3 and Map 7.3.2). This compares with a total of 94

Table 7.3.2 Sites of Special Scientific Interest

Site name	*Grid ref.*	*Area (ha)*	*Date notified/ renotified*
Northumberland			
Northumberland Shore	NT980575-NU010525	1,926	1992
Tweed Estuary	NT990533	154	1988
Lindisfarne	NU100430	3,966	1989
Bamburgh Coast and Hills	NU167355	57	1986
The Farne Islands	NU230370	97	1983
Newton Links	NU230269	78	1988
Castle Point to Cullernose Point	NU260188	56	1988
Howick to Seaton Point	NU262173	186	1989
Alnmouth Saltmarsh & Dunes	NU245100	108	1988
Warkworth Dunes & Saltmarsh	NU260059	122	1988
Coquet Island	NU294047	21	1983
Low Hauxley Shore	NU283016	61	1987
Hadston Links	NZ273995	104	1989
Cresswell Ponds	NZ283944	20	1986
Cresswell & Newbiggin Shores	NZ295942-NZ303915, NZ312897-NZ315879, NZ311872-NZ305854	148	1992
Sandy Bay	NZ305860	16	1988
Close House Riverside	NZ129652	3	1988
Tyne & Wear			
Tynemouth to Seaton Sluice	NZ346755	98	1989
Ryton Willows	NZ152650	7	1985
Hallow Hill	NZ157658	7	1986
Shibdon Pond	NZ195628	15	1985
Harton Down Hill	NZ390655	1	1984
Trow Point to Whitburn Steel	NZ400648	108	1988
Hylton Castle Cutting	NZ360588	1	1987
Wear River Bank	NZ360577	5	1988
Claxheugh Rock & Ford	NZ363574	7	1987
South Hylton Pasture	NZ357568	3	1984
Durham			
Seaham Harbour	NZ429499	7	1986
Durham Coast	NZ436476	284	1986
Hawthorn Quarry	NZ435463	10	1990
Hawthorn Dene	NZ435458	64	1984
Castle Eden Dene	NZ434396	193	1984
Hulham Fen	NZ439374	0.2	1986
Hart Warren Dunes	NZ494363	34	1983
Cleveland			
Hartlepool Submerged Forest	NZ520315	20	1988
Seaton Dunes and Common	NZ535285	312	1985
Seal Sands	NZ529260	294	1984
Cowpen Marsh	NZ500259	117	1989
South Gare & Coatham Sands	NZ547262	381	1988
Redcar Rocks	NZ605253	31	1984
Saltburn Gill	NZ676205	19	1986
Boulby Quarries	NZ745200	40	1989
N.Yorkshire			
Staithes - Port Mulgrave	NZ784189	62	1984
Runswick Bay	NZ809169	10	1984
Whitby to Saltwick	NZ901115	42	1985
Maw Wyke to Miller's Nab	NZ941082	163	1985
Hawsker Bottoms	NZ942082	2	1984
Beast Cliff to Miller's Nab	NZ966028	205	1986
Hayburn Wyke	TA012968	21	1984
Iron Scar & Hundale Point to Scalby Ness	TA017964	125	1986
North Bay - South Toll House Cliff	TA048893	1	1989
Cayton & Cornelian Bays	TA062852	94	1984
Gristhorpe Bay & Red Cliff	TA085840	54	1986
Filey Brigg	TA126816	28	1985
Flamborough Head	TA143764	315	1986
Total		***10,303***	

Source: EN, JNCC: Note: In this table any site that is wholly or partly intertidal, and any terrestrial site at least partly within 1 km of the Mean High Water Mark, or any tidal channel as depicted on 1:50,000 Ordnance Survey maps, is included as coastal.

Table 7.3.3 Local Nature Reserves

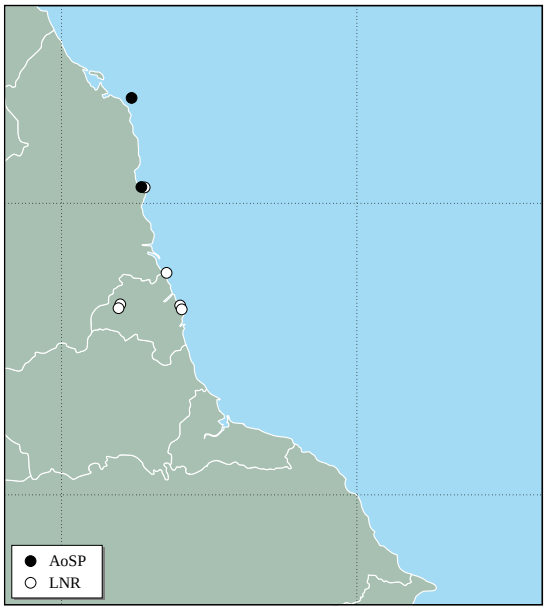
Site name	*Grid ref.*	*Area (ha)*	*Date designated*
Northumberland			
Amble Dunes	NU280037	62	1994
Tyne & Wear			
St Mary's Island	NZ353754	73	1992
Denton Dene	NZ195650	8	1991
Shibdon Pond	NZ195628	14	1980
Harton Down Hill	NZ3964	2	1990
Marsden Old Quarry	NZ396646	7	1990
Total		***165***	

Source: EN 1994 data. Note: In this table any site that is wholly or partly intertidal, and any terrestrial site at least partly within 1 km of the Mean High Water Mark, or any tidal channel as depicted on 1:50,000 Ordnance Survey maps, is included as coastal.

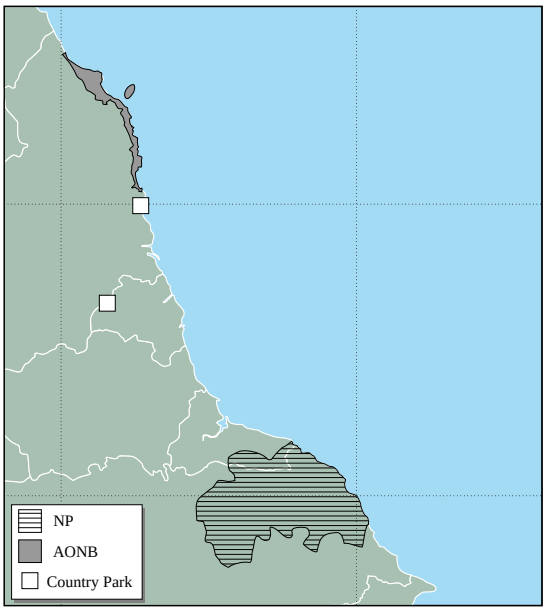
Table 7.3.4 AoSPs

Site name	*Grid ref.*	*Area (ha)*	*Date designated*
Northumberland			
Farne Islands (No. 1096 revoked by No. 402)	NU230370	n/a[a]	1964 then 1980
Coquet Island (No. 1096 revoked by No. 1074)	NU293046	n/a[a]	1964 then 1978

Source: DoE. Key: n/a[a] = not available. Note: In this table any site that is wholly or partly intertidal, and any terrestrial site at least partly within 1 km of the Mean High Water Mark, or any tidal channel as depicted on 1:50,000 Ordnance Survey maps, is included as coastal.



Map 7.3.2 Coastal Local Nature Reserves and Areas of Special Protection. Source: English Nature.



Map 7.3.3 Coastal National Parks, Areas of Outstanding Natural Beauty and Country Parks. Source: Countryside Commission.

coastal LNRs (13,336 ha) in Great Britain, of which 69 (8,731 ha) are on the North Sea coast. There are 396 LNRs (21,513 ha) in total in Britain (data provided by EN, CCW and SNH).

7.3.4 Areas of Special Protection

'Area of Special Protection' (AoSP) is a statutory protection mechanism replacing Bird Sanctuary Orders under the 1954 to 1967 Protection of Birds Acts, which were repealed and amended under the Wildlife and Countryside Act 1981. Designation aims to prevent the disturbance and destruction of the birds for which the area is identified, by making it unlawful to damage or destroy either the birds or their nests and in some cases by prohibiting or restricting access to the site. There are two Areas of Special Protection (AoSP) in Region 5 (see Table 7.3.4 and Map 7.3.2), compared with a total of 23 sites identified as coastal in Great Britain, fourteen of them located on the North Sea coast. So almost two-thirds of Great Britain's 38 AOSPs are coastal (data supplied by DoE, European Wildlife Division).

7.3.5 Areas of Outstanding Natural Beauty

The primary purpose of the Area of Outstanding Natural Beauty (AONB) designation is to conserve natural beauty; but account is taken of the need to safeguard agriculture, forestry and other rural industries, and of the economic and social needs of local communities (Countryside Commission 1994). AONBs are statutorily designated, in England by the Countryside Commission and since 1991 in Wales by CCW, under the National Parks and Access to the Countryside Act 1949. There is one AONB (13,500 ha) in Region 5 (see Table 7.3.5 and Map 7.3.3). This compares with a total of 23 (880,400 ha) that include areas within the coastal zone in Great Britain, of which the whole of thirteen and half of one, together covering 695,300 ha, are on the North Sea coast. In 1993 the total area covered by AONBs in England and Wales was 2,104,200 ha (Countryside Commission 1994). These areas cover nearly 14% of the countryside of England and Wales.

7.3.6 National Parks

The purpose of National Parks is to preserve and enhance the most beautiful, dramatic and spectacular expanses of countryside in England and Wales (Countryside Commission 1993), while promoting public enjoyment of them, and having regard for the social and economic well-being of those living within them. National Parks in England and Wales were statutorily designated by the National Parks Commission and confirmed by the Government between 1951 and 1957, and one area with similar status, The Broads, was established in 1989. The Countryside Commission (England) and CCW (Wales)

Table 7.3.5 Areas of Outstanding Natural Beauty (AONBs) and National Parks

Type	*Site name*	*Area (ha)*	*Date designated*
AONB	Northumberland Coast	**13,500**	1958
National Park	North York Moors, N. Yorks/Cleveland	**143,600**	1952

Source: CC. Key: n/a[a] = not applicable. Note: In this table coastal National Parks are those that fall within 1 km of mean high water mark or normal tidal limit.

advise government on National Parks, each of which is administered by a Park Authority. There is one National Park (143,600 ha) in Region 5 (see Table 7.3.5 and Map 7.3.3). This compares with a total of six National Parks (745,000 ha) that include areas within the coastal zone in Great Britain, of which two sites (173,900 ha) are on the North Sea coast.

7.3.7 Country Parks

Country Parks are primarily intended for recreation and leisure opportunities close to populations and do not necessarily have any nature conservation interest. Nevertheless, many are in areas of semi-natural habitat and so form a valuable network of locations at which informal recreation and the natural environment co-exist. They are statutorily declared and managed by local authorities under section 7 of the Countryside Act 1968. There are two Country Parks (368 ha) in Region 5 (see Table 7.3.6 and Map 7.3.3). This compares with a total of 34 coastal Country Parks (4,441 ha) in Great Britain, of which 20 (2,943 ha) are on the North Sea coast. There are 281 Country Parks (approximately 35,150 ha) in Britain as a whole (data provided by the CC and CCW, and Countryside Commission for Scotland (1985).

Table 7.3.6 Country Parks

Site name	*Grid ref.*	*Area (ha)*	*Date opened*
Druridge Bay, Northumberland	NZ269985	306	1989
Tyne Riverside, Northumberland/ Tyne & Wear	NZ160656	62	1985
Total		***368***	

Source: CC, EN. Note: In this table any site that is wholly or partly intertidal, and any terrestrial site at least partly within 1 km of the Mean High Water Mark, or any tidal channel as depicted on 1:50,000 Ordnance Survey maps, is included as coastal.

7.3.8 Further sources of information

A. References cited

Countryside Commission for Scotland. 1985, *Scotland's Country Park Register.* Edinburgh, Countryside Commission for Scotland.

Countryside Commission. 1992. *Directory of Areas of Outstanding Natural Beauty.* Cheltenham, Countryside Commission.

Countryside Commission. 1993. *The National Park Authority - purposes, powers and administration: a guide for members of National Park Authorities.* Cheltenham, Countryside Commission and Countryside Council for Wales.

Countryside Commission. 1994. *AONBs in England and Wales.* Rev. ed. Cheltenham, Countryside Commission (leaflet CCP276).

Marren, P.R. 1994. *England's National Nature Reserves.* Newton Abbott, David & Charles.

B. Further information

Further details of SSSIs may be found on the *Coastal & Marine UKDMAP datasets module* (Barne *et al.* 1994) disseminated by JNCC Coastal Conservation Branch, Peterborough.

Barne, J., Davidson, N.C., Hill, T.O., & Jones, M. 1994. *Coastal and marine UKDMAP datasets: a user manual.* Peterborough, Joint Nature Conservation Committee.

Countryside Commission. 1992. *National Parks in England and Wales.* Rev. ed. Cheltenham, Countryside Commission (leaflet CCP208).

Countryside Commission. 1994. *Areas of Outstanding Natural Beauty - a guide for members of Joint Advisory Committees.* Cheltenham, Countryside Commission (leaflet CCP246).

Countryside Commission. 1994. *Countryside planning file.* Cheltenham, Countryside Commission.

Countryside Commission. 1994. *United Kingdom protected environment map.* Southampton, Ordnance Survey.

Nature Conservancy Council. 1984. *Nature conservation in Great Britain.* Peterborough, Nature Conservancy Council.

Nature Conservancy Council. 1989. *Guidelines for selection of biological SSSIs.* Peterborough, Nature Conservancy Council.

Nature Conservancy Council. 1989. *Local Nature Reserves.* Peterborough, Nature Conservancy Council. (Library information sheet No. 6.)

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
SSSIs (North & East Yorkshire Humberside)	*Conservation Officer North and Yorkshire (East)/Conservation Officer North Humberside, English Nature (North and East Yorkshire Local Team), York, tel: 01904 432700
NNRs, SSSIs, LNRs (Northumberland, Durham, Tyne and Wear, Cleveland).	*Conservation Officer East Northumberland, English Nature (Northumbria Local Team), Newcastle upon Tyne, tel: 0191 281 6316
Areas of Special Protection	European Wildlife Division, DoE, Room 9/03B, Tollgate House, Houlton Street, Bristol BS2 9DJ, tel: 0117 987 8811
National Park	Countryside Commission (Yorkshire & Humberside Region), 2nd Floor, Victoria Wharf, Embankment IV, Sovereign Street, Leeds LS1 4BA, tel: 0113 246 9222
AONB, (Northumberland, Tyne and Wear and Cleveland), Country Parks	Countryside Commission (Northern Region), Warwick House, Grantham Road, Newcastle upon Tyne NE2 1QF, tel: 0191 232 8252
North York Moors National Park	North York Moors National Park, The Old Vicarage, Bondgate, Helmsley, York YO6 5BP, tel: 01439 70657
National Parks	Council for National Parks, 246 Lavender Hill, London SW11 1LJ, tel: 0171 924 4077

* Starred contact addresses are given in full in the Appendix

7.3.9 Acknowledgements

Thanks are due, in particular, to Ray Woolmore (Countryside Commission), and also to Roger Bolt (JNCC), Phillip Biss (English Nature), Site Safeguards Team (CCW), Kathy Duncan, Natasha O'Connel (SNH), Neale Oliver (DoE), and Paul Johnson (CC).

7.4 Sites identified by statutory agencies

This section covers sites which, although not protected by statute, have been identified by statutory agencies as being of nature conservation or landscape importance.

7.4.1 Nature Conservation Review sites

There are 953 confirmed Nature Conservation Review (NCR) sites (approximately 1,500,000 ha) existing in Britain. NCR sites are non-statutory sites identified by statutory conservation bodies. As defined by Ratcliffe (1977), whose definition differs from that adopted in this chapter (see section 7.1.1), 149 of these sites (approximately 360,000 ha) are coastal (data provided by Biotopes Conservation Branch, JNCC). Coastal NCR sites include all those supporting nationally and internationally important bird populations, as well as those holding the best representative examples of vegetative habitats. The NCR series helps to identify suitable candidates for biological NNR designation.

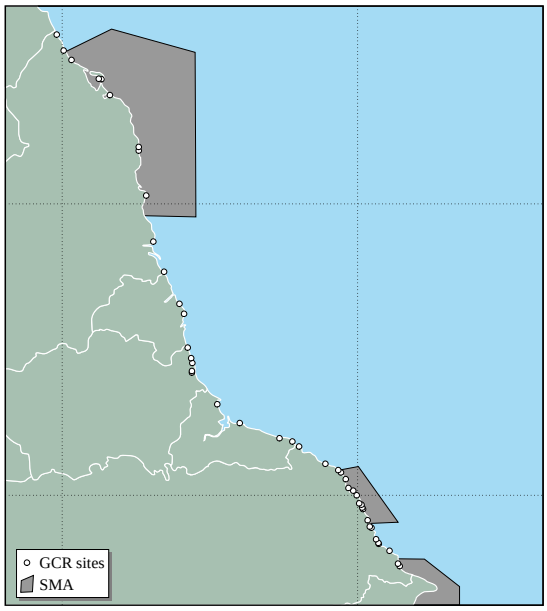
7.4.2 Geological Conservation Review sites

Geological Conservation Review (GCR) sites are non-statutory sites identified by statutory conservation agencies; they are sites of national and international earth science importance. The GCR selection process describes and assesses key sites in the context of their geology, palaeontology, mineralogy or geomorphology; GCR sites are the earth science equivalent of NCRs. Almost 3,000 individual GCR Single Interest Localities (SILs) have been identified. There are 52 GCR SILs within Region 5, listed in Table 7.4.1 with an indication of whether they were selected for their geological or their coastal geomorphological interest (Map 7.4.1). This compares with a total of 1,059 coastal GCR sites in Britain, 508 of which are found on the North Sea coast (data provided by JNCC Earth Sciences Branch). Detailed scientific accounts of 519 of the 2,997 GCR sites in Great Britain so far selected for conservation have been published in nine volumes of a planned 42-volume series (Smith 1995; JNCC in prep., Cleal & Thomas in prep., Gregory in prep., *inter alia*).

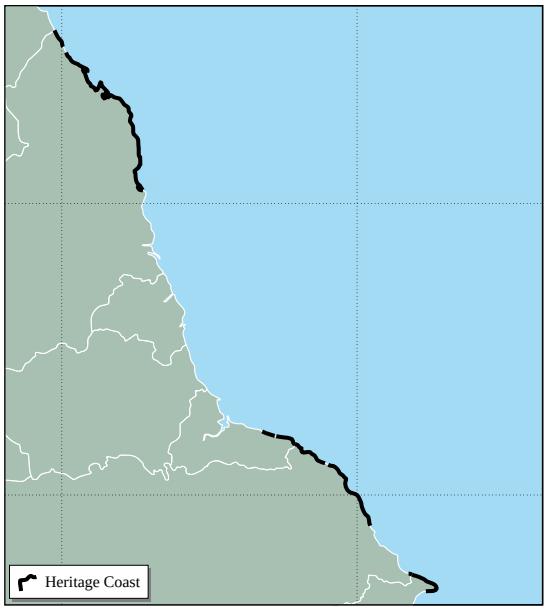
Table 7.4.1 GCR Single Interest Localities (SILs)

Site name
Northumberland
Spittal Shore
Goswick - Holy Island - Budle Bay*
Holy Island (2 SILs)
Budle Point to Harkess Rocks
Cullernose Point to Castle Point
Howick to Seaton Point
Low Hauxley
Sandy Bay
Cresswell and Newbiggin Shores
Tyne & Wear/Northumberland
Tynemouth to Seaton Sluice
Tyne & Wear
Marsden Bay*
Whitburn
Seaham Harbour
Durham
Hawthorn Quarry
Shippersea Bay, Easington
Warren House Gill
Yoden Village Quarry
Cleveland
Hartlepool
Redcar Rocks
North Yorkshire
Boulby Quarries
Staithes - Port Mulgrave
Runswick Bay
Whitby - Saltwick (2 SILs)
Whitby
Hawsker Bottoms
Castle Chamber - Maw Wyke
Maw Wyke (Hawsker Bottoms)
Normandy Stye Batts - Miller's Nab
Robin Hood's Bay*
Millers Nab - Blea Wyke
Blea Wyke
Beast Cliff
Hayburn Wyke
Iron Scar - Hundale
Cloughton Wyke
Hundale Point - Scalby Ness
Scalby Ness
North Bay, Scarborough
South Toll House Cliff
Cornelian Bay
Osgoodby Point
Red Cliff
Gristhorpe Bay
Red Cliff
Yons Nab
Filey Brigg
Speeton
Speeton
Speeton Sands
Speeton Beck to Red Cliff Hole
Humberside
Flamborough Head

Source: EN, JNCC. Key: * Sites selected wholly or partly for their coastal geomorphological interest (all other sites geological). Note: In this table any site that is wholly or partly intertidal, and any terrestrial site at least partly within 1 km of the Mean High Water Mark, or any tidal channel as depicted on 1:50,000 Ordnance Survey maps, is included as coastal.



Map 7.4.1 Coastal Geological Conservation Review (GCR) sites and Sensitive Marine Areas (SMA). Source: English Nature, JNCC. Note: a single symbol may represent more than one site in close proximity.



Map 7.4.2 Heritage Coasts. Source: Countryside Commission.

7.4.3 Heritage Coasts

A Heritage Coast is an area selected for having a coastline of exceptionally fine scenic quality; exceeding 1 mile in length; substantially undeveloped and containing features of special significance and interest. This non-statutory protection is agreed between local authorities and (in England) the Countryside Commission, as an aid to local authorities in planning and managing their coastlines. There are two Heritage Coasts (153 km) in Region 5 (see Table 7.4.2 and Map 7.4.2). This compares with a total of 45 Heritage Coasts, as at May 1993, covering 1,525 km of the English and Welsh Coast, of which the whole of seventeen and part of one, together covering 661 km, are on the North Sea coast. Of the English coastline encompassed by Heritage Coasts, 39.5% is protected by the National Trust (Heritage Coast Forum 1993).

7.4.4 Sensitive Marine Areas

Sensitive Marine Areas (SMAs) are non-statutory marine areas that are nationally important and notable for their marine plant and animal communities or which provide ecological support to adjacent statutory sites. They are identified by the statutory conservation body English Nature, with a further aim of raising awareness and disseminating information to be taken into account in estuarine and coastal management planning. These areas rely on the co-operation of users and local communities for sustainable management, with the help of grant aid. SMAs are the more commonly used term for areas described in previous technical documents (e.g. *Important areas for marine wildlife around England* (English Nature 1994a)) as 'Important Areas for Marine Wildlife' under English Nature's initiative *Managing England's marine wildlife* (English Nature 1994b). There are two whole and part of one other Sensitive Marine Areas within Region 5 (see Table 7.4.3 and Map 7.4.1), out of a total of 27 around the coast of England, of which sixteen whole sites and part of one other are on the North Sea coast.

Table 7.4.2 Heritage Coasts

Site name	*Grid ref.*	*Length (km)*	*Date designated*
North Northumberland	NT979567-NU266051	96	1973
North Yorkshire and Cleveland	NZ668216-TA036909	57	1974
Flamborough Headland, Humberside/N. Yorks.	TA202686-TA151757	2[a]	1979
Total		***153***	

Source: CC, JNCC. Key: [a] 2 km of Flamborough Head Heritage Coast falls within North Yorkshire but is included in the Heritage Coast total figure for Region 6, as the greater part of the Heritage Coast (17 km) is within Humberside. Note: In this region, all Heritage Coasts are completely defined (i.e. have a defined landward boundary as well as a lateral boundary).

Table 7.4.3 Sensitive Marine Areas

Site name	*County*	*Date established*
Holy Island and the Farnes	Northumberland	1994
Robin Hood's Bay & associated coast	Yorkshire	1994
Flamborough Head[a]	N Yorkshire/ Humberside	1994

Source: EN (1994a). Key: [a] Most of Flamborough Head SMA is within Humberside (Region 6).

7.4.5 Further sources of information

A. References cited

Cleal, C.J., & Thomas, B.A. In prep. *British Upper Carboniferous stratigraphy*. London, Chapman & Hall. (Geological conservation Review series.)

English Nature. 1994a. *Important areas for marine wildlife around England*. Peterborough, English Nature.

English Nature. 1994b. *Managing England's marine wildlife.* Peterborough, English Nature.

Gregory, K.J., *ed*. In prep. *Fluvial geomorphology of Great Britain*. London, Chapman and Hall.

Heritage Coast Forum. 1993. *Heritage Coasts in England and Wales; a gazetteer.* Manchester, Heritage Coast Forum.

Joint Nature Conservation Committee. In prep. *Introduction to the Geological Conservation Review.* Peterborough, JNCC.

Ratcliffe, D.A., *ed*. 1977. *A nature conservation review*. Cambridge, Cambridge University Press.

Smith, D.B. In press. *Marine Permian of England.* London, Chapman & Hall. (Geological Conservation Review series.)

B. Further reading

Countryside Commission. 1992. *Heritage Coasts in England: policies and priorities*. Cheltenham, Countryside Commission.

Countryside Commission. 1993. *Heritage Coasts in England and Wales.* Rev. ed. Cheltenham, Countryside Commission (leaflet CCP252*).*

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
NCR and GCR sites; SMAs (North and East Yorkshire and Humberside)	*Conservation Officer North Yorkshire (East)/Conservation Officeer North Humberside, English Nature (North and East Yorkshire Local Team), York, tel: 01904 432700
NCR and GCR sites; SMAs (Northumberland, Tyne & Wear, Cleveland)	*Conservation Officer East Northumberland, English Nature (Northumbria Local Team), Newcastle-upon-Tyne, tel: 0191 281 6316
Heritage Coasts (Northumberland, Tyne and Wear and Cleveland)	*Countryside Commission (Northern Region),Newcastle upon Tyne, tel: 0191 232 8252
Heritage Coasts	*Countryside Commission (Yorkshire & Humberside Region), Leeds, tel: 0113 246 9222

* Starred contact addresses are given in full in the Appendix

7.4.6 Acknowledgements

Thanks to Ray Woolmore and Paul Johnson (Countryside Commission), Roger Bolt and Earth Sciences Branch (JNCC), Sylvia White, Phillip Biss, Paul Gilliland and Alan Remfry (EN), Kathy Duncan and Natasha O'Connel (SNH), and Site Safeguards Team (CCW).

7.5 Other types of protected site

7.5.1 The National Trust

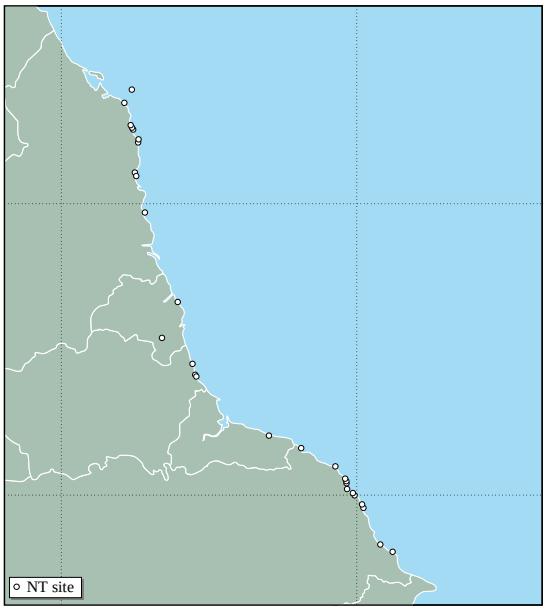
The National Trust (NT) is an independent charity that is currently the largest private landowner in Britain. The National Trust owns about 230,000 ha of land in England, Wales and Northern Ireland, and over 200 buildings of outstanding importance. It has also accepted or bought covenants, which protect against development, for a further 31,600 ha of land and buildings. Many of the tenanted properties have individual intrinsic value; when viewed cumulatively, they protect large areas of unique landscape and countryside. The National Trust has statutory powers to protect its properties, under an Act of Parliament (1907) which declares its holdings of land and buildings inalienable; these properties cannot be sold or mortgaged. In addition, National Trust properties can be protected by bye-laws. In 1985 the National Trust relaunched its 1965 campaign 'Enterprise Neptune' to raise funds for the purchase of coastal areas. A total of 850 km of coast are now protected by the National Trust (National Trust 1993).

There are 34 National Trust sites (1,450 ha) in Region 5 (see Table 7.5.1 and Map 7.5.1). This compares with a total

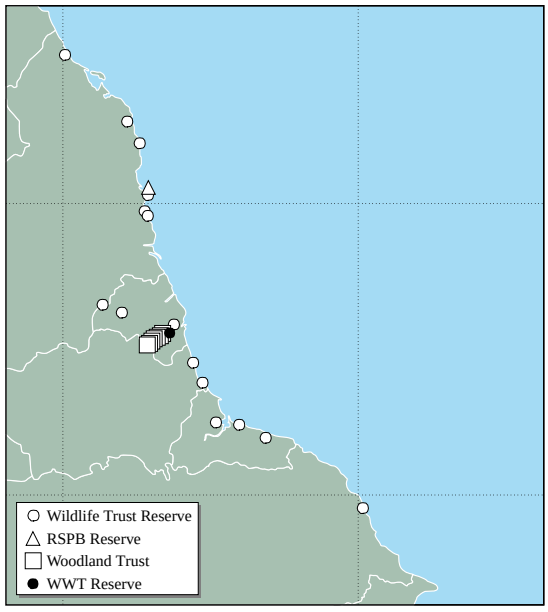
Table 7.5.1 National Trust sites

Site name	*Grid ref.*	*Area (ha)*	*Date acquired*	*Description*
Northumberland				
Farne Islands	NU2337	32	1925	30 islands
St Aidan's and Shoreston Dunes	NU211327	24	1936	sand dunes
Beadnell and Annstead Dunes	NU232298	4	1986	sand dunes and grazing land
Newton Links	NU236260	22	1966	sand dunes and grazing land
Newton Point	NU242253	47	1983	coastal dunes and pasture
Low Newton -by-the-Sea (including Newton Haven)	NU241246	56	1980-82	beach and village
Newton Pool	NU243240	6	1972	freshwater pool
Embleton Links	NU243235	244	1961	dunes, foreshore, golf course
Dunstanburgh Castle	NU258220	4	1961	cliffs and castle
Dunstanburgh Heughs	NU257205	111	1990	coastal farmland
Alnmouth	NU241094	90	1966-78	dunelands/saltings
Buston Links	NU251085	8	1978	sand dunes
Druridge Bay	NZ285965	40	1972	sand dunes/fen
Tyne & Wear				
The Leas & Marsden Rock	NZ388665	114	1987	cliffs and cliff top grassland
Penshaw Monument	NZ333543	18	1939-82	coastal hill and woodland
Durham				
Hawthorn Dene & Chourdon Point	NZ440460	67	1990	beach, cliff-top, wooded dene and farmland
Beacon Hill	NZ440455	14	1987	cliff top, pasture and woodland
Warren House	NZ445425	35	1988	beach,dene and cliff top
Blackhills Gill	NZ450415	45	1990	cliff top and grassland hinterland
Cleveland				
Hunt Cliff and Warsett Hill	NZ692215	62	1991	undercliff and cliffs
N Yorkshire				
Port Mulgrave	NZ796175	15	1988	wild coastal slope
Saltwick Nab	NZ914112	3	1936	cliffland and promontory
Smails Moor	NZ954070	6	1982	cliff field
Bay Ness Farm	NZ958060	72	1981-86	headland, cliffs and coastal fields
Rocket Post Field	NZ955058	5	1976	cliff and coastal land
Boggle Hole	NZ955040	3	1986	cliff
Ravenscar: Stoupe Brow Farm	NZ966024	29	1985-88	cliff and coastal farmland and scrub
Ravenscar Brickyards	NZ973015	7	1981	disused quarry
Ravenscar	NZ980025	105	1977-87	cliff and coastal farmland
Ravenscar: Bent Rigg Farm	NZ995000	39	1985	cliff-top land
Staintondale	TA005985	37	1981-82	cliff and coastal farmland
Hayburn Wyke	TA010970	26	1981	cliffs and wooded valley
Cayton Bay & Knipe Point	TA063850	36	1984	cliff, undercliff and beach
Newbiggin East Farm	TA105825	10	1983	cliffs and coastal farmland
Total			***1,450***	

Source: The National Trust. Note: In this table any site that is wholly or partly intertidal, and any terrestrial site at least partly within 1 km of the Mean High Water Mark, or any tidal channel as depicted on 1:50,000 Ordnance Survey maps, is included as coastal.



Map 7.5.1 Coastal National Trust sites. Source: National Trust. Note: a single symbol may represent more than one site in close proximity.



Map 7.5.2 Other voluntary and private sites. Source: Wildlife Trusts, RSPB, Woodland Trust, Wildfowl & Wetlands Trust Note: a single symbol may represent more than one site in close proximity.

of 446 coastal sites (62,648 ha) in Britain under the protection of the NT or National Trust for Scotland (NTS), of which 190 (17,387 ha) are on the North Sea coast. The NT (encompassing England and Wales) has 426 coastal sites (37,478 ha) (data extracted from National Trust (1992)); the NTS has nineteen coastal sites (25,170 ha) (data extracted from National Trust for Scotland (1993)).

7.5.2 The Royal Society for the Protection of Birds

The Royal Society for the Protection of Birds (RSPB) has substantial non-statutory reserve holdings and currently manages over 130 reserves (84,000 ha) in Britain (RSPB 1993). Wherever possible, reserves are purchased, so that the level of safeguard for the wildlife and their habitats is high. Where reserves are leased, the RSPB aims to acquire long leases (longer than 21 years) with appropriate management rights. There is one RSPB site (6 ha) in Region 5 (see Table 7.5.2 and Map 7.5.2). This compares with a total of 79 coastal RSPB sites (37,142 ha) in Great Britain, of which 52 (23,296 ha) are on the North Sea coast (data extracted from RSPB (1993) and RSPB (*in litt.*)).

7.5.3 The Wildfowl & Wetlands Trust

As well as their wildfowl collections, used extensively for education, The Wildfowl & Wetlands Trust (WWT - formerly the Wildfowl Trust) has established non-statutory reserves in a number of key wintering areas for migrant wildfowl. The level of protection afforded to such sites is high, since the land is either owned or held on long leases. There is one WWT site (41 ha) in Region 5 (see Table 7.5.3 and Map 7.5.2). This compares with a total of six coastal WWT sites (1,585 ha) in Great Britain, of which three (472 ha) are on the North Sea coast (data provided by the Wildfowl & Wetlands Trust).

Table 7.5.2 Royal Society for the Protection of Birds sites

Site name	*Grid ref.*	*Area (ha)*	*Date acquired*
Coquet Island, Northumberland	NU294046	6	1970

Source: RSPB (*in litt.*). Note: In this table any site that is wholly or partly intertidal, and any terrestrial site at least partly within 1 km of the Mean High Water Mark, or any tidal channel as depicted on 1:50,000 Ordnance Survey maps, is included as coastal.

Table 7.5.3 Wildfowl & Wetlands Trust sites

Site name	*Grid ref.*	*Area (ha)*	*Date acquired*
Washington, Co. Durham	NZ333561	41	1975

Source: WWT. Note: In this table any site that is wholly or partly intertidal, and any terrestrial site at least partly within 1 km of the Mean High Water Mark, or any tidal channel as depicted on 1:50,000 Ordnance Survey maps, is included as coastal.

7.5.4 The Wildlife Trusts

The Wildlife Trusts have been established to promote non-statutory nature conservation at a local level. They own, lease and manage, by agreement with owners, over 1,800 nature reserves (more than 52,000 ha). There is usually one trust covering a whole county or group of counties, although both Scotland and the Isle of Man each have a single Trust. The Trusts in the region are the Northumberland Wildlife Trust, the Durham Wildlife Trust, the Cleveland Wildlife Trust and the Yorkshire Wildlife Trust. There are fifteen Wildlife Trust sites (461 ha) in Region 5 (see Table 7.5.4 and Map 7.5.2). This compares with a total of 218 coastal Wildlife Trust sites (23,398 ha) in Great Britain, of which 122 (10,411 ha) are on the North Sea coast. The Wildlife Trusts were revising their databases at

the time this section was written; 1990 data on English/Welsh Wildlife Trust sites have therefore been utilised, with Scottish data extracted from Scottish Wildlife Trust (1994), except where indicated otherwise in Table 7.5.4. Of the 218 sites in Britain covering the 'coast', there are 26 Scottish sites (13,805 ha), 186 English/Welsh sites (9,578 ha) and six Isle of Man sites (14 ha).

Table 7.5.4 The Wildlife Trusts sites

Site name	*Grid ref.*	*Area (ha)*	*Date acquired*
Northumberland Wildlife Trust			
Cocklawburn Dunes	NU033481	5	1979
Annstead Dunes*	NU226305	32	1994
Arnold Memorial, Craster	NU255197	1	1962
Hauxley	NU284024	32	1970
Druridge Pools	NZ274966	57	1979
Cresswell Pond	NZ283943	25	1988
Close House Riverside	NZ130652	2	1969
Durham Wildlife Trust			
Shibdon Pond (Tyne & Wear)	NZ195628	14	1966
Timber Beach (Tyne & Wear)	NZ369584	2	1964
Hawthorn Dene	NZ433457	63	1970
Blackhall Rocks*	NZ473387	79	1973
Cleveland Wildlife Trust			
Cowpen Marsh	NZ510255	65	1972
Coatham Marsh	NZ586247	54	1964
Saltburn Gill	NZ676205	16	1968
Yorkshire Wildlife Trust			
Hayburn Wyke	TA006971	14	1977
Total		***461***	

Source: Wildlife Trusts 1990 data, except sites marked*. Note: In this table any site that is wholly or partly intertidal, and any terrestrial site at least partly within 1 km of the Mean High Water Mark, or any tidal channel as depicted on 1:50,000 Ordnance Survey maps, is included as coastal.

7.5.5 The Woodland Trust

The Woodland Trust was established in 1972 with the aim of conserving, restoring and re-establishing trees (particularly broad-leaved) and woodland plants and wildlife in the United Kingdom. There are seven Woodland Trust sites (25 ha) in Region 5 (Table 7.5.5 and Map 7.5.2). This compares with a total of 64 coastal Woodland Trust sites (1,458 ha) in Great Britain, of which 35 (1,095 ha) are on the North Sea coast (data extracted from Woodland Trust (1993)).

Table 7.5.5 The Woodland Trust sites

Site name	*Grid ref.*	*Area (ha)*
Tyne & Wear		
High Barmston	NZ328555	5
Jubilee Terrace	NZ324551	0.4
Low Lambton & South Bank Woods	NZ322546-322548	1
Biddick Burn Wood	NZ306544	5
Reach Wood	NZ319543	6
General's Wood	NZ297537	5
Mount Pleasant Woods	NZ316538 & NZ314536	2
Total		***25***

Note: In this table any site that is wholly or partly intertidal, and any terrestrial site at least partly within 1 km of the Mean High Water Mark, or any tidal channel as depicted on 1:50,000 Ordnance Survey maps, is included as coastal.

7.5.6 Further sources of information

A. References cited

National Trust. 1992. *Properties of the National Trust.* Reading, The National Trust.

National Trust. 1993. Enterprise Neptune - saving our unspoiled coastline. *Coastline 1993,* No.2, 1-11.

National Trust for Scotland. 1993. *Guide to over 100 properties 1993.* Edinburgh, The National Trust for Scotland.

Royal Society for The Protection of Birds. 1993. *Nature reserves - information for visitors.* Sandy, RSPB.

Scottish Wildlife Trust. 1994. *Reserves 1994 leaflet - a visitors' guide.* Edinburgh, Scottish Wildlife Trust.

Woodland Trust. 1993. *Directory of Woodland Trust properties 1993.* Grantham, The Woodland Trust.

B. Contact names and addresses

Type of information	*Contact address and telephone no.*
National Trust sites (England and Wales)	*Coast and Countryside Adviser, The National Trust, Cirencester, tel: 01285 651818
National Trust sites (Yorkshire)	*Land Agent, The National Trust Yorkshire Region, York, tel: 01904 702021
National Trust sites (Northumbria)	*Land Agent, The National Trust Northumbria Region, Morpeth, tel: 01670 74691
Royal Society for the Protection of Birds sites	*Regional Officer, RSPB North of England Office, Newcastle upon Tyne, tel: 0191 232 4148
The Wildfowl and Wetlands Trust Washington site	C. Francis, The Wildfowl and Wetlands Trust, Ditrict 15, Washington, Tyne and Wear NE38 8LE, tel: 0191 416 5454
Cleveland Wildlife Trust sites	*Conservation Officer, Cleveland Wildlife Trust, Redcar, tel: 01642 480033
Yorkshire Wildlife Trust sites	*Conservation Officer, Yorkshire Wildlife Trust,York, tel: 01904 659570
Durham Wildlife Trust sites	*Conservation Officer, Durham Wildlife Trust, Witton-Le-Wear, tel: 01388 488728
Northumberland Wildlife Trust sites	*Conservation Officer, Northumberland Wildlife Trust, Newcastle upon Tyne, tel: 0191 284 6884
The Woodland Trust sites	The Woodland Trust, Autumn Park, Dysart Road, Grantham, Lincolnshire NG31 6LL, tel: 01476 74297

* Starred contact addresses are given in full in the Appendix

7.5.7 Acknowledgements

The author wishes to thank Jo Burgon and Richard Offen (The National Trust), Dr. J. Fenton (National Trust for Scotland), Bob Scott (RSPB), Mark Pollitt (Wildfowl and Wetlands Trust), Sarah Hawkswell (The Wildlife Trusts), Dr.A. Somerville (Scottish Wildlife Trust), Meryl Eales (Manx Trust for Nature Conservation), Andrew Johnson (Manx Natural Heritage), Martin Mathers (WWF), and The Woodland Trust.

Blyth Harbour Wind Farm, Northumberland. One of only two operating windfarms on the east coast of Great Britain, the nine turbines at Blyth are a new development in a part of the region formerly more known for its coal mines and associated power stations. Photo: N.C. Davidson, JNCC.

Chapter 8 Land use, infrastructure and coastal defence

S.L. Fowler, J.A. Norton, M.J. Dunbar, C.A. Crumpton & M.J. Goodwin

8.1 Introduction

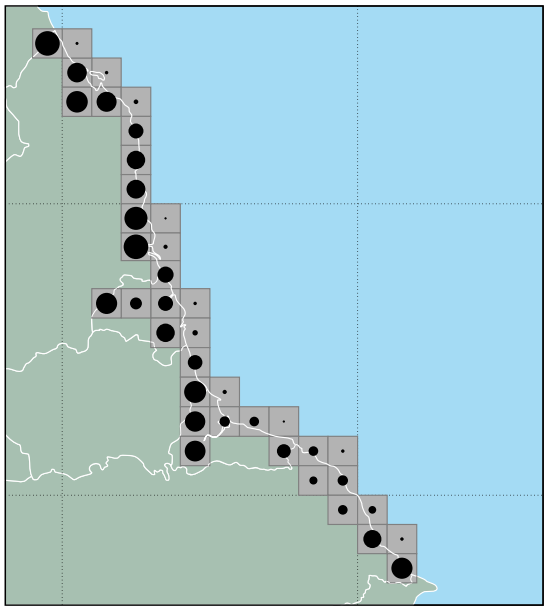
This chapter is divided into three sections: (rural) land use, covering agriculture and woodland; infrastructure, covering population distribution, industry, ports, harbours, ferries, pipelines, cables and power generation; and coastal defence, including sea defence and coast protection.

The region extends from the border with Scotland, through the long, largely rural and agricultural coastline of north Northumberland (where extensive areas are designated as Heritage Coast) into the heavily urbanised and industrial coastline of north-east England, and to the rural North York Moors National Park. The heavily industrialised section of coast starts at Blyth, Northumberland, and continues south almost without break through the counties of Tyne & Wear and Durham to the southern side of the Tees estuary, Cleveland, and includes several large industrialised estuaries (the Tyne, Wear and Tees). This intensive industrial and urban land use finally peters out along the Cleveland to North Yorkshire coastline. Coastal areas of North Yorkshire outside the National Park contain significant urban and tourism-related development.

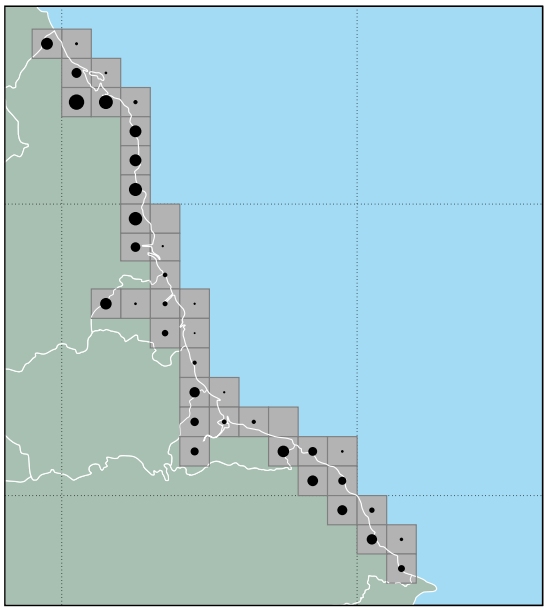
8.2 Land use

8.2.1 Introduction

The predominant land use in the north of the region is agriculture. The coast is largely rural, with scattered small towns and villages, and there is often a fringe of sand dunes or saltmarsh bordering the sea. However, agriculture features very little in the central part of the region. In North Yorkshire, coastal land use varies, with a mixture of urban and agricultural land uses. Map 8.2.1 shows the distribution of coastal arable farm land in the region. The area of arable farm land in the region is roughly comparable with that in many other regions on the North Sea coast and much greater than for regions on the west coast. Map 8.2.2 shows the distribution of pasture in the region. Region 5 is important for livestock production in the context of the North Sea coast but less important than the West Coast in the context of England and Wales. The region has a very low density of coastal woodland, as is typical on the open North Sea coast (Map 8.2.3).



Map 8.2.1 Tilled land. Note: area of circle indicates the area of this land cover type in the 10 km square. Source: Countryside Survey (1990), ITE Monks Wood.



Map 8.2.2 Mown/grazed turf. Note: area of circle indicates the area of this land cover type in the 10 km square. Source: Countryside Survey (1990), ITE Monks Wood.

8.2.2 Locations and land uses

From the Scottish Border to Lynemouth (just north of Newbiggin), agriculture is the dominant land use, mostly on Grade 3 land (Ministry of Agriculture, Fisheries and Food agricultural land classification). There is a fringe of 'unclassified' land along the coast in many areas in the northern part of the region, usually representing sand dunes or saltmarsh under management for nature conservation or recreation. Stock grazing takes place on semi-natural grassland, heath and coastal habitats (see also section 9.3). From Lynemouth south, the land use becomes a mix of agriculture and industry. There is a small area of coastal agriculture between Blyth and Seaton Sluice, and a coastal strip of mainly arable land interspersed with former colliery developments along much of the Durham coast. The agricultural land along this section of coast, where the grade is recorded, is primarily Grade 3.

From Redcar to Saltburn-by-the-Sea there is a mixture of urban and agricultural land use on the coast. There is a small area of Grade 2 agricultural land between Redcar and Marske. South of this point and throughout North Yorkshire (where agriculture is the main coastal land use) the land is also mostly Grade 3, with some Grade 4. As in Northumberland, semi-natural coastal habitats are used for rough grazing.

There is little coastal woodland in the Northumberland, other than a few shelter belts or woodlands alongside burns running down to the coast. Similar features are present between Sunderland and Hartlepool, where the steep sides of stream and river valleys ('denes') running into the sea are mostly wooded, except in the most heavily developed areas. The largest coastal valley woodland in the region is at Castle Eden Dene, near Peterlee, Co. Durham. In North Yorkshire two small areas of woodland are located close to the coast at Sandsend (near Whitby) and at Beast Cliff (seven miles north of Scarborough).

8.2.3 Information sources used

Information for this section was obtained from the 1:50,000 scale Ordnance Survey Landranger maps and from the Countryside Survey 1990 (ITE 1993), which is based on high resolution satellite images. These images show the dominant land cover for each 25 m x 25 m area of Great Britain. Maps 8.2.1 and 8.2.2 are derived from printouts of these data from the DoE's Countryside Information System. The main limitation of these data derives from errors in classifying areas covered by a mixture of land types and from the form of presentation used in the maps. It is important to note that the dots shown in Maps 8.2.1 and 8.2.2 represent the equivalent area of that 10 km square (including sea) that is occupied by the land cover type. Areas of agricultural land set back from the coast are therefore included. Areas of recreational or amenity grassland and abandoned farmland in the industrialised counties may have been included in the mown/grazed turf category.

More detailed information on agricultural land use is available from the Agricultural Development and Advisory Service (ADAS) (for example, information on set-aside targets), Heritage Coast and National Park documents, and local plans. The former Nature Conservancy Council's

Map 8.2.3 Coastal woodland. Source: Ordnance Survey Landranger maps. © Crown copyright.

Inventory of ancient woodlands is another source of comparative data for the region and Great Britain. The Forestry Commission is able to provide maps of forestry areas throughout the country. Frid *et al.* (1991) provides a very useful introduction to land use in most of the region.

8.2.4 Further sources of information

A. References cited

Frid, C.L.J., Evans, S.M., & Clark, R.B. 1991. *The north-east coast of England: environmental appraisal*. (Contractor: University of Newcastle-upon-Tyne, Dove Marine Laboratory, Cullercoats.) Unpublished Report to Shell UK Exploration and Production.

Institute of Terrestrial Ecology. 1993. *Countryside survey 1990: main report*. London, Department of the Environment.

B. Further reading

Spencer, J.W., & Kirby, K.J. 1992. An inventory of ancient woodland for England and Wales. *Biological Conservation*, *62*: 77-93.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Land use, agricultural land grades, set-aside	MAFF, Whitehall Place, London SW1A 2HH, tel: 0171 270 3000
Land use, agricultural land grades, set-aside	ADAS Land Service, Oxford Spire Business Park, The Boulevard, Kidlington, Oxford OX5 1NZ, tel: 01865 842742
Countryside Survey 1990	Department of Rural Affairs, Department of the Environment, Room 919, Tollgate House, Houlton Street, Bristol BS2 9DJ, tel: 0117 921 8811
as above	*Land Use Group, Institute of Terrestrial Ecology, Merlewood, tel: 01539 532264
as above	*Environmental Information Centre, Institute of Terrestrial Ecology, Monks Wood, Abbots Ripton, Huntingdon PE17 2LS, tel: 01487 773381
Woodland extent, ownership, management	Conservator, Forestry Authority, Northumberland and Durham Conservancy, Redford, Hamsterley, Bishop Auckland, Co. Durham DL13 3NL, tel: 01388 488721
as above	Greater Yorkshire Conservancy, Wheldrake Lane, Crockey Hill, York YO1 4SG, tel: 01904 448778

* Starred contact addresses are given in full in the Appendix

8.3 Infrastructure

S.L. Fowler, J.A. Norton, M.J. Dunbar, C.A. Crumpton & M.J. Goodwin

8.3.1 Introduction

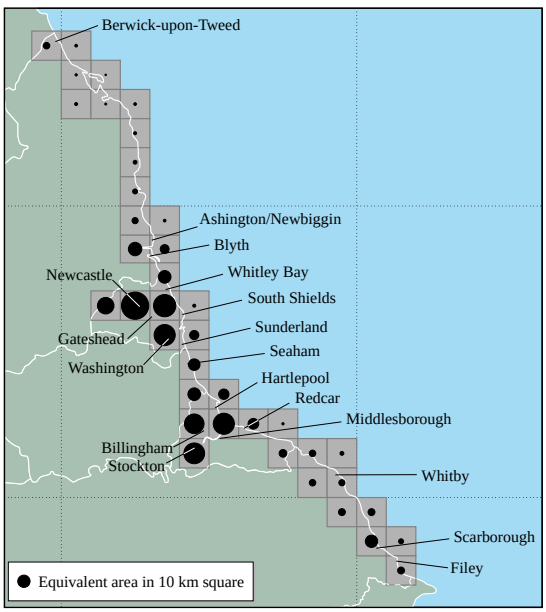
This section summarises the infrastructure of the region, including population distribution, industry, ports, harbours, airports and airfields, ferries, pipelines, cables and power generation, and land claim for these developments. Oil and gas exploration and development are covered in section 9.6.

This region contains sparsely populated areas with scattered small towns and villages in north Northumberland and North Yorkshire, contrasted with heavily populated centres in Tyne & Wear, Durham and Cleveland, although in these areas residential development is frequently set back from the coast. The northern part of the region is one of the most sparsely populated in England and Wales, although the southern section of Northumberland has a denser population than the north. The areas of dense urban development in the region are similar in scale to those around many of the other major industrial estuaries of Britain (the Forth, Humber, Severn and Solent areas) and second in scale only to the major coastal city sprawls of Edinburgh, Greater London, Liverpool and Glasgow.

Traditional industrial development in the region reflected the presence of extensive coal measures and sheltered estuaries. The estuaries of the Tyne, Wear and Tees provided easy access to sea transport and a supply of fresh water from tributaries for industrial processes. Other industries have subsequently gravitated to the same locations. The other major areas are Lynemouth, the Tyne and Sunderland. These are among the most important coastal centres for industry in the country, after the Thames/Greater London and Merseyside/Liverpool areas. With the run down and closure of many heavy industries, collieries and shipyards in the region, some industrial areas have been abandoned. In total, about 55 square km of land in the region are or were formerly occupied by heavy industrial activity, with over three quarters of this industry located on Teeside.

Oil- and gas-related industry occurring within this region is relatively limited, although there are important terminals for oil and gas on Teesside. Teesside's oil refining capacity represented 5.4% of the UK total in 1993 (see also section 9.6).

Industrial development in the region has led to extensive land claim for infrastructure and waste disposal, particularly in estuaries (see also section 4.1). The Tees estuary is one of the worst affected by land claim in Britain, having lost 90% of its intertidal area in the past 120 years. In the past, land-claim was primarily for agricultural land and grazing marshes, which have now largely been converted to intensive agriculture, urban development or industry. There has been a history of waste disposal into the sea or onto economically less important coastal habitats. Adjacent terrestrial habitats are also affected by claim for rubbish and spoil disposal. In the UK as a whole, two-thirds of recent land-claim has been for rubbish and spoil disposal, transport schemes, housing, car-parks, and marinas.



Map 8.3.1 Urban, suburban and rural development. Note: area of circle indicates the combined area of these land cover types in the 10 km square. Major towns and cities are also shown. Source: Countryside Survey (1990); ITE Monks Wood.

Table 8.3.1 Population centres in Region 5

Town or city	*Population*
Northumberland	
Berwick-upon-Tweed	27,000
Ashington/Newbiggin	24,000
Blyth	80,000
Tyne & Wear	
Whitley Bay	37,000
South Shields	87,000
Newcastle*	285,000
Gateshead*	202,900
Sunderland	94,000
Washington**	60,000
Durham	
Seaham	21,000
Cleveland	
Hartlepool	91,000
Middlesbrough	144,000
Stockton (Borough)***	177,000
Redcar	85,000
N. Yorkshire	
Whitby	14,000
Scarborough	110,000
Filey	6,000

Sources: Cook (1993), *Tyne & Wear Research Unit pers. comm., **1991 census, ***Stockton-on-Tees Borough Council pers. comm.

There are no airports or airfields near the coast in the region.

The most important international ports in the region are on the Tyne, and at Sunderland, Hartlepool and Teesport. They are among the largest in Britain and of considerable importance both in a regional and a national context. There are also numerous dock facilities along the major estuaries. Blyth and Seaham are large regional ports, and minor ports include Berwick (Tweedmouth), Whitby and Scarborough. Many modern ports and docks are constructed alongside areas of land claim in estuaries. Almost all necessitate the use of capital and maintenance dredging to enable large vessels to navigate shallow areas safely (see also section 9.5).

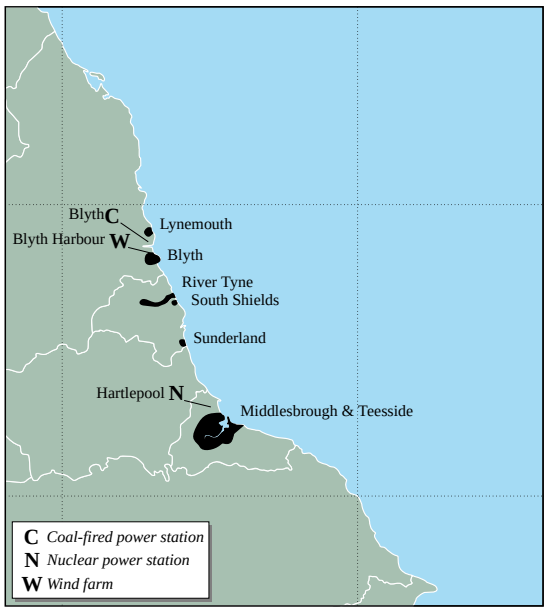
Many of the major ship-building and repair yards associated with the ports and harbours in the region have closed down. There has been a trend for port activity to move down-river from some of the traditional docks to deeper water and 'ro-ro' (roll-on, roll-off) facilities. There are several small fishing and recreational harbours in the region.

The region reflects the national trend towards diversification in power generation technology, with conventional, nuclear and renewable (a wind farm) power generation.

8.3.2 Important locations

Residential development

The general trend in population has been for a decline in the more heavily industrialised areas, whereas in popular tourist areas the population is probably increasing, with an influx of retired people and the increasing importance of leisure activities for the local economy. Populations in coastal tourist towns, for example in North Yorkshire, rise considerably during the holiday season. Areas of urban and suburban development by 10 km square are shown on Map 8.3.1, along with the locations of the coastal towns and cities in Table 8.3.1.



Map 8.3.2 Industrial infrastructure and coastal power stations and wind farms (supplying the national grid)

Industry

The main industrial areas of the region are shown on Map 8.3.2. Power stations are marked separately. Industrial areas in Northumberland are located on the coal measures in the south-east of the county, particularly around the valleys of the Blyth and Wansbeck. Two open cast coal mines were in operation until the early 1990s, at East and West Chevington near the northern end of Druridge Bay, separated from the coast by a line of sand dunes. Near Lynemouth a colliery and associated power station dumps coal waste into the sea on an annual licence. At Alnmouth the aluminium works uses sea water for cooling purposes, with the waste cooling water being used to grow ragworms for the angling bait market (see also section 9.2). In 1989 there was a proposal for a waste incineration plant at Blyth.

Many industries, including several dockyards, are present on the banks of the Tyne and Wear estuaries and along the open coast. Proposals for new industrial developments on the estuary shore in 1989 included a chemical works, a waste incineration plant and oil rig and platform construction at Jarrow Slake. Industrial activity on the Wear Estuary is more limited and includes a metal plant at Pallion. Some areas are now being redeveloped for residential, recreational or commercial purposes, for example the former Walker Naval Yard, now an Offshore Technology Park. There are large new office developments along the north bank of the Tyne, at Elswick and central Newcastle. The National Garden Festival site has river frontage on the south bank of the Tyne at Gateshead. In County Durham, the coastline is dominated by a number of closed collieries at Seaham, Dawdon, Easington, Horden, Blackhall and Vane Tempest. All of these used to dump coal waste into the sea. New industrial sites and business parks are now being developed.

Teesside, Cleveland, is also a major industrial area. The Tees estuary is bordered by industrial developments (particularly chemical, petrochemical and steel works), sites of former industry and open areas of ground originally intended for industrial use. The concentration of refineries, six major petrochemical works and four oil rig and platform construction sites developed as a result of the Tees-Ekofisk oil pipeline coming onshore here. There is a large titanium pigment plant south of Seaton Carew, on the northern side of Teesmouth, and large petrochemical works and an oil refinery at Seal Sands, north of the Tees, owned by Philips and ICI. A second oil refinery is located next to Teesport on the south side of the estuary, just inland from the major British Steel Teeside Steel Works at Bran Sands (which has its own jetty for importing iron ore and coal). Further up the estuary, ICI have an agrochemical plant at Billingham and chemical plant at Wilton and the south shore, and there are several ship repair yards and large port facilities (see Table 8.3.2). The River Tees is predominantly industrial for 13 km in total, upstream as far as Stockton-on-Tees. Along the south side of the estuary, there are also steel works at South Bank, although these have been cut back in recent years. In 1989, proposals for additional developments along the Tees estuary included an extension to the existing steelworks and a waste incineration plant. The major decline in the heavy industries (steel, ship building, oil-related construction) during the 1970s and '80s resulted in a serious fall in employment rates (25% from 1975 to 1987) on Teesside. Ship yards have closed at Haverton Hill and

Table 8.3.2 Major areas of industrial development in the region

Site/area	*Grid ref.*	*Details*
Berwick upon Tweed	NT9952	Boatyards, light engineering
Lynemouth	NZ3090	Aluminium works (100 ha)
	NZ2989	Ellington Colliery and power station (works use only) (80 ha)
Ashington	NZ2985	North Seaton Colliery (closed) (20 ha)
Blyth	NZ2982	Engineering works (40 ha)
	NZ3083	Blyth B Power Station (1,180 MW) (50 ha)
	NZ3082	Colliery (in mothballs) (20 ha)
Tynemouth:	NZ1665	
River Tyne/Tyneside (north shore: Wallsend and Newcastle; south shore: Jarrow, Hebburn, Gateshead, Blaydon and Ryton)	to NZ3567	Docks, several boatyards, oil rig platform construction, aluminium smelting works, and many other industries. Redevelopment of former industrial areas for commercial purposes. New office developments at site of Elswick National Garden Festival. Areas: north bank between Wallsend and Tynemouth: 160 ha; miscellaneous industry at Hebburn and Jarrow, inc. Nissan terminal, Hebburn colliery (closed): 150 ha; miscellaneous industry between Ryton and Gateshead (both banks): 200 ha.
South Shields	NZ3766	Colliery (closed) (15 ha)
Whitburn	NZ4063	Colliery (closed)
Sunderland	NZ4157	Dock and shipbuilding yard (80 ha)
	NZ3758	Metal industry and miscellaneous industry along river (200+ ha)
	NZ4053	Ryhope colliery (closed) (small). Enterprise Zone
Seaham	NZ4250	Colliery (closed)
Peterlee	NZ4343	Easington Colliery (closed)
	NZ4639	Blackhall Colliery (closed)
Hartlepool		Advanced gas-cooled reactor nuclear power station (1,320 MW capacity)
Tees estuary and Teesside		Major oil and chemical industries, including: Ekofisk oil pipeline; three oil refineries; 4 oil rig platform construction sites; British Steel steel works (Bran Sands); tar distillery; titanium pigment plant at Seaton Carew; Wilton Works (large chemical works); Teesport docks. Area: approx 13 km^2 on north bank, 24 km^2 on south bank (may include areas of undeveloped land).
Billingham/Middlesbrough	NZ4721	Industry, both sides of River Tees (5 km^2) ICI Agrochemical plant, Enterprise Zone
Redcar	NZ6124	Steel works
Skinningrove	NZ7019	Steel works

Smiths Dock. The Shell Oil Terminal and Middlesbrough Dock have also closed, with facilities now concentrated on Tees Dock, Hartlepool and the new Nissan terminal.

Skinningrove (east of Saltburn, N. Yorks) is a former iron mining town still dominated by steel mills.

With the decline of heavy industry, attempts to regenerate industrial areas, for example through the use of Enterprise Zones, are now being pursued in many areas (for example Sunderland and Middlesbrough).

Ports and harbours

In the north, Berwick's small port and dock at Tweedmouth transports grain, timber and stone, handles whitefish landings from a small fleet and has a small boat building yard. There are small fishing ports at Seahouses and Amble (Warkworth Harbour in the Coquet estuary, a Trust port), which has an associated boatyard. (Trust ports are former publicly owned ports that have been required by the Government to privatise by 1997.) Other very small fishing fleets are based at Holy Island, Beadnell, Craster, Boulmer and Newbiggin, using the natural shelter provided by estuaries, reefs, islands or tiny harbours. Blyth is the major Northumberland port (a Trust Port). It has several docks with ro-ro and sto-ro (roll on, roll off through same entrance) facilities handling a variety of commercial traffic and also acts as an offshore supply base. The dock facilities are located at Staithes and South Harbour, with wharves upstream close to a boat-building/repair yard.

There are two international ports in Tyne & Wear, with major dock facilities at Tyne, Felling Shore, North Shields and Sunderland. There are also numerous shipbuilding/repair yards along the Tyne shore from Howden to Bill Quay, many now closed, and a shipbuilding yard at Sunderland. The Port of Tyne (a Trust Port) has import/export, car and ro-ro facilities, ferry and container services, handles general bulk and project cargoes, and is an offshore oil base. Containers are taken to the port from the British Rail container depot at Follingsby by road and rail. This port trades mainly with Scandinavia and northern Europe, particularly Denmark, but also has links with the Mediterranean and northern Africa. The Howdon Jetty is

used by Tilling Construction for processing sea-dredged aggregates. The ferry port for Newcastle upon Tyne to Scandinavia is on the north bank of the estuary, opposite South Shields, and there is a fishing port at North Shields. The Port of Sunderland is a municipal port owned by Sunderland District Council. It has a container terminal, ro-ro and general cargo facilities. It is a North Sea offshore support base and also has recreational and inshore fishing facilities. Its main international links are with Scandinavia, northern Europe, east Africa and the Near East.

Seaham, in County Durham, is an open coast harbour with protective harbour walls. A company port, it handles general cargo and containers.

There are now two major ports in Cleveland, at Hartlepool and Teesport, run by a single Port Authority which also owns a number of the many jetties around the estuary. These ports handle oil, chemicals, steel (the main raw materials and products for local industries) and bulk cargoes, and have ro-ro, container and general cargo facilities. There is also a new Nissan Terminal. An area of the South Docks at Hartlepool is to be developed as a marina with associated housing, and there is a marina proposal for Redcar (see Section 9.8). Ship yards at Haverton Hill and Smiths Dock, and the Shell Oil Terminal and former Middlesbrough Dock have closed.

North Yorkshire has two small ports at Whitby and Scarborough, both municipal ports run by Scarborough Borough Council. They handle general cargoes (including export of limestone from Whitby to Scotland and imports from the Baltic, timber, fertiliser and grain) and have commercial fishing and recreational boat and yacht facilities.

No traffic separation schemes are in operation on the Region's coast.

Ports and harbours in the region are shown on Map 8.3.3 and their facilities listed in Table 8.3.3.

Power generation

Map 8.3.2 shows the location of the region's coastal power generation sites. There is one conventional, coal fired power station supplying the national grid in the region, at Blyth. Its capacity of 1,180 MW represents approximately 3% of the UK total conventional power producing capacity. The region's nuclear power station (one of only thirteen in the UK), with two advanced gas cooled (AGR) reactors with a combined capacity of 1,320 MW, is located at Hartlepool.

The scope for wind farming in this region is less than on the west coast because the prevailing south westerly winds blow offshore. The only coastal wind energy project in the region, at Blyth Harbour, with nine turbines, is one of only two operating sites on the east coast of Great Britain; it delivers 1.7% of Britain's wind power generating capacity. There were 22 wind energy projects in Britain in 1994 (British Wind Energy Association pers. comm.).

8.3.3 Information sources used

Sources of information on industry were Cook (1993), Northumberland County Council (1978), Frid *et al.* (1991) and Ordnance Survey Landranger 1:50,000 maps. Some information on industry infrastructure is likely to be out of date (as indicated in Table 8.3.2) as a result of the local and national decline in industrial and mining activity.

Cook (1993) presents data from population censuses and for counties from a number of dates, including the 1981 census, and some figures may be out of date. The reference also omits population data for some towns.

Map 8.3.1 is adapted from the ITE (1993) Countryside Survey database, which is derived from 1990 satellite imagery. Areas represent land cover types 'urban' and 'suburban/rural development' (see notes in section 8.2.3).

Most of the information on ports and harbours was derived from the two national handbooks for the British Ports Federation (undated) and Sutton (1989), which may be incomplete or out of date, and Frid *et al.* (1991). In 1991 the BPF was replaced by the British Ports Association and the UK Major Ports Group. Lord Donaldson (1994) records that there is virtually no clear information available on where ships go within UK waters, and that no records are kept of how many ships use UK port facilities. Under MARPOL (the United Nations' International Convention on the Prevention of Pollution from Ships), the UK must provide port facilities that are "adequate to meet the needs of ships using them and do not cause undue delay to ships". These facilities should prevent ships from discharging oil and other wastes into the sea. However, Lord Donaldson (1994) describes UK facilities as "inadequate". The UK government has commissioned a survey of all UK port reception facilities for the disposal of ship's wastes. The results, which should look at what facilities are available and their quality, were due in September 1994.

Map 8.3.3 Ports and harbours

Table 8.3.3 Ports and harbours

Site name	*Grid ref*	*Details*
Berwick-upon-Tweed (Tweedmouth)	NU0052	Harbour, Tweed Dock (transport of grain, timber and stone; whitefish landings), and small boat-building yard
Holy Island	NU1341	Very small natural fishing harbour
Seahouses	NU2232	Fishing port with breakwater
Beadnell	NU2328	Very small natural fishing harbour
Craster	NU2619	Pier and very small drying harbour with fishing fleet
Boulmer	NU2613	Very small haven with fishing fleet
Amble, Warkworth Harbour	NU2605	Trust fishing port in the estuary with boatyard
Newbiggin	NZ3187	Small fishing fleet in sheltered bay
Blyth (Staithes and South Harbour)	NZ3280	Major Trust port with ro-ro and sto-ro facilities (handles dry cargoes: aluminium, paper, timber, some coal, bulk commodities), several docks and wharves, offshore supply base, boat building/repair, fishing port
Cullercoats	NZ3670	Small drying harbour
North Shields	NZ3566	Dock and fishing port
Port of Tyne	NZ1665 to NZ3768	Trust port. Tyne Dock: import/export, cars, ro-ro facilities, Scandinavian ferry service (north bank), containers, general bulk and dry cargoes (timber, paper, coal and grain), offshore oil base, several (now defunct) shipbuilding/repair yards along river; Howdon Jetty used for processing sea-dredged aggregates.
Port of Sunderland	NZ4157	Container terminal, ro-ro and general cargo facilities (coal and coke, bulk petroleum, oils and chemicals, bulk minerals and scrap, forest products), offshore oil support base, dock, shipbuilding yard, recreational and inshore fishing facilities, fishing port.
Seaham	NZ4349	Company port; general cargo facilities and containers, special facilities for unitised and bulk cargoes, heavy lifts, warehousing and storage.
Hartlepool	NZ5233	Run by Tees and Hartlepool Port Authority (as are several jetties around the estuary). Dock and fishing port. Oil, chemicals, steel, bulk cargoes, ro-ro, container and general cargo. New Nissan terminal. Marina and associated housing being developed at South Docks.
Teesport	NZ5423	Ship yards at Haverton Hill and Smiths Dock, the Shell oil terminal and Middlesbrough Dock now closed. Teesport, run by Tees and Hartlepool Port Authority, now handles oil, chemicals, steel, bulk cargoes, ro-ro, container and general cargo. British Steel Teesside Steel Works jetty handles iron, steel and coal. Marina proposed for Redcar.
Whitby	NZ8911	Municipal port (Scarborough BC). General cargoes, fishing port, two wharves, boat yard.
Scarborough	TA0488	Municipal port (Scarborough BC). Fishing and leisure port.

8.3.4 Further sources of information

A. References cited

British Ports Federation. Undated. *UK member ports directory.* London, British Ports Federation.

Cook, C. 1993. *Pears cyclopaedia 1993-1994.* London, Penguin Books.

Frid, C.L.J., Evans, S.M., & Clark, R.B. 1991. *The north-east coast of England: environmental appraisal*. (Contractor: University of Newcastle-upon-Tyne, Dove Marine Laboratory, Cullercoats.) Unpublished Report to Shell UK Exploration and Production.

Institute of Terrestrial Ecology. 1993. *Countryside survey 1990: main report*. London, Department of the Environment.

Lord Donaldson. 1994. *Safer seas, cleaner ships. Report of Lord Donaldson's inquiry into the prevention of pollution from merchant shipping*. London, HMSO (CM2560).

Northumberland County Council. 1978. *County structure plan survey.* Morpeth, Northumberland County Council.

Sutton, G. *ed.* 1989. *ABP '89, a guide to the ports and shipping services of Associated British Ports Holdings plc.* King's Lynn, Charter International Publications.

B. Further reading

BGS (British Geological Survey). 1994. *Directory of mines and quarries 1994.* 4th ed. Nottingham, British Geological Survey.

British Oceanographic Data Centre, Proudman Laboratory. 1992. *UKDMAP (United Kingdom Digital Marine Atlas).* Computer software. Birkenhead, BODC.

Buck, A.L. 1993. *An inventory of UK estuaries.* Peterborough, Joint Nature Conservation Committee.

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

Department of the Environment. 1992. *Enterprise zones.* London, Department of the Environment.

Department of Trade and Industry. 1994. *Digest of UK energy statistics 1994*. London, HMSO.
Department of Trade and Industry. 1994. The non-fossil fuel obligation. *RE view: the magazine of renewable energy, No. 22, May 1994* (supplement).
Department of Transport & British Ports Federation. 1994. *Port Statistics 1993*. London, HMSO.
ENDS. 1994. *Cleaner combustion technology - a revolution waiting to happen*. London, Environmental Data Services (ENDS Report, No. 230, March 1994).
Technica. 1985. *Shipping routes in the area of the United Kingdom continental shelf*. London, HMSO. (Report for the Department of Energy.)

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Mines and quarries (British Directory of Mines and Quarries)	Director, British Geological Survey, Keyworth, Nottingham NG12 5GG, tel: 0115 936 3100
Details of disused collieries	Coal Authority, Bretby Business Park, Ashby Road, Burton-on-Trent, Staffs. DE15 0QD, tel: 01283 553291
Enterprise Zones	David Gleave, Department of Environment, 2 Marsham Street, London SW1P 3EB, tel: 0171 276 6166
Sunderland Enterprise Zone No. 1	Project Director, Tyne & Wear Development Corporation, Scottswood House, Newcastle Business Park, Newcastle-upon-Tyne NE4 7YL, tel: 0191 226 1234
Sunderland Enterprise Zones Nos. 2 and 3	Economic Development & Marketing Leader, Sunderland City Council, Civic Centre, Burdon Road, Sunderland SR2 7DN tel: 0191 567 6161
Ports	British Ports Association, Africa House, 64-78 Kingsway, London WC2B 6AH, tel: 0171 242 1200
Ports	The UK Major Ports Group Ltd, 150 Holborn, London EC1N 2LR, tel: 0171 404 2008
Warkworth Harbour	*Warkworth Harbour Commissioners, Amble, tel: 01665 710306
Blyth Harbour	*Blyth Harbour Commissioners, Blyth, tel: 01670 352066
Port of Tyne	*Port of Tyne Authority, Newcastle upon Tyne, tel: 0191 232 5541
Port of Sunderland	*Port of Sunderland Authority, Sunderland, tel: 0191 514 0411
Seaham Dock	*Seaham Harbour Dock Company, Seaham, tel: 0191 581 3877
Tees and Hartlepool Ports	*Tees and Hartlepool Port Authority, Middlesborough, tel: 01642 241121
Whitby and Scarborough Ports	*Ports of Whitby and Scarborough, Scarborough, tel: 01723 372351
Nuclear energy and electricity production in the UK. Free speaker service available.	Public Information Officer, Nuclear Electric plc., Barnett Way, Barnwood, Gloucester GL4 7RS, tel: 01452 652222
Nuclear energy production (Hartlepool AGR)	Information Officer, Hartlepool Energy Information Centre, Tees Road, Hartlepool, Cleveland TS25 2BZ, tel: 01429 869201
Renewable energy	The Director, Energy Technology Support Unit (ETSU), Renewable Energy Enquiries Bureau, Harwell, Oxfordshire OX11 0RA, tel: 01235 432450
Wind energy	The Administrator, British Wind Energy Association, 42 Kingsway, London WC2B 6EX, tel: 0171 404 3433
General information on renewable energy	Secretary, Renewable Energy Enquiries Bureau, Energy Technology Support Unit (ETSU), Harwell, Oxfordshire OX11 0RA, tel: 01235 432450
Energy production - general	Department of Energy, 1 Palace Street, London SW1E 5HE, tel: 0171 238 3000
Energy production - general	Secretary, Institute of Energy, 18 Devonshire Street, London W1N 2AU, tel: 0171 580 7124
Radioactive discharges	Information Officer, National Radiological Protection Board (NRPB), Chilton, Didcot, Oxfordshire OX11 0RQ, tel: 01235 831600
Nuclear issues - general	Secretary-General, British Nuclear Forum, 22 Buckingham Gate, London SW1E 6LB, tel: 0171 828 0166

* Starred contact addresses are given in full in the Appendix

8.4 Coastal defence

S.L. Fowler, J.A. Norton & M.J. Dunbar

8.4.1 Introduction

Coastal defence covers two types of works: coast protection and sea or flood defence. Coast protection works prevent or slow the erosion of land and encroachment by the sea and are generally the responsibility of District Councils. Sea or flood defences protect against the flooding of low-lying land and are the responsibility of the National Rivers Authority, although Internal Drainage Boards and local authorities can also undertake flood defence works. Some forms of coastal defence may protect against both erosion and flooding and can provide vital 'toe' support to the base of coastal cliffs. Some coastal defences are owned and maintained privately or by bodies such as the Ministry of Defence. Railtrack (formerly British Rail) maintains some stretches of coastal protection alongside railway lines. NRA (undated) records about 32 km of sea defences in the region and shows that some 20 km are the responsibility of NRA and 1.37 km of the local authority; about 10 km are privately owned.

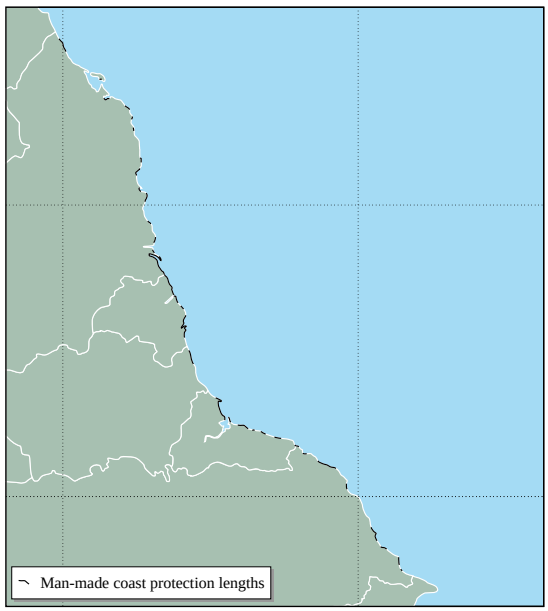
MAFF (1994) has recently published a detailed assessment of the extent and state of repair of coastal protection works on the English coast. Map 8.4.1 shows the distribution of man-made coast protection works (against erosion) in the region; Table 8.4.1 shows that 24% of the region's coast is protected against erosion, although erosion is significant over less than 10% of the whole. In England the greatest density of coast protection works is found around the heavily developed coast of the south-east and the north-west.

Table 8.4.1 Length of coast protection works (against erosion) in Region 5

Council	*Total length (km)*	*Undeveloped length (km)*	*Coast protection length (km)*	*% protected*
Berwick-upon-Tweed	68.4	63.3	5.1	7.5
Alnwick	38.7	34.9	3.8	9.9
Castle Morpeth	12.6	12.3	0.3	2.4
Wansbeck	13.1	7.6	5.5	42.2
Blyth Valley	5.7	2.7	3.0	52.7
North Tyneside	10.4	2.8	7.6	73.1
South Tyneside	11.8	8.4	3.4	28.8
Sunderland	14.9	4.6	10.3	69.1
Easington	20.2	15.7	4.5	22.2
Hartlepool	16.9	3.9	13.0	76.9
Langbaurgh-on-Tees	28.7	22.0	6.7	23.2
Scarborough	76.6	62.8	13.8	18.0
Total	***318.0***	***241.0***	***77.0***	***24.2***
English coast total	2,924.8	2,065.1	859.7	29.4
% of English coast total in region		12.4%	13.1%	10.6%

Source: MAFF (1994) database

Much of the coast of north-east England is generally resistant to marine erosion, although areas in the centre of the region have received artificial protection by the constant dumping of colliery waste, which has built up beaches. Now that most of these collieries have ceased operations,



Map 8.4.1 Locations of coast protection works (against erosion). Source: MAFF (1994).

wind, waves and tides are beginning to return these beaches to their natural state. This will have an impact on adjacent sections of coast, as erosion and accretion take place. In parts of the south of the region, slumping and consequent erosion of soft 'boulder clay' cliffs is continuous. The cliff fall at Scarborough in 1993, which resulted in the loss of a large cliff-top hotel, vividly illustrates the first part of this process. Because there are fewer low-lying or reclaimed areas in the region, flood defences are relatively uncommon, other than around the Tees Estuary or where habitats such as sand dunes have been lost or damaged by erosion or land-claim.

Two non-statutory coastal groups - the Northumbria Coastal Group and the North East Coastal Authorities Group - coordinate coastal defence in the region, which comprises a single natural coastal sediment cell stretching from St Abb's Head to Flamborough Head (see Map 2.4.1, and section 10.3.3).

8.4.2 Important locations

Virtually all the region's estuaries have been altered to some extent as a result of coastal works for either sea defence and coast protection or both, or land claim, dredging or canalisation. However, the northern estuaries in the region are generally quite natural in character, with only small areas of artificial embankment alongside settlements and harbour developments. Land claim has been comparatively minor in the Tweed, Lindisfarne/Budle Bay, Aln and Coquet estuaries. The Wansbeck estuary has been barraged a short distance upstream from the river mouth. Major coastal works are generally more widespread in the larger, more industrial, estuaries from the Tyne southwards. The shores

of the Tyne and Wear estuaries are almost completely artificial. The Tees is a well known example of a highly engineered estuary where only about 10% of the intertidal area still remains after the extensive land claim of the past 120 years (the loss has been even greater compared with areas existing 250 or more years ago).

Coastal works may extend to the open coast in many areas where there are coastal towns and industries. 'Soft engineering' coast protection techniques are being tried in places in the region, for example at Sandy Bay, Northumberland, where a foreshore berm (a breakwater in the intertidal zone) has been built to reduce erosion rates while leaving the base of the cliffs accessible for conservation study. Its effectiveness is being monitored.

8.4.3 Information sources used

The Ministry of Agriculture, Fisheries and Food has recently published the Coast Protection Survey of England (MAFF 1994), which assesses the extent, adequacy and state of repair of coast protection works and notes defence requirements over the next three to five years. These data are held by the contractors (Sir William Halcrow & Partners) and MAFF on a Geographic Information System (GIS database). Data presented above, from MAFF (1994) and the database, show different figures. This may be due to the exclusion of inner estuary or harbour coastlines from some calculations.

The National Rivers Authority holds details of sea defence works, obtained during a sea defence survey in 1991 (NRA 1992) on a proprietary database cross-referenced to maps. No information from the database was available for this review, so the summary data provided above are incomplete.

Summaries of the extent of coast protection and sea defence works in estuaries are included in Buck (in prep.).

8.4.4 Further sources of information

A. References cited

Buck, A.L. In prep. *An inventory of UK estuaries. Volume 5. Eastern England.* Peterborough, Joint Nature Conservation Committee.

Ministry of Agriculture, Fisheries and Food. 1994. *Coast protection survey of England. Volume 1, summary report.* London, MAFF.

National Rivers Authority. 1992. *Sea defence survey 1990/1. Survey Report: Phase 1, Phase 2 & Phase 3.* Bristol, NRA.

B. Further reading

House of Commons. 1992. *Coastal zone protection and planning.* (House of Commons Environment Select Committee report.)

Hydraulics Research Ltd. 1991. A summary guide to the selection of coast protection works for geological Sites of Special Scientific Interest. *Nature Conservancy Council, CSD Report*, No. 1245.

Ministry of Agriculture, Fisheries and Food. 1993. *Flood and coastal defence project appraisal guidance note.* London, MAFF.

Ministry of Agriculture, Fisheries and Food. 1993. *Coastal defence and the environment: a strategic guide for managers and decision makers in the National Rivers Authority, local authorities and other bodies with coastal responsibilities.* London, MAFF.

Ministry of Agriculture, Fisheries and Food. 1994/95. *Shoreline management plans. A procedural guide for operating authorities.* London, MAFF.

Ministry of Agriculture, Fisheries and Food. 1994. *Coast protection survey of England. Volume 1, summary report.* London, MAFF.

National Rivers Authority. 1993. *NRA flood defence strategy.* London, NRA.

Rendel Geotechnics. 1995. *Coastal planning and management: a review of earth science information needs.* London, HMSO.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Flood defence and coast protection policy, provision of grants towards capital expenditure. Coast protection survey of England	Ministry of Agriculture, Fisheries and Food (MAFF), Flood and Coastal Defence Division, Eastbury House, 30/34 Albert Embankment, London SE1 7TL, tel: 0171 238 3000
Coast protection and the prevention of flooding of non-agricultural land.	*Maritime District Councils
Storm tide warning service: Early warnings of storm surges in low-lying areas.	Meteorological Office, London Road, Bracknell, Berkshire RG12 2SZ, tel: 01344 420242
Flood defence	*National Rivers Authority (NRA) Head Office, Bristol, tel: 01454 624400
Flood defence database	*NRA Regional Office, Leeds, tel: 01532 440191
Flood defence	*Maritime District Councils and Internal Drainage Boards
Co-operation between parties responsible for coastal defences, identification of research needs and promotion of strategic planning of coastal defences.	English Coastal Groups Forum, Head of Flood and Coastal Defence Division, MAFF, Eastbury House, 30/34 Albert Embankment, London SE1 7TL, tel: 0171 238 6660
Liaison between agencies undertaking coastal works: Northumbrian Coastal Group	*Mr J Macgregor, Alnwick District Council, Alnwick, tel: 01665 510506
As above: North East Coastal Authorities Group (south Northumbria to North Yorkshire),	*Mr M Clements, Scarborough Borough Council, Scarborough, tel: 01723 372351
Coastal Engineering Advisory Panel	Secretary: Anne-Marie Ferguson, Institute of Civil Engineers, Great George Street, London SW1P 3AA, tel: 0171 222 7722

* Starred contact addresses are given in full in the Appendix

8.4.5 Acknowledgements

Thanks are due to John Horne, MAFF Regional Engineer's Office and Andy Swash, MAFF Flood and Coastal Defence Division, for supplying data from the Coast Protection Survey of England.

Chapter 9 Human activities

9.1 Fisheries

C.F. Robson

9.1.1 Introduction

This section gives an overview of the main fishing activities in the coastal waters and rivers of the region. There are fisheries for pelagic, demersal and several marine shellfish species (demersal fish live on or near the sea bed; pelagic fish do not) and diadromous species - salmon, sea trout and eels - which spend part of their lives in fresh water and part at sea. The section also covers sea angling and bait collection. For more information about the species concerned, including their scientific names, see sections 5.5, 5.7 and 5.8.

At the three major fishing ports in the region - North Shields, Whitby and Scarborough (Map 9.1.1) - it is mainly demersal fish and shellfish, such as *Nephrops*, lobsters and queen scallops, that are landed. The map also shows the twenty other ports and harbours at which landings made in the region are recorded by the Ministry of Agriculture, Fisheries and Food (MAFF). A summary of the total landings for shellfish, pelagic and demersal species is given in Table 9.1.1. The figures show that 3.1% of all recorded landings of fish and shellfish species in Britain were made in this region in 1992. This figure is below average for regions in Britain and is very small compared with some, particularly in Scotland, mainly because recorded landings of pelagic species in this region are very low. In contrast, recorded landings of demersal fish and shellfish are only just below the regional average for Britain. Amongst the demersal fish, recorded landings of several species (catfish, cod, lemon sole, plaice and turbot) are above average for Britain.

The region is important for a wide range of shellfish species (see section 9.1.2), which are landed for UK markets or for live export abroad. The tonnage of queen scallops landed in the region represents 23% of the British total, the second largest amount after that landed in the Northern Irish Sea; the tonnages of lobsters and *Nephrops* landed represent 10.4% and 7.3% of the total British landings

Map 9.1.1 Landing ports, and coverage of the region by Sea Fisheries Committees. Tynemouth Pier marks the boundary between them.

respectively - the highest proportions in English and Welsh regions. The creel fishery for edible crab, lobster and velvet crab is particularly important to the smaller coastal communities of the region.

Three diadromous species - salmon, sea trout and eel - support net and/or rod and line fisheries in the region, the most important of which are for salmon and grilse (young salmon that have spent not more than one winter at sea before maturing) and sea trout. The main rivers of interest are the Coquet, Tyne and Wear, but much larger fish catches are recorded from offshore of the Northumberland coast. Net methods account for over 90% of the region's recorded catch (Table 9.1.6). As shown in Table 9.1.2, a large

Table 9.1.1 Species group landings in 1992 (tonnes)

Species group	*Region 5*	*North Sea coast*	*England & Wales*	*Britain*	*% of North Sea coast total landed in region*	*% of British total landed in region*
Pelagic	220	184,311	23,809	251,482	0.1	0.1
Demersal	15,057	228,068	81,237	275,167	6.6	5.5
Shellfish	3,964	61,940	55,360	101,482	6.4	3.9
All species	***19,241***	***474,317***	***160,406***	***628,131***	***4.1***	***3.1***

Source: Ministry of Agriculture, Fisheries and Food (1994a); Scottish Office Agriculture and Fisheries Department (1993). Note: Amounts landed are rounded up to the next whole tonne. Interpretation of the figures in this table is complex: refer to section 9.1.4.

Table 9.1.2 Average catch of salmon and grilse and sea trout 1989 - 1993 (numbers of fish)

	Salmon and grilse	*Sea trout*
Region 5	32,768	31,139
North Sea coast	196,247	104,789
England & Wales	67,347	76,337
GB	254,829	141,813
% of North Sea Coast total in region	17%	30%
% of GB total in region	13%	22%

Source: Department of Agriculture and Fisheries (1990); National Rivers Authority (1991, 1992, 1993, 1994a & 1994b) and Scottish Office (1991, 1992, 1993 & 1994). Note: Interpretation of the figures in this table is complex: refer to section 9.1.4.

percentage of the salmonids caught by net fishing in England and Wales is recorded from this region (MAFF/SO 1991).

9.1.2 The fisheries

Pelagic species

Pelagic species are caught occasionally and in small quantities, close inshore. In the past herring was targeted in the spawning grounds off the Farne Islands (see section 5.8) but since the collapse of the North Sea herring stock the local stocks have failed to recover: demand is low and fishing effort is minimal in spite of the reopening of the fishery. Herring, sprat and mackerel are occasionally caught in small quantities close inshore. Table 9.1.3 shows the species and tonnages landed in the region and nationally in 1992.

Demersal species

Demersal fish are targeted by inshore trawlers and fixed gear fishermen, using nets and lines. The inshore trawling fleet was dependent on demersal fish up until the 1980s, when *Nephrops* assumed greater importance, as demand for *Nephrops* increased and demersal fish became scarcer inshore. Demersal fish are now caught both as targeted species and as an untargeted by-catch in the *Nephrops* fishery.

A deep-water trench some 10-20 miles offshore, known as the Farne Deeps, has traditionally provided good catches of haddock, cod and whiting for most of the year. These species are also caught closer inshore, particularly in winter. Cod are targeted mainly from autumn to spring, when shoals appear inshore, but also during the summer, especially around wrecks. Whiting, pollack and saithe are frequently caught in cod nets. Small beach boats and cobles set lines for cod, pollack, rays and dogfish.

Flatfish, notably plaice, lemon sole and turbot, form an important part of the mixed demersal trawl fishery as they command a high market price. Plaice and lemon sole are landed virtually throughout the year, but plaice are landed in the greatest quantities from spring to autumn whereas lemon sole are more commonly caught during the winter months. Dover sole are caught mainly in the south, from late spring through to autumn. Turbot, brill and rays are also targeted close inshore from spring to autumn. Table 9.1.4 shows the species and tonnages landed in the region and nationally in 1992.

Shellfish

For certain shellfish species landed in the region in 1992, the tonnages landed (Table 9.1.5) represent a large proportion of the total tonnages landed in Britain. *Nephrops* is the principal species targeted by inshore trawlers working from Seahouses, Amble, Blyth and North Shields, from where demersal fish are also caught. Because of the small mesh size of the *Nephrops* nets a large by-catch of juvenile fish is often taken (see section 5.7.3). *Nephrops* stocks are now targeted in the summer as well as the traditional winter and spring fishery. During the winter the fishery is concentrated around the Farne Deeps approximately 10-20 miles offshore; in summer the fishery is only 3 miles offshore. Fishing effort has increased since the late 1980s, owing to the scarcity of demersal fish and the increase in market demand, especially abroad. The *Nephrops* fishery has already shown signs of over-exploitation, with reduced landings and a decrease in the size of individuals caught: the fishery has a Total Allowable Catch (TAC), further described in section 9.1.3.

Edible crab are targeted for much of the year throughout the region, when weather conditions are favourable. The fishery starts when the crabs return to inshore grounds in the spring. Landings generally fall during the summer

Table 9.1.3 Pelagic species landings (tonnes) for 1992

Species	*Region 5*	*North Sea coast*	*England & Wales*	*Britain*	*% of North Sea coast total landed in region*	*% of British total landed in region*
Argentines	0	137	0	179	0	0
Herring	214	74,706	915	84,796	0.3	0.3
Horse mackerel	0	1,374	1,026	1,500	0	0
Mackerel	6	95,366	9,142	150,727	<0.1	<0.1
Pilchard	0	4,244	4,244	4,244	0	0
Sprat	0	8,478	8,478	10,033	0	0
Whitebait	0	1	1	1	0	0
Others	0	3	3	3	0	0
Total*	***220***	***184,311***	***23,809***	***251,482***	***0.1***	***0.1***

Source: Ministry of Agriculture, Fisheries and Food (1994a); Scottish Office Agriculture and Fisheries Department (1993). Note: Amounts landed are rounded up to the next whole tonne. Interpretation of the figures in this table is complex: refer to section 9.1.4.

Table 9.1.4 Demersal species total landings (tonnes) in 1992

Species	*Region 5*	*North Sea coast*	*England & Wales*	*Britain*	*% of North Sea coast total landed in region*	*% of British total landed in region*
Elasmobranchs						
Dogfish	481	7,449	3,625	13,282	6.5	3.6
Skates and rays	135	3,816	4,142	7,812	3.5	1.7
Gadoids						
Cod	6,397	53,440	23,530	59,429	12.0	10.8
Haddock	2,072	49,221	3,706	53,574	4.2	3.9
Hake	3	589	1,621	3,613	0.5	0.1
Ling	268	4,594	1,708	6,026	5.8	4.4
Pollack (lythe)	54	1,921	1,734	3,018	2.8	1.8
Saithe	185	11,032	2,284	12,592	1.7	1.5
Whiting	1,826	36,733	5,088	41,011	5.0	4.5
Whiting, blue	0	6,531	0	6,531	0	0
Flatfish						
Brill	16	317	392	444	5.0	3.6
Dab	55	1,017	456	1,214	5.4	4.5
Dover sole	98	2,021	2,812	2,868	4.8	3.4
Flounder	0	167	269	274	0	0
Halibut	5	166	80	196	3.0	2.6
Halibut, Greenland	0	119	117	136	0	0
Lemon sole	793	5,004	3,000	5,566	15.8	14.2
Megrim	0	1,379	1,471	4,038	0	0
Plaice	1,722	20,749	15,970	23,872	8.3	7.2
Turbot	70	561	545	742	12.5	9.4
Other types						
Catfish	223	1,896	557	1,935	11.8	11.5
Conger eel	0	99	403	508	0	0
Gurnard	14	368	589	622	3.8	2.3
Monkfish/angler	340	9,813	3,102	14,660	3.5	2.3
Redfish	0	718	581	774	0	0
Sandeel	0	4,152	0	4,152	0	0
Torsk (tusk)	0	165	13	209	0	0
Witch	42	1,405	192	1,980	3.0	2.1
Others	243	2,420	3,151	3,835	10.0	6.3
Fish roes	15	195	99	244	7.7	6.1
Total	***15,057***	***228,068***	***81,237***	***275,167***	***6.6***	***5.5***

Source: Ministry of Agriculture, Fisheries and Food (1994a); Scottish Office Agriculture and Fisheries Department (1993). Note: Amounts landed are rounded up to the next whole tonne. Interpretation of the figures in this table is complex: refer to section 9.1.4.

Table 9.1.5 Shellfish species landings in 1992 (tonnes)

Species	*Region 5*	*North Sea coast*	*England & Wales*	*Britain*	*% of North Sea coast total landed in region*	*% of British total landed in region*
Cockles	0	26,199	29,501	32,047	0	0
Crabs	381	9,117	9,453	16,955	4.2	2.2
Lobsters	111	622	504	1,072	17.8	10.4
Mussels	0	4,865	3,488	6,555	0	0
Nephrops	1,432	8,368	1,918	19,627	17.1	7.3
Periwinkles	0	315	70	1,908	0	0
Queens	1,953	2,207	2,989	8,506	88.5	23.0
Scallops	34	4,519	2,589	7,658	0.8	0.4
Shrimps	0	615	563	743	0	0
Squids	42	1,382	919	1,992	3.0	2.1
Whelks	11	1,905	1,535	2,393	0.6	0.5
Others	0	1,819	1,831	2,026	0	0
Total	***3,964***	***61,940***	***55,360***	***101,482***	***6.4***	***3.9***

Source: Ministry of Agriculture, Fisheries and Food (1994a); Scottish Office Agriculture and Fisheries Department (1993). Note: Amounts landed are rounded to the next whole tonne. Interpretation of the figures in this table is complex: refer to section 9.1.4.

when the crabs moult but then increase in the autumn until they migrate offshore in winter. The largest catches of lobster occur in July and August, as stocks move inshore to feed on moulting edible crabs, and the landings in this region are above average compared with the recorded total landed in Britain. Since the mid-1980s, market demand has increased for velvet crabs. These are caught as a by-catch in the lobster fishery, when creels are set in sheltered inshore areas in winter.

A small scallop fishery is developing to the east of Holy Island and catches are landed in several of the region's ports. A queen scallop fishery exists off the North Yorkshire and Humberside coasts. Mussels, cockles and periwinkles are mainly hand-gathered on a small scale in the region, for example around Holy Island and Budle Bay in Northumberland.

Diadromous species

Table 9.1.6 lists the locations in the region (shown on Map 5.8.1) from which salmon, grilse and sea trout catches have been recorded, giving the catch methods and five-year averages for 1989-1993. Rods are used mainly by game fishermen. Most of these fish are caught as they return to spawn, in drift nets 2 - 4 miles offshore from the mouths of rivers in Northumberland, especially in the north of the county. In the mouths of some rivers fishing for salmon and grilse is prohibited by byelaws. In this region, sea trout (and to a lesser extent salmon and grilse also) are caught by fishermen working T nets as the fish migrate south to feed and then back north to spawn. The most important rivers (rod-caught landings) are the Tyne, Wear and Coquet.

Sea angling

Sea angling has three main forms: angling from the shore, inshore fishing within 6 miles of the shore and deep sea fishing. It is distinguished from two other types of sport fishing: game fishing for salmon, sea trout, brown and rainbow trout (the first two are discussed above) and coarse fishing for freshwater fish (not covered here). The governing body of sea angling in England is the National Federation of Sea Anglers, which has approximately 570 affiliated clubs with approximately 33,000 personal members. Sea angling is a popular pastime in Region 5; see section 5.9.2 for further details.

Bait collection

Many sea anglers collect their own live bait locally, and this activity occurs in many parts of the region, although some areas are targeted more than others and may attract commercial collectors, who travel in teams to suitable shores. Many species are collected in this region, mainly by digging and boulder turning; these include ragworm, lugworm, peeler crabs (moulting shore crabs), mussels, cockles, limpets, razor shells, squid, mackerel and sandeels. Different bait species are collected according to the fish being targeted as well as the location and time of year. The main collecting techniques on the shore are digging and boulder turning. Baitdigging, especially for lugworms, is carried out over the lower part of muddy and sandy shores around the time of low water (see sections 5.11.3 and 9.1.3). Fowler (1992) identified the many locations in the region where bait species were being exploited. Areas such as Budle Bay/Lindisfarne National Nature Reserve, Newton Haven, Boulmer Haven, River Wansbeck, Hartlepool Bay and Filey Beach experience considerable numbers of diggers and some problems have been encountered (see also section 5.5.3).

9.1.3 Management and issues

Responsibility for the management of fisheries in coastal waters, extending from low water mark, rests with the Commission for the European Union, who delegate it to member states under the Common Fisheries Policy. This policy seeks to manage stocks of fish in EU waters on a biological basis (MAFF 1994b) by setting agreed annual Total Allowable Catches (TACs) for particular stocks. The Common Fisheries Policy came into effect in 1983 and was subject to a mid-term review in 1993, with a full review planned for 2002. Under the Common Fisheries Policy, fishing in this region is restricted to national boats in an area of up to 12 nautical miles from the coast, in order to protect the interests of local fishermen. Outside this 12 mile limit, all European Union member countries have equal access to the Exclusive Fishing Zone, whereas under European, national and local byelaw legislation, non-member countries are only allowed to fish by agreement.

Table 9.1.6 Salmon and grilse and sea trout five-year (1989-1993) average catch (as numbers of fish reported to NRA), catch methods used and number of net licences for salmon and grilse issued in 1993, for each river/fishery in the region

River/fishery	*Salmon & grilse*	*Sea trout*	*Method used/licences issued*
Aln	9	99	rod
Coquet	352	313	rod
Tyne	967	736	rod
Wear	132	446	rod
Tees	6	21	rod
Northumbria Coastal (N)	20,578	16,275	drift (67) and T (38) nets
Northumbria Coastal (S)	10,703	13,129	drift nets (40)
Esk	21	120	rod
Region 5	***32,768***	***31,139***	***145***
England & Wales	***67,347***	***76,337***	***780***

Source: Department of Agriculture and Fisheries (1990); National Rivers Authority (1991, 1992, 1993, 1994a & 1994b) and Scottish Office (1991, 1992, 1993, & 1994). Note: interpretation of the figures in this table is complex: refer to section 9.1.4. 'Sea trout' here includes all migratory trout. 'Nets' are defined as instruments other than rod and line. Rivers with very small recorded rod catches are not included in this table (see section 9.1.4). Map 5.8.1 shows the locations of rivers in this table.

For the purpose of stock management, the UK coastal waters have been designated by the International Council for the Exploration of the Sea (ICES) into statistical areas. The coastal seas in this region are part of one 'division': IVb (Middle North Sea). ICES provides scientific advice on the management of all the important exploited species of fin fish and some shellfish stocks in all areas of the Northeast Atlantic. This work is summarised in the annual report of the Advisory Committee on Fishery Management (ACFM), which is responsible for providing scientific advice on Total Allowable Catches (TACs) and other conservation measures. The TACs and actual 'uptake' for 1991 and 1992 for each species in the statistical division (and therefore in the region) are given in MAFF (1994b). Further restrictions applying in the region, on minimum landing sizes and net mesh sizes for certain species, are listed in Tables 5.7.1 and 5.7.2.

In this region the Northumberland Sea Fisheries Committee and the North Eastern Sea Fisheries Committee manage the inshore fisheries from the high water mark out to 6 nautical miles (3 nautical miles until October 1993) offshore from the UK baselines (as defined by the Territorial Water Order in Council 1964). The boundary between these two Sea Fisheries Committees extends due east from the end of the pier at Tynemouth (Map 9.1.1). Local Ministry of Agriculture, Fisheries and Food (MAFF) fishery officers based in North Shields and Grimsby deal with quota management, enforcement of UK and EC fisheries legislation and licensing of fishing vessels (section 9.1.5). The Northumbria and Yorkshire Region of the National Rivers Authority has a responsibility to regulate, protect and monitor salmon, sea trout and eel fisheries from rivers to coastal waters out to the 6 nautical mile limit. The two Sea Fisheries Committees also have powers to support this conservation of salmonid fisheries whilst exercising their responsibilities towards the regulation of sea fisheries.

None of the eight shellfish Regulating Orders in Britain is in this region (MAFF 1994a).

In England and Wales MAFF's Directorate of Fisheries Research (DFR) Laboratory at Lowestoft is responsible for collecting and collating information on fish stocks exploited by UK vessels. The MAFF DFR Fisheries Laboratory at Conwy is the Directorate's centre for assessing the implications of non-fisheries activities and coastal zone usage on fish stocks and fisheries. MAFF DFR databases are described in Flatman (1993).

Issues relating to the fisheries for pelagic, demersal and shellfish species and sea angling and bait collection generally are closely linked to wildlife conservation in several ways. Issues include the effects on target species as major components in marine ecosystems; the changed availability of food for predators; the effects on non-target species (due to multi-species fisheries, especially those directed at demersal species - see sections 5.4 and 5.9) and effects on species and habitats of nature conservation interest (see sources in section 9.1.5 below). These issues are under consideration by the 'Marine Fisheries Task Force', an inter-agency team of the statutory nature conservation organisations (the Countryside Council for Wales, English Nature, Scottish Natural Heritage and the Department of the Environment for Northern Ireland, together with the JNCC). A consultation draft paper prepared by the group, entitled *Developing an action programme for sea fisheries and wildlife* (Marine Fisheries Task Force 1994), identifies the main areas where marine fisheries (broadly defined to encompass the exploitation of all living marine resources) affect wildlife and identifies any action needed.

9.1.4 Information sources used

Inshore fisheries review of England, Scotland and Wales, 1992/1993 (Gray 1994) has been used extensively in compiling this section. It gives details of the numbers of boats operating from ports in the region, the amount of fishing effort involved by various methods and which species or species groups are targeted during the different seasons. Figures given in Tables 9.1.1 - 9.1.5 come from two sources: MAFF and the Scottish Office Agriculture and Fisheries Department (SOAFD), and the method of their interpretation is described below.

Pelagic, demersal and shellfish species

Statistics given here are for landings recorded in the region, not estimated catches made in the region. Some fish caught in the region may not be landed in the region's ports or even in the UK; other fish are landed in the region but are caught outside it - even outside British waters; and until 1993, boats under 10 m were not obliged to register their landings. The tonnages of various pelagic, demersal and shellfish species (fresh and frozen) landed at the major ports in England and Wales by UK vessels come from *UK sea fisheries statistics for 1991 and 1992* (MAFF 1994a): this applies to North Shields, Whitby and Scarborough, the three 'major ports' in the region. A total for the 'other' smaller ports (see Map 9.1.1) was provided by the MAFF Fisheries Statistics Unit. These data have been combined to give the 'total landed in region' column in Tables 9.1.1, 9.1.3, 9.1.4 and 9.1.5. The 'total landed in North Sea coast' column was calculated by adding together all the landings data for the ten regions on the British North Sea coast (see section 1.1.4). The 'total landed in England and Wales' column was obtained by adding together all of the MAFF data for England and Wales, and the 'total landed in Britain' column was obtained by combining MAFF and SOAFD data. Because MAFF and SOAFD do not publish the same categories, landings in some of their categories have been added to the 'others' columns in the tables in this section. Also, SOAFD publish the weight of fish as 'standard landed weight' (gutted fish with head on), whereas MAFF publish them as 'nominal live weight' (whole fish). These two are the same for pelagic and shellfish species, but converted data from SOAFD were used for all demersal species, apart (in other regions) from sandeels, which are not gutted, so that all the data presented are in 'nominal live weight'.

A specialist subset of the electronic mapping system UKDMAP (see 'Core reading list' - section A3 in the Appendix), called SHELLMAP, is being prepared by the MAFF Shellfish Division in Weymouth, to meet the requirements of the EC shellfish harvesting and hygiene directives (section 9.2.3; see also Ramster *et al.* in press). The software includes charts of all coastal areas (principally estuaries) which support known molluscan shellfisheries, showing all details of the production areas and their classification.

Diadromous species

NRA reported catches for salmon, grilse and sea trout vary in accuracy from year to year, as they represent only declared catches by individuals with a net or rod and line licence. Further, in 1992, the introduction of changes to the catch recording system may have resulted in a temporarily reduced level of recording. Also, catches themselves fluctuate, and the relationship between catch and stock is not straightforward. Therefore the figures given in Table 9.1.6 should be used only as an indication of the pattern of the catch in the region. The river/fishery areas listed in Table 9.1.6 are those that support net fisheries or have mean annual rod catches in excess of 30 salmon or 100 sea trout (NRA 1994a): some small rivers selected by the Northumbria and Yorkshire Region of the NRA are also included. Tributaries and minor rivers with a shared estuary are included under the main river and any remaining rivers in each NRA region are recorded separately in the 'others' category in NRA (1994a). The annual NRA *Salmonid and freshwater statistics for England and Wales* (National Rivers Authority 1991, 1992, 1993, 1994a & 1994b) contain fuller information and should be consulted for a more detailed interpretation. The region's salmon net fishery is discussed more fully in MAFF/SO (1991), which reviews salmon net fishing in the Northumbria and Yorkshire region of the NRA and Scottish salmon fishery districts south of the River Ugie.

Bait collection is discussed by Fowler (1992), who presents results from a survey around the coast of Britain in 1985.

9.1.5 Further sources of information

A. References cited

Department of Agriculture and Fisheries. 1990. *Scottish salmon and sea trout catches: 1989*. Edinburgh, (DAFS Statistical Bulletin 1/90).

Flatman, S. 1993. MAFF fisheries databases. *In: The Irish Sea Forum. Marine & Coastal Databases, 50-58.* Irish Sea Forum 3rd Seminar Report. Liverpool, Liverpool University Press for Irish Sea Forum.

Fowler, S.L. 1992. Survey of bait collection in Britain. *JNCC Report*, No.17.

Gray, M. 1994. *Inshore fisheries review of England, Scotland and Wales, 1992/1993.* World Wide Fund for Nature, Godalming.

MAFF/SO. 1991. *Salmon net fisheries: report of a review of salmon net fishing in the areas of the Yorkshire and Northumbria regions of the National Rivers Authority and the salmon fishery districts from the River Tweed to the River Ugie.* London, HMSO.

Marine Fisheries Task Force. 1994. *Developing an action programme for sea fisheries and wildlife.* Peterborough, JNCC. (Draft consultation paper by the Marine Fisheries Task Group.)

Ministry of Agriculture, Fisheries and Food. 1994a. List of Orders in England and Wales (unpublished). London, MAFF.

Ministry of Agriculture, Fisheries and Food. 1994b. *UK sea fisheries statistics 1991 and 1992*. London, HMSO.

National Rivers Authority. 1991. *Salmonid and freshwater fisheries statistics for England and Wales, 1989*. Almondsbury, NRA.

National Rivers Authority. 1992. *Salmonid and freshwater fisheries statistics for England and Wales, 1990*. Almondsbury, NRA.

National Rivers Authority. 1993. *Salmonid and freshwater fisheries statistics for England and Wales, 1991*. Almondsbury, NRA.

National Rivers Authority. 1994a. *Salmonid and freshwater fisheries statistics for England and Wales, 1992*. London, HMSO & NRA.

National Rivers Authority. 1994b. *Salmonid and freshwater fisheries statistics for England and Wales, 1993*. London, HMSO & NRA.

Ramster, J.W., Tabor, A. R., Lockwood, S.J., & Sheehan, R. In press. Access to coastal zone information : a possible common approach for the UK. *In: Proceedings of the conference on management techniques in the coastal zone, University of Portsmouth October 24-25 1994.* University of Portsmouth.

Scottish Office Agriculture and Fisheries Department. 1993. *Scottish sea fisheries statistical tables 1992*. Edinburgh, Scottish Office.

Scottish Office. 1991. *Scottish salmon and sea trout catches: 1990.* Edinburgh, Scottish Office. (Scottish Office Statistical Bulletin, Fisheries Series.)

Scottish Office. 1992. *Scottish salmon and sea trout catches: 1991.* Edinburgh, Scottish Office. (Scottish Office Statistical Bulletin, Fisheries Series No. Fis/1992/1.)

Scottish Office. 1993. *Scottish salmon and sea trout catches: 1992.* Edinburgh, Scottish Office. (Scottish Office Statistical Bulletin, Fisheries Series No. Fis/1993/1.)

Scottish Office. 1994. *Scottish salmon and sea trout catches: 1993.* Edinburgh, Scottish Office. (Scottish Office Statistical Bulletin, Fisheries Series No. Fis/1994/1.)

B. Further reading

Doody, J.P., Johnston, C., & Smith, B. 1993. *Directory of the North Sea coastal margin.* Peterborough, Joint Nature Conservation Committee.

Franklin, A., Pickett, G.D., & Connor, P.M. 1980. *The scallop and its fishery in England and Wales.* Lowestoft, MAFF Directorate of Fisheries Research. (Laboratory Leaflet No. 51.)

Huggett, D. 1992. *Foreshore fishing for shellfish and bait*. Sandy, Royal Society for the Protection of Birds.

Lutchman, I. 1991. A general overview of European and UK fisheries. Godalming, WWF International.

Mason, J. 1987. *Scallop and queen fisheries in the British Isles.* Farnham, Fishing News Books for Buckland Foundation.

Pawson, M.G., & Rogers, S.I. 1989. The coastal fisheries of England and Wales. Part ii: a review of their status in 1988. *MAFF Directorate of Fisheries Research, Internal Report*, No.19.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Central contact for the local Sea Fisheries Committees and advice on general policy issues	Chief Executive, Association of Sea Fisheries Committees, Buckrose House, Commercial Street, Norton, Malton, North Yorkshire YO17 9HX, tel: 01653 698219
Affiliated angling clubs	Secretary, National Federation of Sea Anglers, 51a Queens Street, Newton Abbot, Devon TQ12 2QJ, tel: 01626 331330
Scientific advice on the management of the most important fish and shellfish stocks. Leaflets and publications list.	General Secretary, International Council for the Exploration of the Sea, Palaegade 2 -4, DK-1261 Copenhagen K, Denmark, tel: (+45) 33157092
Assessment of implications of non-fisheries activities and coast usage on fish stocks and fisheries; advice to assist with management and policy decisions for the coastal zone	*Head of Laboratory, MAFF Directorate of Fisheries Research, Fisheries Laboratory (Conwy), tel: 01492 593883
Fish stocks exploited by UK vessels; assessment and advice on their conservation. MAFF publications leaflet.	*Director, MAFF Directorate of Fisheries Research, Fisheries Laboratory (Lowestoft), tel: 01502 562244
Additional statistics other than those in publications (available from HMSO)	MAFF Fisheries Statistics Unit, Nobel House, 17 Smith Square, London SW1P 3JR, tel: 0171 238 6000
Local fisheries information, quota management, licensing of fishing vessels and enforcement and advice on UK and EC legislation, from Scottish border to Redcar.	District Inspector, MAFF Sea Fisheries Inspectorate, District Fisheries Office, 12-15A Union Quay, North Shields, Tyne and Wear NE30 1HN, tel: 0191 257 4520
Local fisheries information, quota management, licensing of fishing vessels and enforcement and advice on UK and EC legislation, from Redcar to Donna Nook.	District Inspector, MAFF Sea Fisheries Inspectorate, District Fisheries Office, 141, Cleethorpe Road, Grimsby, South Humberside, tel: 01472 355112/3
Bivalve molusc production areas, the classification of shellfish waters and shellfish diseases; preparation of SHELLMAP (a subset of UKDMAP)	Director, MAFF Shellfish Division, Fish Diseases Laboratory, Barrack Road, The Nothe, Weymouth, Dorset DT4 8UB, tel: 01305 206600
Local inshore fisheries information and advice on byelaws, national and EC legislation.	Clerk, North Eastern Sea Fisheries Committee, County Hall, Beverley, North Humberside HU17 9BA, tel: 01482 867131
Local inshore fisheries information and advice on byelaws, national and EC legislation.	Clerk, Northumberland Sea Fisheries Committee, Sun Alliance House, 35 Mosley Street, Newcastle-Upon-Tyne NE1 1XX, tel: 0191 261 1841
Details of planned projects and national NRA fisheries policy; salmonid and freshwater statistics for England and Wales.	*Head of Department, Fisheries Department, NRA Head Office, Bristol, tel: 01454 624400
Regional information and advice on diadromous fisheries; salmonid and freshwater statistics for Northumbria and Yorkshire	*Regional Fisheries Manager, National Rivers Authority - Northumbria and Yorkshire Regional Office, Leeds, tel: 01532 440191
Commercial advice on fin fish	Technical Director, Sea Fish Industry Authority, Seafish Technology Division, Sea Fish House, St Andrews Dock, Hull, North Humberside, HU3 4QE, tel: 01482 27837
UKDMAP software with maps showing fishing areas of selected species, ICES Statistical Division boundaries and other information	Project Manager, British Oceanographic Data Centre, Proudman Oceanographic Laboratory, Bidston Observatory, Birkenhead, Merseyside L43 7RA, tel: 0151 652 3950
Publications and shellfish production information	Director, Shellfish Association of the UK, Fishmongers Hall, London Bridge, London EC4R 9EL, tel: 0171 626 3531
Interaction between fisheries and non-fisheries conservation issues	*Marine Fisheries Officer, English Nature HQ, Peterborough, tel: 01733 340345
Marine Fisheries Task Group paper and advice on interaction between fisheries and non-fisheries conservation issues	*Marine Advisory Officer, JNCC Peterborough, tel. 01733 62626
Interaction between fisheries and non-fisheries conservation issues	*Marine Policy Officer, RSPB HQ, Sandy, Beds., tel. 01767 680551
Interaction between fisheries and non-fisheries conservation issues	*Fisheries Officer, WWF-UK, Godalming, tel. 01483 426444
All aspects of marine and coastal conservation.	*Conservation Officer, Marine Conservation Society, Ross-on-Wye, tel: 01989 566017
Interaction between fisheries and non-fisheries conservation issues	Administrator, The Marine Forum for Environmental Issues, Department of Zoology, The Natural History Museum, Cromwell Road, London SW7 5BD, tel: 0171 938 9114
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9.1.6 Acknowledgements

The author thanks the following members of the 'Fisheries Working Group' for their contributions and comments, which enabled the production of this section: Stephen Lockwood (MAFF DFR), Mike Pawson (MAFF DFR), Miran Aprahamian (NRA North-West Region), Bill Cook (NW & NWSFC), Phil Coates (SWSFC), Russell Bradley (Association of SFCs), Paul Knapman (English Nature), Blaise Bullimore (Countryside Council for Wales), Indrani Lutchman (WWF UK), Clare Eno (JNCC), Mark Tasker (JNCC) and Nancy Harrison. Thanks are also due to Sir Derek Bradbeer and A.J. Flett (Northumberland Sea Fisheries Committee), P. Smith and M.D. Wilkinson (North Eastern Sea Fisheries Committee) and P. Knapman (English Nature), for providing information specifically about this region and for reviewing drafts. C. Smith, R. Keddie and J. Mitchell (JNCC) helped compile the tables and map.

9.2 Mariculture

C.F. Robson

9.2.1 Introduction

Mariculture is the cultivation of marine species in coastal waters. There is a small amount of shellfish farming of Pacific and native oysters in the region, at Holy Island in Northumberland. The only culture of the king ragworm for bait in Britain occurs in this region, although not in its coastal waters. There is currently no cultivation of salmonids, non-salmonid fish or algae in this region.

9.2.2 Locations and species

The locations of commercial mariculture areas in the region and the species that are cultivated are shown on Map 9.2.1. Table 9.2.1 lists the main native and non-native species that are under commercial cultivation in the region and in Great Britain and the Isle of Man.

Table 9.2.1 Main species that are cultivated in Great Britain and in this region

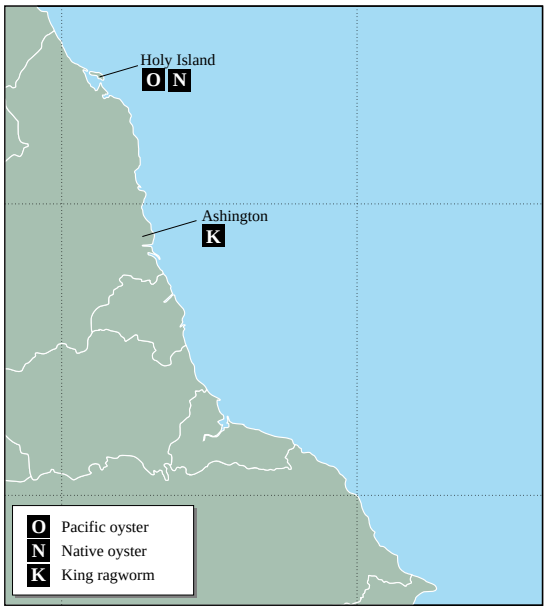
Species	*Native or non-native species*	*Cultivated in region?*
Salmonids		
Atlantic salmon *Salmo salar*	Native	
Rainbow trout *Oncorhynchus mykiss*	Non-native	
Non-salmonids		
Turbot *Psetta maxima*	Native	
Halibut *Hippoglossus hippoglossus*	Native	
Shellfish: bivalve molluscs		
Common mussel *Mytilus edulis*	Native	
Native oyster *Ostrea edulis*	Native	✓
Pacific oyster *Crassostrea gigas*	Non-native	✓
Hard shelled clams *Mercenaria mercenaria*	Non-native	
Manila clams *Tapes philippinarum*	Non-native	
Palourde *Tapes decussatus*	Native	
Scallop/queen scallop *Pecten maximus/ Chlamys opercularis*	Native	
Polychaetes		
King ragworm *Nereis virens*	Native	✓

Shellfish

Pacific (and to a lesser extent native) oysters are cultivated in 'poches' - large mesh sacks on the intertidal flats, south of Holy Island in Northumberland.

Polychaetes

At Ashington, Northumberland, in a scheme that started in 1986, king ragworm are cultivated for use as angling bait. Production has grown from 1.5 tonnes in the first year to 12 tonnes in 1993, with a projected production of 15-17 tonnes in 1994. The production site is located inland close to a power station, and warm water from the power station is used to rear the polychaetes, speeding up their growth by four times.



Map 9.2.1 Location of mariculture areas and the species in culture

9.2.3 Management and issues

In this region there are no densely-populated areas where mariculture occurs. However, there is concern about the effects of sewage discharges on exploited species - both on stocks that are fished (see section 9.1) and those that are cultivated. The Food Safety (Live Bivalve Molluscs) Regulations (which implement European Council Directives) requires that all waters from which bivalve molluscs are taken for human consumption are classified by MAFF, and depending on the resulting category (A - D), restrictions may be imposed. Shellfish and fish farms have to be registered with MAFF under the Fish Farming and Shellfish Farming Business Order 1985. Registration is designed to assist MAFF in dealing with any outbreaks of pests and diseases.

The consent of the owners or managers of the sea bed is required and a lease may be needed before structures for mariculture can be erected on the sea bed. In many areas consent must be sought from the Crown Estate, since it owns or manages 55% of the foreshore and the same proportion of the beds of tidal rivers between mean high and low water in GB, together with virtually the entire territorial sea bed. Of the remainder of the foreshore the majority is owned by the Duchies of Cornwall and Lancaster. If the structures are potentially hazardous to navigation the Department of Transport must also authorise their construction, and if they are to be above mean low water mark planning permission must be sought from the local authority. In this region much of the coast, including the locations of existing maricultural operations, is

protected by national and international designations, including SSSI, Heritage Coast and AONB (Area of Outstanding Natural Beauty), as well as local and voluntary conservation measures, so nature conservation and landscape considerations also apply.

There are no shellfish Several Orders or Regulatory Orders in this region, although there are respectively 22 and eight in Britain as a whole (MAFF 1994). The introduction of non-native shellfish species for cultivation has caused concern over their potential to establish self-sustaining populations which may affect marine ecosystems. Since January 1993 there have been new, less stringent, requirements for the control of shellfish disease in Great Britain and for the 'deposit' and importation of molluscan shellfish and lobsters, under the EC Fish Health Directive (Directive 91/67). Under this legislation, only the deposit of shellfish originating from areas in which *Bonamia ostreae* occurs is now controlled. (*Bonamia* is a parasite that infects the blood cells of native oysters, causing high mortalities of infected oysters.) These changes in the legislation have caused concern that the transfer of molluscan shellfish may be accompanyied by accidental releases of associated non-native predators, pests, parasites and diseases. Shellfish and fish farms in the region have to be registered with MAFF, under the Fish Farming and Shellfish Farming Business Order 1985. Registration is designed to assist MAFF in dealing with any outbreaks of pests and diseases.

Mariculture and its effects are limited in this region compared with some other parts of Britain. However, issues relating to the cultivation of marine species are closely linked to marine nature conservation interests, particularly the possible effects on species and habitats of nature conservation interest. These issues for mariculture in general are under consideration by the 'Marine Fisheries Task Force', an inter-agency team of the statutory nature conservation organisations (the Countryside Council for Wales, English Nature, Scottish Natural Heritage and the Department of the Environment for Northern Ireland, together with the JNCC). A consultation draft paper prepared by the group, entitled *Developing an action programme for sea fisheries and wildlife* (Marine Fisheries Task Force 1994), identifies the main areas where marine fisheries (broadly defined to encompass the exploitation of all living marine resources and which therefore includes mariculture) affect wildlife and identifies any action needed.

9.2.4 Information sources used

For details of the current classification categories in the Designated Bivalve Mollusc Production Areas in the region, reference should be made to the relevant Port Health or Local Authority. A specialist subset of the electronic mapping system UKDMAP (see 'Core reading list', section A3 in the Appendix), called SHELLMAP, is being prepared by the MAFF Shellfish Division in Weymouth in order to meet the requirements of the EC shellfish harvesting and hygiene directives (Ramster *et al*. in press). The software gives charts of all coastal areas (principally estuaries) that support known molluscan shellfisheries, showing all details of the production areas and their classification.

9.2.5 Further sources of information

A. References cited

Ministry of Agriculture, Fisheries and Food. 1994. List of Orders in England and Wales (unpublished). London, MAFF.

Marine Fisheries Task Force. 1994. *Developing an action programme for sea fisheries and wildlife*. Peterborough, JNCC. (Draft consultation paper by the Marine Fisheries Task Group.)

Ramster, J.W., Tabor, A. R., Lockwood, S.J., & Sheehan, R. In press. Access to coastal zone information : a possible common approach for the UK. *In: Proceedings of the conference on management techniques in the coastal zone, University of Portsmouth October 24-25 1994*. University of Portsmouth.

B. Further reading

Addison, J.T., & Bannister, R.C.A. 1994. Re-stocking and enhancing clawed lobster stocks: a review. *Crustaceana, 67* (2): 131-155. (Proceedings of the Fourth International Workshop on Lobster Biology and Management, Sanriku, Japan.)

Bannister, R.C.A., Addison, J.T., & Lovewell, S.R.J. 1994. Growth, movement, recapture rate and survival of hatchery-reared lobsters *Hommarus gammarus* Linnaneus, 1758, released into the wild on the English east coast. *Crustaceana, 67* (2): 156-172. (Proceedings of the Fourth International Workshop on Lobster Biology and Management, Sanriku, Japan.)

Burton C.A. 1993. *The United Kingdom lobster stock enhancement experiments*. First British conference on artificial reefs and restockings, 22-25. Stromness, International Centre for Island Technology.

Dixon, F. 1986. *Development of the bottom culture mussel industry in the UK*. Hull, Sea Fish Authority Industrial Development Unit (Internal Report Number 1271).

Ministry of Agriculture, Fisheries and Food, Welsh Office and Scottish Office Agriculture and Fisheries Department. 1994. *A guide to importing fish*. Lowestoft, MAFF.

Ministry of Agriculture, Fisheries and Food, Welsh Office and Scottish Office Agriculture and Fisheries Department. 1994. *A guide to shellfish health controls*. London, MAFF.

Ministry of Agriculture, Fisheries and Food. 1982. Bonamia, *a new threat to the native oyster fishery*. Lowestoft, MAFF Directorate of Fisheries Research (Fisheries Notices Number 71).

Pawson, M.G., & Rogers, S.I. 1989. *The coastal fisheries of England and Wales. Part ii: A review of their status in 1988*. Lowestoft, MAFF. (Directorate of Fisheries Research Internal Report No.19.) (Being updated.)

Ross, A. 1988. Fish farms and wildlife: are they really compatible? *Marine Conservation, summer 1988*.

Spencer, B.E. 1990. *Cultivation of Pacific oysters*. Lowestoft, MAFF Directorate of Fisheries Research (Laboratory Leaflet No. 63).

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Shellfish reports, other publications and other advice and information on mariculture activities	Clerk, Northumberland Sea Fisheries Committee (NSFC), Sun Alliance House, 35 Mosley Street, Newcastle-Upon-Tyne NE1 1XX, tel: 0191 261 1841
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Commercial advice and information on shellfish	Director, Shellfish Association of the UK, Fishmongers Hall, London Bridge, London EC4R 9EL, tel: 0171 626 3531
Information and advice on the cultivation of king ragworm	The Manager, Seabait Ltd., Woodhorn Village, Ashington, Northumberland NE63 9NW, tel: 01670 814102
Information and advice on interaction between mariculture and non-mariculture conservation issues	*Marine Fisheries Officer, English Nature HQ, Peterborough, tel: 01733 340345
Marine Fisheries Task Group paper and advice on interaction between mariculture and non-mariculture conservation issues	*Marine Advisory Officer, JNCC, Peterborough, tel: 01733 62626
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9.2.6 Acknowledgements

Thanks to the following members of the Fisheries Working Group for their contributions and comments: Bill Cook (NW & NWSFC), Phil Coates (SWSFC), Brian Spencer (MAFF DFR Conwy), Dr McGovern (Crown Estate, Scotland), Paul Knapman (English Nature), Blaise Bullimore (Countryside Council for Wales), Indrani Lutchman (WWF UK), Clare Eno (JNCC), Mark Tasker (JNCC) and Nancy Harrison (RSPB). Additional thanks go to Sir Derek Bradbeer and A.J. Flett (Northumberland Sea Fisheries Committee), P. Smith and M.D. Wilkinson (North Eastern Sea Fisheries Committee), P. Knapman (English Nature), G. Rutherford (Seabait Ltd.) and A. Herbert and A. Panayi (Crown Estate).

9.3 Wildfowling; dune and saltmarsh grazing

Dr N.C. Davidson, D.A. Stroud, C.A. Crumpton and M.J. Goodwin

9.3.1 Wildfowling

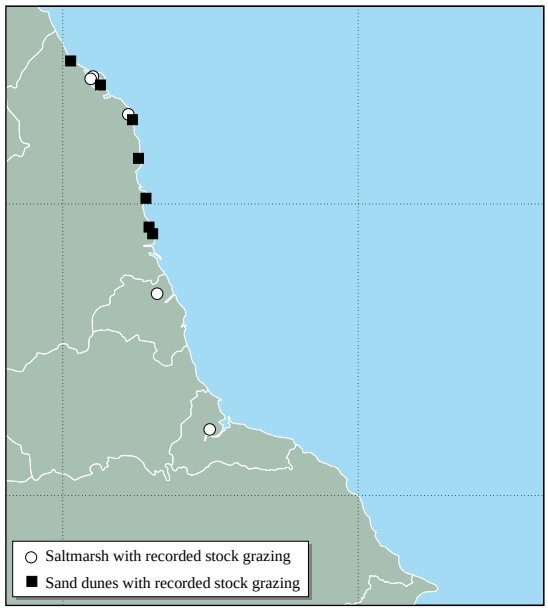
A traditional coastal activity formerly commercially practised for food, wildfowling is now solely recreational. Quarry species and shooting seasons (the open season for coastal wildfowling is 1 September to 20 February) are regulated through the Wildlife and Countryside Act 1981. Coastal quarry species include most ducks, some geese and three waders (only one of which - golden plover *Pluvialis apricaria* - is regularly coastal); in this region it is chiefly ducks (especially wigeon *Anas penelope*, teal *A. crecca* and mallard *A. platyrhynchos*) and grey-lag geese *Anser anser* that are targeted.

As well as statutory constraints on species shot, several sites are subject to further regulation self-imposed by wildfowlers. Local wildfowlers were, for example, instrumental in establishing Lindisfarne as a National Nature Reserve so as to ensure the management of uncontrolled shooting. As elsewhere in Britain, much of the wildfowling in Region 5 is operated and managed through wildfowling clubs and syndicates. The representative body for sport shooting in the UK, the British Association for Shooting and Conservation (BASC), has 19,000 wildfowling members, most of whom belong to 200 affiliated wildfowling clubs; there are 24 clubs (12% of all affiliated clubs), with 1,077 members, operating in the region. Shooting on some coastal sites such as Lindisfarne involves both local wildfowlers and those from further afield.

Wildfowling in the region is focused on Lindisfarne, where there has been a long history of the activity (Chapman 1889). Here the wildfowling is strictly controlled through a permit system and there is close liaison between English Nature, the BASC and wildfowlers. One wildfowling club operates, with many further permits being issued to individuals. Punt-gunning takes place regularly at Lindisfarne, with up to eight permits operating, although there are seldom more than two or three punts operating at any one time. A refuge system operates at Lindisfarne, although in recent years its functioning has been complicated by disturbance from bait-digging within one part of the refuge. The bait-digging and wildfowling appear to have caused sufficient disturbance to some waterfowl for them to use the estuary in smaller numbers in some years (Townshend & O'Connor 1993) (see also section 5.12.3 and Owen (1992) for information on wildfowling regulation in the region and elsewhere).

Elswhere in the region there are wildfowling clubs shooting on the Tweed Estuary and a grazing marsh area at Teesmouth, but wildfowling is usually absent, or at most only occasional, on small estuaries.

During periods of severe winter weather, disturbance to waterfowl (including non-quarry species) from shooting threatens the birds' survival: at these times national statutory wildfowling bans can be imposed after fourteen days of freezing conditions (voluntary restraint is called for after seven days). Bans are important in this region since it is used as a refuge when weather further east in Europe is severe (Ridgill & Fox 1990). This is particularly important for the small Svalbard-breeding population of light-bellied brent geese *Branta bernicla hrota*, most of which depend on Lindisfarne in severe winters (Madsen 1984). Further information on the history and operation of cold-weather shooting bans is given by Stroud (1992).



Map 9.3.1 Saltmarshes and sand dunes with recorded grazing. See Maps 3.6.1 and 3.2.1 for distribution of saltmarsh and sand dune sites. Source: JNCC Integrated Coastal Database.

9.3.2 Dune grazing

Historically, the region's dunes of have been affected by agriculture for most of their existence. The characteristic semi-natural vegetation of most stable dunes has developed as a result of grazing of the indigenous vegetation by sheep, rabbits and cattle (Radley 1994). However, during a recent survey of sand dune vegetation in England, grazing by domestic stock was recorded at only 34 out of 121 dune sites (Radley 1994). In England now the greatest concentrations of grazed dune are in the north and west, where livestock farming is generally strongest. In the south and east, stock grazing is rarely seen. Rabbits remain the most widespread dune grazing animal in England. Map 9.3.1 shows the location of grazed dune sites in the region as identified by the National Sand Dune Survey (Radley 1994).

In north-east England a widespread method of farming involves the use of dunes as winter holding grounds for large numbers of intensively fed cattle. This results in massive inputs of nutrients and organic material to the dune soils, which completely alter the dune vegetation. Sites

where this farming system can be observed include Druridge Bay and Ross Links, both in Northumberland (see also section 3.2.3).

9.3.3 Saltmarsh grazing

There are approximately 44,000 ha of saltmarsh in Great Britain. Agriculture is the oldest form of exploitation of saltmarsh by man. Today in Great Britain as a whole, grazing is the most important operation affecting the saltmarsh. About 31,600 ha are grazed, with major concentrations in the north-west and south-east of England. Stocking figures vary in the UK. Doody's (1988) study of saltmarsh management identified levels across the country ranging from one to six animals per hectare, with grazing usually only taking place from May to September.

There are approximately 311 ha of saltmarsh in the region (Burd 1989), 82% of which are grazed to some extent (Map 9.3.1 and section 3.6.3). However, the grazed saltmarsh in the region accounts for less than 1% of the total area of grazed saltmarsh in Britain.

9.3.4 Information sources used

In addition to the references cited, some of the information about the distribution and management of wildfowling comes from the NCC's 1989 Estuaries Review data collection, now held as part of JNCC's integrated coastal database.

9.3.5 Further sources of information

A. References cited

Burd, F. 1989. *The saltmarsh survey of Great Britain.* Peterborough, Nature Conservancy Council.

Chapman, A. 1889. *Bird life of the Borders.* London, Gurney & Jackson.

Doody, J.P. 1988. The management of saltmarshes. *Coastal habitat network, No.2.* April. Peterborough, Joint Nature Conservation Committee.

Madsen, J. 1984. Status of the Svalbard population of light-bellied Brent geese *Branta bernicla hrota* wintering in Denmark 1980 - 1983. *Norsk Polarinstitut Skrifter, 181:* 119-124.

Owen, M. 1992. An analysis of permit systems and bag records on NNRs. Peterborough, *JNCC Report,* No. 68.

Radley, G.P. 1994. *Sand dune vegetation survey of Great Britain. Part 1: England.* Peterborough, Joint Nature Conservation Committee.

Ridgill, S.C., & Fox., A.D. 1990. *Cold weather movements of waterfowl in western Europe.* Slimbridge, International Waterfowl & Wetlands Research Bureau. (IWRB Special Publication No. 13.)

Stroud, J.M. 1992. Statutory suspension of wildfowling in severe weather: review of past winter weather and actions. Peterborough, *JNCC Report,* No. 75.

Townshend, D.J., & O'Connor, D.A. 1993. Some effects of disturbance to waterfowl from bait-digging and wildfowling at Lindisfarne National Nature Reserve, north-east England. *Wader Study Group Bulletin,* 68 (*Special Issue*): 47-52.

B. Further reading

Bell, D.V., & Fox, P.J.A. 1991. Shooting disturbance: an assessment of its impact and effects on overwintering waterfowl populations and their distribution in the UK. Peterborough, Nature Conservancy Council, *CSD Report,* No. 1242.

Doody, J.P. 1987. *Botanical and entomological implications of saltmarsh management in intertidal areas.* RSPB Symposium. Sandy, Royal Society for the Protection of Birds.

Eno, N.C., *ed.* 1991. *Marine conservation handbook.* 2nd ed. Peterborough, English Nature.

Mudge, G.P. 1989. Night shooting of wildfowl in Great Britain: an assessment of its prevalence, intensity and disturbance impact. Peterborough, Nature Conservancy Council, *CSD Report,* No. 987.

Pain, D. 1990. Lead poisoning of wildfowl: the waste of a natural resource. *IWRB News, No.4, July.*

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Wildfowl and wetlands	*Publicity Officer, Wildfowl & Wetlands Trust, Slimbridge, tel: 01453 890333
Wildfowling (general, including details of affiliated clubs)	Information Officer, British Association for Shooting and Conservation, Marford Mill, Rossett, Wrexham, Clwyd LL12 0HL, tel: 01224 570881
Wildfowling (general information on wildfowl, habitats and conservation)	*Enquiry Officer, Royal Society for the Protection of Birds HQ, Sandy, tel: 01767 680551
Wildfowling (the sport)	Press and Information Officer, British Field Sports Society, 59, Kennington Road, London SE1 7PZ, tel: 0171 928 4742
Severe weather wildfowling bans	*Licencing Officer, English Nature HQ, Peterborough, tel: 01733 340345
Saltmarsh grazing (general information)	Ministry of Agriculture, Fisheries and Food, Whitehall Place, London SW1A 2HH, tel: 0171 270 8080
Shellfish (curios)	Secretary, Shellfish Association of Great Britain, Fishmongers' Hall, London Bridge, London EC4 9EL, tel: 0171 283 8305
Marine conservation	*Campaigns Manager, Marine Conservation Society, Ross-on-Wye, tel: 01989 66017
Marine conservation (topical environmental issues)	Administrator, Marine Forum for Environmental Issues, Dept. of Zoology, The Natural History Museum, Cromwell Road, London SW7 5BD, tel: 0171 938 9114
Marine habitats, coastal science and pollution	*Maritime Team Manager, English Nature HQ, Peterborough, tel: 01733 340345

* Starred contact addresses are given in full in the Appendix

9.3.6 Acknowledgements

The authors wish to thank BASC for help in compiling this section.

9.4 Quarrying and landfilling

C.A. Crumpton & M.J. Goodwin

9.4.1 Introduction

In this section, quarries are included as coastal if they are less than 2 km inland, and landfill sites if they are in a coastal 10 km square. In 1992 there were six coastal quarries/mines in the region (see Map 9.4.1 and Table 9.4.1). The commercially quarried minerals in the region are potash, salt, sand and gravel, limestone and coal. In 1991 the counties of the region accounted for nearly 17% of British limestone production. Local mineral plans are available through the County Councils listed below (see 9.4.5C).

9.4.2 Important locations

Table 9.4.1 Coastal quarries (1992)

Location	*Operator*	*Mineral*
Northumberland		
Cresswell	RMC Northern Aggregates	Sand and gravel
Tyne & Wear		
Whitburn	Tilcon - Eastern	Limestone
Wearmouth	British Coal - North East	Coal
Cleveland		
Seaton Carew	RMC Northern Aggregates	Sand and gravel
Port Clarence	ICI	Salt
Saltburn-by-the-Sea	Cleveland Potash Ltd.	Potash

Source: BGS (1994)

Table 9.4.1 lists coastal quarries operating in the region in 1992. In addition to the sand quarries listed, sand is extracted from dunes in Druridge Bay, and from the foreshore at North Gare Sands, Teesmouth. In 1992 there were 266 operating coal mines in Great Britain as a whole, only one of which was located on this region's coast. Table 9.4.2 presents production levels for the main minerals quarried in the region by county, compared with British figures. Figures given are county totals, including inland areas; figures for coal production by Coastal Directories

Table 9.4.2 Limestone, sand and gravel production in the region (including inland areas) in 1991

Area	*Limestone*		*Sand & gravel*	
	Amount (thousands of tonnes)	*% of GB total*	*Amount (thousands of tonnes)*	*% of GB total*
Northumberland	1,049[a]	1.2[a]	714	0.7
Tyne & Wear			570	06
Durham	779	0.9	**1,522	**1.6
Cleveland	*5,084	*5.8	0	0
North Yorkshire	7,911	9.0	2,590	2.6
Counties of the region	*14,823	*16.9	5,396	5.5
England	70,160	79.4	**82,253	**84.0
Great Britain	***88,313***		***97,918***	

Source: BGS (1994). Key: * due to the method of compiling statistics these figures include production in Cumbria. ** figures include marine dredged material. [a] = figures for Northumberland and Tyne & Wear combined.

Project regions are not available. Table 9.4.3 lists and describes the region's coastal landfill sites (Map 9.4.2).

9.4.3 Management and issues

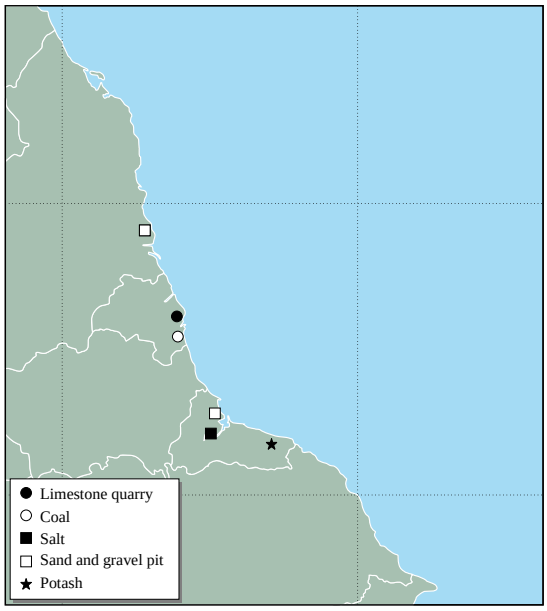
Extraction of sand from dunes and foreshores may in some cases affect natural coastal processes of sediment transport and deposition, which in this region are also affected by the recent cessation of colliery waste dumping on beaches and the consequent relative increase in erosion rates along much of the coast.

Landfill site licensing in Great Britain is the responsibility of the 152 Waste Regulation Authorities (WRAs). In England these are the County Councils, usually through the Environmental Health or Technical Services Departments (in Wales and Scotland this is done through District Councils). Waste management licences were introduced by the 1990 Environmental Protection Act to replace the disposal site licences previously required by the

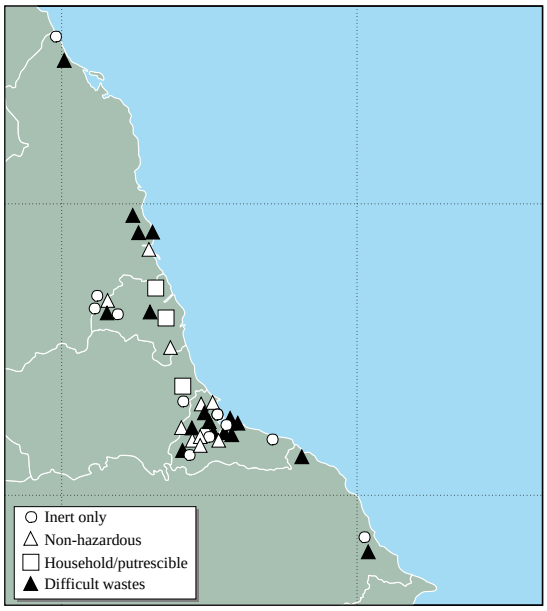
Table 9.4.3 Status of region's coastal landfill sites (see Map 9.4.2)

Status	*Definition*	*Number in region*
1: Inert only	Comprises uncontaminated excavated natural earth materials, and uncontaminated brick rubble and concrete with similar properties to natural earth materials.	12
2: Non-hazardous	Comprise mainly uncontaminated and industrial wastes such as packaging materials, wood and plastic. Some of these wastes are biodegradable but not rapidly so.	9
3: Household/ putrescible	Comprise the typical contents of a household dustbin and similar wastes of industrial origin e.g. food processing wastes.	3
4: Difficult wastes	Any wastes which require particular handling techniques at the disposal site, e.g. vehicle tyres, dry feathers, animal carcasses. They are not the same as Special Wastes, which are toxic and require pre-notification of disposal to the Waste Regulation Authority.	20
Total		***44***

Source: Aspinwall & Co.



Map 9.4.1 Coastal quarries. Source: BGS (1994). © Crown copyright.



Map 9.4.2 Coastal landfill sites. Source: Sitefile Digest (Aspinwall & Co. 1994).

1974 Control of Pollution Act. Each WRA is required to maintain a public register of waste management licences for private sites in its area and a register of resolutions referring to its own sites.

9.4.4 Information sources used

Data on quarrying were obtained from the British Geological Survey's Directory of Mines and Quarries (BGS 1994) and are the most up to date and comprehensive available.

The data used in this section for landfilling were provided by Aspinwall & Co. from their *Sitefile digest* for waste treatment and disposal (Aspinwall & Co 1994). This contains regularly updated information from the 152 Waste Regulation Authorities and represents the most up to date collection of public information on British waste management available.

9.4.5 Further sources of information

A. References

Aspinwall & Co. 1994. *Sitefile digest. A digest of authorised waste treatment and disposal sites in Great Britain*. Shrewsbury, Environment Press.

BGS (British Geological Survey). 1994. *Directory of mines and quarries 1994.* 4th ed. Nottingham, British Geological Survey.

B. Further reading

Eno, N.C., *ed*. 1991. *Marine conservation handbook.* 2nd ed. Peterborough, English Nature.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Landfill database and Sitefile Digest	Aspinwall & Co., Walford Manor, Baschurch, Shrewsbury SY4 2HH, tel: 01939 261144
Mines and quarries (British Directory of Mines and Quarries)	Director, British Geological Survey, Keyworth, Nottingham NG12 5GG, tel: 0115 936 3100
Details of disused collieries	Coal Authority, Bretby Business Park, Ashby Road, Burton-on-Trent, Staffs. DE15 0QD, tel: 01283 553291
Waste management licences, public registers and local mineral plans - Northumberland	*Waste Regulation Officer/Mineral Planning Officer, Technical Services Directorate, Northumberland County Council, Morpeth, tel: 01670 533000
Waste management licences and public registers - Tyne & Wear	Waste Regulation Officer, Tyne & Wear Waste Regulation Authority, Central Depot, Park Road, Gateshead NE8 3HN, tel: 0191 478 1037
Waste management licences, public registers and local mineral plans - County Durham	*Group Manager (Waste Regulation)/Mineral Planning Officer, Durham County Council Environment Department, Durham, tel: 0191 383 3775
Waste management licences, public registers and local mineral plans - Cleveland	Waste Regulation Officer/Mineral Planning Officer, Cleveland County Council, PO Box 77, Gurney House, Gurney Street, Middlesborough TS1 1JL, tel: 01642 262559
Waste management licences, public registers and local mineral plans - North Yorkshire	Waste Regulation Officer/Mineral Planning Officer, North Yorkshire County Council Waste Regulation Office, Central Repair Depot, Romanby, Northallerton DL7 8AP, tel: 01609 780780

* Starred contact addresses are given in full in the Appendix

9.5 Marine aggregate extraction, dredging and disposal of dredge spoil

C.A. Crumpton & M.J. Goodwin

9.5.1 Introduction

Sand and gravel on the sea bed are important sources of industrial aggregates for concrete production, beach replenishment and beach protection. The areas of sand and gravel deposits in the region are shown on Map 2.2.2. Results of prospecting suggest that gravel reserves are limited to minor pockets and the quality is poor (British Geological Survey pers. comm.). Marine aggregates form an increasing part of the total demand for sand and gravel in Britain, each year accounting for 15% of the total national requirement (Crown Estate 1992). Marine sand and gravel are extracted by commercial mineral companies under licence from the Crown Estate. The main market for marine-dredged aggregates is in the south-east of England.

The national demand for aggregates increased steadily during the 1980s. In response, the aggregate industry invested in new ships, which allowed more efficient exploitation of licence areas and new, deeper waters to be dredged (Kenny *et al.* 1994). Marine extraction (including licences specifically for contract fill and beach nourishment) in England and Wales reached a peak of 28 million tonnes in 1989 but accounted for 22.1 million tonnes in 1994, of which 6.6 million tonnes were exported (Crown Estate 1995). Contract fill and beach nourishment accounted for 1.3 million tonnes nationally. The quantity of marine dredged aggregates (895,357 tonnes) landed at the five ports in the region represents 4% of this total.

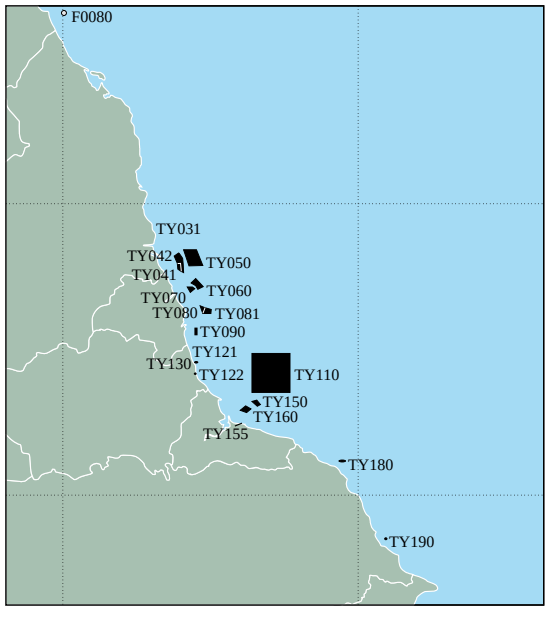
Capital dredging is the one-off removal of sediment, chiefly when deepening shipping channels and during the construction of new dock facilities. Thereafter, maintenance dredging is the regular dredging of existing ports and their approaches to maintain safe navigation. The majority of dredged material, which can range in composition from silts to boulder clay and rock, is dumped at sea. Additionally, dredged material is used for land claim and, increasingly, for beach recharge. From 1988 to 1992, a yearly average of 34,700,000 tonnes (wet weight) of dredged material was dumped at sea in England and Wales. Amounts varied between 24,243,998 tonnes (wet weight) in 1992 and 40,810,718 tonnes in 1989 (MAFF 1994).

During the Estuaries Review surveys, carried out in 1989 (Davidson *et al.* 1991), of the review sites in the region, capital dredging was taking place in many and maintenance dredging in at least five, out of 15 and 72 estuaries respectively out of a total of 155 review sites around Great Britain. In 1989, dredged material was being dumped within 10 (6.5%) of the estuaries surveyed, none of them in the region (Davidson *et al.* 1991). In 1992, 123 licences were issued by the Crown Estate for the disposal in England and Wales of dredged material at sea (164 in the UK as a whole) (MAFF 1994). In 1993 the quantity of dredged material dumped at marine sites in the region (2,655,444 tonnes) constituted 8.9% of the total dredged material (29,866,256 tonnes) dumped at offshore sites in UK.

9.5.2 Important locations

In 1994, a total of 641,858 tonnes of marine dredged aggregates were landed in the three ports in Tyne & Wear - Tyne, Gateshead and Sunderland; a total of 253,499 tonnes of aggregate were landed at Stockton-on-Tees and Middlesbrough (Cleveland). No aggregates were landed in

Map 9.5.1 Tonnages of marine dredged aggregates landed in 1994. Source: Crown Estate.



Map 9.5.2 Dredge spoil dumping sites (see Table 9.5.1). Source: MAFF (1994). © Crown copyright.

Table 9.5.1 Amounts of dredged material disposed of at each licensed site in the region in 1992 and 1993

Site name	*MAFF code*	*Dredging type*	*Depth (m)*	*Tonnage dumped in 1992*	*Tonnage dumped in 1993*
Northumberland					
Eyemouth	FO080	Maintenance	5	8,889	0
Blyth A and B	TY042	Maintenance	40	120,714	97,957
Tyne & Wear					
North Tyne	TY070	Capital Maintenance	46	3,068	0
		Maintenance		80,498	10,080
Souter Point (Outer)	TY081	Capital	46	18,517	157,795
		Maintenance		171,750	107,932
Sunderland	TY090	Capital	25	9,636	610
		Maintenance		14,763	17,845
Noses Point	TY130	Maintenance	10	52,618	29,894
Cleveland					
Tees Bay C	TY150	Capital	45	27,570	60,279
		Maintenance		5,000	48,290
Amoco Cats Pipeline Trench	TY155	Capital	1	0	0
Amoco Cats Pipeline Trench	TY156	Capital	1	N/A	0
Tees Bay A	TY160	Maintenance	30	1,956,322	2,044,322
North Yorkshire					
Whitby	TY180	Maintenance	40	70,875	67,800
Scarborough Rock	TY190	Maintenance	10	8,080	12,640
Total				***2,548,300***	***2,655,444***

Source: MAFF

Northumberland, Durham or North Yorkshire (Map 9.5.1) (Crown Estate 1995). The marketability of gravel deposits along the coast between Blyth in Northumberland and Sunderland in Tyne & Wear has been affected by many years of colliery waste dumping, which has made the aggregates there unsuitable for use in concrete production. No licences were granted in 1994 for dredging sand and gravel in the offshore parts of the region (Crown Estate 1995). Aggregates landed normally come from extraction areas closest to the port concerned. In this region these are off the Lincolnshire coast (Crown Estate pers.comm.), which is one of the main dredging grounds licensed for marine sand and gravel extraction within the coastal waters of Britain.

Map 9.5.2 shows the main marine disposal sites used for the dumping of dredged material in the region in 1992 and Table 9.5.1 shows the quantities of material disposed of at each site. Maps for 1993 were not available at the time of writing.

9.5.3 Management and issues

A proposal has been made for the removal of aggregate from the rich reserves in Filey Bay. Strong local opposition has resulted in the formation of the East Coast Off-Shore Minerals Forum. A study of the proposed gravel extraction in this area has been carried out by the Institute of Estuarine and Coastal Studies at the University of Hull (see section 9.5.5 C).

It is not always possible to state definitely where the aggregate landed at specific ports was dredged, owing to the movement of aggregate to different markets within Britain. Occasional cargoes may have come from a completely different licence as a dredger is moved from one region to another, but the amount involved will be very small in overall terms. In this region, however, aggregates landed usually come from the extraction areas closest to the port concerned, in this case off the Lincolnshire coast (Crown Estate pers. comm.), which is one of the main dredging grounds licensed for marine sand and gravel extraction within the coastal waters of Great Britain.

Disposal of dredged material in the UK is controlled by the Food and Environmental Protection Act (1985) (dumping at sea and inter-tidal areas) and the Town and Country Planning and Environmental Protection Acts, both 1990 (dumping on land). Also, the Oslo Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft, and the London Convention on the Dumping of Wastes at Sea, include within their scope dumping of dredged material at sea. Licences to dump dredged material are granted by the Ministry of Agriculture, Fisheries and Food (MAFF). Each licence is subject to certain conditions, which have become more stringent in the last few years.

9.5.4 Information sources used

The statistics for aggregate extraction relate to royalty returns for 1993. The regional landing port totals will not equate to the amount dredged from each region, owing to the presence of the export market and the movement of aggregates to meet differing home market demands. The data for dredge spoil dumping cover dumping carried out under licenses granted by the Ministry of Agriculture, Fisheries and Food. Additional, illegal material dumping may occur. For instance, in 1986 and 1987 six and three cases respectively of alleged illegal dumping were investigated in England and Wales (MAFF 1989).

9.5.5 Further sources of information

A. References

Crown Estate. 1995. *Marine aggregates - Crown Estate licences - summary of statistics 1994*. London, Crown Estate.

Crown Estate. 1992. *Marine aggregate extraction and the government view procedure*. London, Crown Estate.

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

Kenny, A.J., & Rees, H.L. 1994. The effects of marine gravel extraction on the macrobenthos: early post-dredging recolonisation. *Marine Pollution Bulletin*, *7*: 442-447.

Ministry of Agriculture, Fisheries and Food (Department of Agriculture and Fisheries for Scotland). 1989. *Report on the disposal of waste at sea, 1986 and 1987.* London, MAFF.

Ministry of Agriculture, Fisheries and Food (Directorate of Fisheries Research). 1994. *Monitoring and surveillance of non-radioactive contaminants in the aquatic environment and activities regulating the disposal of wastes at sea, 1992*. Lowestoft. (Aquatic Monitoring Report No.40.)

B. Further reading

British Marine Aggregate Producers Association. 1993. *Aggregates from the sea: why dredge?* London, British Marine Aggregate Producers Association.

British Oceanographic Data Centre. 1992. *United Kingdom Digital Marine Atlas. User Guide. Version 2.0*. Birkenhead, Natural Environment Research Council, British Oceanographic Data Centre.

Doody, J.P., Johnston, C., & Smith, B. 1993. *Directory of the North Sea coastal margin*. Peterborough, Joint Nature Conservation Committee.

ICES. 1978. Input of pollutants to the Oslo Commission area. *International Council for the Exploration of the Seas, Cooperative Research Report, 77:* 57.

Irish Sea Study Group. 1990. *The Irish Sea; an environmental review. Part 1; nature conservation.* Liverpool, Liverpool University Press.

Ministry of Agriculture, Fisheries and Food. 1989. *Coastal defence and the environment: a strategic guide for managers and decision makers in the National Rivers Authority, Local Authorities and other bodies with coastal responsibilities.* London, HMSO.

Nunny, R.S., & Chillingworth, P.C.H. 1986. *Marine dredging for sand and gravel.* London, HMSO for Department of the Environment Minerals Division. (Minerals Planning Research Project No. PECD 7/1/163 - 99/84.)

Parker, M.M. 1987. The future for the disposal of dredged material in the UK. *Maintenance Dredging*. London, TTL.

Posford Duvivier Environment. 1992. *Capital and maintenance dredging: a pilot case study to review the potential benefits for nature conservation.* Unpublished report to English Nature & Poole Harbour Commissioners. Peterborough, English Nature.

Pullen, S. Undated. *Dumping of dredged spoils from ports: contamination, pollution control.* Unpublished note.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Marine sand and gravel extraction in the UK	Secretary, British Marine Aggregate Producers Association, 156 Buckingham Palace Road, London SW1 9TR, tel: 0171 730 8194
Marine aggregate extraction in the UK	Business Manager, Marine Estates (Offshore), 16 Carlton House Terrace, London SW1Y 5AH, tel: 0171 210 4377
Survey and appraisal of proposed gravel extractions in Filey Bay	Deputy Director, Institute of Estuarine and Coastal Studies, University of Hull, Humberside HU6 7RX, tel: 01482 46311
Marine resource management	Technical Manager, Posford Duvivier (Managing Agents offshore for The Crown Estate), Eastchester House, Harlands Road, Haywards Heath, West Sussex RH16 1PG, tel: 01444 458551
Potential environmental conflicts in the region (East Coast Offshore Minerals Forum)	*Minerals Officer, North Yorkshire County Council, Northallerton, tel: 01609 780780
Offshore geoscience data for the UK, including 1:250,000 maps of geology of coastline	Director, British Geological Survey - Coastal Geology Group, Keyworth, Nottingham NG12 5GG, tel: 0115 936 3100
Sand and gravel extraction in the UK	Director, Sand and Gravel Association (SAGA), 1 Bramber Court, 2 Bramber Road, London W14 9PB, tel: 0171 381 8778
Dumping of dredge spoil at sea	The Oslo and Paris Commissions, New Court, 48 Carey Street, London WC2A 2JE, tel: 0171 242 9927
Database containing information on licensing of dredge spoil dumping	Marine Environmental Protection Division, Ministry of Agriculture, Fisheries and Food, Fisheries Laboratory, Remembrance Avenue, Burnham-on-Crouch, Essex CM0 8HA, tel: 01621 782658
Dumping of dredge spoil at sea - international	London Convention Secretariat, International Maritime Organisation (IMO), 4 Albert Embankment, London SE1 7SR, tel: 0171 735 7611

* Starred contact addresses are given in full in the Appendix

9.5.6 Acknowledgements

Thanks to The Crown Estate for information on marine aggregate extraction in the region.

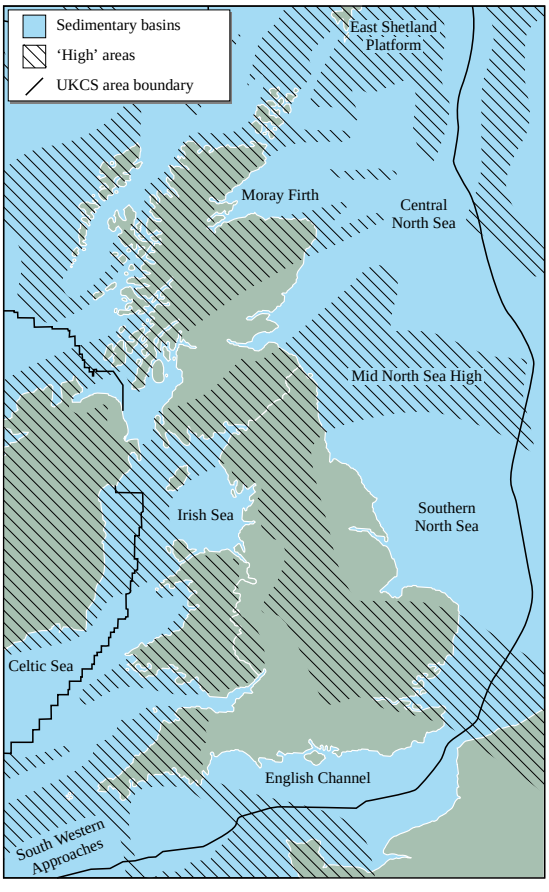
9.6 Oil and gas development

C.A. Crumpton, M.J. Goodwin & J.H. Barne

9.6.1 Introduction

This section describes oil and gas exploration and related development in the region; further information on oil and gas infrastructure is given in section 8.3.

The Gross National Product arising within the UK oil and gas production sector was £7,700 million in 1993 (1.4% of the total GNP). Estimated 'undiscovered recoverable reserves' in the Irish Sea (Regions 12 and 13), the Southern Basin (Regions 5 & 6) and the Celtic Sea combined were 0-70 million tonnes for oil and 245-890 billion cubic metres for gas. North Sea Gas production was a record 65.5 billion cubic metres in 1993 (DTI 1994), and gas piped ashore in Regions 5 and 3 accounted for 28.3% of total UK supplies (including imports). Exploration and appraisal well drilling in the southern North Sea (mainly in Region 6 to the south) in 1993 represented 27% and 15% of the UK totals respectively. Three significant discoveries were made. Map 9.6.1 shows sedimentary basins and structural 'highs' in the UK continental shelf, which determine the distribution of oil and gas deposits. Both maps were adapted from DTI.



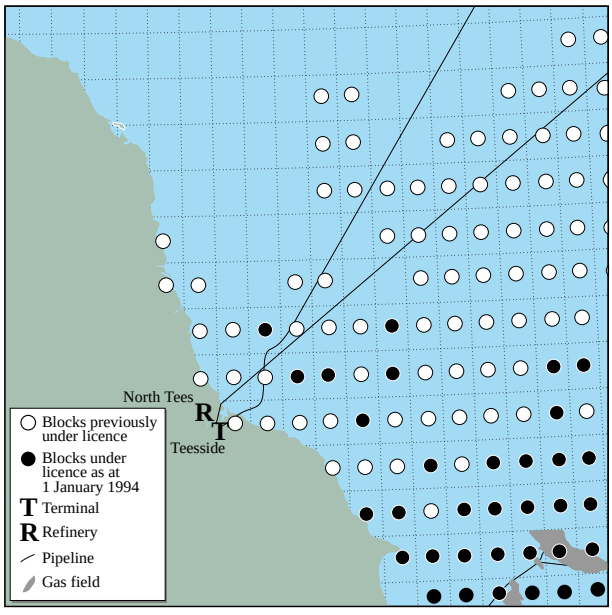
Map 9.6.1 UK Continental Shelf (UKCS) exploration. Source: DTI (1994). © Crown copyright.

9.6.2 Important locations

There are gas fields in production in the south of the region in the Southern Basin, ranging from 65 to 100 km offshore, from which gas is piped for treatment to installations further south. The nearshore part of the region is attracting increasing interest from the oil industry, with offshore licensing blocks being defined right up to the coast in this region. Map 9.6.2 shows the blocks under licence in the region as at 1 September 1994, as well as those previously under licence, out to approximately 1°E longitude. In the 14th Offshore Oil and Gas Licensing Round (1993) and the 15th (1994), the Southern Basin continued to attract interest. The 16th offshore oil and gas licensing round is currently under way, the results being due in June 1995. Map 9.6.2 also shows onshore installations.

9.6.3 Management and issues

The potential for oil spills to harm birds, marine and coastal wildlife is well known. Concern has been expressed particularly about the potential risk to seals and dolphins of oil-related developments in the region. The air-gun arrays used in seismic surveys generate high levels of low frequency sound. Most of the energy in the output from these arrays is at low frequencies, outside the known hearing range of seals, and is unlikely to disturb them. Underwater sounds from seismic activities (as part of oil and gas exploration) are most likely to affect baleen whales, which communicate primarily at these frequencies (20-500 Hz) (Baines 1993), although this species is not recorded from the region. Results obtained during seismic surveys by Marathon and Hamilton oil companies in the Irish Sea were



Map 9.6.2 Oil and gas. Source: DTI (1994). © Crown copyright.

inconclusive and experimental evidence for disturbance to cetaceans arising from seismic activities remains lacking (Evans *et al*. 1993). There is a very small risk of injury to seals in the immediate vicinity of a vessel conducting seismic surveys.

9.6.4 Information sources used

Data on oil and gas development used here are from the Department of Trade and Industry's 'Brown Book' (DTI 1994), which should be referred to for further explanation. Note that the southern North Sea includes many gas fields that lie in Region 6.

9.6.5 Further sources of information

A. References cited

Baines, M.E. 1993. *Marine mammal monitoring during the seismic exploration of block 107/21 in Cardigan Bay, Autumn 1993.* Haverfordwest, Dyfed Wildlife Trust.

Department of Trade and Industry. 1994. *The energy report 2: oil and gas resources of the UK - 1994.* London, HMSO.

Evans, P.G.H., Lewis, E.J., & Fisher, P. 1993. *A study of the possible effects of seismic testing upon cetaceans in the Irish Sea.* Oxford, Sea Watch Foundation. (Report to Marathon Oil UK.)

B. Further reading

Advisory Committee on the Pollution of the Sea. 1990. Surveys of oil pollution around the coasts of the United Kingdom. *In: ACOPS Year Book 1990, 158-163.* Oxford, Permagon Press.

British Gas. 1994. *Transportation and storage.* Solihull, British Gas Transto.

Institute of Petroleum Information Service. 1993. *Know more about oil: the UK refining industry.* London, Institute of Petroleum.

Institute of Petroleum Information Service. 1993. *Know more about oil: the North Sea.* London, Institute of Petroleum.

Institute of Petroleum Information Service. 1993. *UK petroleum industry statistics: consumption and refinery production for 1991 and 1992.* London, Institute of Petroleum.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Oil and gas developments in the UK	Public Relations Officer, Department of Trade and Industry, 1 Palace Street, London SW1E 5HE, tel: 0171215 5000
Oil and gas industry issues	Public Relations Officer, UK Offshore Operators Association, 3 Hans Crescent, London SW1X 0LN, tel: 0171 589 5255
General information on the oil industry	Librarian, Institute of Petroleum Library and Information Service, 61 New Cavendish Street, London W1M 8AR, tel: 0171 467 7100
Oil spillages in the UK	Executive Secretary, British Oil Spill Control Association (BOSCA), 4th Floor, 30 Great Guildford Street, London SE1 0HS, tel: 0171 928 9199
Oil transportation and terminals worldwide	Technical Adviser, Oil Companies International Marine Forum (OCIMF), 15th Floor, 96 Victoria Street, London SW1E 5JW, tel: 0171 828 7966
Potential environmental conflicts in oil and gas exploration: East Coast Offshore Minerals Forum	Minerals Officer, North Yorkshire County Council, County Hall, Northallerton, North Yorkshire DL7 8AQ, tel: 01609 780780
Gas industry in Britain	Director and Secretary, Society of British Gas Industries, 36 Holly Walk, Leamington Spa, Warwickshire CV32 4LY, tel: 01926 334357

9.6.6 Acknowledgements

Thanks to Colin Macduff-Duncan, Esso, for assistance with this section.

9.7 Water quality and effluent discharges

C.A. Crumpton & M.J. Goodwin

9.7.1 Introduction

This section summarises information about water quality and effluent discharge from a number of sources. Full interpretation of the information base on pollutants and water quality is complex and beyond the scope of this book.

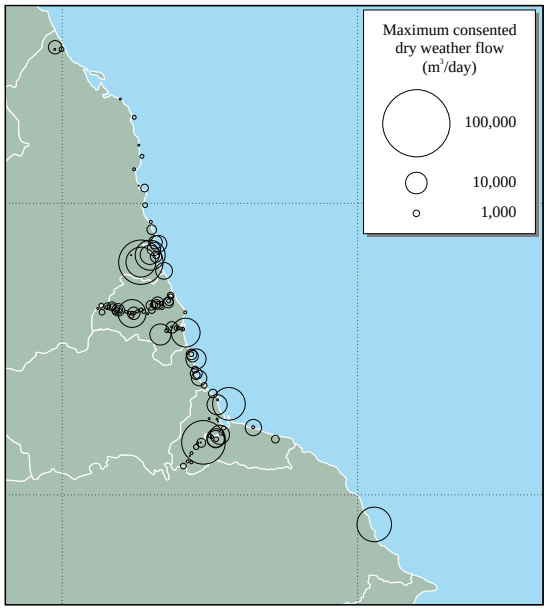
Waste products and effluents containing contaminants reach the marine environment in this region in a number of ways: sewage, agricultural run-off and trade effluents are discharged from outfalls into rivers or directly into the sea, and contaminants can reach the sea by airborne means, for example aerosols and rain. Discharges occurring outside the region may also have an effect. Some sewage sludges are principally of domestic origin and contain low levels of metals and other persistent components. Others include industrial inputs, resulting in higher concentrations of contaminants. In terms of sewage disposal, the UK produces some 1.1 million tonnes of dry solids (tds) annually and disposes of approximately 300,000 tds to the sea. UK sewage sludge production is set to increase dramatically over the next decade, with a predicted increase to 3.3 million tds by 2006. This will have to be disposed of on land, either by dumping or by incineration.

In this region depressed levels of dissolved oxygen do occur within the major urbanised estuaries, particularly during the summer months, mainly attributable to sewage effluents and industrial discharges. Surveys by the Ministry of Agriculture, Fisheries and Food (MAFF) and the Natural Environment Research Council (NERC) have shown the influence of industrial sources on levels of nickel, zinc and cadmium in the Tyne; nickel, zinc and lead in the Wear; and nickel, copper, zinc, cadmium, mercury and lead in the Tees, although high levels do not extend far offshore.

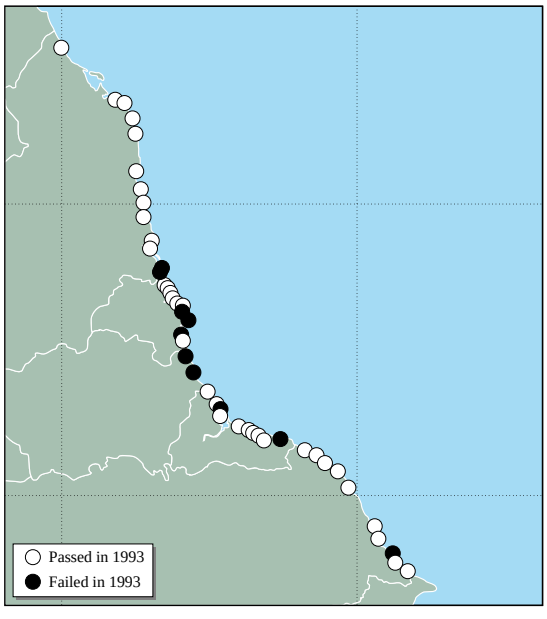
Concentrations of some metals, especially lead, in sea-bed sediments are clearly linked to coastal sources, but this may be due to high levels of lead occurring naturally in the catchments of the Tyne, Wear and Tees. Zinc, mercury and cadmium show less pronounced coastal distributions. Sewage sludge disposal sites were not found to be areas of high metal concentrations. Levels of organic compounds and nutrients in the region have also been studied. These and other studies have been summarised in the North Sea Quality Status Report (North Sea Task Force 1993b).

In a report on marine pollution, MAFF Directorate of Fisheries Research (1994) gives details of the effects of dredging and waste disposal off north-east England, showing the continuing high levels of TBT and metals in sediment (see also section 9.5).

There are 56 bathing waters in this region, as identified under the EC Bathing Water Directive (76/160/EEC). Of these, 46 (approximately 82%) complied with mandatory coliform standards in 1993, an improvement of 13% over 1992 figures (see Map 9.7.2 and Table 9.7.1). The 1993 data for the UK as a whole, assessed by DoE in accordance with the EC Bathing Water Directive (see section 9.7.3), show a very slight increase in compliance with the mandatory standards compared with 1992. The National Rivers Authority (NRA) expects a more dramatic increase in compliance after the majority of capital schemes being undertaken by the Water Service companies are completed in 1995. Trend data show that though the percentage of bathing waters consistently complying with the mandatory standards has remained at around 64%, the number consistently failing has reduced. Analysis of median faecal coliform values suggests that the improved water quality has been maintained over the last four years.



Map 9.7.1 Consented sewage outfalls. Area of circle is proportional to consented 'dry weather flow'. Map shows all outfalls with consented flow greater than 10 m³/day. Trade effluents not shown. Source: MAFF.



Map 9.7.2 Bathing water quality. Results of 1993 sampling of EC-identified bathing waters. Source: NRA (1994). Adapted with permission.

Table 9.7.1 NRA bathing waters survey 1992, 1993

NRA region	*Pass*		*Fail*		*Total*	
	1992	1993	1992	1993	1992	1993
Northumbrian	20	25	14	9	34	34
Yorkshire	20	21	2	1	22	22
England and Wales	328	332	88	86	416	418
UK including N. Ireland	***358***	***365***	***97***	***92***	***455***	***457***

Source: DoE (1993). Note: pass denotes compliance with Bathing Water Directive (76/160/EEC): Coliform standards. Northumbrian and Yorkshire NRA regions were merged in 1993.

The Coastwatch UK Survey of 1993 (see also section 9.7.3) found that, generally, the beaches of Tyne & Wear and North Yorkshire were less littered than those in other counties in the region. In Northumberland, results were consistently worse than the national average - particularly for plastic fishing gear and other plastics - and were considerably worse than in 1992. Results in Tyne & Wear were generally better than the national average. Faeces, sanitary items and medical waste were the only items found above average levels. Plastics were found at or below national averages, but overall results were better than 1992. In Cleveland, the survey found a slight overall improvement on 1992 figures. Items found above national average levels included landfill materials, large metal objects, household furnishings and plastics, and sewage pollution was perceived as a major threat. In County Durham, the overall quality of beaches was below average. General litter items were found at above national average levels and sewage and sanitary waste at considerably higher than average levels. In contrast, in North Yorkshire the overall quality of the beashes was higher than the national average, representing an improvement on 1992 results. Sanitary items and litter such as landfill materials, paper/cardboard and plastic fishing gear were all found at higher than average levels. Table 9.7.2 summarises the results of the 1993 Coastwatch survey of beach quality.

Table 9.7.2 Beach quality in the region in 1993

County	*% of beaches rated as excellent*	*% of beaches rated as moderate*	*% of beaches rated as polluted*
Northumberland	0	43	57
Tyne & Wear	20	47	33
Durham	0	36	64
Cleveland	7	34	59
North Yorkshire	12	52	36
Region 5	8	42	50
England	10	44	46
Great Britain	***8***	***42***	***50***

Source: Coastwatch UK (1993)

9.7.2 Important locations

There are major industrial discharges to the North Sea in this region, especially from the Tyne and the Tees. Along stretches of the coastline between Seaham and Hartlepool also, where for many years colliery waste used to be dumped, water quality has been affected. As coal production increased, the amount dumped exceeded that being removed by the sea; the sand was replaced by dark grey shales and beach terraces formed. In certain areas, particularly in the Blyth and Wear estuaries, water quality is now threatened by pollution from redundant mine workings. Elevated levels of nutrients have been reported in the area of Lindisfarne and Budle Bay (English Nature 1994).

Table 9.7.3 Sewage outfalls in the region with consented 'dry weather flows' >6,000 m^3 per day

Name of outfall	*Location*	*Grid. ref.*	*Type of discharge*	*Consented dry weather flow (m^3)*
Berwick Sewage Treatment Works	Berwick Upon Tweed	NT980525	Primary treated sewage	6,200
Summerhouse Lane Sea Outfall	Newbiggin	NZ313868	Screened sewage (>6 mm)	6,390
Newbiggin Sea Outfall	Newbiggin	NZ323862	Fine screened sewage	10,000
Cambois Main Sea Outfall	Cambois	NZ308843	Untreated sewage	6,500
Cowpen Sewage Treatment Works 1	Blyth	NZ295824	Secondary treated sewage	13,900
Cowpen Sewage Treatment Works 2	Blyth	NZ295824	Secondary treated sewage	31,000
Cramlington Sewage Treatment Works 1	Cramlington	NZ265800	Secondary treated sewage	31,000
Cramlington Sewage Treatment Works 2	Cramlington	NZ265800	Secondary treated sewage	66,000
Seaton Valley Trunk Sewer (Interim)	Seaton	NZ341770	Untreated sewage	10,520
Western Outfall	Gateshead	NZ235627	Untreated sewage	25,429
Hendon Sewage Treatment Works	Sunderland (Hendon)	NZ414562	Screened sewage (>6 mm)	30,000
Washington Sewage Treatment Works	Washington	NZ328557	Secondary treated sewage	15,800
Seaham Outfall Off Nose Point	Seaham	NZ449473	Screened sewage (>6 mm)	14,256
Dene Holme Outfall	Horden	NZ458407	Fine screened sewage	8,230
Seaton Carew Sea Outfall	Hartlepool (Seaton Carew)	NZ558321	Fine screened sewage	36,000
Mainsforth Terrace Pumping Station	Hartlepool	NZ519319	Macerated/comminuted sewage	14,000
Normanby Road Outfall	Middlesbrough	NZ527219	Untreated sewage	13,456
Cargo Fleet Sewage Treatment Works	Middlesbrough	NZ515208	Fine screened sewage	12,010
Middlesbeck Sewer	Middlesbrough	NZ515204	Untreated sewage	10,694
Portrack Sewage Treatment Works	Middlesbrough (Portrack)	NZ472194	Secondary treated sewage	65,400
Portrack Sewage Treatment Works	Middlesbrough (Portrack)	NZ472194	Primary treated sewage	64,500
Langbaurgh Sea Outfall	Redcar (Marske)	NZ640242	Fine screened sewage	8,700
Scalby Ness Outfall	Scarborough	TA047916	Fine screened sewage	39,700

Source: MAFF sewage outfalls database

Map 9.7.1 shows the locations in Region 5 of all the 315 consented (see section 9.7.3) sewage outfalls with consented 'dry weather flows' (i.e. undiluted by rain) in excess of 10 m^3 per day. Table 9.7.3 lists the 23 sewage outfalls in the region whose consented 'dry weather flows' are in excess of 6,000 m^3 per day, showing their locations and the type of discharge. These data do not include trade effluent discharges.

There is one Blue Flag beach (see section 9.7.3) in the region, at Tynemouth Longsands South. It was one of 20 resorts in the UK (18 of them in England and Wales) to enter for a Blue Flag in 1993. All were successful.

In 1994, 165 beaches in the UK attained Tidy Britain Group Seaside Awards; fourteen were located in this region, at Bamburgh, Beadnell Bay, Low Newton, Warkworth, Amble Links, Tynemouth Cullercoats, Tynemouth Longsands South, Runswick Bay, Sandsend, Whitby West Cliff, Robin Hood's Bay, Scarborough North Bay, Scarborough South Bay and Filey.

9.7.3 Management and issues

A range of legislation is in force to control discharges to the aquatic environment. In England the primary statute is the Water Resources Act 1991. The NRA has overall responsibility for the control of discharges and the maintenance of water quality. It authorises sewage discharges by issuing 'consents', with MAFF as a statutory consultee to safeguard fishery interests. Trade effluent involving 'scheduled' (hazardous) substances must be authorised by Her Majesty's Inspector of Pollution under the Environmental Protection Act 1990, with the NRA as a statutory consultee. Environmental Quality Standards (EQSs) for many of these substances are specified in the Environmental Protection (Prescribed Processes etc.) Regulation 1991. The EQSs may be set by the European Union (under the Dangerous Substances Directive 76/464/EEC and Framework Directive 86/280/EEC) or nationally (DoE Circular 7/89, March 1989). The NRA's 1994 booklet on *Discharge consents and compliance* (NRA 1994) contains details of national and European discharge regulations (see section 9.7.5).

MAFF issues licences for the dumping of sewage at sea. From early 1992 all dumping of liquid waste into the sea from ships ceased and all sewage sludge dumping by marine vessels is set to be phased out by 1998, under the Urban Waste Water Treatment Directive (91/271/EEC). Under the same Directive all significant sewage discharges, except those in 'High Natural Dispersion Areas', will require minimum secondary treatment, to be phased in by 2005. Sewage disposal on land is controlled by the local Waste Regulation Authorities (see section 9.4).

There are currently several schemes (statutory and non-statutory) for assessing the quality of beaches and their waters in relation to waste disposal. Firstly, there is the EC Bathing Water Directive (76/160/EEC), with its associated monitoring of identified bathing waters for levels of coliforms (bacteria that indicate sewage presence). Monitoring is carried out by the National Rivers Authority (NRA). Any measures required to improve the quality of the waters are a matter for the dischargers of industrial effluent or the sewerage authorities. Under the terms of the Environmental Protection Act 1990, the quality of bathing beaches is the responsibility of district councils. Secondly, there is the European Blue Flag Award Scheme for beaches that meet the EC guideline standards of beach and water quality, as well as certain land-based criteria. Thirdly, there is the Tidy Britain Group Seaside Award Scheme, designed to complement the Blue Flag scheme, for beaches that meet the minimum standards of beach and water cleanliness and selected land-based criteria but not to the Blue Flag standard. Finally there are the annual litter surveys of Coastwatch UK and Beachwatch, both of which employ volunteers to survey lengths of coastline for litter and other signs of pollution. Beachwatch UK is organised by Readers Digest and the Marine Conservation Society.

A cooperative project known as the Industry and Nature Conservation Association (INCA) operates in Cleveland, with the aim of helping to improve the environment of the industrialised parts of the county and keeping people informed about improvements. A wide range of projects are sponsored by the Association, many of them aimed at improving the water quality of the River Tees. Partners include English Nature, local County and Borough Councils, Teesside Development Corporation, the National Rivers Authority and a number of private companies.

9.7.4 Information sources used

The North Sea Quality Status Report (North Sea Task Force 1993a) and the accompanying subregional report (North Sea Task Force 1993b) give recent monitoring results for a range of pollutants and contaminant levels in organisms living in the water or the sediments and indicate the likely effects of poor water quality in the worst-affected areas.

The Department of the Environment Environmental Protection Statistics Division publishes an annual *Digest of environmental protection and water statistics*, which provides detailed national statistics on aspects of environmental protection including coastal and marine waters, radioactivity, waste and recycling and wildlife (DoE 1992).

Schemes such as the Tidy Britain Group Seaside Award and the European Blue Flag are monitored during the year previous to the publication of their results. Monitoring of the EC Bathing Waters and other beaches under schemes such as Coastwatch UK and Beachwatch take place over one or two days. The results may therefore be skewed by heavy rain or localised effects at the time of survey. Coastwatch UK and Beachwatch do not sample the whole coastline in their region, owing to a shortage of volunteers. The results may therefore sometimes be unrepresentative because of the small sample size.

Other information sources available include the NRA's quarterly ship and air-borne National Coastal Baseline Survey, which monitors a large number of water quality parameters in coastal waters including metals, nutrients and turbidity. MAFF hold a database of consented sewage outfalls in England and Wales. Further information on discharges can be obtained from the local offices of the NRA or HMIP, who issue discharge consents and authorisations. Information on sewage sludge dumping grounds is available from MAFF, who license this activity (see section 9.7.5 C).

9.7.5 Further sources of information

A. References

Department of the Environment. 1992. *Digest of environmental protection and water statistics, No. 15.* London, HMSO.

Department of the Environment (DoE). 1993. Minute No. 818. 1/12/93. London, Department of the Environment.

English Nature. 1994. *Important areas for marine wildlife around England.* Peterborough, English Nature.

McGilvray, F. 1994. Marine debris on Britain's coast. *North Sea monitor,* Vol. 12, Issue 1, March 1994.

Ministry of Agriculture Fisheries and Food. 1994. *Monitoring and surveillance of non-radioactive contaminants in the aquatic environment and activities regulating the disposal of wastes at sea, 1992.* Directorate of Fisheries Research, Lowestoft. (Aquatic monitoring report No.40.)

National Rivers Authority. 1994. *Discharge consents and compliance: the NRA's approach to control of discharges to water.* Bristol, National Rivers Authority.

North Sea Task Force. 1993a. *North Sea Quality Status Report 1993.* London; Oslo and Paris Commissions (OSPARCOM) for North Sea Task Force.

North Sea Task Force. 1993b. *North Sea subregion 3b: Assessment report.* Lowestoft, MAFF Fisheries Laboratory for North Sea Task Force.

Norwich Union Coastwatch UK. 1993. *1993 survey report.* Farnborough College of Technology.

B. Further reading

Anon. 1993. Lies, damned lies and statistics in the great water debate. *ENDS Report, 227* (12/93): 16-19.

Anon. 1987. Shift on sewage sludge disposal methods. *Marine Pollution Bulletin, 18* (12): 619.

Anon. 1989. Sewage sludge statistics. *Marine Pollution Bulletin, 20* (2): 54.

Baker, B. 1993. The burning issue. *Surveyor*. 2/12/93, 18-19.

Eno, N.C., *ed*. 1991. *Marine conservation handbook.* 2nd ed. Peterborough, English Nature.

Evans, P.R., & Parsons, M. 1995. *Effects of nutrient enrichment in Lindisfarne NNR.* Peterborough, unpublished report to English Nature.

Evans, S.M., Arnott, S., & Wahju, R.I. 1994. Evidence of change in the macrofauna of tidal flats subject to anthropomorphic impacts in north-east England. *Aquatic conservation: marine and freshwater ecosystems, 44:* 333-344.

Marine Pollution Monitoring Management Group (Monitoring Co-ordination Subgroup). 1994. *UK national monitoring plan.* London, HMIP.

Frid, C.L.J., Evans, S.M., & Clark, R.B. 1991. *The north-east coast of England: environmental appraisal*. University of Newcastle-upon-Tyne.

Hupkes, R. 1991. Pollution of the North Sea by west European rivers. *Water Science & Technology, 24* (10): 69-75.

Institute of Petroleum Information Service. 1993. *Know more about oil: the UK refining industry.* London, Institute of Petroleum.

National Rivers Authority. 1994. *Bathing water quality in England and Wales - 1993.* Bristol, National Rivers Authority.

Irving, R. 1993. *Too much of a good thing: nutrient enrichment in the UK's coastal waters.* A report to the World Wide Fund for Nature (UK). London, WWF.

Kay, D., & Wyer, M. 1994. Making waves: recreational water quality. *Biologist, 41* (1): 17-20.

Marine Conservation Society. 1994. *The Reader's Digest good beach guide.* Newton Abbot, David & Charles.

C. Contact names and addresses

Type of information	*Contact address and telephone no.*
Discharge consents and pipeline outfalls. Water quality, including bathing waters and National Coastal Baseline Survey	*National Rivers Authority - Northumbria and Yorkshire Region, tel: 0113 244 0191, or Newcastle Office, tel: 0191 213 0266
Waste management licences, public registers - Northumberland	*Waste Regulation Officer, Technical Services Directorate, Northumberland County Council, Morpeth, tel: 01670 533000
Waste management licences and public registers - Tyne & Wear	Waste Regulation Officer, Tyne & Wear Waste Regulation Authority, Central Depot, Park Road, Gateshead NE8 3HN, tel: 0191 478 1037
Waste management licences, public registers - County Durham	*Group Manager (Waste Regulation), Durham County Council Environment Department, Durham, tel: 0191 383 3775
Waste management licences, public registers - Cleveland	Waste Regulation Officer, Cleveland County Council, PO Box 77, Gurney House, Gurney Street, Middlesborough TS1 1JL, tel: 01642 262559
Waste management licences, public registers - North Yorkshire	Waste Regulation Officer, North Yorkshire County Council Waste Regulation Office, Central Repair Depot, Romanby, Northallerton DL7 8AP, tel: 01609 780780
Litter on beaches	Coastwatch UK, Farnborough College of Technology, Boundary Road, Farnborough, Hampshire GU14 6SB, tel: 01252 377503
Beachwatch	*Marine Conservation Society, Ross-on-Wye, tel: 01989 66017
Tidy Britain Group Seaside Awards	Lion House, 26 Muspole St, Norwich NR3 1DJ, tel: 01603 762888
Pollution from large industrial sites	HM Inspector of Pollution (HMIP), Swan House, Merchant's Wharf, West Point Road, Thornaby, Cleveland TS17 6PB, tel: 01642 633753
Industry and Nature Conservation Association (INCA) (Teesside)	INCA, Belasis Hall Technology Park, Billingham, Cleveland TS23 4AZ, tel: 01642 370319
Aquatic environment monitoring reports relating to waste disposal; consented outfalls database	*Ministry of Agriculture, Fisheries and Food - Directorate of Fisheries Research, Fisheries Laboratory, Burnham-on-Crouch, Essex CM0 8HA, tel: 01621 782658

* Starred contact addresses are given in full in the Appendix

9.7.6 Acknowledgements

Thanks are due to Mrs F.L. Franklin (MAFF Fisheries Laboratory, Burnham-on-Crouch) for providing information from their database of consented sewage outfalls.

9.8 Leisure and tourism

M.J. Dunbar & S.L. Fowler

9.8.1 Introduction

The coast of the region includes two areas noted as tourist destinations (with North Yorkshire being more important than Northumberland in terms of scale), separated by a very large area of industrial and residential development, from where many of the coastal visitors come. The wild natural scenery and unspoilt coastal environment in the north and south of the region are important resources for open-air leisure activities. The most important components of the land-based leisure infrastructure are located near centres of population and in the traditional seaside holiday resorts. They include caravan parks and campsites, leisure centres, amusement parks, golf courses and rural car parks (which provide the access points necessary for most land and water-based leisure activities).

The importance of water sports and water-based leisure in the region is also related to the unspoilt environment in Northumberland and North Yorkshire and the large populations in Tyne & Wear, Durham and Cleveland. The main infrastructure developments include marinas, yacht moorings, dinghy parks and launching slips. Many are concentrated in and near the larger conurbations, where new and proposed water sports centres are sometimes a part of schemes to regenerate run-down waterfronts. Limited facilities, primarily recreational craft moorings, are also found in most of the small harbours along the coast, and there are facilities for water sports around the main estuaries.

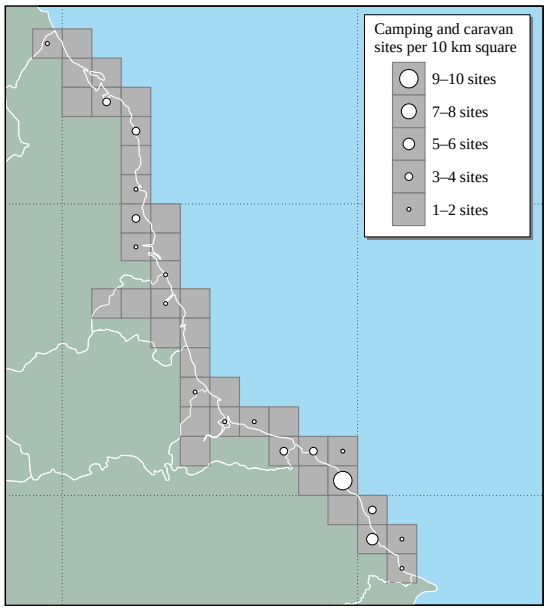
9.8.2 Important locations

Tourism is not a major land use or coastal activity in the northern section of the region, where the largest centres are Berwick and Holy Island. Where present, it is generally associated with outdoor activities and sports, including walking, camping, golf, bird watching, horse riding, fossil hunting and general beach use by holiday makers. The wild natural scenery and unspoilt coastal environment are important resources for these and other tourism activities. Birdwatching is popular in the Lindisfarne National Nature Reserve and Budle Bay. Boat trips are available to the Farne Islands, to watch the seals.

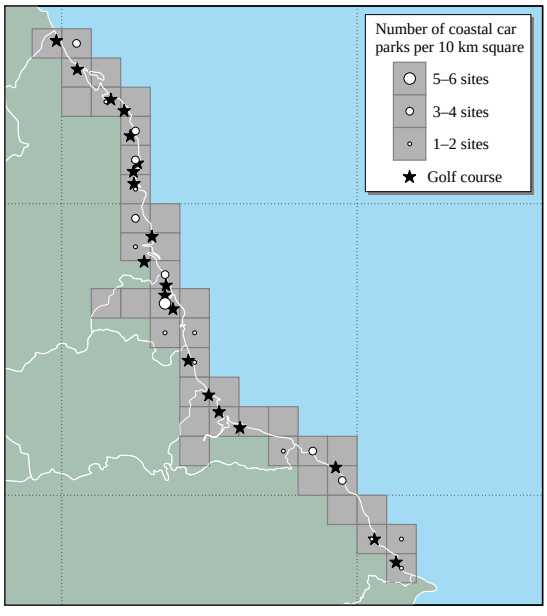
In contrast, the central heavily developed area of the coast has only one major tourism centre, at Whitley Bay. which is close to the major conurbations of Tyne & Wear and an important traditional seaside resort.

Provision of facilities for water sports was one of the main reasons for the construction of the Tees Estuary Barrage at Blue House Point, which became fully operational in December 1994.

Tourism is a crucial source of income and employment on the stretch of coastline between Staithes and Flamborough Head, which includes the traditional coastal resorts of Whitby, Scarborough and Filey. These record over 9 million tourist days per annum (Scarborough Borough Council, Scarborough Tourism Economic Activity Monitor - see section 9.8.5 C.). Many visitors use the coastal resorts here as a base for touring inland areas, in particular the important resource of the North York Moors National Park. There are also a number of historical and cultural facilities,



Map 9.8.1 Number of camping/caravan sites in coastal 10 km squares in the region. Source: Ordnance Survey Landranger maps. © Crown copyright.



Map 9.8.2 Number of car parks in coastal 10 km squares in the region; locations of coastal golf courses. Source: Ordnance Survey Landranger maps. © Crown copyright.

Table 9.8.1 Existing and proposed water-based leisure and tourism facilities

Site	*Facilities*	*Comments*
Northumberland		
Berwick-upon-Tweed	Water ski club and sailing club; moorings	
Budle Bay	Boat club	
Seahouses (near Farne Islands)	Slipway	Slipway and sand launch. Important diving centre.
Beadnell	Sailing club	
Beadnell Harbour	Slipway	No public access
Beadnell Bay, near car park	Slipway	Owned by local authority
Beadnell Bay, by camp site	Slipway	Privately owned
Low Newton	Slipway	Slipway and sand (National Trust)
Alnmouth	Boat moorings	50 moorings
Amble	Coquet Sailing Club & Coquet Yacht Club	
Warkworth estuary, Amble	Marina, moorings & dinghy park	
Druridge Bay	Slipway (Hadston), boat club (Cresswell), Druridge Bay Watersports Club	
Newbiggin-by-the-Sea	Sailing club & slipway in harbour	
Ashington	Watersports	
Blyth	Royal Northumberland Yacht Club, River Blyth Sailing Association	
South Harbour, Blyth	Moorings	
Tyne & Wear		
Seaton Sluice	Slipways and boat park	
North Tyneside Royal Quays	Proposed marina (Tyne & Wear Development Corporation)	
River Tyne	Tynemouth and South Shields Sailing Clubs; Tynemouth Rowing Club; Northeast Powerboat Club (location unknown); three marinas totalling 260 berths (see below)	There are at least nine water sports clubs on the Tyne
Jarrow	Jarrow Motor Boat Club	
Willington Quay	Willington Quay Boat Club; water sports	
North Shields	Slipway	Private, use by permit
South Shields	South Shields Motor Boat and Yacht Club (marina); Littlehaven water activities centre	
Tynemouth	Marina	
Hebburn	Hebburn Marina Boat Club; water sports	
Garden Festival site	Water sports	
Derwent Haugh	Water sports	
Ouseburn	Ouseburn Water Sports	
Friar's Goose, Gateshead	Slipway; Friar's Goose Water Sports Club	Club-operated
Gateshead	Powerboat racing club	
Walker	Water sports	
St Peters Basin, R. Tyne	Marina/yacht haven	110 berth marina; proposed marina
Hendon	Two short concrete slipways	
Ryhope	Short concrete slipway	
Wearmouth	Proposed marina development	
Claxheugh	Marina; watersports	
South Hylton	South Hylton Rowing Club; watersports	
Fatfield	Watersports	
Sunderland	Sunderland Yacht Club, slipways, North Sunderland Marine Club, Wear Boating Association	
County Durham		
Seaham	Slipway	
Cleveland		
Hartlepool	Yacht club; proposed marina development	
South Docks, Hartlepool	Marina	With associated housing
Stockton on Tees	Proposed barrage, Castlegate Marine Club	
Seaton Carew	Slipway	
South Gare, Tees	Slipways and sailing club	
Blue House Point, Tees	Tidal barrage and associated lagoon	
Tees	Motor boat club, sailing club, rowing club	
Redcar	Three wide concrete slipways; proposed marina development	
North Yorkshire		
Runswick Bay	Sailing club	
Whitby	Yacht club and marina	Marina to be expanded
Scarborough	Yacht club	
Filey	Sailing club	

Source: Frid *et al.* (1992)

for example in Whitby and Scarborough, which draw tourists. Fossil hunting takes place in the Whitby, Robin Hood's Bay and Scarborough areas.

Along the coast there are currently ten main sailing centres with marinas or yacht clubs (Map 9.8.3 and Table 9.8.1) (Frid *et al*. 1992). The sheltered estuaries of the Tyne and Wear are also important locations for watersports. There are at least nine water sports clubs on the Tyne alone and the Royal Yachting Association lists 34 water sports clubs in the region as a whole (RYA 1992). Commercial shipping activities restrict water-based recreation on the Tees below the barrage.

A total of 20 caravan parks and/or campsites are located immediately adjacent to the coast. Nine of these, all quite small, are in Northumberland, including some on sand dunes around Beadnell. There are only three sites in the centre of the region: a large site on the Links at Whitley Bay, one at Marsden Bay, Tyne & Wear, and one at Crimdon, Co. Durham. From Staithes south into North Yorkshire there are 11 campsites/caravan parks, including four very large sites around Scarborough and Filey, and one large holiday camp. These are marked on Map 9.8.1, together with other campsites further inland, but within the coastal 10 km squares.

Bathing beaches and facilities for visitors are found at the major resorts of Whitby, Scarborough and Filey, and at South Shields, Seaham, Seaton Carew, Redcar, Saltburn, Staithes, Cayton Bay, Runswick Bay and Filey.

There are 20 coastal golf courses in the region, ten in Northumberland, six in the heavily urbanised central area from Whitley Bay to Saltburn, and four from Whitby to Scarborough. A total of 42 coastal car parks, which are an important means of providing access for tourism and leisure pursuits, were recorded in coastal 10 km squares (not including car parks in urban areas, which are not marked on the 1:50,000 Ordnance Survey maps from which these figures were obtained) (Map 9.8.2).

The coastline is well served by footpaths, but there are no designated coastal paths. There is a ten mile coastal path from Beadnell to Howick Haven. In Cleveland and North Yorkshire the Cleveland Way Long Distance Footpath follows the Heritage Coast between Saltburn and Filey, with breaks at Whitby and Scarborough.

Recreational boat-fishing takes place along most of the coastline, and shore fishing is also important, particularly at Amble Harbour, Whitby and Filey Brigg (see sections 5.9.2 and 9.1.2). The most important scuba diving area is around the Farne Islands, although diving also takes place along much of the North Yorkshire coast, particularly off Whitby, Scarborough and Filey. Other important water sports using the basic recreational infrastructure or simply access to the coast include jet-skiing, water skiing, canoeing, wind surfing, surfing and bathing. Tourist boat trips take place to the Farne Islands and along the North York Moors coastline during the main tourist season. Table 9.8.1 lists the locations of water-based leisure and tourism facilities in the region.

9.8.3 Management and issues

Many of the land-based leisure developments have had significant effects on coastal habitats: golf course developments at Newbiggin, Hartlepool, Seaton Carew and Redcar have reduced the area of semi-natural vegetation at these sites. Sand dune systems have also been affected by

Map 9.8.3 Important locations for water-based leisure. Named locations are listed in Table 9.8.1. Sources: Tourist Offices.

car parks and campsites. Low-key visitor activities, such as walking, climbing and bird-watching, have also caused conflicts with other uses of the coast in the region, either because of the numbers of visitors involved in the activity or because of the sensitivity of the areas involved.

Despite the high nature conservation interest of much of the Northumbrian and Yorkshire coasts, and part of Cleveland, facilities for birdwatchers, tourists and study groups are relatively limited. The Northumberland Wildlife Trust has a visitor centre and birdwatching hides at Hauxley. The local authority has a visitor management plan to deal with the heavy pressure on the coast at Holy Island, Northumberland. North Tyneside Council run a visitors centre on St. Mary's Island (north of Whitley Bay), which also has conference facilities. Durham County Council operate Seaham Harbour Coastal Centre. On the Tees the Teesmouth Field Centre provides educational facilities for school groups, and there are bird hides on the NNR at Seal Sands and at Cowpen Marsh. The RSPB reserve at Bempton Cliffs on the southern edge of the region has hides and a visitor centre. There are country parks/nature reserves at Druridge Bay and Filey Brigg.

A weir was built across the Wansbeck estuary in 1969/70 to cover up rubbish tips on intertidal mud and create a deep water leisure facility. This barraged about 80% of the original area of the estuary. The freshwater lake that formed upstream of the weir is now rather narrow and silted. On the Tees, the amenity barrage completed in 1994 at Blue House Point, Portrack, Stockton-upon-Tees, has more than halved the tidal length of the river, from 41 km to a mere 17 km. INCA, the Industry/Nature Conservation Association in Cleveland, is monitoring the environmental effects of the barrage to enable plans to be made to deal with issues arising in future.

9.8.4 Information sources used

Most of the information was obtained from Tourist Information Centres (up to date, but of varying detail within

the region) and from Ordnance Survey 1:50,000 Land Ranger maps; further information on land-based activities was obtained from Frid *et al*. (1991) and on water based activities from Admiralty Charts and a nautical almanac (D'Olivera & Featherstone 1993). These sources generally do not indicate the scale of campsite or car park infrastructure, or of many leisure activities (or even their precise locations), which naturally vary considerably. Frid *et al.* (1991) map the distribution of a range of commonly occurring activities along the southern section of coast from Amble to Flamborough. The Royal Yachting Association (1992) lists affiliated organisations in the region.

9.8.5 Further sources of information

A. References cited

D'Olivera, B., & Featherstone, N.L. 1993. *The Macmillan and Silk Cut nautical almanac 1994.* Basingstoke, Macmillan Press Ltd.

Frid, C.L.J., Evans, S.M., & Clark, R.B. 1991. *The north-east coast of England: environmental appraisal*. University of Newcastle-upon-Tyne.

Royal Yachting Association. 1992. *RYA affiliated organisations*. Eastleigh, RYA.

B. Further reading

City of Sunderland. 1994. *Open space recreation report*. Prepared for the City of Sunderland by Director of Architecture & Planning & Director of Leisure Services.

East Yorkshire Borough Council. In prep. *Draft Flamborough Headland Heritage Coast management plan*. Bridlington, East Yorkshire Borough Council.

Godfrey, A., & Lassey, P. 1988. *Dive Yorkshire*. London, Underwater World/Barnacle.

North Yorkshire and Cleveland Heritage Coast. 1994. *Management plan (second review, 1995).* Northallerton, North York Moors National Park.

Northern Council for Sport and Recreation. 1993. *A strategy for sport and recreation in the Northern Region*. Newcastle upon Tyne, Northern Council for Sport and Recreation.

Northumberland County Council. 1989. *The Northumberland coast management plan: tourism and recreation report*. Morpeth.

Robinson, A., & Millward, R. 1983. *The Shell book of the British coast*. Newton Abbot, David and Charles.

Royal Northumberland Yacht Club. 1990. *Sailing Directions, Humber Estuary to Rattray Head*. Newcastle upon Tyne, Barclays Bank.

Shaw D. & Winfield B. 1988. *Dive North East*. London, Underwater World/Barnacle.

Sports Council. 1992. *Heritage Coasts: good practice in the planning, management and sustainable development of sport and active recreation*. London, Sports Council.

Sports Council. 1992. *Planning and managing watersports on the coast: lessons from Canada and the USA. Factfile 3: Countryside and water recreation*. London, Sports Council.

Sports Council. 1993. *Water skiing and the environment*. London, Sports Council.

Tyne & Wear County Council. 1979. *Tyne leisure plan*. Newcastle upon Tyne.

Usher, M.B., Pitt, M., & de Boer, G. 1974. Recreational pressures in the summer months on a nature reserve on the Yorkshire Coast. *Environmental Conservation, 1*(1): 43-49.

C. Contact names and addresses

Type of information	Contact address and telephone no.
National tourism information service: British Tourist Authority/English Tourist Board	Commercial Information Library, BTA/ETB, Thames Tower, Black's Road, Hammersmith, London W6 9EL, tel: 0181 846 9000
Scarborough Tourism Economic Activity Monitor (STEAM)	*Scarborough Borough Council, Scarborough, tel: 01723 372351
INCA; Tees Barrage	Jane Lacey, Estuary Management Plan Project Officer, INCA, Belasis Hall Technology Park, Billingham, Cleveland TS23 4AZ, tel: 01642 370319
Tourist Information Centres	
Berwick upon Tweed	Castlegate Car Park, Berwick-upon-Tweed, Northumberland TD15 1JS, tel: 01289 330733
Adderstone	Adderstone Services, Adderstone Garage, Belford, Adderstone, Northumberland NE70 7JU, tel: 01668 213678
Alnwick	The Shambles, Alnwick, Northumberland NE66 1TN, tel: 01665 510665
Amble	Council Sub-Offices, Dilston Terrace, Amble, Northumberland NE65 0DT, tel: 01665 712313
Whitley Bay	Park Road, Whitley Bay, Tyne & Wear NE26 1EJ, tel: 0191 252 4494
Newcastle -upon-Tyne	Central Library, Princess Square, Newcastle-upon-Tyne, Tyne & Wear NE99 1DX, tel: 0191 230 0030
South Shields	Museum & Art Gallery, Ocean Road, South Shields, Tyne & Wear NE33 2HZ, tel: 0191 454 6612
Sunderland	Unit 3, Crowtree Road, Sunderland, Tyne & Wear SR1 3EL, tel: 0191 565 0960/0990
Peterlee	20 The Upper Chare, Peterlee, Co. Durham SR8 5TE, tel: 0191 586 4450
Hartlepool	Department of Economic Development & Leisure, Civic Centre, Victoria Road, Hartlepool, Cleveland TS24 8AY, tel: 01429 266522 extn. 2408
Middlesborough	51 Corporation Road, Middlesbrough, Cleveland TS1 1LT, tel. 01642 243425/264330
Saltburn	3 Station Buildings, Station Square, Saltburn, Cleveland TS12 1AQ, tel: 01287 622422
Whitby	Longbourne Road, Whitby, North Yorkshire YO21 1YN, tel: 01947 602674
Scarborough	St. Nicholas Cliff, Scarborough, North Yorkshire YO11 2EP, tel: 01723 373333
Filey	John Street, Filey, North Yorkshire YO14 9DW, tel: 01723 512204
Yachting organisations	
National office	Royal Yachting Association, RYA House, Romsey Road, Eastleigh SO5 4YA, tel: 01703 629962.
Regional office	Chairman, RYA North East Region, Whiteoaks, Woolsington Park South, Newcastle upon Tyne NE13 8BJ, tel: 0191 286 9694
Regional office	Chairman, RYA Yorkshire & Humberside Region, 23 Mayfield, Oxspring, Sheffield S30 6YN, tel: 01226 763818
Canoeing	British Canoe Union, Adbolton Lane, Westbridgford, Nottingham NG2 5AB, tel: 0115 982 1100
Diving	British Sub Aqua Club, Telfords Quay, Ellesmere Port, South Wirral, Cheshire L65 4FY, tel: 0151 357 1951
Water skiing	British Water Ski Federation, 390 City Road, London EC1Z 2QA, tel: 0171 833 2855
Jet skiing	Personal Watercraft Association, PO Box 119, Farnborough, Hampshire GU14 8YH, tel: 01252 378882
Marine leisure industries	British Marine Industries Federation, Meadlake Place, Thorpe Lea Road, Egham, Surrey TW20 8HE, tel: 01784 473377

* Starred contact addresses are given in full in the Appendix

9.8.6 Acknowledgements

The authors thank R. Irving for providing material for this section, and C.A. Crumpton and M.J. Goodwin for their assistance. David James and M.D. Clements of Scarborough Borough Council made helpful comments.

The Tees Estuary from South Gare. Much of the intertidal Tees Estuary has been claimed for agriculture and industry. Now many interests co-exist, including nuclear power generation, petrochemical industries, shipping, steel manufacture, leisure activities and wildlife. Managing such a complex environment depends on co-operation between users, supported here by INCA, the Cleveland-wide Industry Nature Conservation Association. Photo: N.C. Davidson, JNCC.

Chapter 10 Coastal management

S. L. Fowler

10.1 Introduction

This chapter describes national (section 10.2) and local and regional (section 10.3) coastal management initiatives taking place wholly or partly within Region 5. GB and UK national initiatives without a specific regional focus, notably those led by non-governmental agencies and user groups, are outside its scope. However, as the chapter ends with a list of contacts with a wider involvement or interest in coastal management (section 10.3.5), contact points for some of these organisations are included there. Names and addresses of many contacts are given within the relevant section also.

10.1.1 Coastal management in the UK

This section outlines the direction of national policy-making, within which many of the regional initiatives operate. Many, frequently competing, issues and activities affect the coastal environment and inshore waters. So coastal planning and management are very complex especially as numerous different authorities are responsible for particular statutory duties. Coastal management promotes an inter-disciplinary approach to multiple use and the resolution of conflict between interest groups, 'to ensure the long-term future of the resources of the coastal zone through environmentally sensitive programmes, based on the principle of balanced, sustainable use' (Gubbay 1990). Coastal management ensures that all land and sea use issues are co-ordinated, including development, conservation, waste disposal, fisheries, transport, and coastal protection and flood defence. The advantages of this have been recognised by coastal planners in many areas, with several local authorities and other bodies now promoting coastal management. However, approaches differ from area to area, with overlap in some places and patchy coverage elsewhere (Earll 1994).

The House of Commons Environment Committee Second Report (House of Commons 1992), although limited in scope to England and the estuaries it shares with Wales and Scotland, made recommendations for the planning and implementation of coastal management that have had policy and practical implications throughout the UK. Amongst these recommendations were:

- the endorsement of an integrated approach to coastal management, incorporating maritime land, sea and intertidal areas;
- a review of existing legislation;
- the need for international (EU-wide) policy initiatives;
- clearer responsibilities for planning and action in the coastal zone, based on a national strategic framework;
- appropriate funding for accountable bodies with responsibilities;
- research into the physical functioning of the coastal zone and associated protection and conservation measures;
- a review of planning mechanisms to allow effective safeguard of the coastal resource;
- monitoring and environmental assessment of coastal activities to assess their impacts;
- the involvement of local communities in coastal management planning;
- the integration of responsibility for coast protection and sea defence under one body;
- better statutory protection for sites of nature conservation importance;
- better provisions for control of marine pollution;
- the need for fisheries activities to take account of marine conservation issues.

Later in 1992, the Department of the Environment and the Welsh Office issued *Planning Policy Guidance: Coastal Planning (PPG 20)*, which made clearer the requirement for planning decisions to take account of environmental and conservation issues.

The Environment Select Committee's recommendations were followed up, in 1993, by the publication of *Development below low water mark: a review of regulation in England and Wales* (Department of the Environment/Welsh Office 1993a), in parallel with the discussion paper *Managing the coast: a review of coastal management plans in England and Wales and the powers supporting them* (Department of the Environment/Welsh Office 1993b). That same year, the Ministry of Agriculture, Fisheries and Food (MAFF) and the Welsh Office brought out their *Strategy for flood and coastal defence in England and Wales* (MAFF/WO 1993). In this their policy is spelled out: ". . . reducing the risks to people and the developed and natural environment from flooding and coastal erosion by encouraging the provision of technically, environmentally and economically sound and sustainable defence measures." Section 10.3.5 B gives additional notes on the content of these publications.

In 1994 the Department of the Environment announced the forthcoming publication of national policy guidelines for the coast and the creation of a standing forum (the Coastal Forum) on coastal management. It also undertook to highlight good practice in coastal management plans, clarify the interaction of the different elements of coastal management and review relevant byelaw powers. The European Commission was asked by the Council of the EC to propose a strategy for the whole of the Community coast before the end of 1994; it is still awaited at the time of writing. The strategy is to be based on the principles of sustainability and sound ecological and environmental practice, but will have no legal standing.

By the end of 1994, Government had published its Regulations to implement the EU Habitats Directive (Department of the Environment/Welsh Office 1994). As they relate to the coast, these regulations provide for single management groups to be set up for whole sites, making the production of unified management plans a practical proposition. Where these sites are of European importance for their nature conservation interest, the conservation of that interest must be the primary consideration of the management plan. For this, the regulations require all relevant authorities to exercise a general duty of care for their long-term conservation. At the time of writing, discussions are continuing on how these requirements will work in practice.

10.2 National coastal initiatives with regional elements

10.2.1 Introduction

Partly as a result of developments at a UK and international level, many national bodies are now becoming involved in the promotion of coastal management initiatives, including several with no direct management role through a statutory remit or ownership of coastal land. These include the National Coasts and Estuaries Advisory Group (NCEAG) and non-governmental organisations with a particular interest in the conservation of the coastal zone: the Marine Conservation Society, World Wide Fund for Nature (UK) and the Royal Society for the Protection of Birds (RSPB) (see section 10.3). Only national initiatives that have distinct local elements in the region are described here. Many other diverse interest groups and organisations now have national policies with regard to coastal management and estuaries management; for example the British Association for Shooting and Conservation, Royal Yachting Association, and their representatives are involved in most local or regional groups or fora, listed in section 10.3.5. For further information on regionally-led coastal management initiatives, see section 10.3.

Map 10.2.1 River catchment areas. Reproduced by kind permission of the NRA.

10.2.2 English Nature's coastal management initiatives

Estuaries Initiative

The Estuaries Initiative for achieving the sustainable management of estuaries is described in *Caring for England's estuaries: an agenda for action* (English Nature 1992). Fifteen sites on the English coast have been selected, out of a planned total of 25 by the year 2000, and management plans are being prepared for them in partnership with national and local statutory and voluntary bodies. Estuaries selected in the region are the Coquet and Blyth, the Wear, and the Tees.

Sensitive Marine Areas

English Nature's Sensitive Marine Areas (SMA) initiative is set out in *Managing England's marine wildlife* (English Nature 1994) (see also section 7.4.4). Under the initiative, which is modelled on the Estuaries Initiative, English Nature and the

Table 10.2.1 Estuary initiatives in Region 5

Initiative name	*Current activity*	*Organisations involved*	*Contact address and telephone no.*
Coquet and Blyth Estuaries Initiative	Management plans being progressed in 1994/5 for these two sites	English Nature	Ms J Loring, English Nature Northumbria Local Team, Newcastle, tel: 0191 281 6316
Wear Estuary Initiative	Part of Les Esturiales Group (see section 10.3.5). Estuary Management Plan due for preparation in 1996. Managed by a Forum and Steering Committee led by Sunderland City Council.	City of Sunderland, NRA, Tyne & Wear Development Corporation, English Nature, University of Sunderland	*Mr R. Arkell, Dept. of Planning, Sunderland City Council, Sunderland, tel: 0191 563 2394
Tees Estuary Initiative	Initiative involves all members of INCA (Industry-Nature Conservation Association - a mutual forum of industry and nature conservation interest in Cleveland, funded by its members). Produced draft Issues Report (July 1995); Estuary Management Plan due end 1996.	INCA including: English Nature, RSPB, local authorities, NRA, Cleveland Wildlife Trust	Jane Lacey, Project Officer, INCA, Bellasis Hall Technology Park, Billingham, Cleveland TS23 4AZ, tel: 01642 370319

*Starred contact addresses are given in full in the Appendix.

managers and users of the marine environment are, with joint funding, developing ways of managing areas of marine wildlife importance, based on voluntary measures used in conjunction with existing regulatory controls. There are three trial SMAs sites in the region: Holy Island & the Farnes, Flamborough Headland, and Maw Wyke Hole to Beast Cliff.

Maritime Natural Areas

English Nature has, through consultation, identified 23 proposed Maritime Natural Areas around the coast of England (described in *Conserving England's maritime heritage - a strategy* (EN 1993)). These non-statutory areas represent coherent maritime wildlife systems based on major sediment cells and other coastal features. There are three Maritime Natural Areas within this region, running from the Scottish border to the north bank of the Tyne, from the Tyne to Saltburn, and from Saltburn to Bridlington (including part of neighbouring Region 6). The Maritime Natural Areas approach is currently being tried out at Lyme Bay, Dorset (Region 9).

10.2.3 Royal Society for the Protection of Birds

In 1990, the Royal Society for the Protection of Birds (RSPB) launched a national campaign to promote the importance of estuaries in the UK, and the need for coordinated management (Rothwell & Housden 1990). The campaign ran for three years. The RSPB Estuaries Inventory project compiled mapped and numerical information on land use and selected human activities for 57 major UK estuaries. In Region 5 the Inventory covers the Tweed and the Tees. In 1994, the RSPB launched its Marine Life Campaign, which aims to increase awareness of issues and to promote integrated coastal and marine management.

10.2.4 Shoreline management plans

Shoreline Management Plans (coastal defence plans based on coastal sub-cells compiled in accord with government guidelines on assessing the environmental impacts of proposals, including soft defence and 'do nothing' options) are now being considered and will be produced in association with MAFF. Scarborough Borough Council is the chair authority of the North East Coastal Authorities Group, which through three local groups related to coastal sedimentary sub-cells (see section 2.4) is preparing shoreline management plans for the region from Tyneside south to Flamborough Head. A steering group under the Northumbrian Coastal Authorities Group is preparing a shoreline management plan for the coast from the Tweed to the Tyne (Table 10.2.2; see also section 10.3.3).

10.2.5 National Rivers Authority (NRA) catchment management plans

River catchments, including estuaries and coastal waters, are the NRA's basic management unit. A catchment management plan is an agreed strategy to realise the environmental potential of the catchment, within prevailing economic and political constraints. The nine rivers in the region for which catchment management plans are currently being prepared under the NRA's five-year programme, consultation reports for which are due for completion in 1994/5, include the rivers Aln, Coquet, Wansbeck (including Lyne), Blyth, Tyne (including Ouseburn) and Wear, and the Esk and associated coastal streams (Map 10.2.1) (NRA 1994). In addition, the NRA is preparing a Coastal Management Plan for the Northumbria Area Coast.

Table 10.2.2 Shoreline management plans in preparation in Region 5

Initiative name	*Current activity*	*Organisations involved*	*Contact address and telephone no.*
Sub-cell 1a shoreline management plan	Management Plan for coast from Berwick-upon-Tweed to north Tyneside	Steering Group led by North Tyneside Metropolitan District Council	*Terry Gurr (Secretary), Blyth Valley District Council, tel: 01670 352066
Sub-cell 1b shoreline management plan	Management plan for coast from south Tyneside to Easington, Co. Durham	Steering Group led by Sunderland Metropolitan District Council	*Sunderland Metropolitan District Council, tel: 0191 567 6161
Sub-cell 1c shoreline management plan	Management plan for coast from Easington, Co. Durham, to Huntcliffe, Cleveland	Steering Group led by Hartlepool Borough Council	*Neil Dyson, Hartlepool Borough Council, tel: 01429 869625
Sub-cell 1d shoreline management plan	Management plan for coast from Huntcliffe to Flamborough Head. Plan due mid 1996.	Steering Group led by Scarborough Borough Council and including Langbaurgh BC, East Yorkshiure BC, NRA, English Nature, the Countryside Commission and MAFF (as consultees)	*John Riby, Principal Engineer, Scarborough Borough Council, tel: 01723 372351

* Starred contact addresses are given in full in the Appendix

10.2.6 Designated sites

Discussed in detail in Chapter 7, statutory and non-statutory designations are also relevant here because they provide a degree of coastal management through their area or site management plans (Table 10.2.3). These often tend to focus strongly on the conservation of landscapes, buildings and/or habitats and species, rather than on wider and more integrated coastal issues, although in management planning for some sites a focus on visitor use and community involvement is important (as, for example, at Holy Island - see Table 10.3.2). Designated sites range from Nature Reserves, managed by English Nature, Wildlife Trusts, local authorities, RSPB or other approved bodies for nature conservation objectives, to the proposed marine Special Areas for Conservation (sections 7.1 and 10.2.7), and Heritage Coast plans.

Most Heritage Coast Services (management teams working from within local authorities) are producing or implementing management plans through their respective local authorities and associated Steering Groups. The defined areas of Heritage Coasts include only the finest sections of undeveloped coast (section 7.4.3), but much larger coastal areas are frequently covered by Coastal or Countryside Management Services plans (see section 10.3).

The National Trust, which has extensive coastal land holdings along the region's coast, has recently been carrying out a complete review of its Coastal Strategy Plans and is reviewing management plans for its coastal sites.

10.2.7 Management of marine SACs under the Habitats Directive

Under the EC Habitats Directive 1992, a list of marine Special Areas of Conservation (SACs) to be designated in the UK must be agreed by 1998 (see section 7.1). A list of possible sites on which consultations will be carried out was published in March 1995. Under the Habitats etc. Regulations (1994), marine SACs (which will include terrestrial coastal habitats) will have to be managed in a way that secures their 'favourable conservation status'. A range of bodies and individuals will be involved, including all 'relevant and competent authorities', e.g. local authorities, the National Rivers Authority (NRA), ports and harbour authorities, Sea Fisheries Committees and English Nature, as well as owners and occupiers of foreshore land and representatives of those who rely on marine areas for their livelihood or for recreation. Management will be coordinated through an agreed management scheme, backed by existing statutory measures.

Table 10.2.3 Management of coastal designated sites

Initiative name	*Activities*	*Organisations involved*	*Contact address and telephone no.*
Northumberland Coast Management Plan (1993)	Coastal Advisory Committee established. Recommends extension of Heritage Coast and offshore boundary, work with local communities, improve access, restore degraded areas, reduce land and water pollution. Implementation through Northumberland Coastal Forum (see below) and development of Coastal Management Service with Coastal Officer.	Managed by Northumberland County Council. Other agencies: Alnwick DC, Berwick-upon-Tweed, Blyth Valley and Morpeth Borough Councils, Countryside Commission, English Nature, Northumberland Wildlife Trust and National Trust.	*Coastal Officer, Planning & Environment Dept., Northumberland County Council, Morpeth, tel. 01670 533000
North Yorkshire and Cleveland Heritage Coast Management Plan (Second Review, 1995)	To provide management framework for the Heritage Coast (see Chapter 7). Focus on conservation of natural assets and enhancing public enjoyment on basis of resource capacity of sites and areas; landscape and water quality improvement; community involvement. Revised work programme to follow. Project Officer proposed.	Heritage Coast Steering Committee (elected members and reps. from North York Moors NP, Cleveland & N.Yorkshire CCs, Langbaurgh-on-Tees & Scarborough BCs, EN, NRA, National Trust, Countryside Commission).	Heritage Coast Officer, North York Moors National Park, The Moors Centre, Danby, Whitby, North Yorkshire YO21 2NB, tel. 01439 70657
Flamborough Headland Heritage Coast Management Plan	Draft First Review of 1989 plan for consultation and publication, 1995. Will have zoning policies and programmes of projects. Implementation through partnership with Project Officer. Sensitive Marine Area pilot project with English Nature.	Heritage Coast Steering Committee (elected members and reps. from North York Moors NP, Cleveland & N.Yorkshire CCs, Langbaurgh-on-Tees & Scarborough BCs, EN, NRA, National Trust, Countryside Commission).	Project Officer, 4-6 Victoria Road, Bridlington, North Humberside YO15 2BW, tel: 01262 606322

Starred contact addresses are given in full in the Appendix

10.3 Regional coastal management groups and initiatives

10.3.1 Introduction

There are currently numerous regional coastal management initiatives arising around the coastline under the leadership of local planning, harbours and ports authorities. Other locally-based coastal management initiatives, although not strictly integrated as defined in section 10.1.1, are also under way. These include Coastal Engineering Groups (see section 10.3.3), which are primarily concerned with promoting co-ordination and liaison between organisations undertaking coastal works (section 8.4).

10.3.2 Local authority and ports/harbours initiatives

The maritime local authorities are involved in most, if not all, of the major coastal zone management initiatives described in the following sections. Port and harbour authorities also have a statutory remit to control activities within their areas of authority, which may include coastal waters, and will receive wider powers to manage Special Areas of Conservation under the EC Habitats Directive (see section 10.2.7).

Local authorities are also instigating a large number of coastal zone management initiatives, not least through their own planning documents (County Structure, Unitary and Local Plans), which also usually pay particular attention to coastal matters, particularly when produced following PPG 20 (see section 10.3.5). Table 10.3.1 includes examples of recent local authority planning documents.

Northumberland County Council's coastal management initiatives include a coast management team employed by the Council; a coast advisory group of elected members, County Council, District Council and Countryside Commission; and a technical officers' working party, including representatives from RSPB, Wildlife Trust, and English Nature. Other local authority-led initiatives are outlined in Table 10.3.2.

10.3.3 Coastal (engineering) groups

Three non-statutory coastal groups (sometimes known as coastal engineering groups) have been established within the region, to improve co-ordination and liaison between agencies undertaking coastal works. Together they cover the single natural coastal sediment cell which extends from St Abb's Head to Flamborough Head. Their main aim is to seek a co-ordinated approach to all coastal engineering works by member authorities; reduce the risk of works adversely affecting the neighbouring coastline; and improve their understanding of coastal processes. The Northumbria Coastal Group has six members, and the North East Coastal Authorities Group, created in November 1991, is comprised of eight agencies, from East Yorkshire Borough to southern Northumbria. Table 10.3.3 lists coastal groups in the region.

Table 10.3.1 Local authority planning documents

Planning Authority	*Title*	*Date*
Northumberland County Council	County Structure Plan approved written statement	1980
	Northumberland Coast Management Plan	1993
	Northumberland Draft Countryside Strategy	1989
Berwick upon Tweed Borough Council	Berwick upon Tweed Borough Local Plan	(in prep.)
Newcastle City Council	Unitary Development Plan	(in draft)
North Tyneside Metropolitan District Council	Unitary Development Plan (draft)	1992
Gateshead Metropolitan District Council	Unitary Development Plan (draft)	1992
South Tyneside Metropolitan District Council	Unitary Development Plan (draft)	1992
Sunderland Metropolitan District Council	Unitary Development Plan (draft)	1992
Durham County Council	The Durham Coast: a review of achievements & developments	1980
	Durham County Structure Plan	1992
Easington District Council	Easington District Draft Local Plan	1994
Cleveland County Council	Cleveland County Structure Plan	1988
	Cleveland Wildlife Strategy	(c. 1990)
	Coastal Zone Management Strategy	1994
Hartlepool Borough Council	Hartlepool Local Plan	1991
Stockton-on-Tees Borough Council	Stockton on Tees Local Plan	1992
Middlesbrough Borough Council	Middlesbrough Local Plan	(in prep.)
Langbaurgh Borough Council	Langbaurgh District Wide Local Plan	(in prep.)
North Yorkshire County Council	North Yorks. County Structure Plan	1981
North York Moors National Park Committee	North York Moors Local Plan	1991
	North York Moors National Park Plan (Second Review)	
North Yorkshire and Cleveland Heritage Coast Steering Group, North York Moors National Park	North Yorkshire and Cleveland Heritage Coast Management Plan. Second Review: Position Statement of Issues	1993
	Second Review: Issues Report	1992
Scarborough Borough Council	Scarborough Local Plan	1988
	Filey Local Plan	1990
	Scarborough Borough Local Plan (draft consultation plan)	1994
Scarborough Borough Council North York Moors National Park	Whitby Local Plan (first review)	1983

Table 10.3.2 Local government coastal management initiatives

Initiative name	*Scope/aims*	*Organisations involved*	*Contact address and telephone no.*
Holy Island Visitor Management Plan	Address extreme visitor pressure	Berwick Borough Council	*Council Offices, Berwick Borough Council, Berwick-upon-Tweed, tel. 01289 330044
Coastal Archaeological Site Collation	Detailed coast-wide assessment and survey commenced 1992	Northumberland County Council, English Heritage, Glasgow University Archaeological Research Division	Archaeological Research Division, 10 The Square, The University, Glasgow G12 8QQ, tel: 0141 330 5541

* Starred contact addresses are given in full in the Appendix

10.3.4 Coastal fora

In some places wider coastal fora have developed from a range of coastal designations and various management initiatives. There are several of these operating in the region (some listed in Table 10.3.3 and Table 10.3.4), with others likely to be established. The great value of these fora is that they bring all interest and user groups together and enable issues of concern to be examined from all points of view.

10.3.5 Further sources of information

A. References cited

Brooke, J., Thomas, D., & Paterson, C. 1994. *Durham coastal management plan.* London, MAFF.

Department of the Environment/Welsh Office. 1993a. *Development below low water mark: a review of regulation in England and Wales.* London, HMSO.

Department of the Environment/Welsh Office. 1993b. *Managing the coast: a review of coastal management plans in England and Wales and the powers supporting them.* London, HMSO.

Department of the Environment/Welsh Office. 1994. *The conservation (natural habitats etc.) Regulations.* London, HMSO (SI 2716).

DoE/Welsh Office. 1992. *Planning policy guidance - coastal planning.* PPG 20. London, HMSO.

Earll, R.C., *ed.* 1994. *Statutory and non-statutory plans in the estuarine and coastal environment. Overlapping plans - is this an issue?* Unpublished report of a meeting in July 1994.

English Nature. 1992. *Caring for England's estuaries: an agenda for action.* Peterborough, English Nature.

English Nature. 1993. *Conserving England's maritime heritage - a strategy.* Peterborough, English Nature.

English Nature. 1994. *Managing England's marine wildlife.* Peterborough, English Nature.

Gubbay, S. 1990. *A future for the coast? Proposals for a UK coastal zone management plan.* A report to the World Wide Fund for Nature from the Marine Conservation Society (unpublished).

House of Commons. 1992. *Coastal zone protection and planning.* London, HMSO. (Environment Committee Second Report.)

MacMillan, G.M. 1994. *Cleveland coastal zone management strategy.* Cleveland County Council.

Table 10.3.3 Coastal groups in Region 5

Initiative name	*Scope/aims*	*Organisations involved*	*Contact address and telephone no.*
Northumbria Coastal Authorities Group	Aims to improve co-ordination and liaison between agencies undertaking coastal works.	Alnwick, Berwick, Blyth Valley, North Tyneside and Wansbeck District Councils and Castle Morpeth Borough Council.	*Mr J Macgregor, Alnwick District Council, Alnwick, tel. 01665 510506
Durham Coastal Group	Management Plan/Action Plan and Strategy for the Durham Coast	Steering Group of elected members and representatives of agencies involved: East Durham Task Force: Durham CC, Easington DC, Countryside Commission, EN, NRA, Northumbrian Water, British Coal. (Contractor Posford Duvivier - MAFF & EU grant aid.)	*Mr M. Jones, Environment Dept., Durham County Council, Durham, tel. 0191 383 3636
North East Coastal Authorities Group	Aims to improve co-ordination and liaison between agencies undertaking coastal works. Four sub-groups are preparing MAFF shoreline management plans (see section 10.2.4)	Easington, Langbaurgh, East Yorkshire and Scarborough Borough Councils, Sunderland City Council, and South Tyneside Metropolitan Borough Council.	*Mr M Clements, Scarborough Borough Council, Scarborough, tel: 01723 372351

* Starred contact addresses are given in full in the Appendix

Table 10.3.4 Coastal fora in Region 5

Initiative name	*Scope/aims*	*Organisations involved*	*Contact address and telephone no.*
Northumberland Coastal Forum	In process of being established, will guide work on North Northumberland Heritage Coast.	National Trust, EN, Northumberland WT, English Heritage, RSPB, local authorities	*Coastal Officer, Planning & Environment Dept., Northumberland County Council, Morpeth, tel. 01670 533000
Blyth Valley Coastal Officers Forum	Internal working group of officers involved in the Northumberland Coastal Forum. Aims to maintain and enhance the coastal zone for visitor recreation.	Blyth Valley Borough Council	*Principal Planner, Blyth Valley Borough Council, Blyth, tel: 01670 542000

* Starred contact addresses are given in full in the Appendix

Ministry of Agriculture, Fisheries and Food/Welsh Office. 1993. *Strategy for flood and coastal defence in England and Wales.* London, MAFF

National Rivers Authority. 1994. *Corporate Plan 1994/95.* Bristol, NRA.

Rothwell, P.I. Y., & Housden, S.D. 1990. *Turning the tide, a future for estuaries.* RSPB, Sandy.

B. Further reading

Arkell, R. 1991. *Estuary development in the north-east of England: meeting the challenges of economic regeneration and environmental improvement*. Borough of Sunderland.

Blatchford, D., & Green, J. 1994. *Nature conservation and development plans: a review of good practice. Policy development, north-east England*. English Nature, Newcastle.

Earll, R.C., *ed.* 1994. *Statutory and non-statutory plans in the estuarine and coastal environment. Overlapping plans - is this an issue?* Unpublished report of a meeting held in July 1994.

English Nature. 1992. *Caring for England's estuaries: an agenda for action.* Peterborough.

English Nature. 1993. *Conserving England's maritime heritage - a strategy.* Peterborough.

English Nature. 1994. *Environmental objective setting for shoreline management plans.* Peterborough. (Marine Guidance Note.)

English Nature. 1994. *Managing England's marine wildlife.* Peterborough.

Gubbay, S. 1990. *A future for the coast? Proposals for a UK coastal zone management plan*. A report to the World Wide Fund for Nature from the Marine Conservation Society (unpublished).

Gubbay, S. 1994. *Seas: the opportunity. Working together to protect our marine life*. Sandy, RSPB.

Heritage Coasts Forum. 1993. *Heritage Coasts in England and Wales - a gazetteer.* Manchester, Heritage Coasts Forum.

Jones, R. 1993. Coastal cell studies - a basis for coastal zone management. *Earth Science Conservation, 32:* 12-15.

King, G. & Bridge, L. 1994. *Directory of coastal planning and management initiatives in England.* Maidstone, National Coasts and Estuaries Advisory Group.

Ministry of Agriculture, Fisheries and Food. 1994. *Shoreline management plans.* London, MAFF. (4th draft, July 1994.)

National Coasts and Estuaries Advisory Group. 1993. *Coastal planning and management: a good practice guide.* Maidstone, National Coasts and Estuaries Advisory Group.

Rendel Geotechnics. 1994. *Coastal planning and management: a review*. London, HMSO. (Report for the Department of the Environment.)

Rothwell, P.I.Y, & Housden, S.D. 1990. *Turning the tide, a future for estuaries*. RSPB, Sandy.

RSPB. 1992. *A shore future. RSPB vision for the coast*. RSPB, Sandy.

WWF UK. In prep. Coastal management plans. *Marine Update* 18. Godalming.

WWF UK. In prep. International commitments to integrated coastal zone management. *Marine Update* 17. Godalming.

Newsletters

Many national statutory, non-governmental and scientific bodies are now producing publications or newsletters on the subject of coastal management. These provide either information on particular local or national initiatives (such as the statutory or non-governmental organisations' estuaries and firths initiatives) or general information on a range of coastal news (for example the newsletters of Eurocoast UK and the European Union for Coastal Conservation). Some of these publications are listed below. Addresses of those publishing the newsletters are given in section 10.3C.

Coastal News. Newsletter of the Coastal Research and Management Group. Publication intended to stimulate co-operation and communication between the many disciplines working in the coastal zone. Contains information on coastal management, reviews of publications and notices of meetings. Published by JNCC.

Coastline UK. Newsletter of the National Coasts and Estuaries Advisory group (NCEAG). Aimed at local authority planners. Published by NCEAG.

Coastline. Quarterly magazine of the European Union for Coastal Conservation (EUCC). Intended to establish a pan-European forum on coastal issues, including coastal management. Published by EUCC.

Coastline. The Bulletin of the Parliamentary All Party Coastal Group. Provides information summaries for MPs. Published by the All Party Coastal Group.

CZM News. Occasional Newsletter of Eurocoast UK, reporting on projects and developments in the field of coastal zone management. Published by Eurocoast UK.

Marine Scene. Occasional marine newsletter of the statutory conservation agencies in UK. Aimed at marine scientists, and users and regulators of the sea. Published by JNCC.

Wavelength. The Coastal Forum newsletter. Reports the work of the Forum to a wider audience. Published by the Department of the Environment.

National and local planning/management publications

DoE/Welsh Office. 1992. *Planning policy guidance - coastal planning*. PPG 20. London, HMSO. (Recognises the need to define a coastal zone incorporating areas affected by natural near-shore processes. Advises local authorities to consider the impacts of off-shore and on-shore developments within the full coastal zone. Endorses the precautionary approach.)

DoE/Welsh Office. 1993. *Development below Low Water Mark - a review of regulation in England and Wales*. London, HMSO. (Rejects the 1992 Environment Committee's recommendations for the extension of development controls off-shore. Seeks to

strengthen existing arrangements to overcome limitations and draw-backs in the present land-use planning system.)

DoE/Welsh Office. 1993. *Managing the coast: a review of coastal management plans in England and Wales and the powers supporting them*. London, HMSO. (Includes proposals for coastal management plans to be based on a voluntary, multi-agency approach, generally led by local authorities.)

DoE/Welsh Office. In prep. *National coastal policy guidance statement*. (Government undertaking to produce this Statement made on 15 July 1994. Remit may go beyond PPG 20 on coastal planning.)

House of Commons Environment Committee. 1992. *Second report - coastal zone protection and planning*. London, HMSO. (Recommended that coastal zone management be adopted as the framework for all coastal zone planning and management practice in the United Kingdom. Called for a national coastal strategy, a review of the many organisations responsible for the coast, the extension of planning controls offshore, and the establishment of a Coastal Zone Unit in Department of the Environment.)

MAFF. 1994. *Shoreline management plans. (*A procedural guide for operating authorities. 4th draft, July 1994.)

C. Contact names and addresses

(See also Tables 10.2.1 - 10.3.4.)

Organisation/group	*Activities*	*Contact address and telephone no.*
Coastal Forum	Launched in 1994 by the DoE, the Coastal Forum provides for an exchange of views on issues related to the coastal zone in England by a wide range of interested bodies, including central and local government, and conservation, commercial and recreation organisations. Forum proceedings are reported to government ministers.	Secretariat: Department of Environment, Room 912, House, Houlton Street, Bristol BS2 9DJ, tel: 0117 9878003
Coastal Research and Management Group (CR&MG)	Liaison between research workers and managers in the field of coastal ecology. Concentrates on research and management issues relevant to landscape and wildlife conservation along the coastal zone (marine and terrestrial).	*Coastal Research and Management Group, Coastal Conservation Branch, JNCC, Peterborough tel: 01733 62626
Coastal Technical Officers Group	The coastal group of the statutory conservation agencies (English Nature, Scottish Natural Heritage, Countryside Council for Wales, Department of the Environment for Northern Ireland, Joint Nature Conservation Committee and the Countryside Commission)	*Coastal Technical Officers Group: Coastal Conservation Branch, JNCC Peterborough tel: 01733 62626 (secretariat)
English Coastal Groups Forum	Established by MAFF in 1991. Co-ordinates the work of the English Coastal Groups (see 10.1.3); promotes the formation of coastal groups; acts as a link between centrally-based organisations and coastal groups; promotes sustainable coastal management and common standards. Forum members include one representative from each coastal group, the National Rivers Authority, Local Authority Associations, English Nature, British Rail/Railtrack and Department of the Environment.	Head of Flood and Coastal Defence Division, MAFF, Eastbury House, 30/34 Albert Embankment, London SE1 7TL, tel: 0171 238 6660
English Nature	Management of designated coastal sites; nature conservation and development planning, Estuaries Initiative, Sensitive Marine Areas, Maritime Natural Areas	*English Nature, Northminster House, Peterborough, tel: 01733 340345
Eurocoast UK	The Eurocoast Association aims to improve the basis for protection, development and management of the coastal zone. Primarily a communication network.	Eurocoast UK, Burderop Park, Swindon, Wiltshire SN4 0QD, tel: 01793 812479
European Union for Coastal Conservation (EUCC)	International grouping of organisations and individuals with an interest in coastal nature conservation matters, including coastal management. The CR&MG (see above) is the basis of the UK branch of EUCC.	European Union for Coastal Conservation (EUCC) Secretariat, P.O. Box 11059, NL-2301 EB Leiden, tel: +31 71 122900/123952
Heritage Coast Forum	Funded by the Countryside Commission. Provides up to date factual information on 45 Heritage Coasts in England and Wales.. Provides contact between individuals and groups concerned with the management of Heritage Coasts in England and Wales.	Heritage Coast Forum, Centre for Environmental Interpretation, The Manchester Metropolitan University, St Augustine's, Lower Chatham Street, Manchester M15 6BY, tel: 0161 247 1067
Industry and Nature Conservation Association (INCA) (Teesside)	Mutual forum of industry and nature conservation interest in Cleveland, funded by its members.	INCA, Belasis Hall Technology Park, Billingham, Cleveland TS23 4AZ, tel: 01642 370319
Joint Nature Conservation Committee	Information and advice on coastal management initiatives. Publishes *Coastal News*, aimed at stimulating co-operation and communication between those involved with the coast	*Coastal Conservation Branch, Joint Nature Conservation Committee, Peterborough, tel: 01733 866825
Joint Nature Conservation Committee	Information and advice on marine issues. Publishes *Marine Scene*, which summarises marine conservation news from the JNCC, Scottish Natural Heritage, English Nature and the Countryside Council for Wales.	*Marine Conservation Branch, Joint Nature Conservation Committee, tel: 01733 866833

C. Contact names and addresses (continued)

(See also Tables 10.2.1 - 10.3.4.)

Organisation/group	*Activities*	*Contact address and telephone no.*
Les Esturiales Environmental Study Group	International programme for co-operation, the exchange of experience on estuarine management and personal contacts between local authority practitioners in Europe.	Esturiales Environmental Study Group, Professor Graham King, Swansea Institute of Higher Education, Faculty of Leisure and Tourism, Mount Pleasant Campus, Swansea SA1 6ED, tel: 01792 456326
Les Esturiales environmental study group in Region 5	Local activities of the above	*Richard Arkell, Assistant Director of Planning, Sunderland Metropolitan District Council, tel: 0191 563 2394
Marine Conservation Society	Provides advice and supports local coastal management initiatives: runs grant-aided coastal management workshops and courses for coastal managers; promotes the establishment of voluntary coastal groups.	*Marine Conservation Society, Ross-on-Wye, tel: 01989 566017
Marine Forum	National network provides forum for discussion of marine issues relating to the seas around UK. Members include governmental and non-governmental organisations and individuals. Occasional seminars are held, covering a range of topics including coastal management.	Marine Forum, Natural History Museum, Cromwell Road, London SW7 5BD, tel: 0171 938 9114
Ministry of Agriculture, Fisheries and Food	Shoreline Management Plans (mainly aimed at formulating a coast protection strategy)	MAFF, Eastbury House, 30/34 Albert Embankment, London SE1 7TL, tel: 0171 238 3000
National Coasts and Estuaries Advisory Group (NCEAG)	On behalf of local authorities, provides advice on sustainable management of coastal and estuarine environments; published guide to good practice (NCEAG 1993)	Secretary, National Coasts and Estuaries Advisory Group (NCEAG), Environment Programme, Kent County Council, Springfield, Maidstone ME14 2LX, tel: 01622 696180
National Rivers Authority	Catchment management planning, 5-year programme	*Flood Defence Section, NRA HQ, Bristol, tel. 01454 624400, or *NRA Northumbria/ Yorkshire Region, Leeds, tel: 0113 244 0191
National Trust	Has extensive coastal land holdings in the region (see section 7.5.1). Recently carried out a complete review of its Coastal Strategy Plans; has an ongoing review of coastal site management plans.	The National Trust Yorkshire Region, Goddards, 27 Tadcaster Road, Dringhouses, York YO2 2QG, tel: 01904 702021 The National Trust Northumbria Region, Scots' Gap, Morpeth, Northumberland NE61 4EG, tel: 0167 074691
Royal Society for the Protection of Birds	Launched national campaign in 1990 to promote the importance of estuaries in the UK. Monitors the development of coastal zone initiatives around the UK. In 1994, launched Marine Life campaign, to increase awareness and to promote integrated coastal and marine management.	*Coastal Policy Officer, RSPB HQ, Sandy, tel: 01767 680551
World Wide Fund for Nature - UK	Provides funding for research, local voluntary policy development and local initiatives, and publications on integrated coastal management. Draws on considerable international experience with coastal management initiatives.	*World Wide Fund for Nature - UK, Godalming, tel: 01483 426444

Addresses and telephone numbers of local planning authorities are given in full in the Appendix, as are * starred contact addresses.

Appendix

A.1 Frequently cited contact names and addresses

Name	*Contact address and telephone no.*
Statutory bodies	
English Nature HQ	Northminster House, Peterborough PE1 1UA, tel: 01733 340345
English Nature, Northumbria Local Area Team,	Archbold House, Archbold Terrace, Newcastle NE2 1EG, tel. 0191 281 6316
English Nature, North & East Yorkshire Local Area Team	Institute for Applied Biology, University of York, York YO1 5DD, tel. 01904 432700
Joint Nature Conservation Committee (JNCC), Head Office	Monkstone House, City Road, Peterborough PE1 1JY, tel: 01733 62626
JNCC, Aberdeen Office	17 Rubislaw Terrace, Aberdeen AB1 1XE, tel: 01224 642863
Institute of Terrestrial Ecology (ITE), Monks Wood	Abbots Ripton, Huntingdon, Cambridgeshire PE17 2LS, tel: 01487 773381
ITE Merlewood	Windermere Road, Grange-over-Sands, Cumbria LA11 6JU, tel: 01539 532264
Countryside Commission (Northern Region)	Warwick House, Grantham Road, Newcastle upon Tyne NE2 1QF, tel: 0191 232 8252
Countryside Commission (Yorkshire & Humberside Region)	Victoria Wharf, Embankment IV, Sovereign Street, Leeds LS1 4BA, tel: 0113 246 9222
National Rivers Authority (NRA), Northumbria & Yorkshire Region	Rivers House, 21 Park Square South, Leeds LS1 2QG, tel: 0113 244 0191
NRA Head Office	Rivers House, Waterside Drive, Aztec West, Almondsbury, Bristol BS12 4UD, tel: 01454 624400
NRA Newcastle Office	Eldon House, Regent Centre, Gosforth, Newcastle upon Tyne NE3 3UD, tel: 0191 213 0266
Ministry of Agriculture, Fisheries and Food (MAFF) Directorate of Fisheries Research, Fisheries Laboratory, Conwy	Benarth Road, Conwy, Gwynedd LL32 8UB, tel: 01492 593883
MAFF Directorate of Fisheries Research, Fisheries Laboratory, Lowestoft	Pakefield Road, Lowestoft, Suffolk NR33 OHT, tel: 01502 562244
MAFF Directorate of Fisheries Ressearch, Fisheries Laboratory, Burnham-on-Crouch	Remembrance Avenue, Burnham-on-Crouch, Essex CM0 8HA, tel. 01621 782658

Name	*Contact address and telephone no.*
Wildlife Trusts	
Northumberland Wildlife Trust	The Garden House, St Nicholas Park, Jubilee Road, Newcastle-upon-Tyne NE3 3XT, tel. 0191 2846884
Cleveland Wildlife Trust	Bellamy Pavillion, Kirkleatham, Redcar, Cleveland TS10 5NW, tel: 01642 480033
Yorkshire Wildlife Trust	10 Toft Green,York YO1 1JT, tel: 01904 659570
Durham Wildlife Trust	Low Barns Nature Reserve, Witton-Le-Wear, nr Bishop Auckland, Co. Durham DL14 OAG, tel: 01388 488728
Northumberland Wildlife Trust	The Garden House, St. Nicholas Park, Jubilee Road, Newcastle upon Tyne NE3 3XT, tel: 01912 846884
National voluntary bodies	
Marine Conservation Society	9 Gloucester Road, Ross-on-Wye, Herefordshire HR9 5BU, tel: 01989 566017
The National Trust HQ	33 Sheep Street, Cirencester, Gloucestershire GL7 1QW, tel: 01285 651818
National Trust (Yorkshire Region)	Goddards, 27 Tadcaster Road, Dringhouses, York YO2 2QG, tel: 01904 702021
National Trust (Northumbria Region)	Scots' Gap, Morpeth, Northumberland NE61 4EG, tel: 0167 074691
Royal Society for the Protection of Birds (RSPB) HQ	The Lodge, Sandy, Bedfordshire SG19 2DL, tel: 01767 680551
RSPB North of England Office	'E' Floor, Milburn House, Dean Street, Newcastle upon Tyne NE1 1LE, tel: 01912 324148
The Wildfowl & Wetlands Trust (WWT) HQ	Slimbridge, Gloucestershire GL2 7BX, tel: 01453 890333
Worldwide Fund for Nature - UK (WWF-UK)	Panda House, Weyside Park, Cattershall Lane, Godalming, Surrey GU7 1XR, tel: 01483 426444

A.2 Local planning authorities, ports and harbour authorities addresses

Authority	*Location*
Alnwick District Council	Allerburn House, Alnwick, Northumberland NE66 1YY, tel: 01655 510505
Berwick-upon-Tweed Borough Counci	Council Offices, Wallace Green, Berwick-upon-Tweed, Northumberland TD15 1ED, tel: 01289 330044
Blyth Harbour Commissioners	79 Bridge Street, Blyth, Northumberland NE24 2AW, tel: 01670 352066
Blyth Valley Borough Council	Civic Centre, Blyth, Northumberland NE24 2BX, tel: 01670 542000
Castle Morpeth District Council	Council Offices, The Kylins, Loansdean, Morpeth, Northumberland NE61 2EQ, tel: 01670 514351
Cleveland County Council	Municipal Buildings, Middlesbrough, Cleveland TS1 2QH, tel: 01642 248155
Durham County Council	County Hall, Durham DH1 5UQ, tel: 0191 383 3636
Easington District Council	Easington DC Offices, Peterlee, Co. Durham SR8 3TN, tel: 0191 527 0501
Hartlepool Borough Council	Civic Centre, Hartlepool, Cleveland TS24 8AY, tel: 01429 869625
Langbaurgh-on-Tees Borough Council	Middlesbrough, Cleveland TS6 9AR, tel: 01642 231212
Middlesbrough Borough Council	Town Hall, Corporation Road, Middlesbrough, Cleveland, TS1 1LT, tel: 01642 245432
Newcastle upon Tyne Metropolitan District Council	Civic Centre, Newcastle, Tyne & Wear, tel: 0191 232 8520
North Tyneside Metropolitan District Council	14 Northumberland Square, North Shields, Tyne and Wear NE30 1PZ, tel: 0191 257 5544
North Yorkshire County Council	County Hall, Northallerton DL7 8AD, tel: 01609 780780
Northumberland County Council	County Hall, Morpeth, Northumberland NE61 2EF, tel: 01607 533000
Port of Sunderland Authority	Barrack Street, Sunderland SR1 2BU, tel: 0191 514 0411
Port of Tyne Authority	Bewick Street, Newcastle upon Tyne NE1 5HS, tel: 0191 232 5541
Scarborough Borough Council	St Nicholas Street, Scarborough, North Yorkshire YO11 2HG, tel: 01723 372351
Seaham Harbour Dock Company	North Terrace, Seaham, Co Durham SR7 7EU, tel: 0191 581 3877
South Tyneside Metropolitan District Council	Town Hall and Civic Offices, Westoe Road, South Shields, Tyne and Wear NE33 2RL, tel: 0191 427 1717
Stockton-on-Tees Borough Council	Church Road, Stockton-on-Tees, Cleveland TS18 1LE, tel: 01642 670067
Sunderland Metropolitan District Council	PO Box 102, Civic Centre, Sunderland, Tyne and Wear SR2 7DN, tel: 0191 563 2394
Tees and Hartlepool Port Authority	Queen's Square, Middlesbrough, Cleveland, TS2 1AH, tel: 01642 241121
Tyne & Wear Development Corporation	Scotswood House, Newcastle Business Park, Newcastle-upon-Tyne, Tyne & Wear NE4 7YL, tel: 0191 226 1234
Wansbeck District Council	Town Hall, Station Road, Ashington, Northumberland NE63 9XL, tel: 01670 814444
Warkworth Harbour Commissioners	Harbour Office, Quayside, Amble, Morpeth, Northumberland NE65 0AP, tel: 01665 710306

A.3 Core reading list

There are a number of important publications that either provide information on a variety of topics covered in these regional reports (and so are frequently referred to) or give a good overview of regional and national information on coasts and seas. They are listed below.

Barne, J., Davidson, N.C., Hill, T.O., & Jones, M. 1994. *Coastal and Marine UKDMAP datasets: a user manual.* Peterborough, Joint Nature Conservation Committee.

British Oceanographic Data Centre. 1992. *United Kingdom Digital Marine Atlas. User Guide. Version 2.0.* Birkenhead, Natural Environment Research Council, British Oceanographic Data Centre.

Buck, A.L. In prep. *An inventory of UK estuaries. 5. Eastern England.* Peterborough, Joint Nature Conservation Committee.

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

Doody, J.P., Johnston, C., & Smith, B. 1993. *The directory of the North Sea coastal margin.* Peterborough, JNCC.

Eno, N.C., ed. 1991. *Marine conservation handbook.* 2nd ed. Peterborough, English Nature.

Frid, C.L.J., Evans, S.M., & Clark, R.B. 1991. *The north-east coast of England: environmental appraisal.* Newcastle, Dove Marine Laboratory. Report commissioned by Shell UK Exploration & Production.

Gubbay, S. 1988. *A coastal directory for marine conservation.* Ross-on-Wye, Marine Conservation Society.

Lee, A. J., & Ramster, J. W. 1981. *Atlas of the seas around the British Isles.* MAFF Atlas Office.

Ministry of Agriculture Fisheries and Food Fisheries Laboratory. 1993. *North Sea Subregion 3b Assessment report.* North Sea Task Force.

North Sea Task Force. 1993. *North Sea Quality Status Report 1993.* London; Oslo and Paris Commissions.

Robinson, A., & Millward, R. 1983. *The Shell book of the British coast.* Newton Abbot, David and Charles.

Steers, J.A. 1964. *The coastline of England and Wales.* 2nd ed., 112 - 183 (Geology and geomorphology). Cambridge, Cambridge University Press.

A.4 Contributing authors

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