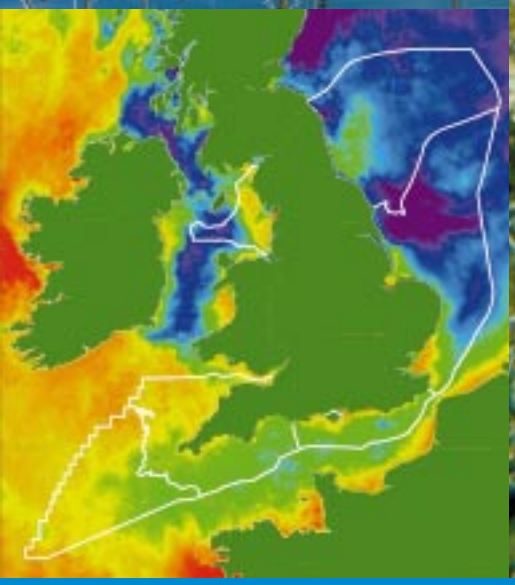
ENGLISH NATURE

The South Western Peninsula Marine Natural Area

A contribution to regional planning and management of the seas around England



working today
for nature tomorrow

Foreword

Over the last few years, there has been a greater recognition not only of the need to manage our maritime environment in a more holistic way, but also the ways in which this might be achieved. In their report *Safeguarding our Seas*, Defra (2002a) set out a vision and ideas to address this need, founded on an ecosystem approach. English Nature also set out the case for such an approach in its *Maritime State of Nature* report (Covey & Laffoley 2002). Both documents emphasise that we need to take a more integrated approach to managing human activities in order to restore and maintain healthy ecosystems. This will benefit both present and future generations. The UK Government's commitment to developing this approach is reflected in various European and international statements such as the output of the World Summit on Sustainable Development. The challenge now is how to put the ecosystem approach into practice. The Marine Natural Areas concept and the information set out in this document is a positive step forward in meeting this challenge.

English Nature initially conceived the idea of 'Natural Areas' on land and in the nearshore zone. They were identified on the basis of their underlying geology, natural systems and physical processes. As wildlife is not restricted to designated sites, Natural Areas provide an essential context that help us to manage specific sites better. They also help us to understand the nature conservation value of the wider countryside. Natural Areas provide a strategic framework for English Nature, in consultation with stakeholders, to set objectives at a broad scale, to plan action and resources to achieve these, and to bring partners on board. It was a logical step to extend the concept into the marine environment. So, English Nature has identified and described, together with the Joint Nature Conservation Committee and in consultation with other organisations, six Marine Natural Areas. Though the boundaries of the Marine Natural Areas reflect a number of natural factors, the boundaries only encompass the seas around England, not other parts of the UK. However, we hope that the approach set out here, together with initiatives such as the Review of Marine Nature Conservation's Irish Sea Pilot project, will help catalyse a more comprehensive approach to regional seas that incorporates areas of sea beyond England's borders.

Marine Natural Areas take account of natural processes and the interaction between them, the underlying geology and wildlife. They offer a biogeographic framework within which we can develop and implement an ecosystem approach to managing human uses of the marine environment. The information contained within this report provides advice on the nature conservation value of large areas of sea. It also outlines our knowledge of where natural features are and the context this provides for a variety of human uses. This information should continue to be updated and refined. Such spatial data is essential if we are to consider tools such as sea use planning for the range of activities that occur in the marine environment.

We need a healthy, resilient marine environment supporting biodiversity and a variety of sustainable economic uses. That requires new ideas and initiatives and as such we commend this report as a contribution to the debate about how best to achieve this.

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Contents

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1 Introduction

1.1 Definition and role of Marine Natural Areas

Marine Natural Areas are areas of sea around England that have been identified using oceanographic processes, bathymetry and biogeographic characteristics to define broad natural divisions in the marine environment. Marine Natural Areas seek to identify ecologically relevant boundaries at a broad scale for which ecologically relevant objectives and targets can then be identified. Like Natural Areas identified in the terrestrial and near-shore environment[1], Marine Natural Areas emphasise the importance of natural processes, the interaction between these, geology, and wildlife. We have identified 6 Marine Natural Areas, as explained below.

Natural Areas offer a biogeographic framework within which to develop and implement an ecosystem approach to managing human activities (see Appendix 1) and to securing a sustainable future for the marine environment. However, we recognise that the basis of 'regional seas' is likely to evolve as interest in a regional approach to the marine environment gathers momentum. This is especially so in relation to Scotland, Wales and the Irish Sea, as the boundaries of our Natural Areas are currently restricted to England's borders.

We hope that the Marine Natural Areas and the information presented in this document will be of use to those interested or involved in the stewardship of our seas. This includes those responsible for planning, regulating or managing human activities, other agencies, local, regional and national Government and the wider public. In particular, we hope that the Marine Natural Areas:

- provide an ecological rationale for defining broad regional units;
- suggest an appropriate scale and potential framework in which to manage and govern the seas adjacent to England;
- provide information on habitats and species, physical features and nature conservation importance across the wider marine environment, and the key human activities relevant to these;
- complement or assist other initiatives, such as the 'regional seas' approach currently being piloted under the Defra-led Review of Marine Nature Conservation[2];
- present information in a structured and easily accessible manner which can be adapted for use by others as required.

English Nature will continue to use and build on Marine Natural Areas, within the context of our developing Maritime Strategy and initiatives led by the Joint Nature Conservation Committee (JNCC), Government and others. We will use them to:

[1] 120 Natural Areas, including 23 coastal Natural Areas, each identified by distinctive habitats, physical features and species that distinguish it from neighbouring areas. (Profiles for terrestrial and coastal Natural Areas can be found at (www.english-nature.co.uk/Science/natural/NA_search.asp).

[2] The Irish Sea Marine Natural Area is only part of the area covered by the Irish Sea Pilot (ISP). The ISP Project has dealt with some of the issues discussed in the Marine Natural Area Profile in much more detail. We have published the Irish Sea Marine Natural Area Profile because it contains some information not considered by the ISP. It also highlights what could be achieved in other regional areas by building on Marine Natural Areas.

- draw up objectives and targets for nature conservation at a regional scale together with key stakeholders and Government;
- promote a strategy and policies for the management of seas around England; and
- manage our work and resources to achieve objectives and targets, including those under the UK's Biodiversity Action Plan.

1.2 The basis for Natural Area boundary selection

Marine Natural Areas take account of oceanographic processes, bathymetry and broad biogeographic characteristics. Using these features as a basis for delimiting the individual areas, English Nature explored options with the Joint Nature Conservation Committee to identify the six Marine Natural Areas shown in Figure 1.1.

The boundaries between adjacent Marine Natural Areas are partly based on the 50 metre isobath. This is the approximate depth at which wave action on the seabed (a mechanism for driving sedimentary processes) tends to become of minimal significance. The 50 metre isobath also marks the transition between shallow, well-mixed turbid conditions and deeper, seasonally stratified waters such as that found in the North Sea (Brampton and Evans 1998). This delineation between well-mixed and seasonally stratified water masses is significant in plankton dispersal and therefore in distinguishing between marine biological assemblages (Hiscock 1996). In addition, such transitions sometimes form 'fronts' with associated high biological productivity. For example, the distribution of seabird breeding colonies may indicate not only suitable nesting conditions, but also the distribution of important marine feeding grounds, for example to the north east of Flamborough Head (Skov *et al* 1995).

Broad biogeographic characteristics were also used to set the boundaries between some of the Marine Natural Areas. In particular, a well established biogeographical transition has been used to derive the boundary between the English Channel and South Western Peninsula Natural Areas. The transition occurs between the relatively warmer Boreal-Lusitanean region to the west and colder Boreal region to the east. Such a transition has a marked influence on the distribution of temperature-sensitive marine species (Hayward and Ryland 1995). The boundary selected, ie a line running from Portland to Cherbourg, was recognised by Holme (1966), who divided the English Channel on the basis of differences in tidal streams and water temperature stratification either side of this boundary, and is the same as that used by Dinter (2001) in relation to the OSPAR Convention.

The offshore extent of Marine Natural Areas is the 200 nautical mile limit or the median line of UK Controlled Waters[3].

Inshore, we have used the Mean Low Water Mark as the boundary of the Marine Natural Areas. This means that the Marine Natural Areas overlap with the previously identified

[3] There are clear differences in the legal and institutional frameworks within 12 nautical miles (Territorial Waters) and beyond (UK waters). For example, beyond 12 nautical miles, the remit for providing advice on nature conservation changes from English Nature to the JNCC. However, wildlife and human activities cross such artificial administrative boundaries and therefore there is a need to work closely together to address issues of common concern. For the same reason, we feel it would be inappropriate to limit MNAs to the 12-nmile administrative boundary. For convenience, the term "seas adjacent to England" is used when referring to waters within and beyond 12 nautical miles.

Coastal Natural Areas (which extend from about 6 nautical miles to above Mean Low Water). These were based on the coastal process cells and sub-cells in which sediment movement is largely contained within discreet zones. However, the Marine Natural Areas span much greater areas as they reflect other, broader scale processes and the need to take account of large areas for pelagic species.

Estuaries and inlets are generally excluded from Marine Natural Areas as they are already covered within Coastal Natural Area descriptions. However, in discussing and implementing an ecosystem approach to the maritime environment, it will be essential to take account of Coastal and Marine Natural Areas together.

1.3 The audience for this document

We hope that the Marine Natural Areas and the information presented in this document will be of use to those interested or involved in the stewardship of our seas. We envisage this will include those responsible for planning, regulating or managing human activities. This document is therefore aimed at a wide audience that includes local authorities, regional government, and the Regional Development Agencies. We hope that the Marine Natural Areas will also be of interest to a wider public as well as to national government, other agencies, marine authorities, industry and the scientific community.

1.4 The aim and structure of this document

The main product from our work on Marine Natural Areas is a series of 'profiles', documents which provide a thumbnail sketch of each Area including its physico-chemical characteristics, key habitats and species, and, in brief, relevant human activities.

These documents are not intended to be a comprehensive description of all the wildlife and human interest within each area. Rather, they aim to highlight and describe key features of each Marine Natural Area from a nature conservation perspective. The main text begins with a description of the geology, physical processes and chemical conditions of each Natural Area. This provides the 'big picture' within which to consider nature conservation and human values of the area. The next two sections briefly describe the nature conservation value of the area in terms of habitats and then species. The final descriptive section outlines significant human activities.

Whilst we are publishing paper copies of the documents, the profiles will also be provided on CD and via the Internet (www.english-nature.org.uk). This is largely to facilitate use of the text by others, eg those progressing a regional approach to managing the marine environment.

Whilst the document contains some technical information it does not attempt to go into any great level of detail on any particular topic. Therefore the reader may wish to follow up on a particular topic by referring to other technical reports such as the JNCC's *Coastal Directories,* the Marine Nature Conservation Review (eg Hiscock 1998), the Joint Cetaceans Atlas (Reid *et al* 2003), and Regulation 33 advice published by the Agencies for European marine sites designated under the Habitats and Birds Directives. Further sources of relevant information and links to websites can be found at www.english-nature.org.uk and www.jncc.gov.uk. This document also provides references to material from other organisations.

A glossary of terms used throughout this report can be found in Appendix 4.

1.5 Geographic Information System

In addition to producing the profiles, English Nature has used a Geographic Information System (GIS) to hold and display the data referred to in this document. A number of other organisations have provided the data including the British Geological Survey (BGS), Centre for Environment, Fisheries and Aquaculture Science (CEFAS), the Crown Estate and Department for Environment, Food and Rural Affairs (Defra). GIS is invaluable for viewing data on different subjects altogether, often enabling a better understanding of the interaction between them. The Marine Natural Areas GIS is no exception and allows more detailed and dynamic use of data than can be shown in document form. We hope that the data will be useful in the further development of Marine Natural Areas and the implementation of any regional seas approach. We also hope to make the data available more widely but this will require agreement with those organisations that have provided data. Such access may be facilitated by initiatives to improve data sharing and integration in response to recommendations in *Safeguarding our Seas* (Defra 2002a).

1.6 Conservation objectives

We hope that the information set out in these profiles will contribute to a more comprehensive regional seas approach. We also intend to develop nature conservation objectives relevant to each Natural Area. However, we will do this within the current debate and emerging ideas about conservation objectives for broad sea areas, particularly through the work of the Irish Sea Pilot (see Lumb *et al* 2004 for example). This work will depend on the extent to which Marine Natural Areas become part of a more comprehensive regional approach to managing the seas around the UK.

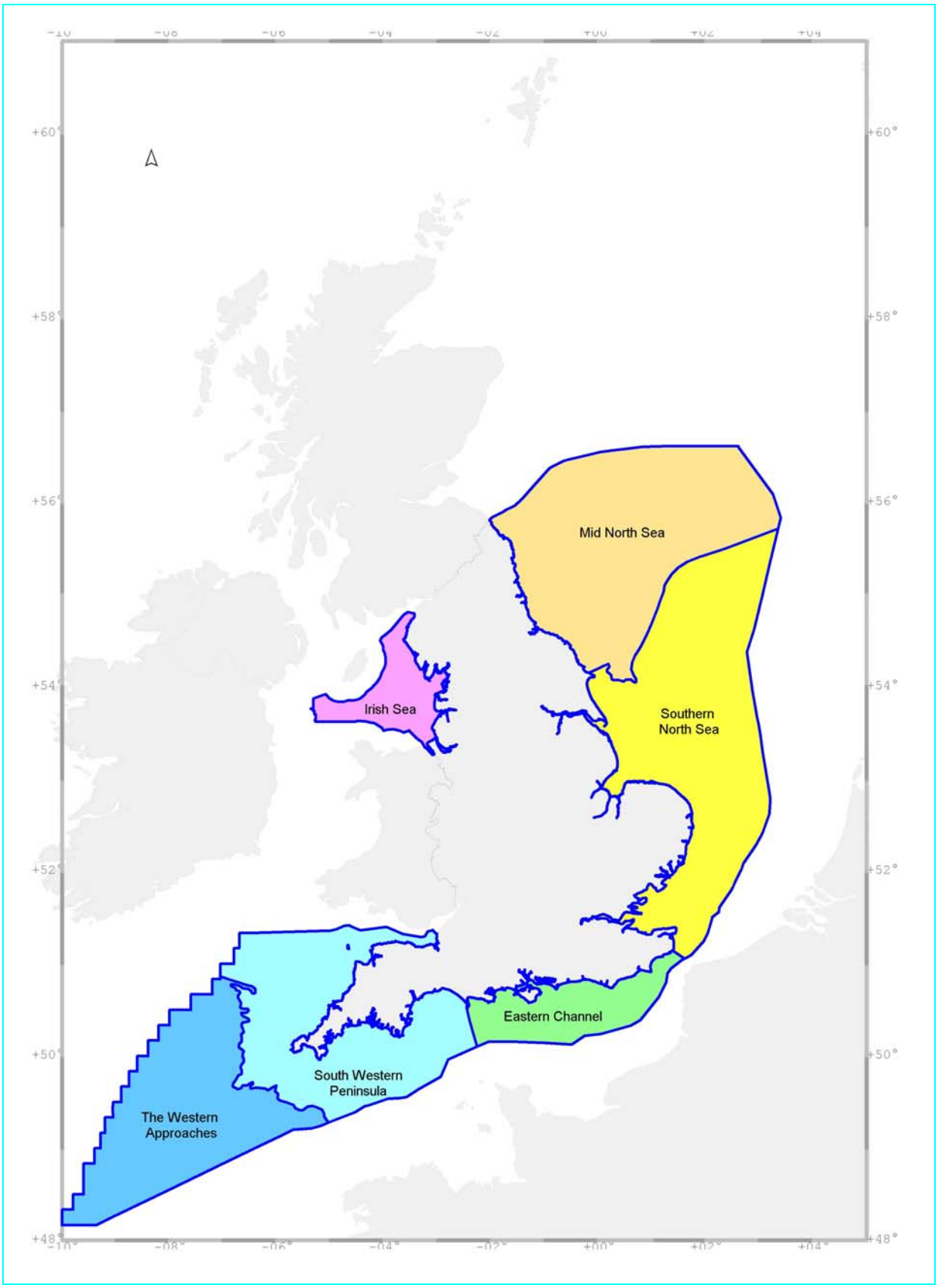


Figure 1.1 The six Marine Natural Areas around England.

2 General summary

The South Western Peninsula Marine Natural Area includes the seas around the south west peninsula of England (including the Isles of Scilly), from Portland Bill in Dorset to Brean Down just south of Weston-super-Mare on the southern side of the Severn Estuary. The eastern boundary of the Natural Area follows a division between two biogeographical provinces – the Boreal and Boreal-Lusitanean (Dinter 2001). Further west, the boundary follows the 100-metre isobath (chosen to represent the delineation between the shallow coastal and deep offshore waters) to the west of the Isles of Scilly, with the northern boundary following the mid-line between Wales and England. The inshore boundary of the South Western Peninsula Natural Area is delimited as Mean Low Water (MLW) and the offshore boundary is at the limit of UK jurisdiction. The area above MLW is included within English Nature's coastal series of Natural Areas, whose boundaries are set out in Figure 2.1.

The marine conditions in the south west are influenced by the Lusitanean-Boreal biogeographical region which, together with the varied geology present, produces a diverse marine community. The plankton is charac teristic of temperate shelf sea species, with some influence from the North Atlantic Drift. Species considered to be at the edge of their range and which are more normally associated with the Mediterranean, such as turtles and some exotic fish species, are occasionally reported within this Marine Natural Area (Pater 1999).

Many important 'key species' occur within this Marine Natural Area, including various cetaceans, grey seal, basking shark and a number of invertebrates of high nature conservation importance. Several of these key species are covered by UK Biodiversity Action Plans (BAPs). There are grouped BAPs for commercial marine fish, toothed whales, small dolphins and marine turtles. There is also a single Species Action Plan for harbour porpoise. Other BAP species that occur within the Marine Natural Area include the pink sea fan. There are also a large number of algae and marine invertebrates present which are considered to be nationally rare or scarce (Sanderson 1996 a, b).

The main commercial activities within the South Western Peninsula Marine Natural Area are fishing and commercial shipping in the Bristol Channel. The main commercial fish species targeted within the area (in order of decreasing tonnage of landings) are mackerel, pilchard, sprat, monkfish, plaice, megrim, hake, lemon sole, Dover sole, horse mackerel, whiting and pollack. There are also important fisheries for crabs, mussels, scallops, lobsters and whelks (Barne *et al* 1996a, b, c). On land adjacent to the Natural Area, tourism is a major activity, with the region's mild climate, sandy beaches and fine scenery attracting large numbers of visitors, particularly during the summer months.

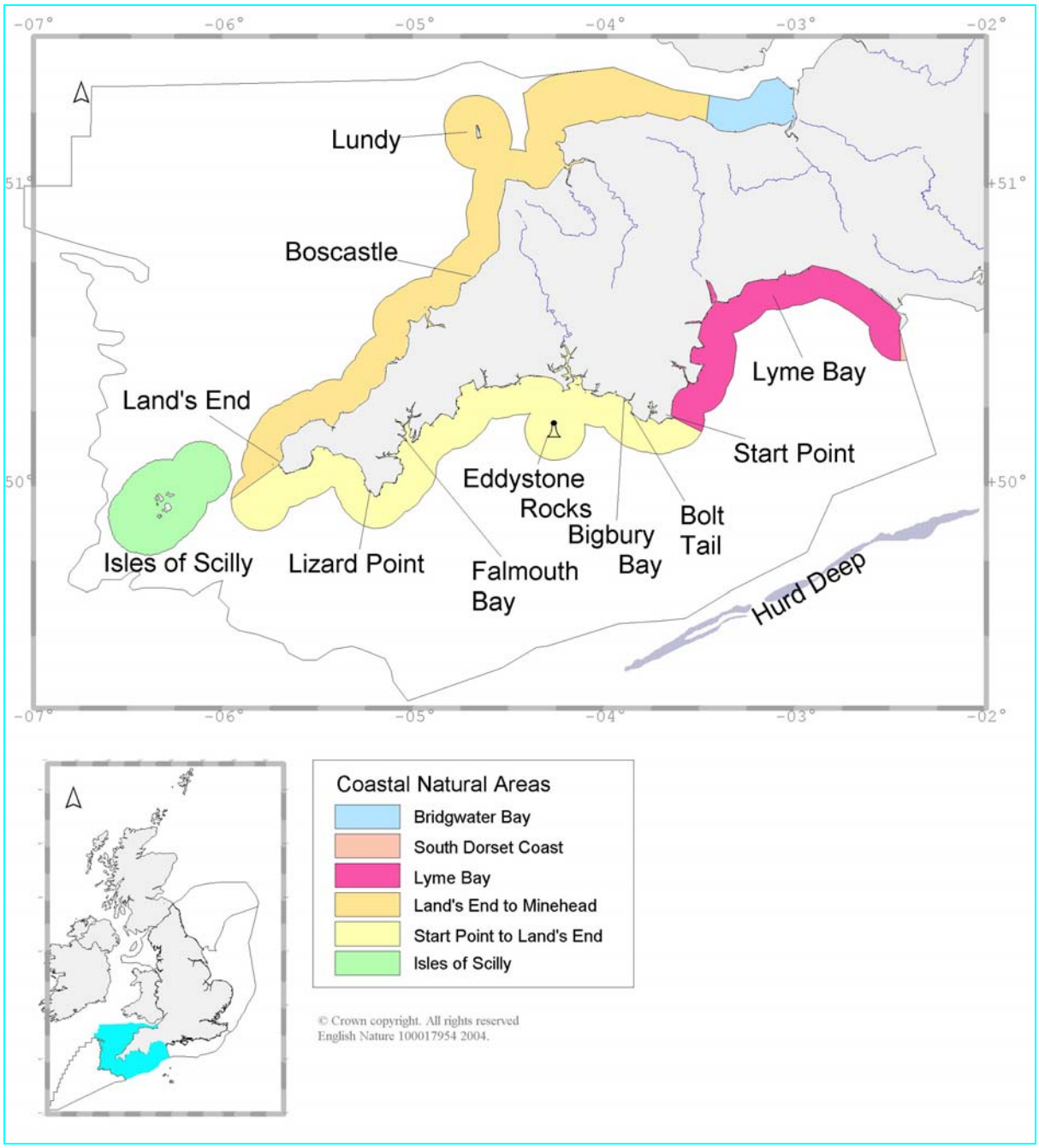


Figure 2.1 South Western Peninsula Marine Natural Area and adjacent coastal Natural Areas with the names of places mentioned in the text.

3 Physical environment and character of the Natural Area

This section outlines the geology, physical processes and chemical characteristics of the Natural Area. It describes the underlying processes that determine the presence of natural features and biodiversity, and which in turn influence human activities. For simplicity, the human influences on physical and chemical characteristics, such as water quality, are described in the same section.

3.1 Geology

The geology of the Natural Area has direct and indirect influences on the morphology of the seafloor, the distribution of seafloor sediments (see Figure 3.1), and the distribution of many of the associated habitats. Many of these influences form a complex set of inter-relationships. The broader geological patterns (such as the range of rock types and geological structures) were set in the early geological history of the area. But, more recent geological events (in particular the sea-level changes associated with glaciation, as well as the glaciers themselves) have had a profound effect upon the distribution of modern seafloor topography and sediments. Given the complexity of the geology, the description given below is necessarily brief.

The Natural Area is underlain by bedrock ranging from late Precambrian to Neogene in age. Pleistocene and Holocene sediments of variable thickness rest upon the bedrock. The outcrop pattern of the bedrock shows predominant east-west or east-north-east – west-south-west trend. This reflects a complex history of continental separation, continental collision, crustal extension, thinning and rifting. The diverse range of rock types in the Natural Area illustrates this complexity.

During the Devonian and Carboniferous Periods, most of this area was covered by sea. The collision of Britain and Ireland with France during the Carboniferous led to the folding and metamorphosis of these rocks, as well as the intrusion of the granites that extend from Dartmoor westwards forming part of the Cornubian Ridge. During this process deep low-angle faults developed. These faults were reactivated later as the crust was extended during the earliest stages of the opening of the Atlantic Ocean. The effect of this extension was to open up a series of elongate troughs with a general east-west orientation. These troughs or sedimentary basins acted as the focus for the deposition of sediment from the Permian to the Eocene. The red sandstones, conglomerates and mudstones of the Permian and Triassic were deposited in deserts, arid alluvial plains and coastal plains. Mudstones, sandstones and limestones of a marine origin were deposited over the eastern part of the Natural Area during the Jurassic. Uplift during the early Cretaceous resulted in erosion throughout the Natural Area, but by the late Cretaceous the opening of the North Atlantic and global sea-level rise meant that the Natural Area was partially submerged again and chalk was deposited throughout the area. Sedimentation continued into the Eocene, when regional uplift associated with the development of the Alps led to the erosion of Tertiary rocks within the Natural Area. Some Tertiary sediment remains in the South Celtic Sea Basin, Bristol Channel Marginal Basin, and the Stanley Bank Basin (NW of Lundy). Uplift and erosion of the Natural Area during the Oligocene and Miocene led to the planation (levelling) of the

inner shelf. This is thought to have been responsible for the submerged cliff-lines that surround parts of the coast.

Most of the area lay to the south of the Pleistocene ice sheets. As a consequence of low sea levels during the Pleistocene any sediments deposited during high sea-level stands were removed by erosion. Other than in the approaches to the Bristol Channel, inshore Quaternary sediments are Holocene in age. Low sea level also allowed rivers to extend onto the continental shelf. As a consequence, a complex of deep valleys (palaeovalleys) were cut in the floor of the English Channel. All the valleys are now buried and infilled with Holocene sediments.

In parts of the Natural Area, a poorly sorted, sandy, shelly gravel may be present. It is rarely more than a few decimetres in thickness. These sediments represent a 'lag' deposit created by vigorous wave action as sea level rose at the end of the last glaciation. These sediments take the form of quartzitic sands south and west of the Isles of Scilly and the Cornish Peninsula, and moribund tidal sand ridges off the north Devon coast.

Much of the seafloor in the Natural Area is covered with a thin layer of sediments that have been deposited over the past 10,000 years, and are still partially mobile. The overall grade of the sediment, its degree of sorting, mobility and carbonate content all influence the types of habitat that can develop on these substrates, and are largely controlled by the bedrock topography. Within the Natural Area significant areas of the seafloor consist of rocky outcrops, reefs, submerged cliffs and sea caves (submerged and emergent). Those outcrops off Devon and Cornwall are formed from folded Devonian and Carboniferous rocks and igneous intrusions. A variety of rock types and structures present are an important factor in the establishment of the diverse range of associated habitats.

3.2 Bathymetry

In the western English Channel (from Portland Bill to Land's End and the area south of this), the seabed slopes away from the coast quite steeply to a depth of 50 metres (see Figure 3.3). Beyond this, the gradient decreases and a gentle slope continues to depths of 100-120 metres (70-75 metres to the edge of the Natural Area). Deeper water occurs closer inshore around Start Point and the Lizard Point, where the 60-metre depth contour comes to within 8 kilometres of the coast. Around parts of the mainland coast and the Isles of Scilly a number of submerged cliffs are present, dropping to depths of 70 metres. Otherwise, the large-scale topography of the seabed is generally featureless. However, there are exceptions where igneous rocks outcrop (such as the Eddystone Rocks or around the Lizard), where tidal sand ridges and sand waves are present, or where isolated depressions or deeps occur.

The largest such 'bathymetric depression' is the Hurd Deep, a 50-kilometer long linear feature in the western English Channel that reaches a maximum depth of 172 metres.

Another deep, wide channel extends in a north east/south west direction into the north western part of the Natural Area, is the Celtic Deep. The northern part of this seabed depression lies midway between the Pembrokeshire and Wexford peninsulas.

The bathymetry of the north coast of the Cornish peninsula is relatively smooth, with the seabed sloping steeply out to the 50-metre contour before levelling out onto the west-sloping

continental shelf. The seabed bathymetry gradually becomes uniformly shallower further into the Bristol Channel.

3.3 Tidal currents and range

On the English Channel side of the Natural Area, tidal currents flood eastwards and ebb westwards. The constriction of Atlantic water flow between Start Point and the Cotenton Peninsula on the French coast increases current speed. Currents are at their strongest (in the region of 2 metres per second at mean spring tides) around headlands, such as Start Point, and in the Channel between the Isles of Scilly and the mainland. Within the main embayments, such as Lyme Bay, currents are relatively weak especially in shallow water. For much of the central part of the English Channel the maximum speed of tidal currents is between 0.75 metres per second and 1.25 metres per second (British Geological Survey 1996a).

Within the Bristol Channel, the ebb flow is dominant, with complex circulatory flows around the major sandbanks. On the northern side of the peninsula and into the Bristol Channel, current speeds steadily increase. Admiralty Charts give a maximum surface ebb current of 4.6 metres per second off Foreland Point near Lynton, North Devon, and a maximum flood current of 4.2 metres per second off Weston-super-Mare, Somerset. Offshore, current speeds are slightly lower, ranging from 0.72 metres per second off Lundy to over 3.0 metres per second in the Bristol Deep off Avonmouth (Poulton *et al* 2002).

The tidal range for the southern part of this Natural Area is not particularly large. At Portland at the western boundary to the Natural Area, it is 2.5 metres at mean spring tides. This increases to 4.0 metres in Lyme Bay, increasing to over 4.5 metres towards the west. Tidal range increases progressively offshore into the English Channel and is particularly high near the Channel Islands. On the northern side of the peninsula, the mean tidal range at spring tides along the coast shows a steady and large increase north eastwards, from 5 metres at Land's End to 12.3 metres at Avonmouth. This increase is due to the amplification of the tidal movement as it is funnelled up the Bristol Channel (British Geological Survey 1996b). The tidal range of the Severn Estuary (which abuts the boundary of this Natural Area), at around 12 metres, is the largest in the UK and the second largest in the world.

3.4 Sea-level change

3.4.1 The past and present

Changes in sea level derive from the combined effect of two phenomena. The first are 'local crustal movements' where Scotland is rising and southern England sinking, due to the removal of the weight of ice since the last glacial period. This is also known as isostatic or post-glacial adjustment. The second is a global rise in sea level, which has been estimated as rising at between 1.5 and 2 millimetres per year (IPCC 2001). This is known as eustatic or sea-level change.

Geological evidence for sea-level change in the past may be found in the presence of fossil coastlines (raised beaches, etc) on or inland from the present shorelines, or in the presence of peat and alluvial gravels on or below the sea floor. Multiple or individual raised beaches, ie former beaches which are now higher than the contemporary shoreline or platforms, may produce a stepped or staircase profile to the coast. These features are higher than their modern equivalents, implying a higher sea level during their formation. There is also

evidence for shoreline change in deposits below present sea level and this indicates where coasts have been submerged since the sediments were laid down.

The best estimates of recent sea-level change within this Natural Area are based on information from the tide gauges at Newlyn (adjacent to Penzance in south west Cornwall), with corroborative data from Devonport (Plymouth) and sites further afield (British Geological Survey 1996a). Measurements from 1916 to 1983 show an average rise of about 1.6 millimetres each year (Woodworth 1987), with no recent increase in this rate attributable to global warming. In terms of land-level change, Cornwall is known to be rising at between 0 and 2 millimetres each year (Shennan 1989). The annual rise in sea level for this Natural Area is therefore between -0.4 and + 1.6 millimetres.

3.4.2 The future

As with all predictions of climate and sea level change, the following Figures carry a range of uncertainty with them. Global mean sea level increased by 1.0–1.5 millimetres per year during the 20th century. The Intergovernmental Panel on Climate Change have predicted that mean sea level would rise by 48 centimetres by 2100 and the range will vary by 9-80 centimetres, as a result of the thermal expansion of ocean water and melting ice from the poles. The most recent estimate from the United Kingdom Climate Impact Programme (UKCIP) report predicts rises in sea level in the south east of England by as much as 86 centimetres by 2080 (Hulme *et al* 2002).

The gradual rise in sea level will have serious implications for a number of important coastal wildlife habitats, though it is difficult to say exactly what may happen as the rate will be tempered by the rise in land level too. Habitats particularly vulnerable to 'coastal squeeze' (where they are trapped between an advancing sea and 'fixed' land defences) include shingle beaches, saltmarshes, grazing marshes and estuaries. A good source of further information is on the Proudman Oceanographic Laboratory website (**www.pol.ac.uk/ntslf/reports**).

3.5 Water temperature

Sea surface temperatures in this Natural Area are strongly influenced by the Gulf Stream, which also influences the climate of the west coast Britain. There is also a smaller, yet still significant, warm water current which emerges from the Mediterranean and flows northwards across the Bay of Biscay and affects the marine life around the South Western Peninsula. Thus, there are a number of warm water species, such as the sunset coral *Leptopsammia pruvoti*, the seaslug *Greilada elegans* and the triggerfish *Balistes capriscus*, which are able to survive in this Natural Area.

In winter, relatively warm waters affect the coastal regions of the South Western Peninsula, with average February temperatures ranging from 9 ºC (around Land's End) to 6 ºC (at the mouth of the Severn Estuary, reflecting the close proximity of surrounding land). The waters around the Isles of Scilly are between 0.5-1 ºC higher than at adjacent mainland sites during the winter. In August, surface water temperatures throughout the Natural Area are approximately 16 ºC (Lee & Ramster 1981), though temperatures are likely to be slightly higher closer to the coast.

3.5.1 Predicted rises in seawater temperatures

According to UKCIP predictions (**www.ukcip.org.uk**), a gradual rise in seawater temperature in the coastal waters surrounding Britain and Ireland may already be occurring, and by 2100 average temperatures may be 2 °C higher compared to 2000. Air temperatures are also rising. Hiscock *et al* (in prep) report that it is most likely that inshore seawater temperatures around Britain and Ireland will increase progressively over the next 50-100 years, according to the most recent predictions and historical precedents. By the 2050s, surface seawater temperatures may be as much as 2.5 °C higher in summer and 2.3 °C higher in winter than in 2000 (Viles 2001). It may be that, in enclosed waters especially, the rise of inshore seawater temperature may be higher than the average on the open coast.

Hiscock *et al* (in prep) predict the effects that seawater temperature rises may have on marine wildlife. Increasing temperature will induce changes in the abundance and distribution of species, but there will not be a wholesale movement northwards of southern species or a retreat northwards of northern species. Factors such as the hydrodynamic characteristics of water masses, the reproductive mode of species, the presence of geographical barriers and the longevity of already established species, will be important in determining whether or not there is a significant change in species distribution and abundance in the next hundred years.

3.6 Salinity

The body of water present within this Natural Area is Atlantic in origin, with a relatively high mean surface salinity of 35.2 in the summer off Land's End (Barne *et al* 1996). Salinity remains fairly constant moving eastwards into the English Channel (though it decreases closer to the shore due to freshwater inputs). Reduced salinity is more noticeable along the northern boundary into the Bristol Channel (with mean values of 34 being recorded from the 'mouth' of the Bristol Channel, ie between Bideford Bay, in North Devon, and St Govan's Head, in Pembrokeshire).

3.7 Water quality

About 80% of marine pollution comes from a variety of land-based activities (Defra 2002a). Most pollutants enter the waters of the South West Peninsula through direct discharges of effluents or land run-off (mainly via rivers). The highest concentrations of contaminants, and hence the greatest effects, are therefore often in inshore areas. Additional inputs include sources at sea (ships, offshore platforms, dumping of dredged materials) and atmospheric deposition. On entering the sea, the fate and behaviour of chemicals will vary markedly depending on their physio-chemical properties, and the physical characteristics of the receiving environment. The following section provides a summary of the water quality in the Natural Area, including consideration of sediment and biota quality.

3.7.1 Turbidity

Turbidity is a measure of the decrease of light down through the water column and is primarily due to Suspended Particulate Matter (SPM), including plankton; plankton is dealt with in greater detail in section 4.1.1. Turbidity can affect water quality in a number of ways, especially in relation to oxygen levels, algal growth, nutrient cycling and the availability of particle reactive contaminants.

Within this Natural Area, the regions with the greatest concentration of SPM (and therefore greatest turbidity) occur nearer the coast, particularly in the vicinity of estuaries (OSPAR 2000b). Areas with lower concentrations of suspended particulate matter (and therefore lower turbidity) tend to occur further offshore.

The turbidity similarly affects the pattern and levels of plankton in the waters of this Natural Area. As most plankton species are neritic (of coastal waters), the highest concentrations of plankton tend to be found inshore.

In the St Austell area of south Cornwall, increased turbidity has affected nearshore water quality. This has been caused by inert and non-toxic china clay waste washing from nearby workings into Mevagissey Bay, and to a lesser extent into neighbouring St Austell Bay (Crumpton & Goodwin 1996).

3.7.2 Non-toxic contaminants

3.7.2.1 Organic matter

Organic matter can enter the marine environment through externally and internally derived sources. External inputs of organic matter include point source discharges of sewage and industrial effluents, and diffuse sources such as agricultural run-off. Organic matter can enter the marine environment in both dissolved and particulate form. However, in common with most land-based sources of pollution, the effects from these inputs are more noticeable in estuaries and nearshore areas and are unlikely to be detected in offshore locations within this Natural Area. Inputs of organic matter result in an increased Biochemical Oxygen Demand (BOD) in receiving waters, which can lead to oxygen depletion in water and sediments. Reductions in point sources of organic matter are being addressed through the implementation of the Urban Waste Water Treatment Directive (91/271/EEC).

3.7.2.2 Nutrients

Nutrients (dissolved and particulate forms of nitrogen, phosphorus and silicon) play an important role in aquatic ecosystems as they form the basis for primary productivity. Nitrogen and phosphorus enter the marine environment predominantly from point sources, such as sewage treatment works and from diffuse sources, such as agricultural run-off. Rivers often transport nutrients from both sources. In nutrient-poor waters, atmospheric deposition of nitrogen can be a significant source of this nutrient. Silicon, essential for the growth of diatoms but of less importance for other marine organisms, enters the Eastern Channel predominantly via rivers.

The ratio of nitrogen/phosphorus consumption for marine phytoplankton is 16:1, and under normal circumstances, nitrogen is the limiting nutrient in marine waters (North Sea Task Force 1993). Nutrient enrichment could have little or no impact on aquatic environments, depending on the influence of a number of physical, chemical and biotic factors (Scott *et al* 1999). In some cases, enrichment of marine waters with nutrients may stimulate accelerated growth of algae or other higher plant forms, and result in adverse ecological impacts. This process is known as eutrophication. Observable signs of eutrophication in the marine environment include repeated phytoplankton blooms, increased fluctuation in dissolved oxygen concentrations, increased turbidity, and increased occurrences of toxic blooms. These effects are more likely to be observed in estuaries and nearshore areas.

On occasions during the summer months, a number of the smaller estuaries and inlets along the coastline of the Natural Area have shown local eutrophication resulting from elevated nutrient levels from time to time during the summer months. For instance, in the Exe Estuary, sewage discharge and run-off from agricultural land has produced elevated nutrient levels in the water column. In part of the Fal in south Cornwall, a loss of species richness recorded in the early 1990s was traced to locally high nutrient levels, together with elevated concentrations of metals from mining activity (Crumpton & Goodwin 1996).

Improvements to sewage treatment under the Urban Waste Water Treatment Directive are likely to reduce some point sources of nitrates. The implementation of the Nitrates Directive (91/676/EC) will also provide some controls on nitrate from diffuse agricultural sources. This Directive requires Member States to designate Nitrate Vulnerable Zones (NVZs) and to produce action plans to reduce nitrate run-off from agricultural areas. Those areas already identified are shown in Figure 3.4. In the first instance, these measures are established to ensure that nitrate levels in rivers and groundwater are below 50 milligrams per litre (drinking water standard).

The catchment of the Fal Estuary was designated a Nitrate Vulnerable Zone in October 2002.

3.7.3 Toxic substances

3.7.3.1 Oil

The input of any petroleum hydrocarbons within this Natural Area will most likely to be the result of sea-based activities (eg shipping) or coastal discharges of sewage and industrial effluents. Oil spills may occur from ships and can be as a result of both legal and illegal discharges or accidents. The majority of these spills consist of ship's 'bilge oil' and, increasingly, heavy fuel oil, but crude oil and lubricating oils also occur along with non-mineral oils (OSPAR Commission 2000b).

3.7.3.2 Trace metals

Trace metals reach the marine environment predominantly via rivers, direct discharges and from some sea-based activities, such as exploitation of offshore resources and dumping of dredged materials. Highest concentrations of trace metals are found near freshwater outlets, with much lower levels in the open sea.

Concentrations of dissolved metals in water vary considerably depending on a number of factors including the mixing of river and seawater, interactions with particles and the inputs from industrial and sedimentary sources (Millward & Turner 1995). In Cornwall, water quality in the past has been affected mainly by mining activity. Levels of silver in the east Looe Estuary have been high (North Sea Task Force 1993), and there have also been raised levels of trace metals in the Fowey Estuary (Fowey Harbour Commissioners 1996), and in the Fal, the latter due to drainage water leaking from disused tin mines.

Some metals show a strong affinity for particulates, will accumulate in sediments and may subsequently bioaccumulate up the food chain. Monitoring for the National Monitoring Programme (NMP) between 1992 and 1995 found higher concentrations of metals in

sediments at estuarine sites than at offshore sites (Marine Pollution Monitoring Management Group 1998).

CEFAS (1998) reported relatively low concentrations of metals in the liver and muscle of dab *(Limanda limanda*) caught within this Natural Area. Mercury and arsenic in muscle samples ranged from 0.04 to 0.07, and 4.7 to 5.5 mg/kg respectively. Lead in liver samples was reported as 0.09 mg/kg, and cadmium was undetected.

3.7.3.3 Trace organics

It has been estimated that there are probably more than 60,000 organic pollutants present in the marine environment (Maugh 1978). The following section provides information on some of the more commonly studied groups of chemicals.

3.7.3.4 Organo-tin compounds

Tributyl tin (TBT) is widely used as an anti-fouling agent in paint for ships. Its use has been banned for vessels under 25 metres in length since 1987, since it was shown to have harmful effects on molluscs such as dogwhelks and oysters. But, it is still commonly used on vessels longer than 25 metres. These vessels still act as a major source of TBT to the marine environment. TBT concentrations in offshore waters are generally less than 1 µg/l when compared with values recorded up to 100 µg/l in frequently used waterways. The current Environmental Quality Standard for tributyl tin in seawater is 2 µg/l (Cole *et al* 1999). Neither CEFAS (2001) nor Thomas *et al* (2000) detected TBT in water and sediment analysed from offshore stations within the Natural Area. However, TBT has been detected in the tissue of pelagic cetaceans, for example CEFAS (2001) reported a concentration of 33 µg/kg in the liver of a Risso's dolphin found off the Cornish coast.

The International Maritime Organisation adopted a Convention on the Control of Harmful Anti-fouling Systems at a Conference in October 2001. Amongst other measures, this (a) prohibits the application or re-application to ships of organo-tin (TBT) compounds as biocides in antifouling systems from 1 January 2003; and (b) requires that vessels already painted with organo-tin compounds acting as biocides either remove the paint or cover it with an impermeable barrier by 1 January 2008[4].

3.7.3.5 Polychlorinated biphenyls (PCBs)

Historically, the majority of PCBs entering coastal waters have been from riverine inputs, whereas atmospheric deposition was a more important input to the open sea. The main source has been the disposal of electrical equipment (OSPAR Commission 1998). It is estimated that more than 90% of the total release of PCBs occurred before 1980, though low levels of release do still occur. Due to the hydrophobicity (water repellence) of these compounds, concentrations in surface waters are extremely low, and in most cases

[4] The provisions of the Convention are being implemented in Europe by two instruments:

- Directive 2002/62/EC, which amends Directive 76/769/EEC and prohibits the placing on the market of organotin compounds as biocides to prevent the fouling of all craft used in marine, coastal, estuarine and inland waterways and lakes.
- Council Regulation (EC) 782/2003 addressing vessels already treated with organotin compounds as biocides.

undetectable (MPMMG 1998). PCBs are persistent, will bind to sediments and can be accumulated up the food chain.

Concentrations in sediment and biota are markedly higher in nearshore areas than the open sea. For example, CEFAS (1998) found concentrations of PCBs in offshore sediment within this Natural Area up to 0.49 µg/kg. According to concentration guidelines defined by Wells *et al* (1989), these sediments fall into the "slightly contaminated" category. These concentrations contrast with a station further inshore adjacent to the Tamar of 10.18 µg/kg. Levels found here are comparable with data collected on dredged sediment taken from UK estuaries, which typically contain 10µg/kg (CEFAS 2001). CEFAS (1998) reported PCBs in dab liver of between 0.079 and 0.1 mg/kg, collected from offshore stations within this Natural Area.

3.7.3.6 Polycyclic aromatic hydrocarbons (PAHs)

PAHs are formed during the incomplete combustion of fossil fuel, and are also components of petroleum products. They can enter this marine Natural Area via industrial and sewage discharges, surface run-off, atmospheric deposition and oil spills. MPMMG (1998) found that the highest concentrations of PAHs in the water column were in estuaries, (with total PAH concentrations >1 µg/l). At sites further offshore, PAHs were undetectable. Like PCBs, most PAHs show a strong affinity for particulates and may accumulate in sediments and bioaccumulate up the food chain. CEFAS (1998) reported concentrations in sediments collected offshore from the Tamar Estuary and off Plymouth Sound of 0 and 2,579 µg/kg. This compares with concentrations of over 7,000 µg/kg found in sediments taken from the Tamar Estuary.

3.7.3.7 Endocrine distrupters

Some contaminants can act as endocrine (hormone) disrupters as they have the ability to adversely change endocrine function in fish and other animals. Known, or potential, endocrine disrupters include natural and synthetic hormones, and industrial chemicals. The Quality Status Report on the Celtic Seas (OSPAR Commission 2000b) highlighted that more research was needed into the effects of endocrine disruption in marine species.

Allen *et al* (2000) report that reliable information on the effects of endocrine disrupters in aquatic wildlife is patchy, with the most complete data available for fish exposed to oestrogens and their mimics. Relatively poor information is available on other marine vertebrates such as birds and mammals. Knowledge of endocrine disruption in invertebrates is even sparser because their endocrine systems are poorly understood, although there is one example (the effects of tributyl tin in molluscs) that is well documented.

A recent report on Endocrine Disruption in the Marine Environment (Defra 2002b) details the findings of a £1.5 million three-year project involving Defra, Government agencies and the chemical industry's Long-Range Research Initiative. The project found that endocrine disruption does occur in some species at certain estuarine locations, and a range of chemicals may be implicated. There is insufficient field data currently available to assess whether such changes impact on reproductive success.

3.7.3.8 Radionuclides

Radioactivity has both natural and man-made sources. Inputs to the sea from natural sources, which are often enhanced by human activities, originate mainly from mining and ore processing, oil and gas extraction, burning coal, oil or natural gas in thermal power plants and the production of phosphate fertiliser (OSPAR Commission 2000b; European Commission 2002) - although there is no phosphate fertiliser production which would affect this Natural Area.

A variety of artificial radionuclides are discharged directly into the Severn Estuary, and these are likely to enter the waters of this Natural Area. Their sources include the nuclear power stations at Oldbury and Hinkley Point, and local hospitals around the estuary. On the English Channel coastline, sources of artificial radionuclides which affect the Natural Area are the Devonport Dockyard in Plymouth, where nuclear-powered submarines are serviced, and the UK Atomic Energy Authority site at Winfrith, Dorset, which is currently being decommissioned. Other sources of artificial radioactivity in the area include discharges from the nuclear fuel reprocessing plants at Sellafield (Cumbria) and Cap de la Hague (near Cherbourg, north west France), as well as fallout from the Chernobyl accident and atmospheric nuclear weapons testing in the 1950s and early 1960s.

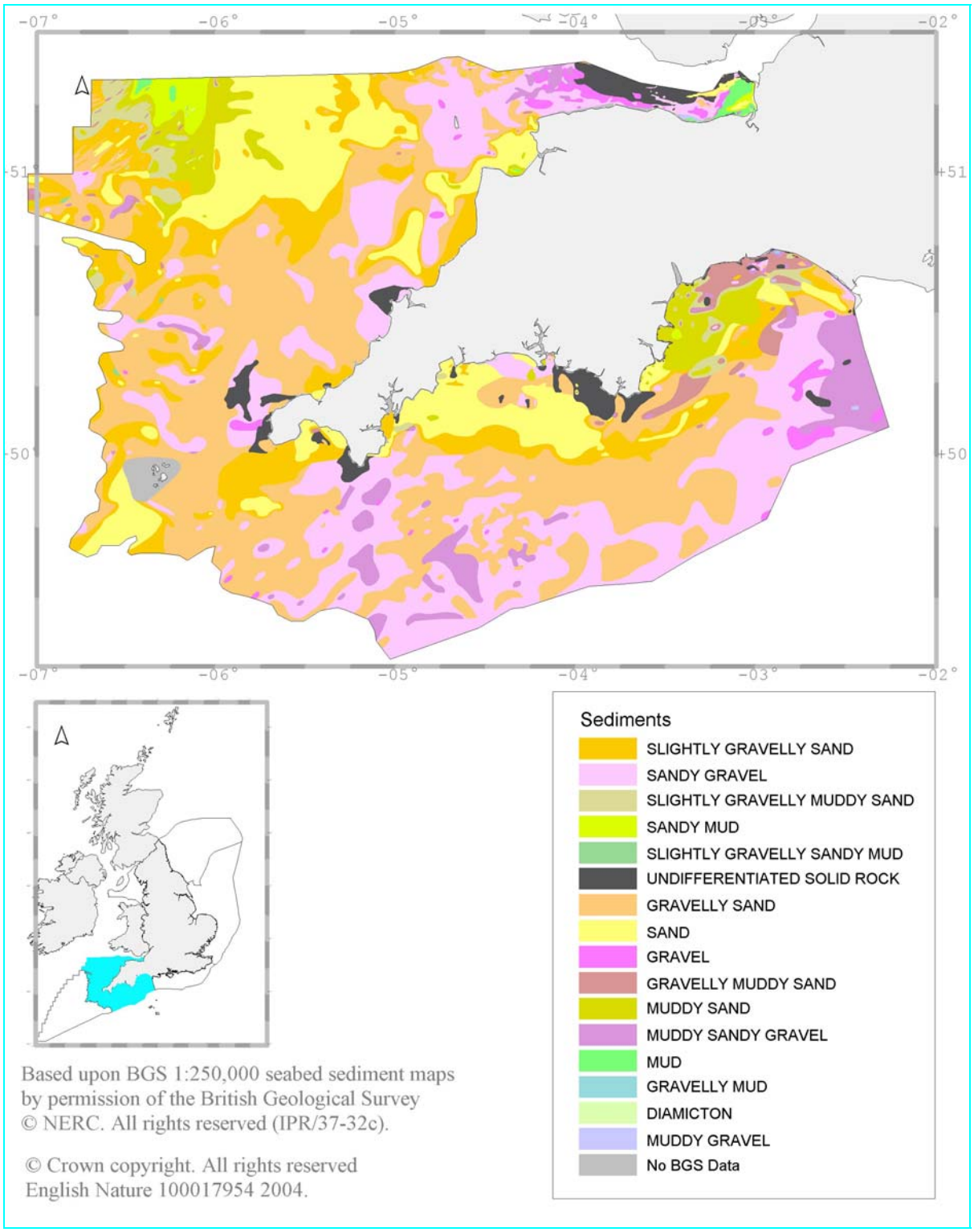


Figure 3.1 Seabed sediments of the South Western Peninsula Natural Area (taken from Poulton *et al* 2002). See Figure 3.2 for a definition of sediments.

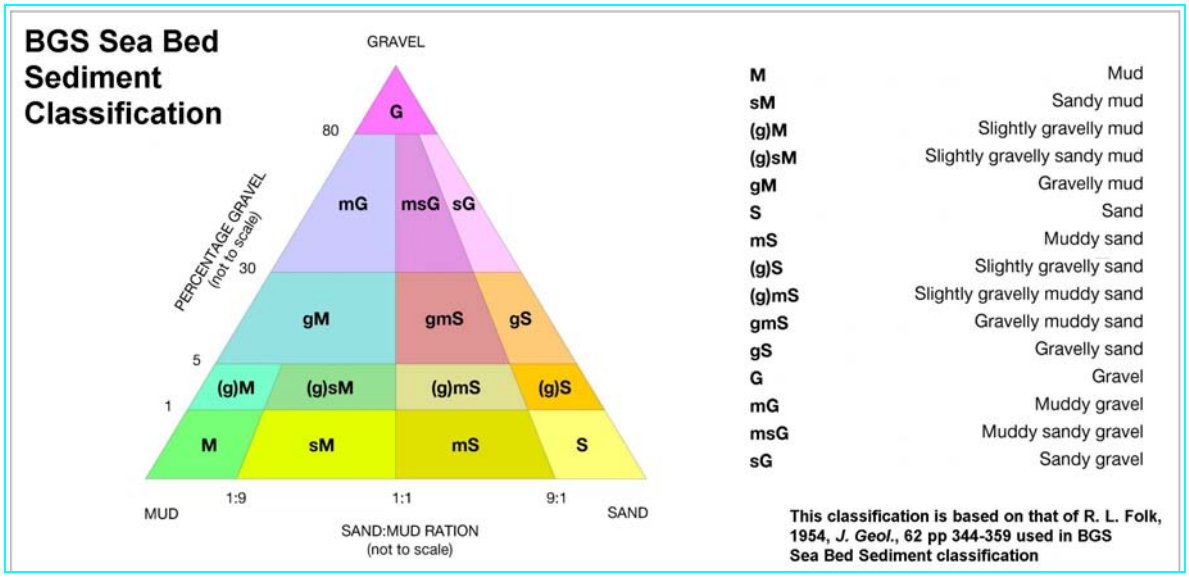


Figure 3.2 British Geological Survey sea bed sediment classification taken from Poulton *et al* (2002).

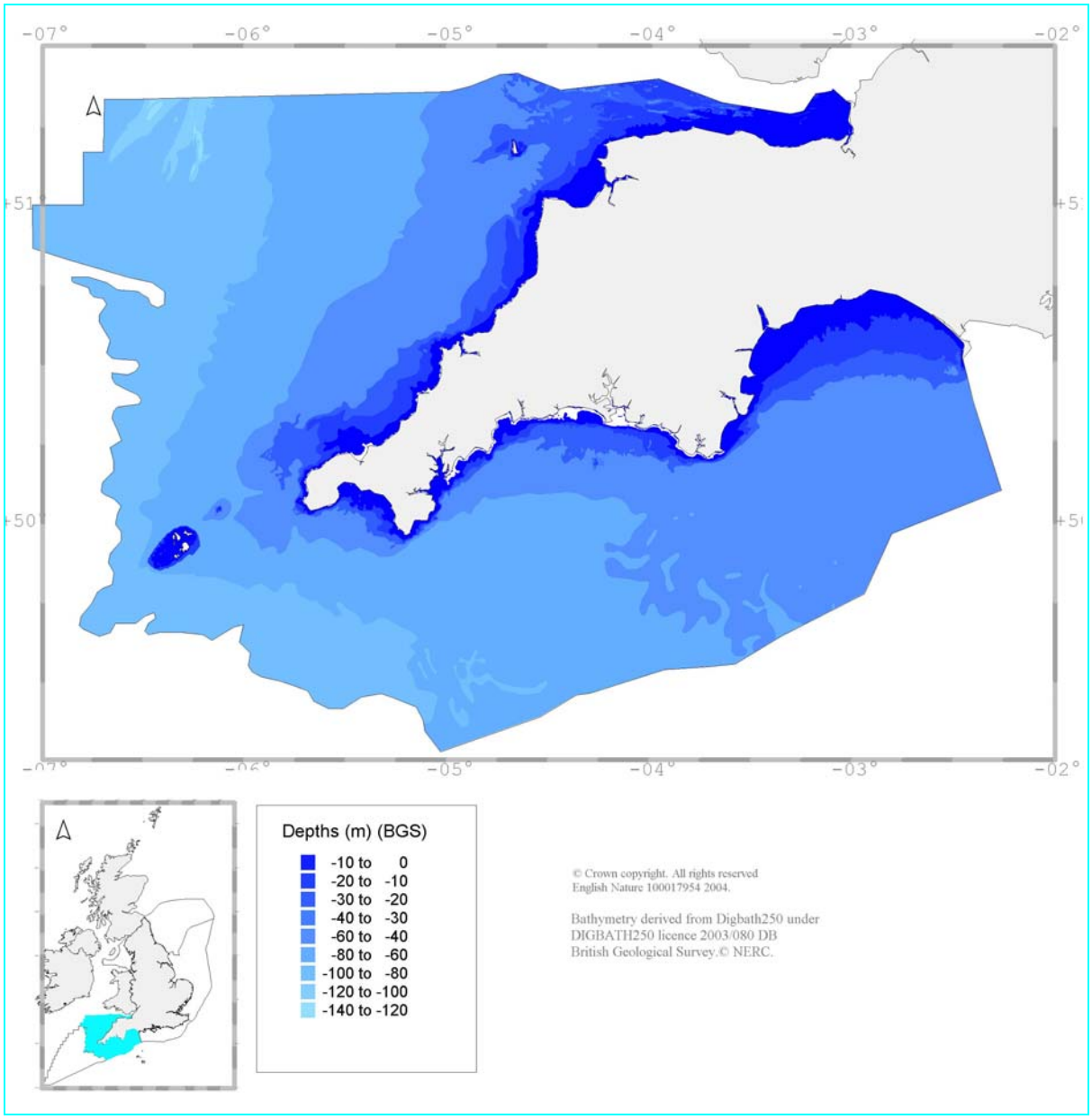


Figure 3.3 Bathymetry of the South Western Peninsula Natural Area.

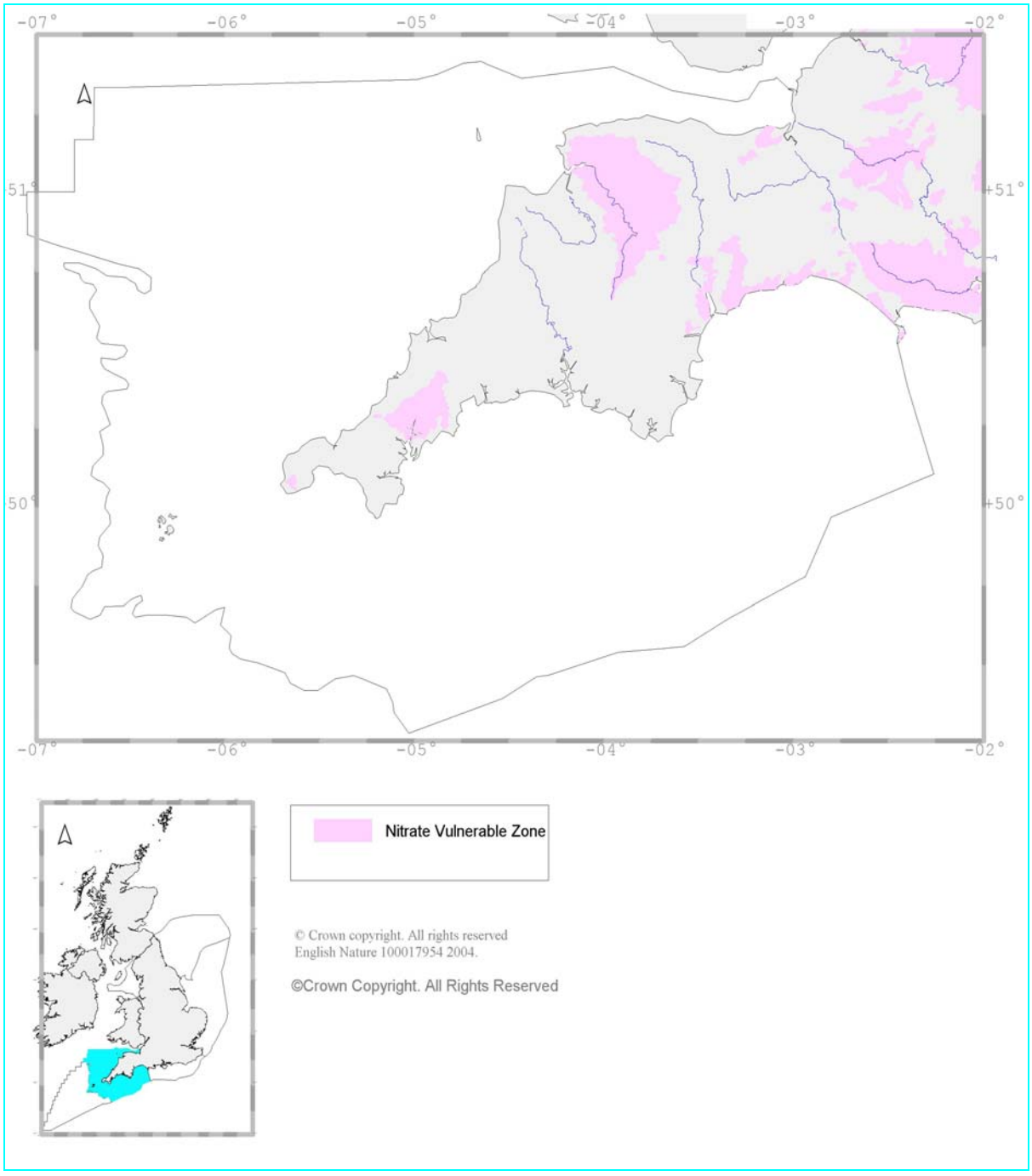


Figure 3.4 The distribution of Nitrate Vulnerable Zones (NVZ) adjacent to this Natural Area (map provided by Defra).

4 Key habitats

This section describes the main habitats in the South Western Peninsula Marine Natural Area. Different initiatives have used different ways of classifying seabed habitats (particularly the Habitats Directive and the Biodiversity Action Plan systems identified in Table 4.2 and Appendix 2). Here we have taken account of both. This section gives a description of the water column (to highlight its importance), the seabed geology and the different types of sediment and rock habitat present, largely based on information provided by the British Geological Survey. However, certain habitats that are formed by plants or animals are also described to highlight both their conservation and functional importance. For each feature, the main specific conservation measures currently in place are noted, to indicate the effort being made towards their protection.

The intention is to provide the 'big picture' with selected highlights rather than a detailed description of habitats which would repeat information provided elsewhere (such as designated site citations or environmental statements).

4.1 The water column

The waters around the South Western Peninsula are largely influenced by the Atlantic (particularly the Gulf Stream), and to a lesser extent by a weak current from the Mediterranean. The waters here support important fisheries and, in addition to commercial species of fish, the rich supply of plankton attracts a variety of other species, including jellyfish, sunfish *Mola mola* and the basking shark *Cetorhinus maximus.* The coastal waters here have some of the richest and most diverse populations of non-exploited fish in British waters, with 181 species recorded out of the 336 found around the UK coast (Potts & Swaby 1996). This high diversity of fish species in particular is attributable to the presence of southern species on the edge of their distribution, and ocean vagrants brought in on the North Atlantic Drift (see also section 5.4).

Plankton (both phytoplankton and zooplankton) provide a fundamental role in the food chain of pelagic (oceanic) wildlife. Any stress on the plankton will have consequences throughout the food chain and may affect the food available to those at the top of the food chain such as fish, birds and marine mammals etc (Edwards and John 1996). The abundance of plankton is strongly influenced by factors such as depth, tidal mixing and temperature stratification (layering), all of which determine the vertical stability of the water column. The distribution of plankton species is influenced directly by salinity and temperature, by water flows in the area and by the presence of local seabed communities.

Plankton blooms occur through late spring to early summer as daylight increases and the seawater gradually warms. Seasonal shoals of fish such as mackerel *Scomber scombrus*, herring *Clupea harengus* and sandeels *Ammodytes* spp. also occur. These, in turn, are exploited by a variety of other animals and provide a vital food resource for birds such as storm petrel *Hydrobates pelagicus,* Manx shearwater *Puffinus puffinus*, gannets *Morus bassanus,* terns *Sterna* spp. and guillemots *Uria aalge.*

These waters support important commercial fisheries, with several species of fish feeding directly on plankton.

4.1.1 Fronts

Fronts indicate transition zones, usually between 'layered' and 'well mixed' waters and give rise to a marked horizontal temperature gradient in the surface layers. There are three fronts within this Natural Area (see Figure 4.1). A front divides the shallows of Lyme Bay from deeper offshore water, approximately following the 40-metre contour. A second front runs south from Bigbury Bay, west of Start Point, in an 'S' shape. Another front curls around Land's End, while a fourth snakes out from near Boscastle on the north Cornwall coast in a north westerly direction. A number of seasonal fronts appear in the waters adjacent to the Scilly Isles from time to time. On the landward side of these fronts there is mixed water, while on the open sea side there is stratified water.

These frontal regions represent important physical, chemical and biological boundaries. Studies have shown that these boundaries are significant in determining distributions of phytoplankton (Pingree *et al* 1975). This is because the features of frontal systems largely influence the availability of light and nutrients to plankton. Within the frontal zone both primary and secondary production are enhanced, and this attracts fish, birds and cetaceans.

4.1.1.1 Nature conservation measures

There are no conservation measures that specifically protect fronts. However, fronts may be subject to some indirect conservation measures if they support concentrations of individuals from a species that qualifies for protection.

4.2 Seabed substrata

The benthic habitats of the South Western Peninsula Natural Area are defined primarily by the seabed substrata. Within the Natural Area the seabed is varied, ranging from the fine muds of sheltered estuaries and rias (drowned river valleys, resulting from post-glacial rise in relative sea level), to exposures of granite bedrock, and to a lesser extent sandstone, limestone, shales and mudstone. In general, the nearshore seabed is composed of an assortment of mixed sediments (especially gravel and shells) with sand and, in sheltered locations, mud. Where mixed sediments are consolidated and stable, an associated rich fauna more characteristic of rocky areas can develop. There are also occasional and sometimes extensive exposures of bedrock and boulder reefs, often occurring off headlands. In deeper water, which may not be that far from the shore, the seabed is dominated by sediments, mainly of sand, sandy gravel and gravel (see Figure 4.2).

The coastline of south Devon and Cornwall is predominantly fringed with rock, and this typically extends beyond Low Water Mark into the subtidal. Of particular note are spectacular rocks and reefs, many of which rise steeply from the deep seabed to within a few metres of the surface. Much of the coastline is wave exposed, with the shallows dominated by kelps and other seaweeds. Where rocks extend deeper offshore, conditions are calmer and extremely rich animal communities are present, often with spectacular growths of dead man's fingers *Alcyonium digitatum*, pink sea fans *Eunicella verrucosa*, jewel anemones *Corynactis viridis* and Devonshire cup corals *Caryophyllia smithii*. Isolated rocks, particularly off headlands such as the Lizard, are affected by strong tidal currents which encourages lush growths of sponges and anemones, filtering food from the passing water (English Nature 1997b).

Nearshore rocky reefs extend along the north coast of Cornwall and Devon too, particularly adjacent to hard cliffs and shores. The reefs around the Isles of Scilly, 45 kilometres west of Land's End, and the island of Lundy, some 18 kilometres north of Hartland Point, are of particular importance and are described in more detail below.

As a result of this mosaic of different sediment types there are a wide variety of habitats found on the seabed of this region. Sediments are generally classified by either the Folk (1954) or Wentworth (1922) systems (the Wentworth scales divides the Folk classes into smaller fractions – see Appendix 3). The habitats below are described using a modified version of the Folk classification, since more detailed information of the seabed sediments is currently unavailable for the whole of the Marine Natural Area. As different types of sediment grade into one another, separating gravel, sand and mud habitats (as we have done here) is simply a means of dividing up what is a continuum. An exception to this is the "muddy gravel" which, in terms of ecology is closer to mud rather than gravel habitats and is therefore included with the former. One outcome of using the Folk classification is that areas defined as gravel by the British Geological Society may include cobbles, boulders, pebbles, and granules (see Appendix 3). Stable aggregations of boulders and cobbles may be considered to constitute reef habitat (for example under the Habitats Directive, Johnston *et al* 2002) and this is reflected in the text.

The JNCC have developed the Marine Nature Conservation Review (MNCR) biotope classification system (Connor *et al* 1997)[5] which has been used here to describe the biological characteristics of each habitat type. The MNCR standardised the description of benthic communities throughout the UK and this provides a framework for assessment and future surveys. The biotope classification takes into account not only the most dominant species present but also the substrate, currents and other physical factors known to have an influence on the communities present.

4.2.1 Gravel habitats

The particle structure of these habitats ranges from various combinations of sand and gravel to pure gravel. The diversity and types of community associated with this habitat type are determined primarily by the sediment type, and also a variety of other physical factors such as the relative exposure of the coast and differences in the depth, turbidity and salinity of the surrounding water.

Several areas of gravel occur offshore within this Natural Area and dominate the seabed at the south east and north east margins (Figure 4.2). Inshore and adjacent to Chesil Beach, gravels occur out into Lyme Bay, though as a result of their mobile nature these support a relatively impoverished epifauna. Further west off Start Point, the seabed is composed of areas of mobile sand and gravel, interspersed with bedrock outcrops covered in a rich turf of animal species (Irving 1996a). These are described in more detail in the next section on sand habitats.

Exposed gravel is often colonised by keelworms *Pomatoceros triqueter* and by barnacles *Balanus* spp. On deeper areas of stable gravel and cobbles, the hydroids *Halecium halecinum*, *Kirchenpaueria pinnata*, *Hydrallmania falcata* and *Nemertesia antennina* are found. The foliose bryozoan *Flustra foliacea* occupies a similar niche. Mobile species

[5] At the time of writing, JNCC were revising the classification. Latest updates can be seen at www.jncc.gov.uk/marine/biotopes/default.htm

commonly found on gravel include the whelk *Buccinum undatum*, topshell *Gibbula cineraria* and the netted dogwhelk *Hinia reticulata*, together with hermit crabs *Pagurus* spp. and swimming crabs *Liocarcinus* spp. In general, the gravel habitats found in deeper offshore areas (>30 metres) tend to be less affected by natural disturbance than those found closer inshore. As a result they tend to support a more diverse marine fauna. This may include a wide range of anemones, polychaete worms, bivalves and amphipods, and both mobile and sessile epifauna. It is likely that the sandy gravels adjacent to the southern margin of the Natural Area support these fauna.

4.2.1.1 Nature conservation measures

Gravel habitats are covered by a priority Habitat Action Plan for sublittoral sands and gravels (UK Biodiversity Group 1999).

However, no provision for gravel habitats is made under the Habitats Directive. They do not meet the definition of 'Sandbanks which are slightly covered by seawater all the time' given under the Directive, since this habitat is restricted to sediments which predominantly comprise sand (0.0625-2 millimetres). However, some gravel habitat may meet the definition of 'Reefs' under the Directive, where they are predominantly composed of stable boulders and cobbles, as these can form a reef-like structure.

At present, all marine candidate Special Areas of Conservation (which form part of the Natura 2000 network) are adjacent to the coast. Work is underway to identify offshore sites both beyond 12 nautical miles (see Johnston *et al* 2002), and within English territorial waters. Preliminary work has been undertaken to derive areas of seabed which contain qualifying habitat and this is shown in Figure 4.3. Further work is being undertaken to verify and refine these areas, eg to identify reef and reef-like habitat within areas of rocky or gravelly habitat. Prior to the identification of proposed Natura 2000 sites, locations supporting relevant features of interest should be treated with care to ensure that they are not damaged or altered in such a way that might affect their selection as Natura 2000 sites

See Table 4.2 for a summary of the conservation measures.

4.2.2 Sand habitats

Sand habitats are widespread throughout much of this Natural Area (see Figure 4.4), particularly in the west of Lyme Bay, in the large embayment between Salcombe and the Lizard, in Mount's Bay, to the south west of the Isles of Scilly, off Port Isaac Bay, in Bideford Bay and in the approaches to the outer Bristol Channel. The nearshore seabed sediments between Bridport and Budleigh Salterton mostly comprise gravelly sands.

Sandy sediments are found in regions of moderate to strong tidal currents where they are able to settle. In such situations, the sand tends to be coarse and clean with little silt/mud, but occasional shell fragments are likely to be present. This is certainly true of the shallow sand deposits that accumulate in sheltered conditions between the islands in the Isles of Scilly. Much of the sand here is formed of coarse, clean particles of granite rock. However, there are also places, such as the sheltered beach at Porth Mellon on St Mary's, where very fine sand is found. Finer sediments of fine sands and silt are deposited in deeper water too, where the effect of the waves on the seabed is limited.

The communities which these sand areas support are determined by a number of factors including the exact nature of the sediment, the relative exposure of the coast and differences in the depth, turbidity and salinity of the surrounding water. More mobile sand habitats tend to be characterised by robust fauna and sometimes impoverished faunas. Venerid bivalves, amphipods (shrimps), polychaetes (worms) and heart urchins are particularly characteristic (see Table 4.1 for MNCR biotopes). These areas also provide nursery grounds for juvenile fish such as plaice *Pleuronectes platessa*, sole *Solea solea* and cod *Gadus morhua* (Brown *et al* 1997), which feed on the invertebrates present. Sand habitat in deeper water, and where currents are weak, can support a more delicate fauna.

Subtidal sediments consisting of muddy sand are either restricted to areas sheltered from the prevailing winds and currents (eg the western side of Lyme Bay), or to areas of seabed deeper than 50 metres where there is little or no wave action (such as in the approaches to the outer Bristol Channel). Most of the rias within the region have areas of shallow or intertidal sandbanks, often with areas of subtidal muddy gravel. On the south coast of Devon, the seabed of Tor Bay is of relatively uniform muddy sand that supports a diverse burrowing community dominated by bivalves, brittlestars and anemones. A small yet important population of the unusual burrowing red band fish *Cepola rubescens* was discovered in the Bay (Devon Wildlife Trust 1995), with other small populations reported from Brixham Harbour (as well as from more muddy sediments). The rare black-faced blenny *Tripterygion atlanticus* has also been found in Tor Bay (English Nature 1997a).

Sediments of muddy sand in Lyme Bay support a community dominated by the bivalve *Corbula gibba*, the polychaete worms *Chaetozone setosa* and *Megalona filiformis* and the amphipod *Bathyporeia tenuipes* (Ambios Environmental Consultants 1995). Elsewhere in Lyme Bay a number of rare infaunal species have been recorded, such as the worm anemone *Scolanthus callimorphus*, the bristle worm *Sternapsis scutata* and the mantis shrimp *Rissoides desmaresti*. A small area of fine sand and mud sediment is present off Whitsand Bay to the west of Plymouth Sound (Figure 4.4). The infaunal communities here are dominated by polychaetes but include sea cucumbers *Leptosynapta inhaerens* and *Trachythyone elongata* and the burrowing prawn *Callianassa subterranea*.

A number of the sediment-dwelling species that occur off the south coast of Devon and Cornwall have a distribution which is limited to south western waters. Of particular note is the rich shell fauna, including species such as the bivalve *Callista chione* (English Nature 1997a). Steven's goby *Gobius gasteveni*, a rare fish thought to be close to its northern limits in the English Channel, has been recorded from offshore sediments within the Natural Area, at seabed depths between 35-100 metres. In the tide-swept waters around Start Point, 'mobile dunes' of coarse sand are present (English Nature 1997a). A little further west, areas of clean sand off Plymouth Sound support an infaunal community featuring polychaetes, amphipods and bivalves, particularly *Dosinia exoleta* and *Abra prismatica* (Hiscock & Moore 1986).

The JNCC Marine Nature Conservation Review (MNCR) biotope classification scheme (Connor *et al* 1997) has identified a number of biotopes which may be found associated with the sand substrata of this Natural Area (see Table 4.1).

4.2.2.1 Nature conservation measures

Sand habitats are covered by a priority Habitat Action Plan for sublittoral sands and gravels (UK Biodiversity Group 1999).

The Habitats Directive includes the habitat "Sandbanks which are slightly covered by seawater all the time". In the UK this has been interpreted as comprising a range of sandy sediments (particle size range 0.0625-2 millimetres and where sand is dominant), on distinct banks which may arise from horizontal or sloping plains of sandy sediment. Water depth for this habitat is seldom more than 20 metres below chart datum (European Commission 1999), so it excludes deeper relict sandbanks. Thus shallow sandbanks and mounds may be designated as SACs but large, flat areas of sand habitat may not be selected. Sandbanks which are vegetated by *Zostera* spp. are also included in this habitat type. Four candidate SACs have been designated for sandbank habitat in this Natural Area: Isles of Scilly, Lundy, Fal and Helford, and Plymouth Sound and Estuaries (see Figure 4.5).

At present, all marine candidate Special Areas of Conservation (which form part of the Natura 2000 network) are adjacent to the coast. Work is underway to identify offshore sites both beyond 12 nautical miles (see Johnston *et al* 2002), and within English territorial waters. Preliminary work has been undertaken to derive areas of seabed which contain qualifying habitat and this is shown in Figure 4.5. Further work is being undertaken to verify and refine these areas, eg sandbanks within the broad swathes of shallow sandy seabed. Prior to the identification of proposed Natura 2000 sites, locations supporting relevant features of interest should be treated with care to ensure that they are not damaged or altered in such a way that might affect their selection as Natura 2000 sites.

See Table 4.2 for a summary of the conservation measures.

4.2.3 Mud habitats (including muddy gravel)

As a result of the exposure of much of the open coast and nearshore waters of the South Western Peninsula to wave action and tidal streams, there are few areas of shelter which allow for finer sediments to settle. Consequently, mud habitats are either restricted to those areas offering some shelter from the prevailing winds and currents, such as in Tor Bay, or to deeper areas of seabed where the effects of wave action are diminished, such as in the outer Bristol Channel. The main areas of muddy habitat can be seen in Figure 4.6.

Note that estuarine areas, harbours and rias tend to be dominated by muddy habitats, are excluded from this Marine Natural Area Profile but are described in the relevant Coastal Natural Area Profiles. Most of the rias within the region have areas where shallow or intertidal sand and mud banks are present, often with areas of subtidal muddy gravel. The burrowing red band fish *Cepola rubescens* has been found in sheltered sandy or gravelly mud, such as off the east coast of Lundy.

A small area of fine sand and mud sediment is present off Whitsand Bay to the west of Plymouth Sound (Figure 4.5). The infaunal communities here are dominated by polychaete worms but include the sea cucumbers *Leptosynapta inhaerens* and *Trachythyone elongata* and the burrowing prawn *Callianassa subterranea*. Further west, the sediment becomes muddier, being characterised by an *Echinocardium cordatum – Amphiura filiformis* (heart urchin/brittlestar) community (Irving 1996a).

The JNCC Marine Nature Conservation Review (MNCR) biotope classification scheme (Connor *et al* 1997) identified a number of biotopes which may be found associated with the mud habitats of this Natural Area (see Table 4.1).

4.2.3.1 Nature conservation measures

Two types of mud habitat are covered by Habitat Action Plans (HAPs), 'Sheltered muddy gravels' and 'Mud habitats in deep water'. The former primarily covers muddy gravels in estuaries, rias and sea lochs , which do occur in this Natural Area. The latter HAP applies to mud habitats below 20 to 30 metres.

Subtidal mud habitat is not listed on the Habitats Directive but may be included as a constituent of 'Large shallow inlets and bays' and 'Estuaries'. The Plymouth Sound and Estuaries SAC is designated for this feature (Figure 4.5).

See Table 4.2 for a summary of the conservation measures.

4.2.4 Rock habitats

Rock habitats include exposed areas of bedrock, which have a flat profile or rise from the seabed to form, together with stable areas of boulders and cobbles, reefs or reef-like habitats (often containing sea caves). The diversity of rock habitats is of considerable conservation importance as they often support sites of high biodiversity (Hill *et al* 1998). Different types of rock, such as limestone or sandstone, also have an effect on biotope type. Figure 4.6 shows the distribution of rock habitats within the Natural Area.

4.2.4.1 Reefs

The term reef generally refers to an area of rock habitat which arises from the surrounding seabed, although it has a specific definition under the Habitats Directive. The communities which are found on reefs and reef-like habitats are dependant on a number of factors including the rock type, depth, exposure to wave action and tidal streams, and turbidity. In shallow water, light intensity is sufficient to allow the growth of dense forests of kelp. In deeper water, where light intensity is lower, communities become animal-dominated, particularly with turfs of bryozoans and hydroids, sponges and sea squirts.

Subtidal rock in the Lyme Bay area consists largely of rocky reefs which fringe the coastline, particularly adjacent to hard cliffs and shores (English Nature 1997a). Also of particular note are offshore bedrock reefs which emerge from sediment. These discrete reefs, most of which are between 3 and 8 kilometres offshore, support rich faunal communities with some conspicuous, though rarely encountered, Mediterranean-Atlantic species. These include the bryozoan *Pentapora fascialis*, dense stands of the pink sea fan *Eunicella verrucosa* and a population of the rare solitary coral *Leptopsammia pruvoti* (at Saw Tooth Ledges). The occurrence of these last two species is of national importance (Irving 1996a).

Seven kilometres west south west of Bolt Tail, just west of Salcombe, lies the East Rutts pinnacle (Figure 4.8). This rock outcrop rises from the seabed at 35 metres to just 9 metres below the surface. A similar sub-surface outcrop occurs a little further west at the Eddystone Rocks, which is some 20 kilometres south of Plymouth Sound and is formed of hard, pink

granite. Except for the lighthouse rock itself, these rise to 12-15 metres below the surface from a level area of seabed at 50-60 metres below chart datum. Flat-faced, angular vertical cliffs with overhangs dominate the underwater scenery, colonised by a turf of bryozoans, hydroids, anemones and extensive patches of jewel anemones *Corynactis viridis*. A high proportion of southern species are present here with similar communities being found off Hands Deep, another rock outcrop to the north west of Eddystone.

Patches of sublittoral rock (an uncommon habitat within marine inlets) are present within the Fal Estuary, and provide a substratum for a rich sponge and sea squirt community. Further to the south east lie the Manacles, a small group of rocks about 2 kilometres offshore. Here, strong tidal currents encourage dense growths of sponges, hydroids and sea squirts to proliferate. In the Isles of Scilly, subtidal bedrock reefs fringe the coastline, particularly adjacent to rocky shores, though there are also reefs further offshore which emerge from sediment. Off the sheltered east coast of St Mary's, in depths of 25-35 metres, several south west species of nature conservation importance are found, including the branching sponge *Axinella dissimilis*, the corals *Leptopsammia pruvoti* and *Hoplangia durotrix*, and the sea fan *Eunicella verrucosa*. Eighteen sub-types of subtidal rock habitat have been identified around the islands (Hiscock 1984), reflecting the wide range of environmental conditions affecting the sites.

Along the north Cornwall coast, rock may extend into the sublittoral zone adjacent to rocky shores, particularly around headlands (Figure 4.8). At Boscastle, for instance, rock extends a considerable distance offshore and is dominated by algae (most noticeably the brown algae *Dictyopteris membranacea* and *Dictyota dichotoma*) to depths in excess of 20 metres. (Elsewhere in the Natural Area the depth to which algae extends is restricted by suspended sediment in the water column see - Irving 1996b). Extensive bedrock reefs are present off the west and north coasts of Cornwall, with smaller outcrops occurring in Mount's Bay, south west Cornwall.

At Lundy, the reefs present are varied in their geology (either granite or slate bedrock), exposure to wave action and to tidal currents, depth, inclination and aspect, all of which adds to their overall interest. They range from west-facing bedrock reefs, which are very exposed to wave action, to more sheltered east-facing reefs. Each contains a diverse range of features, such as vertical surfaces, overhangs, gullies and upward-facing silted surfaces. There are also sheltered boulder slopes close to the east coast of the island. This diversity of habitats leads to a wide range of marine life, including many south western species which have a limited occurrence elsewhere in the area (English Nature 1997c). Several of these species have their own Biodiversity Species Action Plans (see section 5.5.2).

4.2.4.2 Sea caves

The UK has the most varied and extensive sea caves on the Atlantic coast of Europe (Brown *et al* 1997). Caves can vary in extent, from only a few metres to more extensive systems that may extend several tens of metres into the rock. There may be tunnels or caverns with one or more entrance, in which the vertical and overhanging rock faces provide the principal habitat. Sea cave communities vary considerably depending on the structure and extent of the cave system, their degree of submergence and of exposure to scour and surge, and the nature of the geology. Caves are typically colonised by encrusting animal species but may also support shade-tolerant algae near their entrances.

Within the South Western Peninsula Natural Area, sea caves are present along much of the coast. Although predominantly in the littoral zone, some caves are also present below Low Water Mark. Within the Lundy candidate Special Area of Conservation, submerged or partially submerged sea caves have been highlighted as being of particular conservation importance, ie they are listed as an Annex I habitat. The 'beaches' at the far ends of some partially submerged caves on Lundy and along the north Cornwall coast, which may be 50-70 metres or more from their entrances, are used by grey seals to give birth to their pups (Clark 1977).

The JNCC Marine Nature Conservation Review (MNCR) biotope classification scheme (Connor *et al* 1997) has identified a number of biotopes which are associated with rocky habitats in this Natural Area (see Table 4.1).

4.2.4.3 Nature conservation measures

The Habitats Directive includes two rock habitat types for which Special Areas of Conservation (SACs) can be designated, 'Reef' and 'Submerged or partially submerged seacaves'[6]. There are four SACs identified where reef habitat is a primary feature of interest: The Fal and Helford SAC; Plymouth Sound and Estuaries SAC; the Isles of Scilly Complex SAC; and Lundy SAC. Within this Natural Area, Lundy SAC has been designated for its submerged sea caves (see Figure 4.7).

At present, all marine candidate Special Areas of Conservation (which form part of the Natura 2000 network) are adjacent to the coast. Work is underway to identify offshore sites both beyond 12 nautical miles (see Johnston *et al* 2002), and within English territorial waters. Preliminary work has been undertaken to derive areas of seabed which contain qualifying habitat and this is shown in Figure 4.3. Further work is being undertaken to verify and refine these areas eg to identify reef and reef-like habitat within areas of rocky or gravelly habitat. Prior to the identification of proposed Natura 2000 sites, locations supporting relevant features of interest should be treated with care to ensure that they are not damaged or altered in such a way that might affect their selection as Natura 2000 sites.

See Table 4.2 for a summary of the conservation measures.

4.3 Notable biogenic habitats

Animals and plants can have a profound influence on the habitats in which they reside, for example the presence of large numbers of kelp plants on flat bedrock makes a very different habitat to bare flat bedrock. In this section, a small number of biogenic habitats are highlighted. This reflects their nature conservation importance but also demonstrates that there are habitats in the seas around England that are formed by plants and animals, rather than their classification simply being based on the seabed substrata.

Particular biogenic habitats are often associated with specific broader habitats, for example, maerl is usually associated with 'gravel', seagrass beds with 'sand', though reefs formed by animals such as the ross worm *Sabellaria* spp can be associated with a range of habitats such as gravel, pebbles and cobbles, and bedrock.

[6] Defined as "Caves situated under the sea or opened to it, at least at high tide, including partially submerged sea caves…".

4.3.1 Maerl beds

Maerl is the collective name given to certain coralline algae that grow, unattached, on the seabed in sheltered areas. The twig-like nodules (often referred to as maerl 'hedgehogs') form a fragile, three-dimensional lattice structure, allowing seawater to penetrate several tens of centimetres below the surface. The living (photosynthesising) maerl, typically pink or purple in colour, is found on or near the surface. Maerl beds are an important habitat for a wide variety of marine animals and plants which live amongst or are attached to its branches, or burrow in the coarse gravel of dead maerl beneath the top living layer. Maerl is also very slow-growing – the largest nodules are amongst the oldest plants found in Europe – and some of the dead material at the base of beds may have been there for 8,000 years.

Maerl beds are found off the southern and western coasts of the British Isles, particularly in the Fal Estuary and Flamouth Bay which hold the most extensive beds in England and Wales. The beds are primarily found in Carrick Roads (pers. comm., Roger Covey, English Nature), though smaller beds have also been found within the Helford River which flows into Falmouth Bay (Tompsett 1996). Live maerl is also found in Lyme Bay but in smaller and less dense aggregations.

The distributions of the three main maerl bed-forming species in the UK are not entirely clear because of problems with identification in the field. *Phymatolithon calcareum* occurs throughout British waters, while *Lithothamnion glaciale* is a northern species with its southern limits at Lundy in the Bristol Channel. *Lithothamnion corallioides* has caused the most problems with identification, but appears to be a south western species. The maerl in the Fal Estuary off St Mawes Bank consists of *Phymatolithon calcareum* and *Lithothamnion corallioides*. Maerl beds have a wide range of animals and plants associated with them, with species diversity tending to be greater in the south and west. Certain species associated with the Fal maerl beds are considered rare, such as the red seaweeds *Gelidium calcicola* and *Cruoria cruoriaeformis* and Couch's goby *Gobius couchi* (Sanderson 1996b)

Due to the fragility of the maerl nodules and the manner in which they are arranged, maerl beds are easily damaged and have probably declined substantially in some areas.

4.3.1.1 Nature conservation measures

Maerl habitat has its own priority Habitat Action Plan.

In relation to the Habitats Directive, maerl beds have been included as a sub-type of the habitat 'Sandbanks which are slightly covered by sea water all the time' (Brown *et al* 1997). As such, they are included as an interest feature in the Fal and Helford SAC. Maerl beds can also occur as sub-features of other habitats listed in the directive, ie: 'Large shallow inlets and bays' and 'Estuaries' but there are no such sites in this Marine Natural Area.

At present, all marine candidate Special Areas of Conservation (which form part of the Natura 2000 network) are adjacent to the coast. Work is underway to identify offshore sites both beyond 12 nautical miles (see Johnston *et al* 2002), and within English territorial waters. In relation to the Habitats Directive, sites may be designated for maerl (if in less than 20 metres water depth). Prior to the identification of proposed Natura 2000 sites, locations

supporting relevant features of interest should be treated with care to ensure that they are not damaged or altered in such a way that might affect their selection as Natura 2000 sites.

The two most common species which constitute 'maerl' are *Phymatolithon calcareum* and *Lithothamnion coralloides* and both are listed in Annex V of the EU Habitats Directive (Birkett *et al* 1998). This Annex includes 'animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures'.

See Table 4.2 for a summary of the conservation measures.

4.3.2 Sabellaria reefs

Sabellaria in the subtidal (usually *S. spinulosa*) and intertidal (usually *S. alveolata*) reefs comprise dense, subtidal aggregations of a small, tube-building polychaete worm. *Sabellaria spinulosa* can stabilise cobble, pebble and gravel habitats, providing a consolidated habitat for other species. *Sabellaria spinulosa* reefs are solid structures, at least several centimetres thick, raised above the surrounding seabed, which persist for many years. As such, they provide a biogenic habitat that allows many other associated species to become established. Reefs found in mixed sediment areas are important, as they allow fauna and crevice infauna to become established in areas where they would normally be absent. The MNCR biotope classification scheme (Connor *et al* 1997) defines two *Sabellaria* biotopes (see Table 4.1).

Within Bridgwater Bay in the upper Bristol Channel, subtidal coarse sediments of gravel, pebbles and cobbles tend to be colonised by the reef-building worm *Sabellaria alveolata*. This species, known as the honeycomb worm on account of the appearance of its tube masses, is more commonly associated with building reefs in the intertidal zone. The fact that it forms extensive reefs in the subtidal within this area appears to be unique to the Bristol Channel. Interestingly, its sister species *Sabellaria spinulosa*, more commonly found in the subtidal zone, may also be present. These *Sabellaria* reefs may cover extensive areas of the seabed, particularly where there are tide-swept hard substrata affected by turbid water, which is the case further into the Severn Estuary (Irving 1996b).

Within much of its geographical range, *S. spinulosa* does not form reefs but is solitary or occurs in small groups encrusting pebbles, shell, kelp holdfasts and bedrock. Where conditions are favourable, much more extensive thin crusts can be formed, sometimes covering extensive areas of the seabed. However, these crusts are ephemeral in nature, being broken up during winter storms. As a result, these crusts do not constitute true *S. spinulosa* reef habitats. *Sabellaria spinulosa* requires only a few key environmental factors for survival in UK waters. Most important seems to be a good supply of sand grains, which are put into suspension by strong water movement and are used for tube building.

The JNCC Marine Nature Conservation Review (MNCR) biotope classification scheme (Connor *et al* 1997) has identified a number of biotopes which may be found associated with *Sabellaria* reefs of this Natural Area (see Table 4.1).

4.3.2.1 Nature conservation measures

Sabellaria spinulosa and *Sabellaria alveolata* reefs have their own Habitat Action Plans and are also indirectly covered by the Habitats Action Plan for sublittoral sands and gravels.

Under the Habitats Directive the habitat "reef" includes biogenic reefs such as those formed by *Sabellaria* spp. However, currently there are no sites selected for this habitat in this Natural Area although they are included within the proposed SAC for the Severn Estuary.

At present, all marine candidate Special Areas of Conservation (which form part of the Natura 2000 network) are adjacent to the coast. Work is underway to identify offshore sites both beyond 12 nautical miles (see Johnston *et al* 2002), and potentially within English territorial waters. Prior to the identification of proposed Natura 2000 sites, locations supporting relevant features of interest should be treated with care to ensure that they are not damaged or altered in such a way that might affect their selection as Natura 2000 sites.

See Table 4.2 for a summary of the conservation measures.

4.3.3 Seagrass beds

Seagrasses grow in shallow coastal areas, often forming dense underwater meadows. These are productive and diverse habitats which provide shelter and food for a variety of other species. They also provide food for wildfowl and shelter the juvenile stages of a number of commercially important fish. Being in the coastal zone, they are increasingly threatened by human pressure.

There are two (possibly three[7]) species of the seagrasses *Zostera* sp. that occur in the UK, although only one, *Zostera marina*, is predominantly subtidal. Commonly referred to as eelgrass, *Z. marina* is the largest seagrass species. It occurs just below Low Water Mark, on fine to coarse sand which may also have flint gravel mixed with it.

Within this Natural Area localities where *Z. marina* eelgrass beds are present include around Torbay (in part within the intertidal zone, which is unusual); Salcombe Harbour; at the mouth of the Yealm Estuary; on the north side of Drake's Island within Plymouth Sound; on the south side of Looe Bay; at the mouth of the Fowey Estuary; within the Helford River and the Fal Estuary; and in sheltered sandy areas of the Isles of Scilly (Irving 1996a, b).

The eelgrass beds within the Isles of Scilly are of particular note. They are very extensive, well-developed and rank amongst the best in Britain (English Nature 2000). Associated with the beds is a diverse community including rare red algae, anemones, stalked jellyfish, polychaetes, molluscs and echinoderms. Rare species include the diminutive seahorse *Hippocampus ramulosus* which is known to breed in the beds. However, the beds appear to be suffering from a 'wasting disease' caused by the slime mould *Labyrinthula*, which may cause die-back of stressed eelgrass. This disease devastated the seagrass beds in the Islands during the 1930s. In addition, the potential effect of the non-native brown alga *Sargassum muticum* within the beds (first noted in the early 1990s) is unknown at present. The eelgrass

[7] The other two species are *Zostera noltii* and *Zostera angustifolia*. However, it has been thought for some time now that *Z. angustifolia* (found intertidally) is just a different growth form of *Z. marina* (see Davidson & Hughes 1998). Latest developments in the taxonomy of this genus is the recognition of two varieties of *Z. marina*: var. *stenophylla* and var. *marina* (pers. comm., Chris Davis, English Nature).

beds within the Isles of Scilly were monitored for several years in the late 1980s by the Nature Conservancy Council and have been re-surveyed more recently by groups of volunteer divers (eg Irving *et al* 1998).

4.3.3.1 Nature conservation measures

Seagrass beds have their own Habitat Action Plan but are also indirectly covered by the HAPs for other 'host' habitats, such as sublittoral sands and gravels, mudflats and saline lagoons (Brown *et al* 1997)

In relation to the Habitats Directive, sandbanks which are vegetated by seagrass *Zostera* spp. are included as a sub-type of the habitat 'Sandbanks which are slightly covered by sea water all the time'.

At present, all marine candidate Special Areas of Conservation (which form part of the Natura 2000 network) are adjacent to the coast. Work is underway to identify offshore sites both beyond 12 nautical miles (see Johnston *et al* 2002), and potentially within English territorial waters. Prior to the identification of proposed Natura 2000 sites, locations supporting relevant features of interest should be treated with care to ensure that they are not damaged or altered in such a way that might affect their selection as Natura 2000 sites. However, it is unlikely there would be any such sites supporting seagrass beds beyond the SACs already identified within the South Western Peninsula.

See Table 4.2 for a summary of the conservation measures.

Table 4.1 MNCR biotopes (Connor *et al* 1997) associated with habitats in the South Western Peninsula Natural Area.

Key habitat	Biotope description (and higher/biotope code)
Sand and gravel	Venerid bivalves in circalittoral coarse sand or gravel (CGS.Ven)
	Sabellaria spinulosa and *Polydora* spp. on stable circalittoral mixed sediment (CMX.SspiMx)
	Burrowing anemones in sublittoral muddy gravel (IMX.An)
Sand	Shallow sand faunal communities (IGS.FaS)
	Venerid bivalves in circalittoral coarse sand or gravel (CGSVen)
Sandy mud	*Amphiura filiformis* and *Echinocardium cordatum* in circalittoral clean or slightly muddy sand (CMS.AfilEcor)
Reefs	Kelp with cushions fauna, foliose red seaweeds or coralline crusts (exposed rock) (MIR.KR)/(EIR.KfaR)
	Kelp with red seaweeds (moderately exposed rock) (IR.FaSwV)
	Fauna and seaweed (shallow vertical rock) (MCR.SfR)
	Faunal crusts or short turfs (wave-exposed/moderately exposed rock) (ECR.Efa/MCR.XFa)
	Alcyonium digitatum with massive sponges (*Cliona celata* and *Pachymatisma johnstonia*) and *Nemertesia antennina* on moderately tide-swept exposed circalittoral rock (ECR.AlcAlcMaS)
	Ophiothrix fragilis and/or *Ophiocomina nigra* beds on slightly tide-swept circalittoral rock or mixed substrata (MCR.BriOph)
	Sponges, cup corals and *Parerythropodium coralloides* on shaded or overhanging circalittoral rock (CR.CvSCup)
	Circalittoral *Sabellaria* reefs (MCR.Csab)
	Sabellaria spinulosa and *Polydora* spp. on stable circalittoral mixed sediment (CMX.SspiMx)
Maerl beds	*Phymatolithon calcareum* maerl beds with red seaweeds in shallow infralittoral clean gravel or coarse sand (IGS.MrlPhy.R)
	Lithothamnion corallioides maerl beds on infralittoral muddy gravel (IMX.Lcor)
Seagrass beds	*Zostera marina*/*angustifolia* beds in lower shore or infralittoral clean or muddy sand (IMS.SgrZmar)

Table 4.2 Summary of nature conservation measures.

Habitat type	EU Habitats Directive[1]				UK Biodiversity Action Plan[2]					
	Sandbanks which are slightly covered by seawater all the time [a]	Submerged or partially submerged sea caves[a]	Large shallow inlets & bays[a]	Reefs[a]	Mud habitats in deep water	Sublittoral sands and gravels	*Sabellaria alveolata* reefs[b]	*Sabellaria spinulosa* reefs[b]	Seagrass beds	Maerl beds
Gravel habitats			●	● boulders and cobbles		●				
Sand habitats	●		●			●				
Mud habitats			●		●					
Reefs				●						
Seagrass beds	●		●						●	
Sea caves		●								
Sabellaria reefs				●			●	●		
Maerl beds	●									●

[1] 'Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora' is commonly known as the Habitats Directive.

[a] Annex I natural habitat of community interest whose conservation requires the designation of Special Areas of Conservation.

[2] The UK Government's plan for the protection and sustainable use of biodiversity, published in 1994. It represents a commitment to joint action nationwide through the securing and better use of resources.

[b] Priority habitat which has been identified as being rare or in sharp decline.

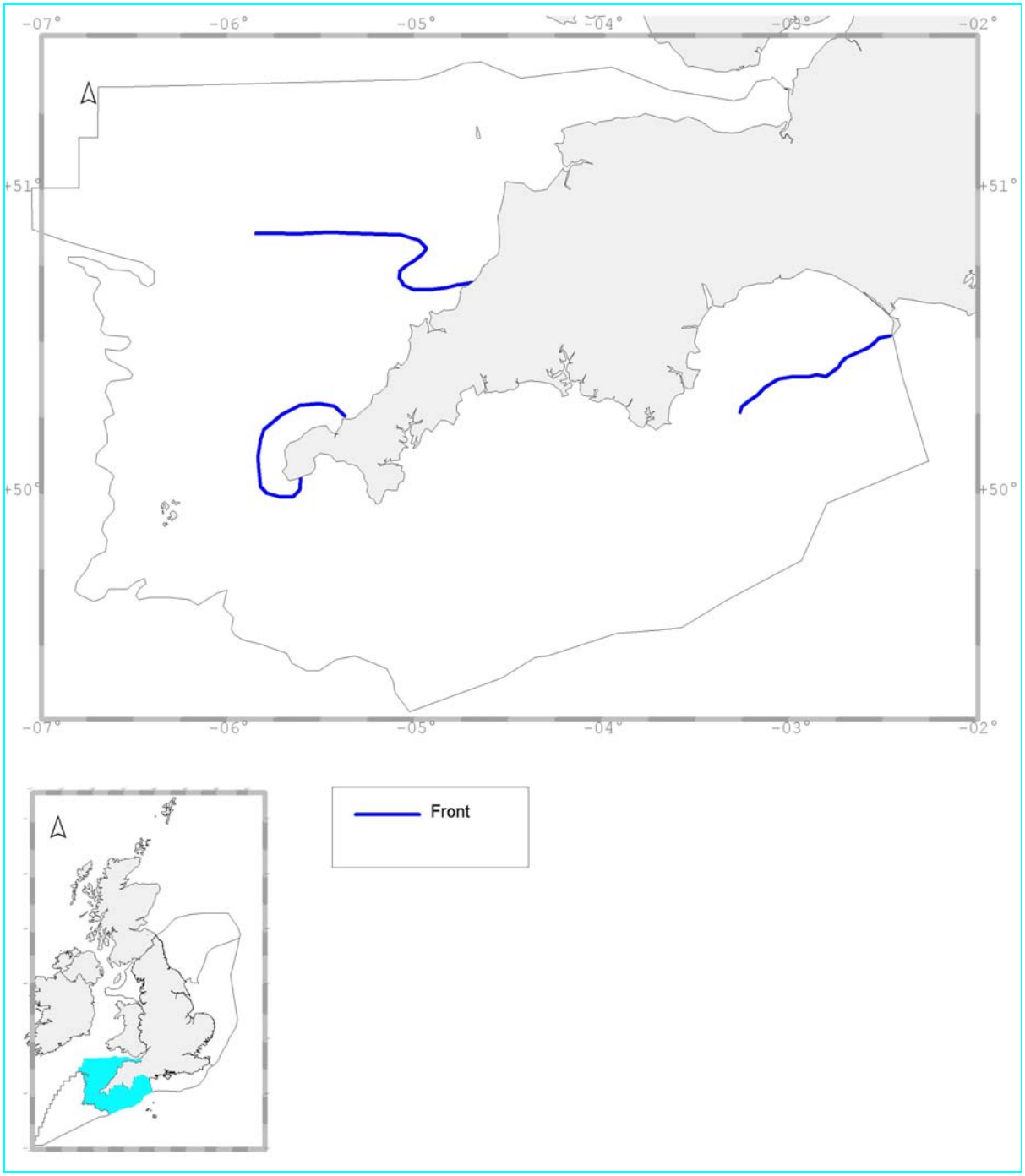


Figure 4.1 The location of fronts within the South Western Peninsula Natural Area. (Source: Sir Alister Hardy Foundation for Ocean Science, Plymouth).

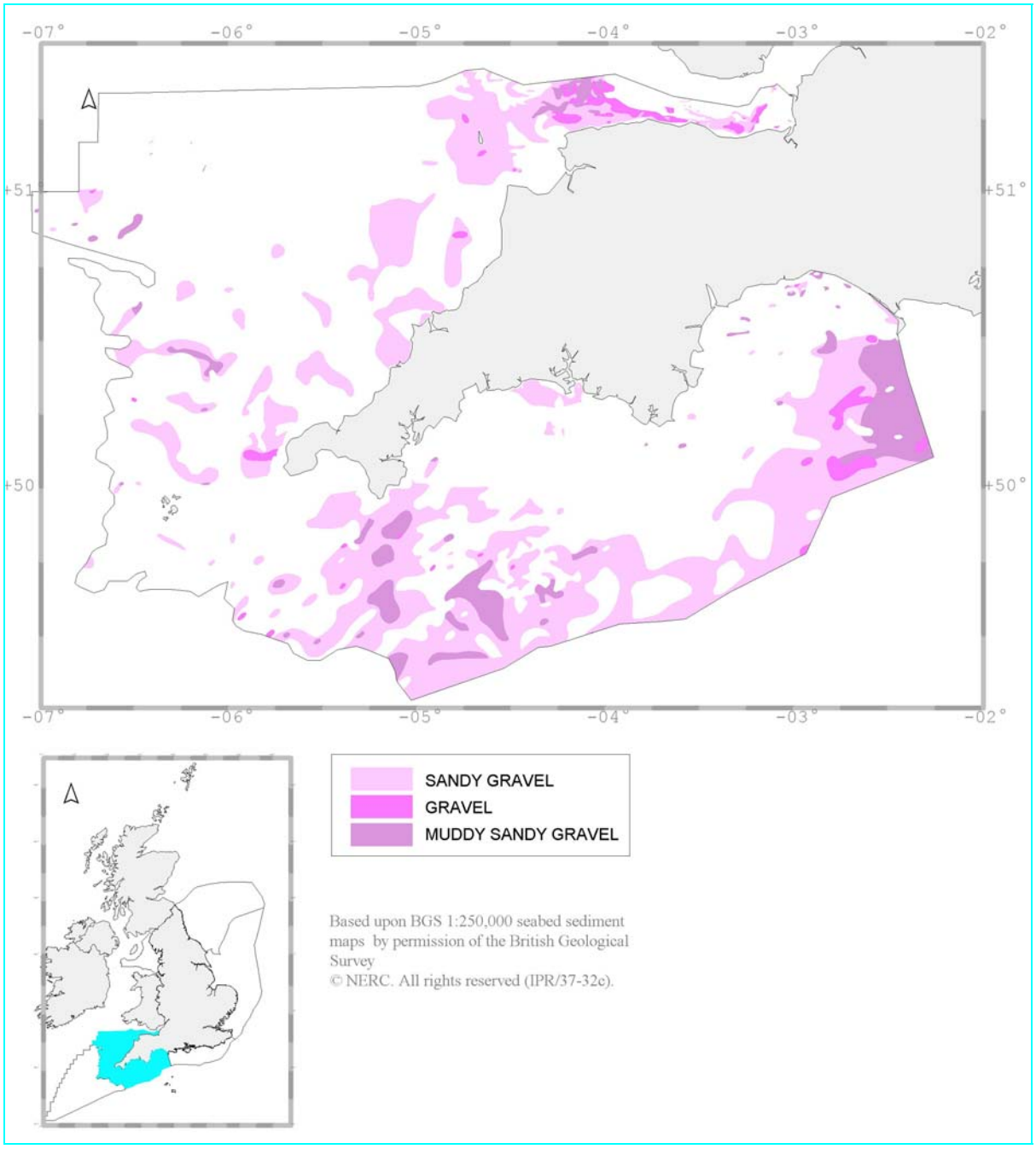


Figure 4.2 Gravel habitats in the South Western Peninsula Natural Area.

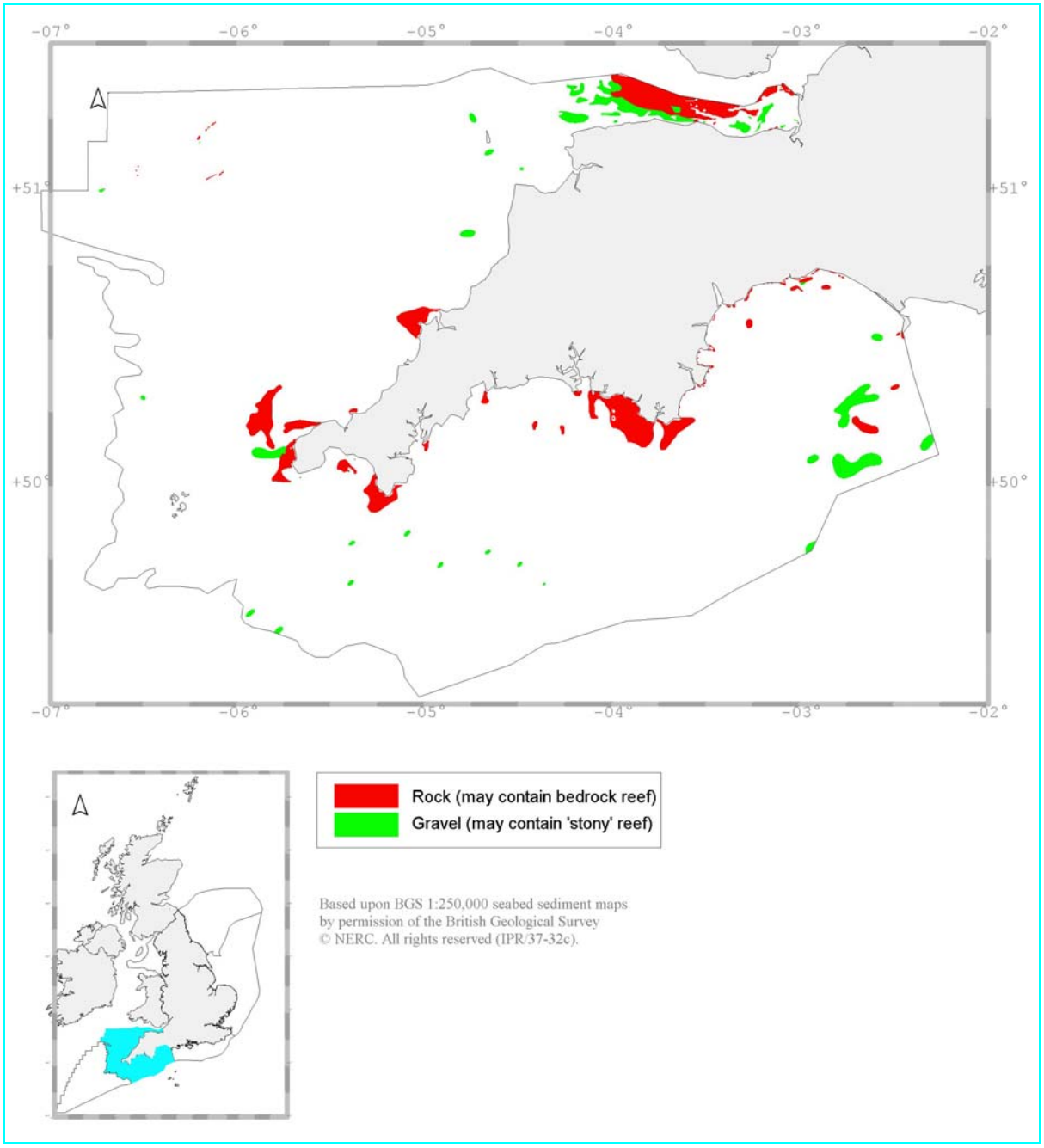


Figure 4.3 The distribution of rocky habitat and gravel which indicates the potential location of 'reef' (*sensu* the Habitats Directive) in the South Western Peninsula Natural Area. Further refining of these areas will define seabed which qualifies as Habitats Directive habitat. Gravel is included here as some gravel habitat may meet the definition of 'Reefs' under the Directive, where they are predominantly composed of stable boulders and cobbles as these are stable and can form a reef-like structure (ie 'stony' reef).

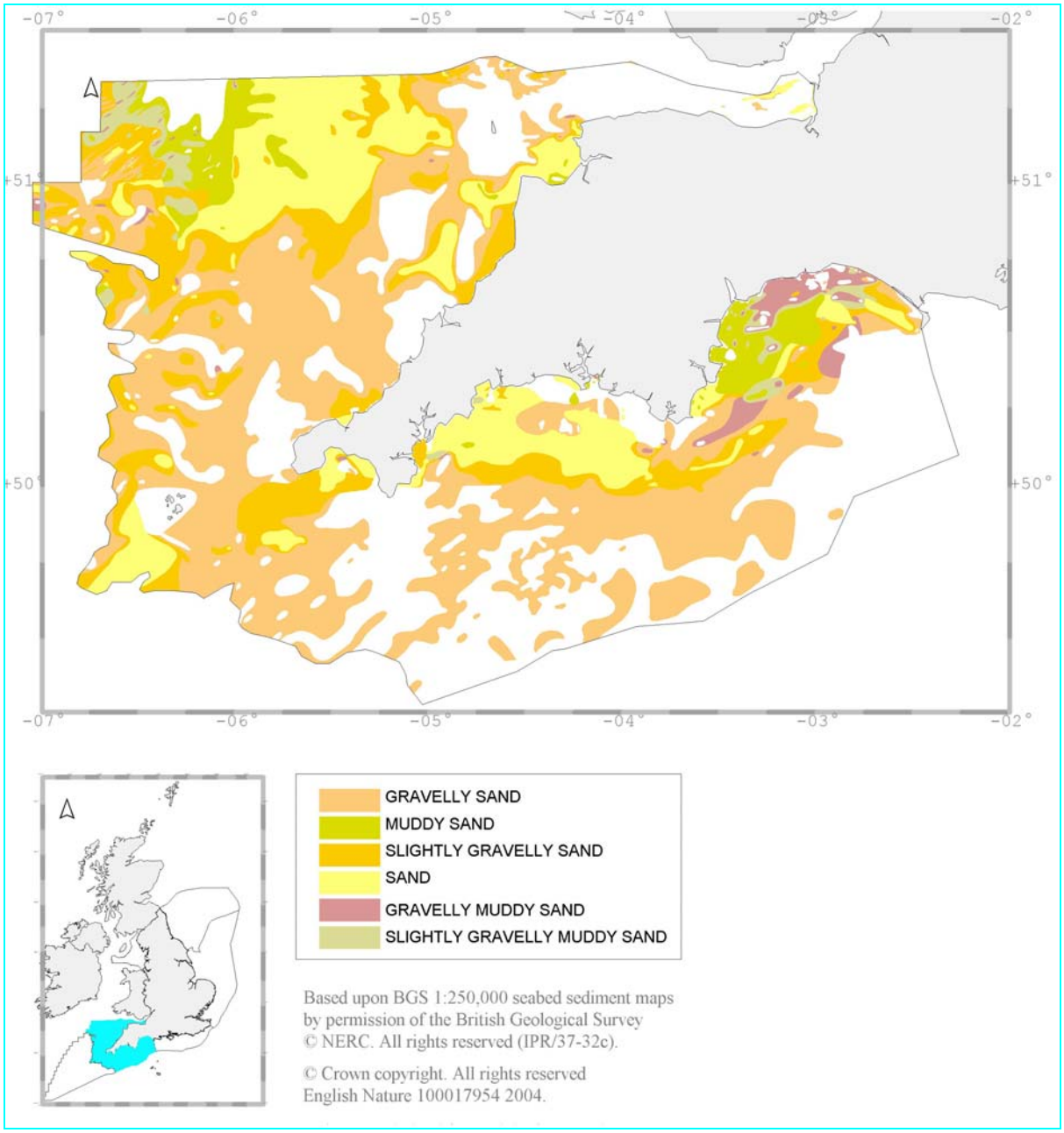


Figure 4.4 Sand habitats in the South Western Peninsula Natural Area.

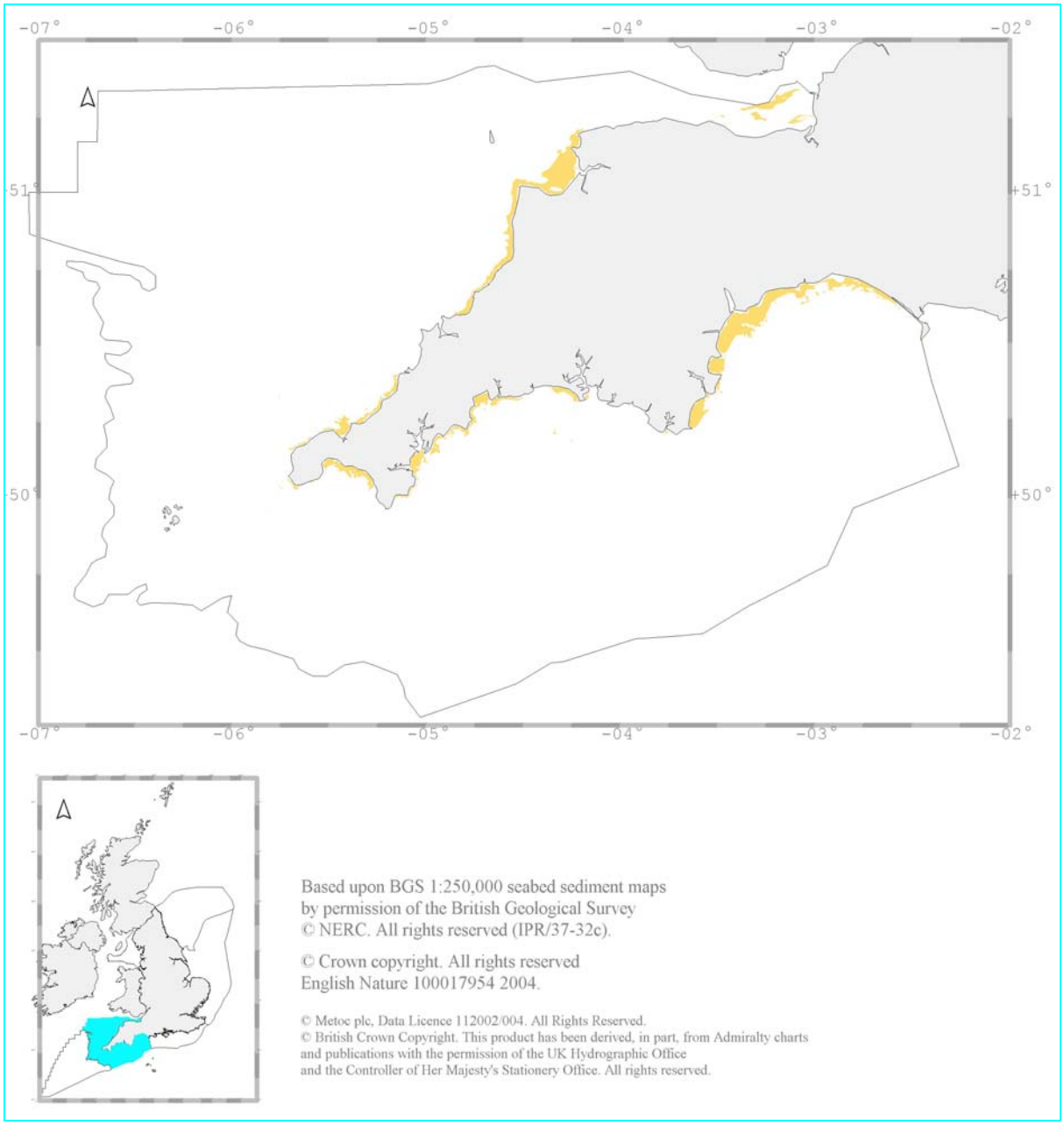


Figure 4.5 The distribution of shallow (<20 metres) sandy seabed areas, which indicates the potential location of 'Sandbanks which are slightly covered by sea water all the time' (*sensu* Habitats Directive) in the South Western Peninsula Marine Natural Area. Further refining of these areas will define seabed which qualifies as Habitats Directive habitat.

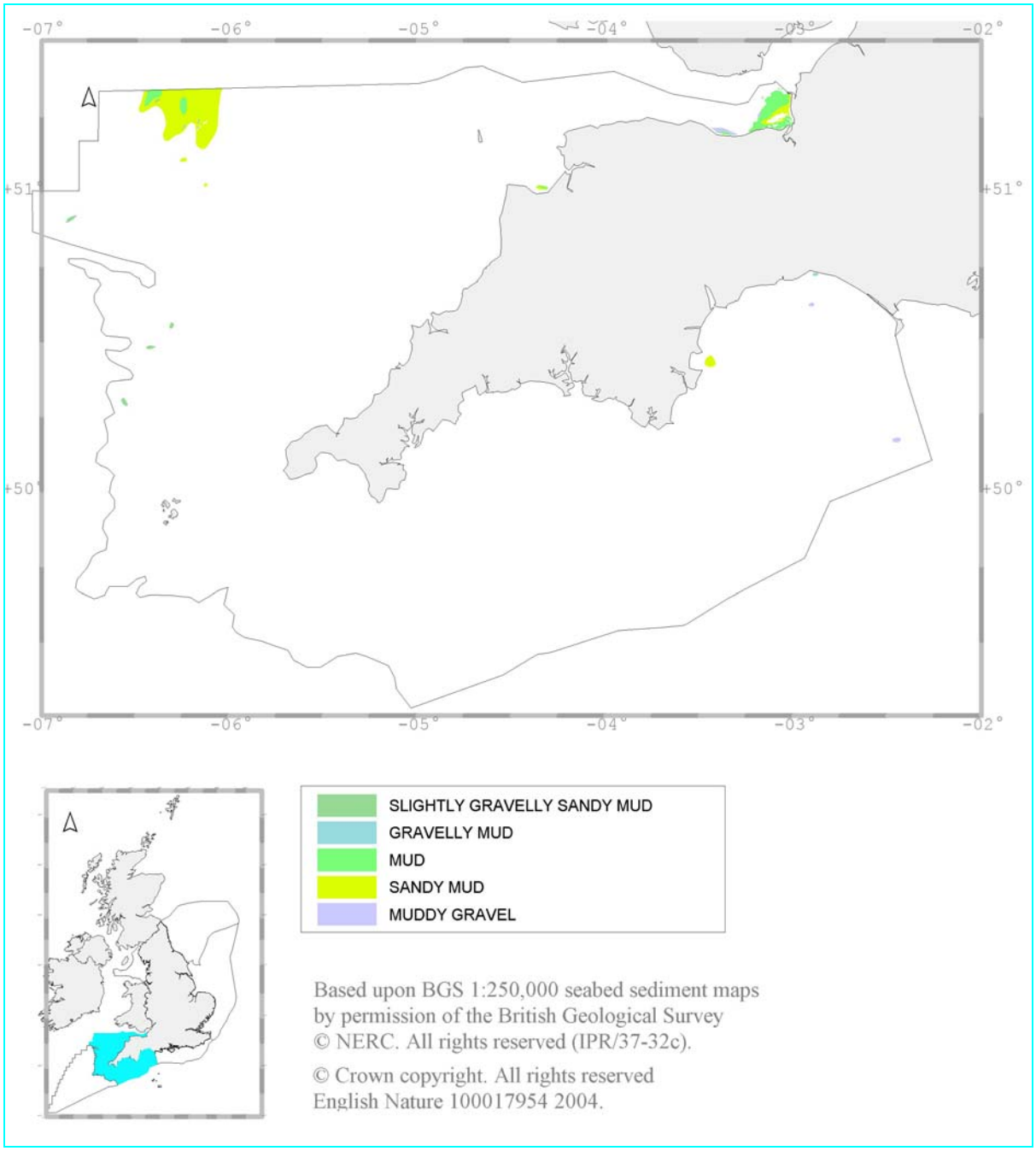


Figure 4.6 Mud habitats in the South Western Peninsula Natural Area.

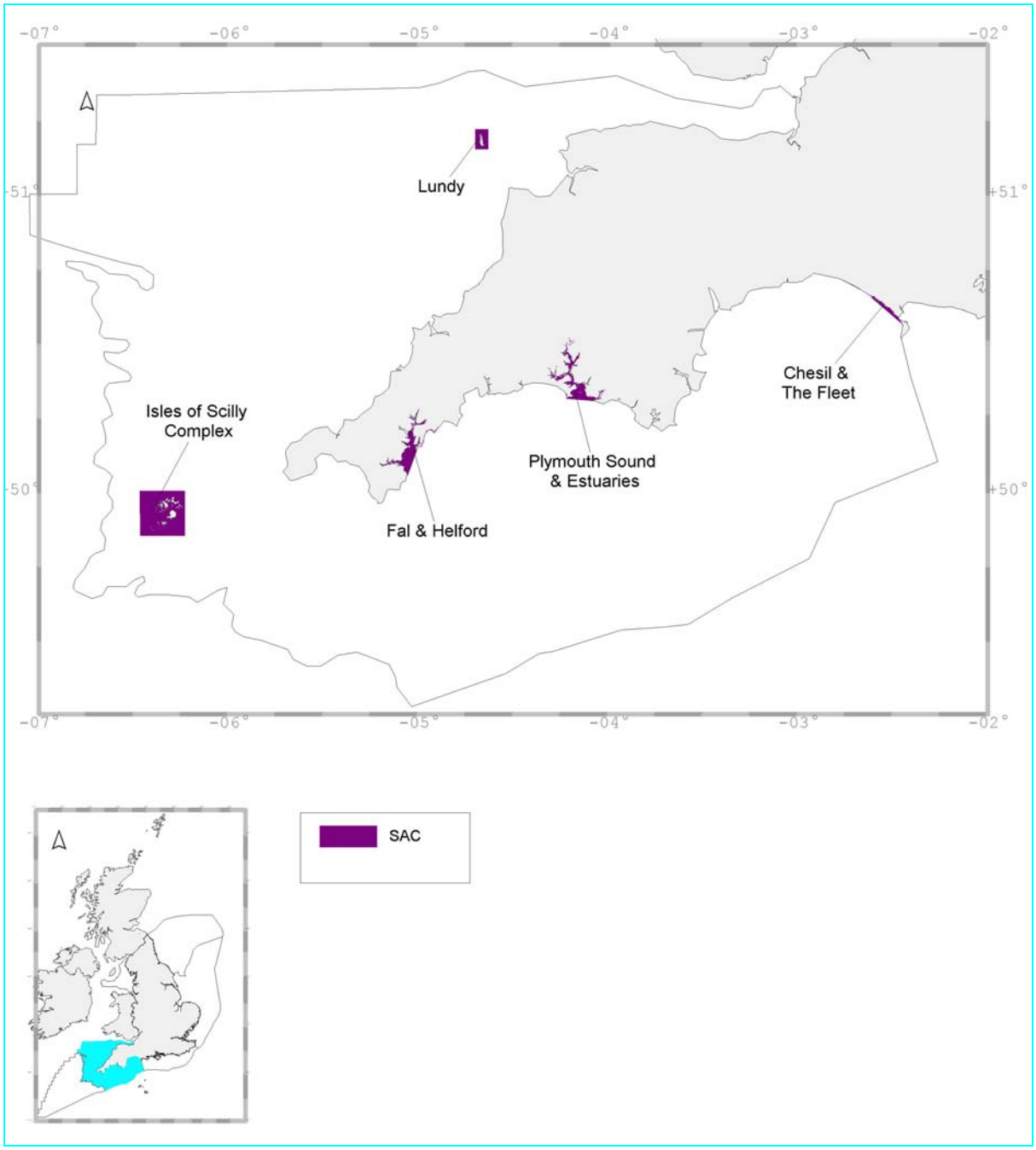


Figure 4.7 Map of candidate Special Areas of Conservation (mentioned in the text) in the South Western Peninsula Natural Area.

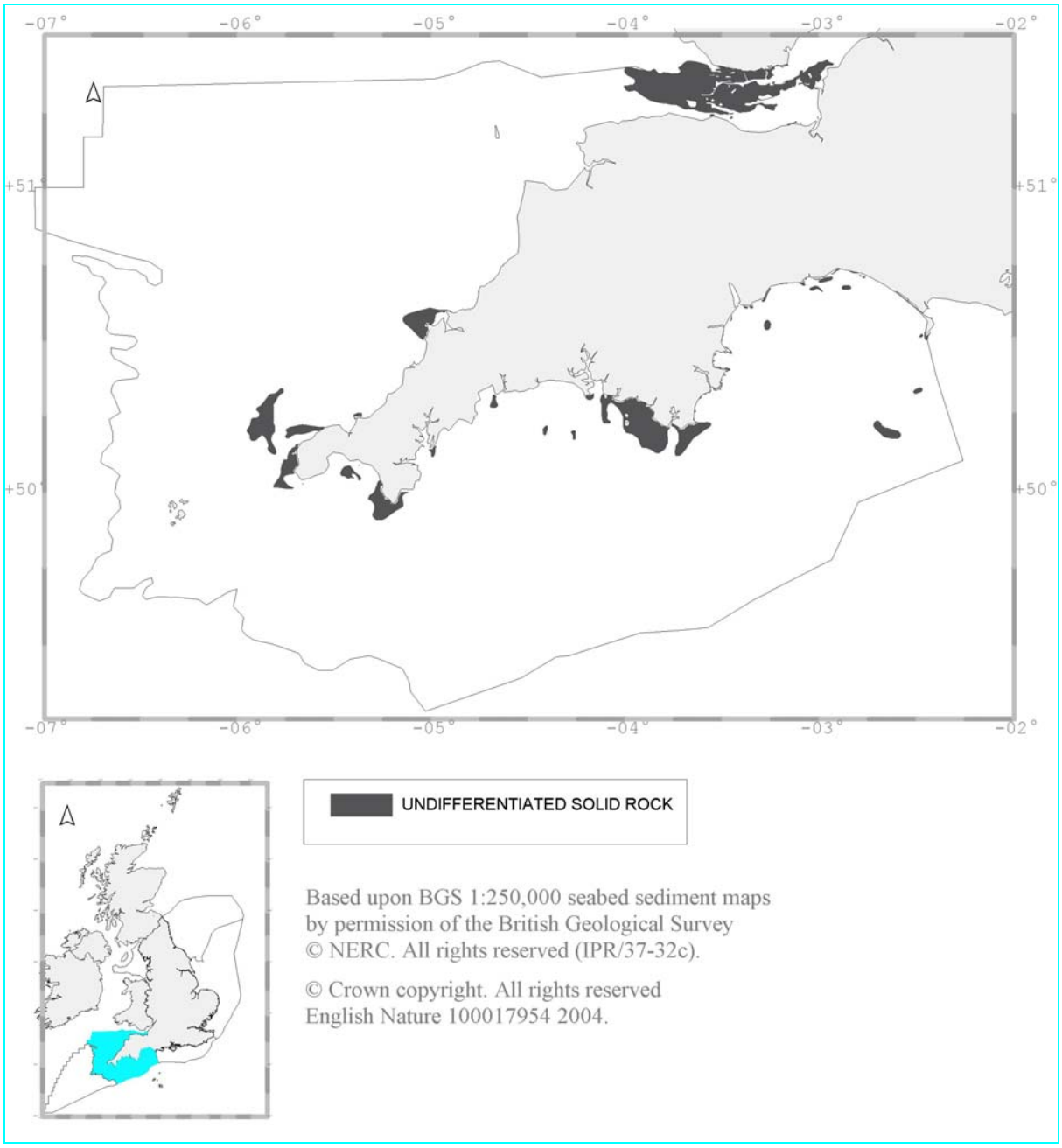


Figure 4.8 Rock habitats within the South Western Peninsula Marine Natural Area.

South Western Peninsula

Pink sea fan, a Biodiversity Action Plan species, recorded from various locations around the Natural Area.
Francis Bunker/English Nature. (right)

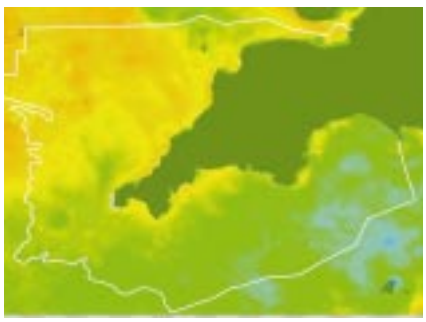
The Scillies archipelago supports one of only two English breeding colonies of Manx shearwater.
Chris Gomersall/ RSPB-images.com (below)

Spiny starfish is restricted to the SW coast of England.
Paul Kay/Marine Wildlife Photo Agency (above)

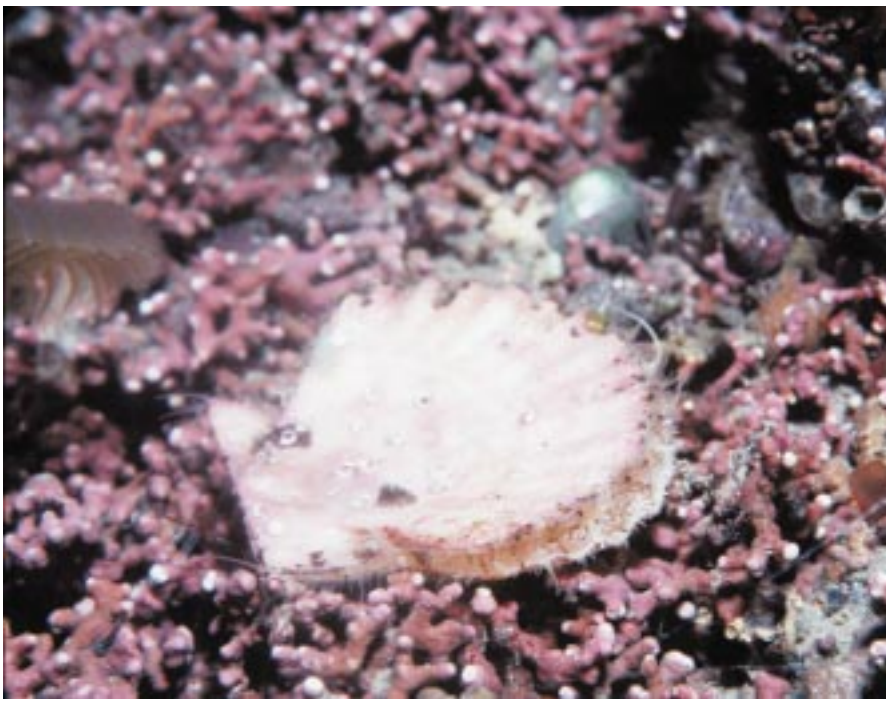
Grey seal on Lundy which is one of its main breeding sites in England.
English Nature (left)

Beam trawler *en route* to Mounts Bay. Beams are towed from 'derricks' at right angles to the boat. Spike Searle (above)

Small pleasure craft off Exmouth. The south Devon coast is one of the most important areas for water-based activity in the UK. Peter Wakely/English Nature (left)



Seawater surface temperature in the South Western Peninsula Natural Area in June 1997. © Natural Environment Research Council (NERC) & Plymouth Marine Laboratory (PML) 2004 (above)



Juvenile scallop on maerl bed in the Fal Estuary, Cornwall where the beds are the largest recorded in England and Wales and cover approximately 150 hectares. Jason Hall-Spencer (left)

5 Key species

This section describes key species of nature conservation value in the Mid North Sea. We have used the UK Biodiversity Action Plan (BAP) and the Habitats and Birds Directives as a focus and basis for structuring the text. Hence, for example, whilst a number of the fish species described are of commercial importance, they are included here because they are covered by Species Action Plans under the UK BAP. The main conservation measures currently in place are noted for each group of species, to indicate the effort being made towards their protection.

5.1 Marine birds

5.1.1 Background

The UK's coastal and offshore waters are of exceptional importance for several species of resident and migratory marine birds[8]. Of the 25 species of seabird which regularly breed in the UK, 17 are present in UK waters in numbers greater than 50% of the EU population (Lloyd *et al* 1991).

The distribution of marine birds is influenced by a wide-variety of factors. Perhaps the most important of these is food availability (Hunt & Schneider 1987), though proximity to suitable nesting habitat is of crucial importance throughout the breeding season (Skov *et al* 1994).

Fish are the main prey for the majority of marine bird species. Among the most important are sandeel (Ammodytidae), herring *Clupea harengus*, sprat *Sprattus sprattus* and mackerel *Scomber scombrus* (Skov *et al* 1995). The larvae of many of these species feed on plankton and occur at elevated densities where plankton is abundant. Such conditions occur at fronts (see section 4.1.1), where deeper, nutrient-rich waters mix with warmer, sunlit surface waters (Lloyd *et al* 1991; Pingree *et al* 1978). The abundance of food at fronts attracts both fish and marine birds (eg Stone *et al* 1995).

During the breeding season, the distance over which a nesting species will forage varies according to the species. Northern fulmar *Fulmarus glacialis* may feed 400 kilometres or more from their breeding colony (Dunnet & Ollason 1982), whilst others, such as the black guillemot *Cepphus grylle*, rarely feed more than a few kilometres offshore (Lloyd *et al* 1991). Outside the breeding season, many species of seabirds disperse over a wider area.

Many species congregate at high densities to feed, nest and moult. In such situations, a large proportion of the total population can be vulnerable to local incidents, such as oil spillages. The majority of marine birds are long-lived and do not reach breeding condition for several years. For example, on average, fulmar do not breed until their ninth year and may live for at least another 35 years (Dunnet & Ollason 1978). Many marine birds also have low reproductive rates. Hence, even highly localised incidents can have a significant impact upon

[8] Marine birds include all birds that are wholly or partly reliant upon the sea. For the purpose of this document we have divided marine birds into two categories:

- True seabirds – birds reliant on the sea all year. These include terns, gulls, petrels, cormorants, auks, skuas and Northern gannet.
- Coastal birds – birds reliant on the sea for only part of the year. These include divers, grebes and seaduck.

a population particularly where adults are affected (Tasker *et al* 1990). Several species of marine bird, most notably the auks, divers, grebes and seaducks, moult their flight feathers simultaneously, becoming temporarily flightless. Such species are particularly vulnerable at this time.

Predation can significantly affect breeding marine bird populations. The threats from predation are most severe for seabirds nesting on islands due to limited space, restricted available habitat and lack of effective anti-predator behaviour (Burger & Gochfeld 1990).

5.1.2 Distribution of marine birds

The South Western Peninsula is important for birds. Forty one species that regularly occur here and these are indicated in Table 5.1, together with a summary of their status, distribution and abundance within the Natural Area.

The varied coastline adjacent to this Natural Area provides suitable nesting habitat for a wide range of marine bird species, especially the cliff grasslands on offshore islands which are home to species including puffin *Fratercula arctica* and several species of gull and tern. The rugged cliffs, pinnacles and islands present ideal nesting conditions for fulmar, guillemot *Uria aalge* and razorbill *Alca torda*. Shag *Phalacrocorax aristotelis* tend to prefer the more gentle boulder-strewn slopes, whilst terns and gulls nest on sparsely vegetated upper foreshore.

All these birds rely upon the marine waters of the Natural Area to a greater or lesser degree for feeding, preening, mating, resting. The majority, including fulmar, gannet *Morus bassanus* and guillemot *Uria aalge*, occur within the Natural Area throughout the year. Other species, notably the terns *Sterna spp.*, are seasonally dependent on the area, migrating to more distant waters outside the breeding period.

Away from inshore waters, marine birds may feed, roost or fly over most areas of open sea in low numbers. Larger concentrations tend to occur only where food resources are both available and abundant. During the breeding season nesting birds are also limited by distance from nesting grounds.

Several seasonal fronts of temporary importance exist in the waters adjacent to the Isles of Scilly (Stone *et al* 1995). The high levels of phytoplankton biomass that occur at these fronts attract shoals of foraging fish and marine birds, including several species of shearwater, petrel, auk and gull.

Table 5.1 Summary of marine birds occurring within the South Western Peninsula Natural Area. This information has been compiled from a variety of sources including county avifaunas, county bird reports, Stone *et al* (1995), Lloyd *et al* (1991), Mavor *et al* (2001), Stroud *et al* (2001), Skov *et al* (1995) and Brown & Grice in press.

Species	Jan → Dec	Key areas	Status
Red-throated diver		Principally concentrated in shallow inshore waters.	PM, A1
Black-throated diver		Principally concentrated in shallow inshore waters.	PM, A1
Great northern diver		Principally concentrated in shallow inshore waters.	M, A1
Little grebe		Sheltered inshore waters, estuaries and bays.	PM
Great crested grebe		Sheltered inshore waters, estuaries and bays.	PM
Red-necked grebe		Sheltered inshore waters, estuaries and bays.	M
Slavonian grebe		Sheltered inshore waters, estuaries and bays.	PM, A1
Black-necked grebe		Sheltered inshore waters, estuaries and bays, eg Poole Bay 5-20 birds per year and Fal Estuary 20-30 birds per year since 1995.	PM
Fulmar		Throughout, largest concentrations in offshore deep waters.	PM
Cory's shearwater		Throughout, major concentrations off Tamar and Exe Estuaries and the Isles of Scilly.	M
Great shearwater		Mainly concentrated to west of the Isles of Scilly.	M
Sooty shearwater		Regularly 100 individuals per year, mainly in offshore deep waters.	M
Manx shearwater		Main presence in offshore deep waters.	M
Balearic shearwater		Majority of records around Isles of Scilly but max. yearly total of 1,263 birds off Cornwall in 1961.	M
Wilson's petrel		Regular in small numbers, mainly off Isles of Scilly, offshore deep waters.	M
Storm petrel		Feeding birds congregate around fishing vessels and fronts of offshore deep waters.	M, A1
Leach's petrel		Occasional, dispersed records.	M, A1
Gannet		Throughout. Highest numbers outside breeding season.	PM
Cormorant		Principally coastal distribution, shallow inshore waters.	PM
Shag		Principally coastal distribution, shallow inshore waters.	PM
Common scoter		Small numbers annually, mainly during passage.	PM
Red-breasted merganser		Principally coastal distribution, shallow inshore waters.	PM
Skua (Arctic, Pomarine)		Scattered records throughout.	M
Great skua		The shallow offshore deep waters represent the northernmost extreme of non-breeding range.	M
Mediterranean gull		Scattered records in coastal areas.	M, A1

Species	Jan → Dec	Key areas	Status
Little gull		Throughout whilst on passage.	M
Black-headed gull		Mainly coastal distribution.	PM
Common gull		Present throughout winter, numbers peaking during passage.	PM
Lesser black-backed gull		Throughout.	PM
Herring and great black-backed gull		Throughout.	PM
Sabine's gull		Occasional whilst on passage to and from breeding grounds in Greenland.	M
Kittiwake		Highest densities in offshore deep waters, numbers peaking post-breeding.	PM
Sandwich, common, little tern		Shallow areas adjacent to breeding colonies.	M, A1
Arctic tern		Main numbers during passage, sporadic breeding species in area.	M, A1
Guillemot, razorbill, puffin		Highest densities within 10 km of breeding colony during breeding season.	PM

Table notes:

Graded lines indicate relative seasonal abundance within a species.

Scattered or irregular — Common

Present in small numbers — Abundant

Uncommon

Key areas (refer to Figure 5.1) Names in **bold** indicate those species which breed on adjacent coasts.

Status A1 = Listed on Annex I of the Birds Directive.
M = Migratory species (as cited in Stroud *et al* 2001).
PM = Partially migratory species (as cited in Stroud *et al* 2001).

5.1.3 Nature conservation measures

Under the EC Council Directive on the Conservation of Wild Birds (The 'Birds Directive'), the UK Government is obliged to identify and classify the most suitable territories in size and number for rare and vulnerable species and for migratory species. This applies to both sea and land areas. The most 'suitable territories' are designated as Special Protection Areas (SPAs).

Lundy Island has been designated as a SPA (Fig 5.1). Here the wide-range of coastal habitats, together with low levels of disturbance and predation allow the Isles of Scilly to support an exceptionally rich variety of breeding marine bird species. The archipelago qualifies as a Special Protection Area (SPA) for its internationally important seabird populations. The Isles regularly support at least 26,000 individual seabirds including great black-backed gull *Larus*

marinus, shag, lesser black-backed gull *Larus fuscus* and storm petrel. The Isles of Scilly also have internationally important populations of breeding storm petrel and lesser black-backed gull (Stroud *et al* 2001). Storm petrels have a restricted global breeding range with up to 75% of the world's total population confined to the British Isles. The Isles of Scilly support at least 6.4% of this total (Lloyd *et al* 1991; Stroud *et al* 2001). The most recent study found an estimated 1,475 pairs of storm petrel on 11 islands, with Annet supporting 73% of these (Heaney *et al* 2002). The Scillies archipelago also supports one of only two English colonies of Manx shearwater (Chown & Lock 2002). The current population is estimated to be in the region of 201 pairs ('apparently occupied burrows') (Heaney *et al* 2002). Nesting marine bird species, particularly burrow-nesting species such as Manx shearwater, storm petrel and puffin, are particularly susceptible to predation from introduced predators such as rats *Rattus* spp. cats *Felis domesticus* and mink *Mustela vison* (Lloyd *et al* 1991). Lundy Island in the Bristol Channel has experienced similar problems.

Two other SPAs of note include the long, linear beach at Chesil which is one of only three major shingle structures in the UK and is an internationally important breeding site for little terns. The site regularly supports up to 55 pairs of little tern *Sternus albifrons*, representing 2.3% of the breeding population of Great Britain (Stroud *et al* 2001). Little terns generally feed in shallow water and at Chesil they make use of both the lagoon (the Fleet) and the adjacent marine waters in the Natural Area. The second SPA is the Exe Estuary, which supports a large and diverse population of wintering waterfowl.

Currently, the majority of SPAs extend no further seaward than Mean Low Water, although work is underway to identify additional marine areas that should be considered for designation. These sites will include areas where birds aggregate, eg for feeding and over-wintering. However, in the period prior to identification of proposed Natura 2000 sites, locations supporting relevant features of interest should be treated with care to ensure that they are not damaged or altered in such a way that might affect their selection as Natura 2000 sites.

5.2 Cetaceans

Cetaceans (whales, dolphins and porpoises) form a group of top predators in the marine environment. Seventeen species have been recorded in this Natural Area, including large and small cetaceans which are divided into two suborders:

- **Baleen whales** (Mysticeti), which use plates of baleen (keratin) to filter out food from the water column.
- **Toothed whales** (Odontoceti), which have teeth. These include dolphin and porpoise species.

Figure 5.2 shows sightings of cetaceans within the Natural Area over the period 1992-2001. Although very large, the dataset used to compile the map reflects the degree of observer effort and the location of observers such as on ferries, coasts and offshore platforms. Therefore, it should only be considered as illustrative and not as a definitive picture of cetacean distribution in this area. A more qualified account is given by Reid *et al* (2003) which also includes an analysis of species abundance within a defined area. This work can be viewed at www.jncc.gov.uk/publications/cetaceanatlas.

The most common offshore species within the Natural Area are the common dolphin *Delphinus delphis*, Risso's dolphin *Grampus griseus* and the long-finned pilot whale *Globicephala melas*. In inshore waters the bottlenose dolphin *Tursiops truncates* and harbour porpoise *Phocoena phocoena* are more frequently seen.

5.2.1 Baleen whales

The fin whale *Balaenoptera physalus* and the humpback whale *Megaptera novaeangliae* are the only species of baleen whale that are found within this Natural Area, and then only rarely.

5.2.2 Toothed whales

The bottlenose dolphin *Tursiops truncatus* is one of the most frequently recorded cetaceans of inshore waters within the Natural Area, though in far fewer numbers than once was the case. They seem to favour prominent headlands and enclosed bays, and are seen throughout the year. Most sightings have come from Tor Bay, at the mouth of the Salcombe/Kingsbridge Estuary, Bigbury Bay, Whitsand Bay, Mevagissey and St Austell Bays, Gerrans Bay, Falmouth Bay, Penzance Bay, the Land's End peninsula and St Ives Bay. The harbour porpoise *Phocoena phocoena* occurs in small numbers in nearshore waters around the coasts of Cornwall and north Devon, mainly between September and December. Although it is still the commonest small cetacean, numbers of harbour porpoise appear to have declined over the last 50 years, particularly in the southern North Sea and English Channel (Doody *et al* 1993).

Of the other species of toothed cetacean, the common dolphin *Delphinus delphis* are frequently reported between August and January. Both the common dolphin and the long-finned pilot whale *Globicephala melas* are relatively deep-water, offshore species, being mainly recorded more than 10 kilometres from the coast. Risso's dolphin *Grampus griseus* may be found in small herds and feeds mainly on squid (as opposed to fish). Killer whales *Orcinus orca* tend be found in the colder waters of the Arctic, but during the summer months they may venture south along the west coast of Britain. The South Western Peninsula is likely to be close to the southern limit of their extent. Sperm whales *Physeter macrocephalus* move northwards from the Azores and Madeira during the summer, following deep ocean basins to the west of the British Isles. A few individuals may move onto the continental shelf and can sometimes be found in offshore waters within this Natural Area.

The Atlantic white sided dolphin *Lagenorhynchus acutus* is sighted only occasionally in this Natural Area. This species favours the cool temperate and sub-arctic waters of the North Atlantic, and is rarely found south of the English Channel. The Atlantic white-sided dolphin has a similar distribution to the white-beaked dolphin *Lagenorhynchus albirostris*, but white-sided dolphins tend to occur more offshore, particularly along the continental slope. Like many of the other smaller species of dolphin in these waters, they appear to move nearer the shore in summer.

5.2.3 Nature conservation measures

A summary of protection measures can be seen in Table 5.2.

With the exception of Risso's dolphin all of the other species which have been sighted in this Natural Area are included on either Appendices I or II of CITES. The former lists species that

are the most endangered and therefore prohibits commercial trade and the latter lists species that are not necessarily now threatened with extinction but that may become so unless trade is closely controlled.

All cetaceans are protected by the Bern Convention (1979) which conveys special protection to those species which are vulnerable or endangered. Although an international convention, in the UK it is implemented through the Wildlife and Countryside Act 1981.

The Bonn Convention (1979) protects migratory wild animals across all or part of their natural range through international co-operation, particularly those species that are in danger of extinction. One of the measures identified is the adoption of legally binding agreements, of which ASCOBANS (described below), is one.

In addition to those protection measures listed in Table 5.2, there is an Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS). Formulated in 1992, this agreement has been signed by eight European countries (including the UK) bordering the Baltic and North Seas (including the English Channel). Under the Agreement, provision is made for protection of specific areas, monitoring, research, information exchange, pollution control and increasing public awareness of small cetaceans.

Under schedule 5 of the Wildlife and Countryside Act 1981 (as amended), all cetaceans are fully protected within British territorial waters. This protects them from killing or injury, sale, destruction of a particular habitat (which they use for protection of shelter), and disturbance. Common and bottlenose dolphins and harbour porpoises are also listed under schedule 6 of the Act, which prevents these species being used as a decoy to attract other animals. This schedule also prohibits the use of vehicles to take or drive them, prevents nets, traps or electrical devices from being set in such a way that would injury them, and prevents the use of nets or sounds to trap or snare them. Under the Countryside and Rights of Way Act 2001 is it an offence to deliberately or recklessly damage or disturb any cetacean in English and Welsh protected waters.

All cetaceans are protected under Annex IV of the Habitats Directive because they are either endangered, vulnerable or rare. Harbour porpoise and bottlenose dolphin are also listed under Annex II of the Habitats Directive which requires Member States to designate SACs to ensure their conservation. However, within this Natural Area no areas essential to life and reproduction have been identified for these species and therefore no SACs have been designated for them.

Table 5.2 Summary of cetacean protection measures (see notes below for explanation of designations and abbreviations).

	Schedule 5 Wildlife & Countryside Act	EC Habitats Directive (annex)	CITES (Appendix)	Bonn Convention (Appendix)	IUCN Red Data List Species	Bern Convention (Appendix)	UK Biodiversity Action Plan
Fin whale *Balaenoptera physalus*	•	IV	I		EN	III	Baleen whales grouped plan
Humpback whale *Megaptera novaeangliae*	•	IV	I	I	VU	II	Baleen whales grouped plan

	Schedule 5 Wildlife & Countryside Act	EC Habitats Directive (annex)	CITES (Appendix)	Bonn Convention (Appendix)	IUCN Red Data List Species	Bern Convention (Appendix)	UK Biodiversity Action Plan
Harbour porpoise *Phocoena phocoena*	•	II IV	II	II	VU	II	Harbour porpoise species plan
White-beaked dolphin *Lagenorynchus albirostris*	•	IV	II	II		II	Small dolphins grouped plan
White-sided dolphin *Lagenorynchus acutus*	•	IV	II	II		II	Small dolphins grouped plan
Killer whale *Orcinus orca*	•	IV	II	II	LR	II	Toothed whales grouped plan
Sperm whale *Physeter macrocephalus*	•	IV	I			III	Toothed whales grouped plan
Risso's dolphin *Grampus griseus*	•	IV		•			Small dolphins grouped plan
Common dolphin *Delphinus delphis*	•	IV	II	II			Small dolphins grouped plan
Bottlenose dolphin *Tursiops truncatus*	•	II IV	II	II		II	Small dolphins grouped plan
Long-finned pilot whale *Globicephala melas*	•	III IV	II	II		II	Toothed whales grouped plan

Table notes:

Annex IV EC Habitats Directive – This annex includes 'Animal and plant species of community interest in need of strict protection'. Under Annex IV the keeping, sale or exchange of such species is banned, as well as deliberate capture and killing.

CITES (Convention on International Trade in Endangered Species)
Appendix I - Prohibits the commercial trade of species included on this appendix.
Appendix II - Imposes strict regulation on the trade of species that may not necessarily be currently threatened with extinction.

IUCN Red List of Threatened Species - LR = Lower risk
VU = Vulnerable
EN = Endangered

Biodiversity Action Plan
This is the UK Government's response to Article 6 of the Convention on Biological Diversity (1994). The overall goal is to conserve and enhance biodiversity in the UK. A Species Action Plan provides detailed information on the threats facing species and the opportunities for maintaining and enhancing populations. A 'Grouped' Species Action Plan has been produced for baleen whales as a range of common policies and actions are required for all species listed.

5.3 Seals

The UK is home to between 97,900-123,000 grey seals *Halichoerus grypus*. This accounts for approximately 39% of the world population (Natural Environment Research Council 2003). Seal populations in the South Western Peninsula comprise the grey seal *Halichoerus grypus*, with reliable sightings of common seals *Phoca vitulina* being very rare. Grey seals are more frequently seen along the north coast of the peninsula than the south (east of the Fal Estuary). Their main breeding sites are in the Isles of Scilly, around Boscastle on the north Cornish coast, on Lundy, and, to a lesser extent, around Lizard Point, Land's End and along the north Cornwall coast. There is also one known breeding site just west of Salcombe in south Devon. Pups are born from July to November and occasionally as late as March. Approximately 0.5% of the grey seal pups born in Great Britain are from this Natural Area (Duck 1996).

Grey seals breed and haul-out at the rear of sea caves, on remote islands and on beaches on isolated stretches of the coast. Breeding sites are frequently inundated by water at high tide and/or during storms, and pups regularly have to swim within a few days of birth.

5.3.1 Nature conservation measures

Grey and common seals are protected under Annex II of the Habitats Directive, which requires Members States to designate Special Areas of Conservation (SACs) for their conservation. Where areas support concentrations of seals and contain areas considered to be essential to their life and reproduction, the area may be designated as an SAC. The Scilly Isles is the most important areas for seals on the west coast of England and as such lists the grey seal as an interest feature of the Isles of Scilly complex SAC (see Figure 4.5.).

Grey and common seals are also listed on Annex V of the Habitats Directive, which requires their exploitation or removal from the wild to be subject to management measures. These measures are provided for within national legislation. Both the grey and common seals are listed under Appendix III of the Bern Convention. This Appendix requires appropriate and necessary legislative and administrative measures to ensure the protection of the listed species. Any exploitation of wild fauna must also be regulated in order to keep the populations out of danger.

The Conservation of Seals Act 1970 provides for closed seasons, during which it is an offence to take or kill any seal except under licence or in certain particular circumstances. For grey seals, the closed season is from 1 September to 31 December, and for common seals it is from 1 June to 31 August. Following the halving of the common seal population as a result of the phocine distemper virus in 1998, an Order was issued under the Act which provided year-round protection of both grey and common seals on the east coast of England. The Order was last renewed in 1999. A re-occurrence of the disease, albeit at a much smaller scale, occurred in 2002.

5.4 Marine turtles

Two species of marine turtles are regularly recorded from within the Natural Area: the leatherback *Dermochelys coriacea* and the loggerhead *Caretta caretta*. Most of the leatherbacks have been sighted swimming west of Land's End, and three loggerheads have

been found stranded in Mount's Bay, Cornwall. A high proportion of these turtles became entangled in nets at sea and were drowned. Although all the turtle species are believed to arrive in UK waters accidentally (with the possible exception of the loggerhead which may be at the extreme limit of its range), the occurrence of the leatherback is almost certainly the result of a deliberate, migratory movement (see the UKBAP web site – www.ukbap.org.uk).

5.4.1 Nature conservation measures

The leatherback turtle and the loggerhead are listed on Appendix I of the Convention on the International Trade in Endangered Species of Flora and Fauna (CITES) 1975. They are also listed on Appendix II of the Bern Convention 1979, Appendices I and II of the Bonn Convention 1979 and Annex IV of the EC Habitats Directive. The loggerhead is also listed as a priority species[9] on Annex II of the EC Habitats Directive, which allows for SACs to be designated in areas identified as essential for life and reproduction. It is unlikely that any SACs will be identified in UK waters for loggerhead turtle.

Both species are protected under schedule 5 of the Wildlife and Countryside Act 1981 and schedule 2 of the Conservation (Natural Habitats &c.) Regulations 1994. Under schedule 5 of the Wildlife and Countryside Act 1981 (as amended), all turtles are given full protection within British territorial waters. This protects them from killing or injury, sale, destruction of a particular habitat which they use for protection of shelter, and disturbance. Leatherback turtles are also listed in schedule 4 of the Wildlife and Countryside Act 1981, which restricts their sale.

5.5 Fish

Populations of a number of commercial fish species are present within the waters surrounding the South Western Peninsula, and the region provides important spawning grounds, nursery and feeding areas for these fish. Fish are referred to in terms of being pelagic or demersal species. Pelagic species are generally found in shoals swimming in mid-water, whereas demersal species are found living on or near the seabed.

In the South Western Peninsula Natural Area, important commercial fish species include mackerel, horse mackerel, herring, sprat, pilchard, dogfish, skates and rays, cod, hake, ling, pollack, whiting, brill, dab, Dover sole, lemon sole, plaice, bream, bass, red mullet, megrim, gurnard and monkfish/angler. Only those species which are covered by the 'Commercial marine fish Grouped Species Action Plan' (under the UK BAP) are featured below.

5.5.1 Pelagic fish

Mackerel *Scomber scombrus* is one of the most abundant pelagic species off the west coast of Britain. Mackerel spawn in low densities in Lyme Bay and further east into the English Channel (Figure 5.3a). Growing juveniles and adults migrate to coastal waters after spawning, where they remain until autumn. Concentrations of overwintering mackerel are found within this Natural Area off the south coast of Cornwall (Pawson & Robson 1996).

[9] Priority species means a species for the conservation of which the Community has particular responsibility in view of the proportion of their natural range which falls within the territory. Priority species are indicated by an asterix in Annex II of the Habitats Directive.

Herring *Clupea harengus* are locally abundant around the Cornish coasts, where spawning occurs in estuaries in the spring. They are fished in small quantities in Barnstaple Bay off the north Devon coast, where they also spawn. Spawning also occurs in Lyme Bay on the south coast and there is a distinct nearshore spawning area between Plymouth and St Austell on the south coast (Figure 5.3b). Commercial quantities of herring are taken as an opportunist catch by mid-water trawlers usually fishing for sprat *Sprattus sprattus*.

Individual records of two non-commercial species occur within this Marine Natural Area. The twaite shad *Alosa fallax* and allis shad *Alosa alosa* are anadromous, which means that individuals spawn in they spawn in freshwater, where the young feed and grow for approximately five months, before heading downstream to the sea. These species are declining throughout the UK although they have been recorded within this Natural Area (Potts & Swaby 1993). The occurrence of shad during the autumn is noteworthy because most of the shad in the UK are recorded in spring (mostly during late April and May). The Atlantic salmon *Salmo salar* is also anadromous and may be found in the coastal waters of this Natural Area.

One of the most notable (and certainly the largest) fish species that is regularly seen in the coastal waters of the Natural Area during the spring and summer is the basking shark *Cetorhinus maximus*. Although this is the largest fish in British waters (growing up to 12 metres in length and weighing up to 7 tonnes), relatively little is known of its reproductive biology and population dynamics. The basking shark feeds on plankton which it filters from the water as it swims along with its mouth open. The shark's common name comes from its habit of 'basking' on the surface during the summer months as it feeds. In these situations, it is often seen in association with shoals of herring and mackerel, which are also plankton feeders.

5.5.2 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 in some cases may recruit to inshore nursery grounds. Some juveniles making the transition to the adult phase may move into the Irish Sea from the Bristol Channel, or vice-versa (Pawson & Robson 1996).

Cod *Gadus morhua* are still reported to be seasonally abundant and widely distributed throughout the Natural Area, despite concerns regarding the decline in stocks elsewhere (particularly in the North Sea populations). Local fishermen suggest that cod in the area migrate between deep-water wrecks and reefs in the summer to inshore waters in the winter (Pawson 1995). Spawning cod aggregate in two main areas within the Natural Area, off Start Point in south Devon, with numbers peaking in February; and off Trevose Head, north Cornwall, peaking between March and April (see Figure 5.3c).

Plaice *Pleuronectes platessa* are the most abundant commercial flatfish species within the coastal waters of this Natural Area, often found on sandy bottoms down to depths of 120 metres. Juveniles live close to the shore in nursery areas (such as Port Isaac Bay off the north Cornish coast), gradually moving into deeper water as they mature. Plaice are long-lived fish, which reach maturity after three years. Two 'moderate intensity' spawning grounds

occur in the mid/western Channel off Dorset and off the north Cornwall coast; and a 'low intensity' one is present off the Dorset/south Devon coast (Figure 5.3d).

Dover sole *Solea solea* are present throughout the Natural Area and have a similar lifestyle to plaice, though they are more limited to areas with higher bottom temperatures (Pawson & Robson 1996). Dover sole spawn in early spring (February to April) in Lyme Bay; in a large area offshore between Start Point and the Lizard peninsula; around the Isles of Scilly; and off the north Cornwall and Devon coast. Juvenile Dover sole spend up to two years in inshore nursery areas, particularly on the western side of Lyme Bay and along the north Devon coast. (Figure 5.3e).

Sandeels *Ammodytes* spp. are distributed widely throughout the Natural Area and are common in the shallow harbours and bays. Sandeels provide an important food source for many other exploited fish species as well as certain seabirds. They burrow in coarse sand at night and during the winter and their distribution is thus influenced by that of coarse sand.

5.5.3 Conservation measures

The Common Fisheries Policy (CFP) is the European Union's instrument for the management of fisheries and aquaculture. The CFP was created to manage a common resource and to meet the obligations set out in the Treaty of Rome. It provides the legal framework for the exploitation of living marine resources in EU waters and for those vessels registered in the EU fishing in non-EU waters. The CFP not only sets the framework for the allocation of fisheries resources amongst Member States and their rights of access to community waters, but also allows the introduction of technical measures for the conservation of fisheries resources. The Commission for the European Community has exclusive rights to administer up to the High Water Mark. However, in practice they devolve authority to the UK Government (Defra) to manage the fisheries within the 12 mile limit of the UK and to control the activities of UK-registered fishing vessels.

Under the Sea Fisheries Regulation Act 1966, the Sea Fisheries Committees (SFCs) of England and Wales are responsible for the management of fisheries within six nautical miles of Mean High Water Mark. They also share responsibility for marine nature conservation. They have the power to introduce byelaws within this six nautical mile zone, and they enforce UK and EC fishery conservation legislation. Four SFCs operate within this Natural Area: the Southern SFC; the Devon SFC, the Cornwall SFC and the Isles of Scilly SFC.

5.5.3.1 Total Allowable Catch and Quotas

One of the four components of the Common Fisheries Policy is the conservation and enforcement policy, which aims to set fishing activity at a sustainable level. An objective of the Conservation Policy is the sharing or allocation of resources to Member States. In order to regulate this, a fixing system of Total Allowable Catches (TACs) and quotas has been implemented. TACs are agreed annually by the Council of Ministers for each protected species in waters administered by the CFP, and are divided so that each Member State receives a percentage or quota of a TAC. It is difficult to break down species quotas for this Natural Area, as quotas are given for waters within the ICES fishing areas, of which three overlap this Natural Area. Adding the quotas together for each ICES area which is encompassed by the Natural Area boundary would be meaningless and would not give an accurate indication of the quota for the Natural Area as a whole.

5.5.3.2 Technical measures

Mesh size

This is the most basic form of technical measure. This sets a minimum mesh size that may be used for nets in a particular area or fishery, allowing small and immature fish to pass through the net. This can be a very successful conservation measure, as it allows more fish to reach sexual maturity and become part of the spawning stock. In addition, it avoids catching unmarketable fish that would be discarded. However, demersal fisheries often consist of mixed species of varying sizes. This can lead to immature fish of larger species being caught, such as cod.

Minimum Size (MS)

Another fisheries conservation measure is concerned with regulating the Minimum Landing Size (MLS) of fish. Fish not attaining the MLS may not be kept on board or landed for sale, and must be returned to the sea. The approach aims to discourage fishermen from targeting concentrations of juvenile fish and from using small mesh nets.

5.5.3.3 Sea Fisheries Committees' byelaws

Each Sea Fishery Committee is able to introduce byelaws within their districts for governing the management of sea fish and for the marine environment. These cover regulations such as boat size, gear type as well as the dimensions and the size of fish and shellfish.

5.5.3.4 Other conservation measures

Closed areas

Closures of a fishery can be spatial or temporal. There can be total closures, where no fishing is permitted; seasonal closures, where fishing is suspended at particular times of the year; temporary closures, where fishing may be suspended at short notice; and selective closures, where only specific fishing gears are permitted. Closures may also be voluntary or statutory.

The South West Mackerel Box (Fig 5.4) was introduced in 1986 by Council Regulation (EEC) No. 3094/86. It is intended to protect juvenile mackerel by diverting fishing effort away from juvenile stocks to older fish. Vessels are prohibited from retaining mackerel caught in the Box if it exceeds 15% by weight of the total catch on board taken in the area (10% by weight of the total catch of mackerel, horse mackerel and pilchards for vessels of flags which have no quota for mackerel). Fishing by hand line is still permitted within the Box. The South West mackerel season is usually from October to April, and considerable resources are devoted to ensuring that the integrity of the Mackerel Box is maintained and that pelagic vessels fishing in and around the area comply with the rules.

An example of a voluntary closed area exists in Lyme Bay off Bridport, Dorset, where, since 1999, fishermen have agreed not to trawl or dredge close to important reefs areas. The waters around the whole island are a Marine Nature Reserve and a candidate SAC, designated for, amongst other features, subtidal rocky reefs. The first statutory 'No Take Zone' in the UK was established off the eastern side of Lundy Island in the mouth of the Bristol Channel (in January 2003). The NTZ was designated primarily for nature conservation purposes, and

extends to cover the area known to include the most sensitive marine communities. A Devon Sea Fisheries Committee byelaw prevents all forms of fishing from taking place within the zone.

Closures for reasons other than fisheries conservation

Many areas around the UK are closed to fishing activity for a number of reasons not related to fisheries conservation. Reasons range from the need to protect high-security Royal Navy ports to ensuring safety near oil and gas installations. For example, within the North Sea there are safety exclusion zones (extending to a radius of 500 metres) for all fishing activity around operational oil and gas well heads.

Reduction in fishing effort

Many of the commercially exploited fish stocks are too heavily fished, and a reduction in fishing pressure is needed from both a biological and an economical point of view.

Following the reform of the Common Fisheries Policy reductions in fishing effort to achieve a stable and enduring balance between fishing capacity and fishing opportunities have continued. These are detailed in Chapter III of the Council Regulation EC 2371/2002. Implementation of the reduction in the Community fleet capacity, in terms of tonnage and power, is provided in Council Regulation EC 1438/2003. In addition, a special incentive has been put in place (Council Regulation EC 2370/2002) for the period 2003 to 2006, to provide Member States with funds to co-finance the scrapping of fishing vessels to achieve the additional reductions in fishing effort resulting from recovery plans.

Fishing rights

Access rights to the waters around the UK also control the level of fishing activity. Access to fisheries in the six nautical mile belt of UK Territorial Seas is limited to UK vessels. Access by non-UK fishing vessels to the 6-12 nautical mile belt of the UK Territorial Sea is limited to nations with 'historic rights'. Within the Natural Area, France and Belgium have rights to fish to demersal species within the 6-12 nautical mile belt. In addition to this, France has rights to lobster, crawfish and scallops between Eddystone and Longships, and to lobster and crawfish between Longships and Hartland Point.

5.5.4 Nature conservation measures

A summary of protection measures can be seen in Table 5.3.

Only three species found within this Natural Area are protected by the EC Habitats and Species Directive - the twaite shad *Alosa fallax* , and the Allis shad *Alosa alosa* and Atlantic salmon *Salmo salar.* All species are listed on Annex II (species 'of community interest whose conservation requires the designation of special areas of conservation') and Annex V (species 'of community interest whose taking in the wild and exploitation may be subject to management measures'). The Allis shad is an interest feature of the Plymouth Sound and Estuaries SAC. There are no SACs designated for either Twaite shad or Atlantic salmon within or adjacent to this Natural Area (the latter only qualifies as an interest feature of an SAC in freshwater).

The shads are also listed on Appendix III of the Bern Convention which includes species for which appropriate and necessary legislative and administrative measures must be taken to ensure the protection of the wild fauna species. Any exploitation of wild fauna specified in Appendix III is regulated in order to keep the populations out of danger. Measures which should be taken include:

- closed seasons and/or other procedures regulating the exploitation;
- the temporary or local prohibition of exploitation, as appropriate, in order to restore satisfactory population levels;
- the regulation as appropriate of sale, keeping for sale, transport for sale or offering for sale of live and dead wild animals.

There is a grouped Species Action Plan for Commercial Marine Fish. This provides detailed information on the threats facing species and the opportunities for maintaining and enhancing populations. A 'grouped' Species Action Plan was produced as a range of common policies and actions are required for a number of similar species. The Commercial Marine Fish action plan differs from others in that it is aimed at particular stocks rather than the individual species as a whole. Within this Natural Area, stocks of cod, herring, mackerel, plaice and sole are included in the plan. There is also a Species Action Plan for the common skate, the allis shad and the twaite shad.

The basking shark is a protected species under Schedule 5 of the 1981 Wildlife & Countryside Act (1998 Amendment) which prohibits the intentional killing, capture or disturbance within 12 nautical miles of the coast. The species also has its own Species Action Plan (see Table 5.3). In early November 2002 it was added to Appendix II of the Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES). This CITES Appendix II listing provides important data collection and reporting requirements on 160 countries that attend the Convention with regards their trade in basking shark products.

Table 5.3 Summary of conservation protection measures in place to protect South Western Peninsula fish species.

Species	EC Habitats Directive (annex no.)	Wildlife & Countryside Act (schedule 5)	IUCN Red Data List Species	Bern Convention (Appendix III)	CITES	Biodiversity Action Plan
Cod *Gadus morhua*						Commercial marine fish grouped Species Action Plan
Herring *Clupea harrengus*						Commercial marine fish grouped Species Action Plan
Mackerel *Scomber scombrus*						Commercial marine fish grouped Species Action Plan
Plaice *Pleuronectes platessa*						Commercial marine fish grouped Species Action Plan
Sole *Solea solea*						Commercial marine fish grouped Species Action Plan
Allis shad *Alosa alosa*	II & V	•		•		Allis shad Species Action Plan
Twaite shad *Alosa fallax*	II & V	•		•		Twaite shad Species Action Plan
Atlantic salmon *Salmo salar*	II & V					
Basking shark *Cetorhinus maximus*		•	Vulnerable		Appendix II	Basking shark Species Action Plan

Table notes:

Annex II EC Habitats Directive – This annex includes 'Animal and plant species of community interest whose conservation requires the designation of special areas of conservation'.

Annex V EC Habitats Directive – This annex includes 'Animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures'.

Bern Convention - Conveys special protection to those species which are vulnerable or endangered. Although an international convention, in England it is implemented through the Wildlife and Countryside Act 1981.

Biodiversity Action Plan - This is the UK Government's response to Article 6 of the Convention on Biological Diversity (1994). The overall goal is to conserve and enhance biodiversity in the UK. A Species Action Plan provides detailed information on the threats facing species and the opportunities for maintaining and enhancing populations. A 'Grouped' Species Action Plan has been produced for Commercial Marine Fish as a range of common policies and actions are required for all species listed.

5.6 Shellfish

In the past beds of *Ostrea edulis* were present at a number of locations within the Natural Area. However, severe winters in the 1920s, coupled with diseases such as bonamia and martelia have depleted stock levels. Pacific oysters *Ostrea gigas* are now cultivated as they are less susceptible to disease.

The fan mussel *Atrina fragilis* is rare throughout the Natural Area, being found on subtidal sediment (mud, sand or gravel) from the shallows to considerable depths (~ 400 metres). They typically occur as individuals but sometimes gregariously. Apparently, the fan mussel was once frequently found in estuaries throughout the south west, but these populations have now largely disappeared.

5.6.1 Nature conservation measures

The native oyster has its own Species Action Plan, and its exploitation is governed by various Sea Fisheries Committees' byelaws, as well as Several and Regulating Orders granted under the Sea Fisheries (Shellfish) Act 1967. The fan mussel also has its own Species Action Plan.

5.7 Invertebrates

Many subtidal invertebrates of nature conservation importance are Lusitanean species at the northern limits of their distributions. The pink sea fan *Eunicella verrucosa* occurs at localities scattered throughout the Natural Area, on vertical or steeply-sloping bedrock surfaces in the circalittoral zone. Pink sea fans may be found individually or in groups of tens or hundreds of individuals. Work has recently been undertaken to ascertain the distribution of pink sea fans and overall their 'health' (eg Marine Conservation Society). To date, it has been found in the south west at Portland Bill, Lyme Bay, Salcombe, Eddystone Rocks, Plymouth, the Manacles, Isles of Scilly, Land's End, Lundy (and Skomer and St David's Head in south west Wales) (pers. comm., C. Wood, National Seasearch Coordinator). Another species closely associated with sea fans is the sea fan anemone *Amphianthus dorhnii*. This small anemone was once thought to be common on the south coast, but it now appears to be quite rare. The MCS study has found that out of 592 sea fans counted and measured, *Amphianthus* anemones were only present on four of them (ie < 1%).

The sunset cup coral *Leptopsammia pruvoti* is another Lusitanean species with a very restricted distribution. It seems to prefer vertical or slightly overhanging circalittoral rock faces at sheltered sites. It has only been found at a handful of sites in the south west, including at Portland Bill (its easternmost locality), on two reefs in Lyme Bay, on the east side of St Mary's in the Isles of Scilly and at Lundy. These populations in the south west are at the northern limit of their distribution and may be a relic of a former, more extensive distribution approximately 700 years ago.

5.7.1 Nature conservation measures

The pink sea fan, sea fan anemone and the sunset cup coral all have their own Species Action Plans. The pink sea fan is protected under Schedule 5 of the Wildlife and Countryside Act 1981 and is listed as 'Endangered' in the International Union for the Conservation of Nature and Natural Resources (IUCN) red list of threatened species.

Figure 5.1 Map of the Special Protection Area within the South Western Peninsula Marine Natural Area.

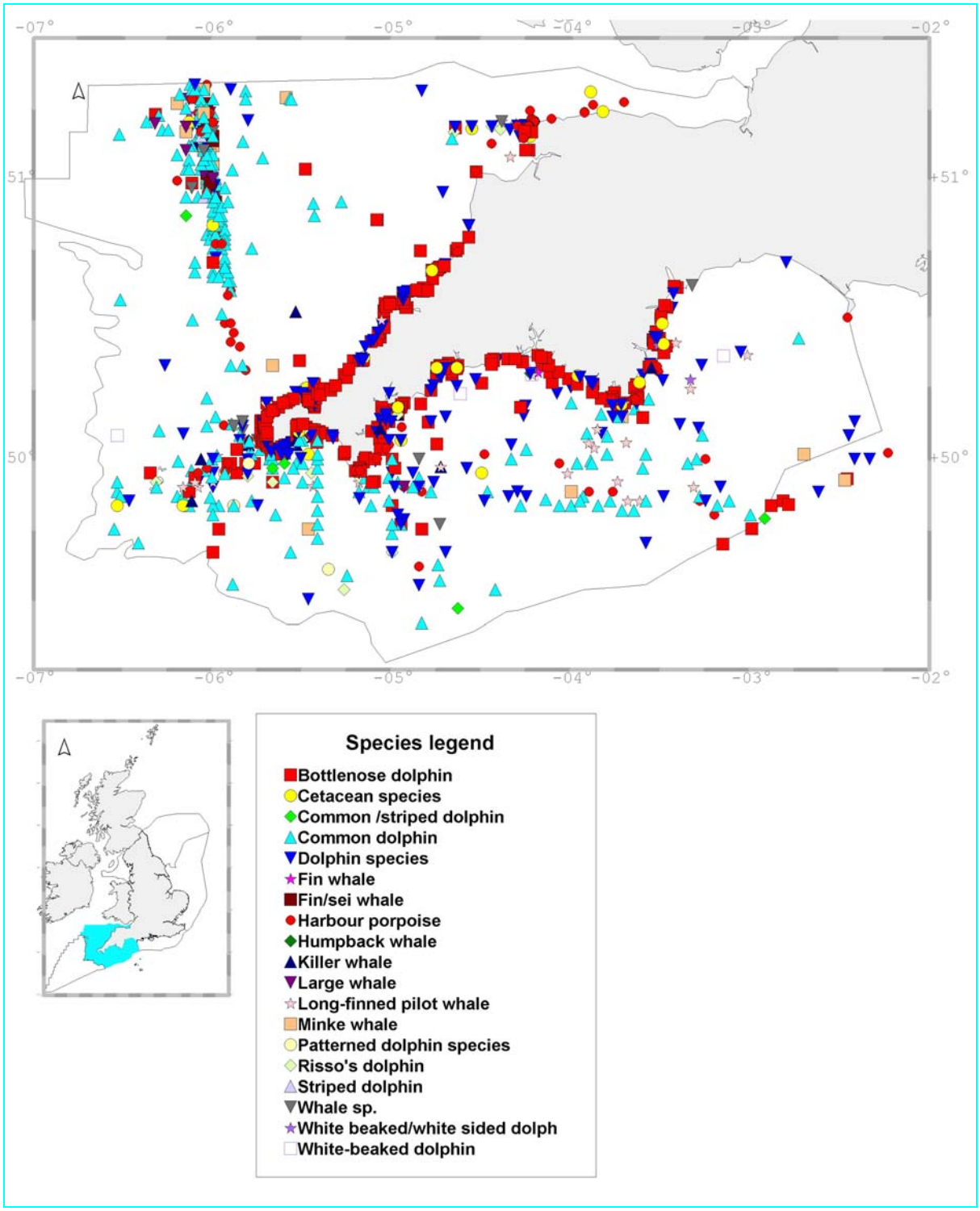
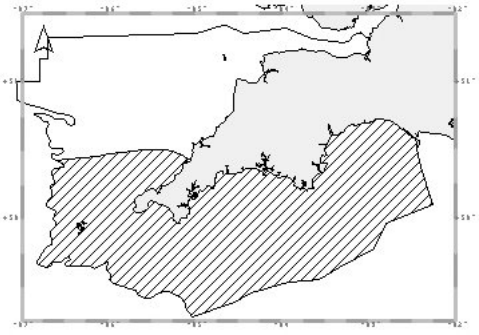
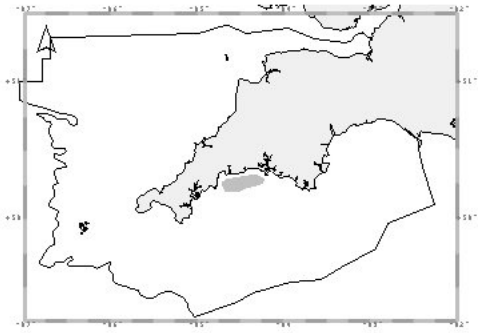


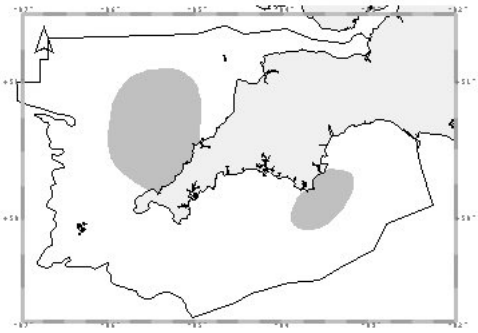
Figure 5.2 Records of cetaceans seen in the South Western Peninsula Natural Area (after Evans *et al* 2003).



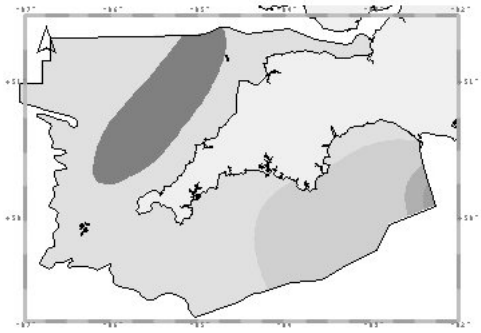
(a) Distribution of mackerel nursery areas within the South Western Peninsula Natural Area.



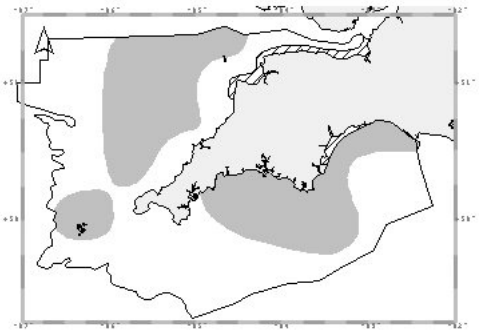
(b) Distribution of herring spawning areas within the South Western Peninsula Natural Area.



(c) Distribution of cod spawning areas within the South Western Peninsula Natural Area.



(d) Distribution of plaice spawning areas within the South Western Peninsula Natural Area.(dark grey = intensive spawning → light grey = low intensity spawning).



(e) Distribution of Dover sole spawning and nursery areas within the South Western Peninsula Natural Area.

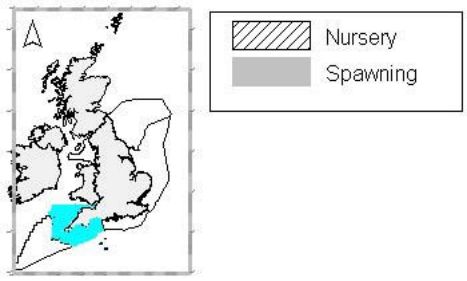


Figure 5.3 Maps showing the distribution of nursery and spawning areas within the South Western Peninsula Natural Area (data taken from Coull *et al* 1998 and provided by CEFAS).

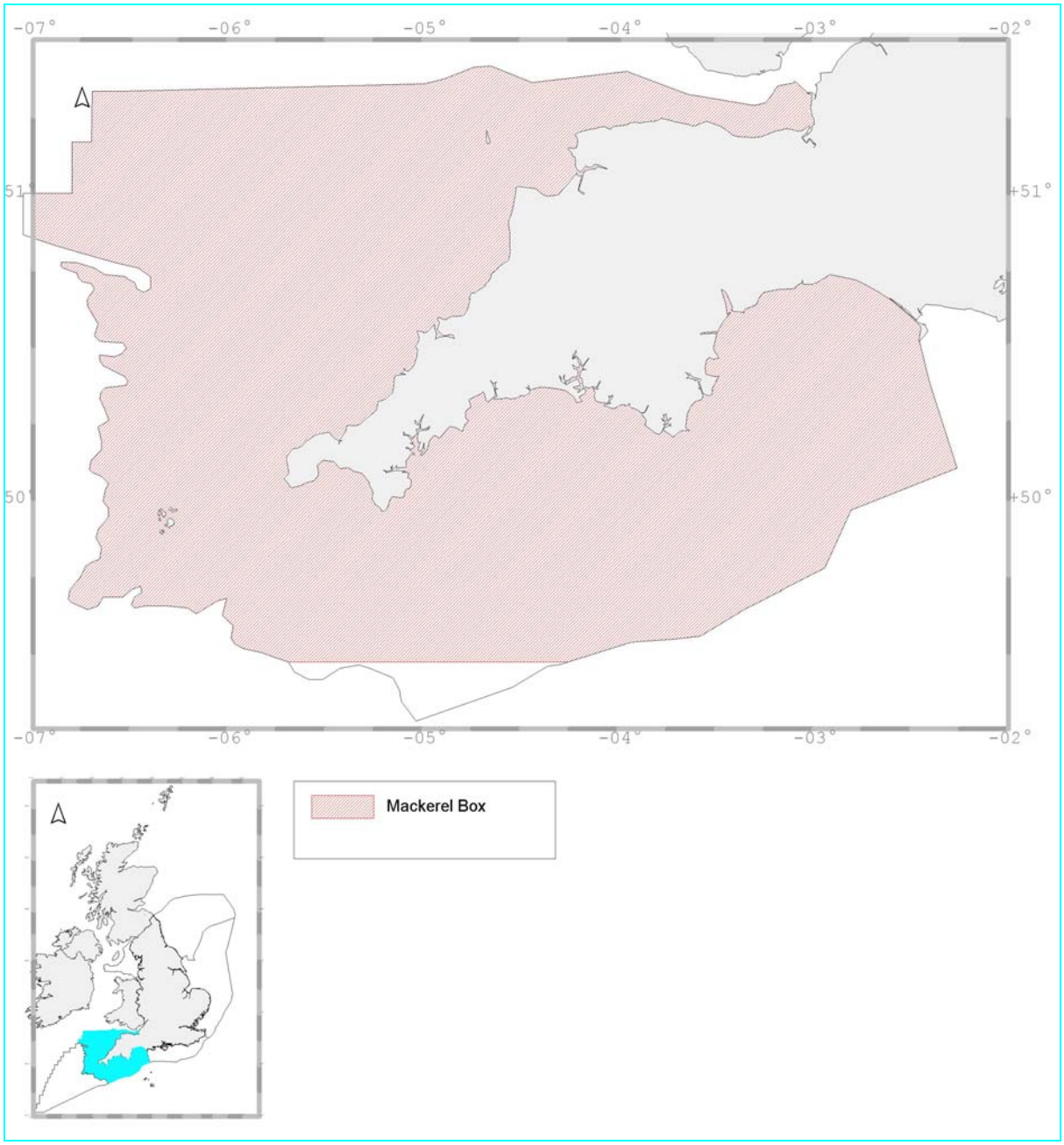


Figure 5.4 Location of Mackerel Box within the South Western Peninsula Natural Area.

6 Human activity and use

This section outlines significant human activities in the Mid North Sea which are relevant to the nature conservation values described in the previous sections. This section does not provide a comprehensive listing of all the social and economic activities of the South Western Peninsula, and for those that are included, the descriptions are brief. Rather, the intention is to give an overview of the range of activities which do or could interact with the environment. We have emphasised the need to consider these together if we are to achieve sustainable use of the marine environment and its biodiversity.

6.1 Fisheries

The fishing industry plays a major part in the economy of the South West, with many small and large ports scattered along the coast (Fig 6.1). Populations of a number of commercial fish species occur within the Natural Area, together with their spawning grounds and nursery and feeding areas for the fish (see section 5.5). There are four 'major' fishing ports (as defined by Defra) within this Natural Area, all on the south coast: Brixham, Plymouth, Falmouth and Newlyn. There are, though, numerous other smaller ports where fish are also landed .

The local fishing fleet can be split into two groups: offshore vessels (the majority of which are based in Brixham, Plymouth and to some extent Newlyn), and smaller inshore vessels (Pawson *et al* 2002). The methods of fishing undertaken are the same across the fleet (except the offshore vessels are usually larger), although present-day economics force smaller boats further out to sea. The design of some boats allows diversification, for example, a beam trawler or an otter trawler can be converted into a scallop dredger. Some vessels are built to undertake multi-functional roles. In such instance, a potter could also be a netter or an otter trawler (pers. comm., N. Downes, Devon Sea Fisheries Committee).

The main methods of capture in the south west are beam trawling, scallop dredging, otter trawling, mid-water trawling (single boat and pair team for pelagic fish), potting, gill netting, tangle netting, long lines and hand lines (pers. comm., N. Downes).

Fishing opportunities on the north coast of Devon and Cornwall are as diverse and as productive as those on the south coast. However, on the north coast suitable berthing sites for larger vessels are limited. Local vessels therefore tend to be a maximum of 17 metres in length. The large vessels fishing the grounds are based in the three major ports, with additional effort from vessels based at Milford Haven and the continent. On both coasts, most fisheries are very seasonal.

As restrictions on several 'traditional' catch species increase, many non-quota species such as squid, cuttlefish and lemon sole are becoming increasingly important. The brown (or edible) crab fishery attracts a lot of effort, with landings in Salcombe and Kingswear alone accounting for around 15% of total crab landings into England and Wales in 2000 (Pawson *et al* 2002). Beam trawling for flatfish is intense in some inshore areas, for example between Looe and Lizard Point.

Fishing activity impacts on the environment with both direct and indirect effects on the environment. Although the most evident and direct impact of fishing is mortality and

removal of fish from the marine ecosystem, other impacts are described in the following sections

6.1.1 Physical impact of fishing gears

6.1.1.1 Towed or dragged gears

Trawling is the principal method of fishing for demersal species such as sole, plaice, rays and turbot – these species are landed all year round. Red mullet are usually taken during late summer, along with squid.

Examples of towed gears include beam trawls, dredges and trawl nets. These may be further considered in terms of mid-water and bottom trawl nets, depending on the depth of water and the species being targeted.

Beam trawls - Beam trawlers are largely used to target flatfish such as sole and plaice that burrow in the sand. The gear used by beam trawlers runs over the top of the seabed, leaving behind a track or scour mark depending on the type of ground being worked (Gubbay & Knapman 1999). In this type of trawl, the mouth of the net is kept open by the beam that is mounted at each end on guides or skids that travel along the seabed. The trawls are adapted and made more effective by attaching tickler chains that drag along the seabed in front of the net, causing the fish to rise from the sand and into the oncoming trawl. The extent to which the seabed is affected depends on the type of fishing gear, the substrate and its physical characteristics (Jennings & Kaiser 1998; Lindeboom & De Groot 1998). The tracks will gradually fill in, the time taken for this to happen depending on the type of ground, the depth of water, the strength of the tide and the weather conditions.

The impact of beam trawls appears to be greatest on densities of small, fragile benthic species, possibly because larger animals live deeper in the sediment or are better able to escape (Bergman & Hup 1992). Changes in benthic community structure occur following beam trawling but the effects can be variable (De Groot 1984; Jennings & Kaiser 1998; Lindeboom & De Groot 1998). In intensively trawled areas it has been suggested that there is the community shifts towards being dominated by highly productive, opportunistic species such as polychaetes.

Beam trawling is widespread within this Natural Area. The main target species for beam trawls are Dover sole, lemon sole, plaice, rays, turbot and megrim (Pawson *et al* 2002), with cuttlefish being taken offshore from November to March (pers. comm., N. Downes). However, other methods may be used for catching some of these species such as otter trawls, tangle and trammel nets (see below).

Otter trawls - The otter trawl is a large cone-shaped net which is towed across the seabed. The mouth of the net is kept open by otterboards. These are in contact with the seabed. They may mound the sediment as well as creating a scour furrow (Gilkinson *et al* 1998). This may alter the surface roughness of an area as well as the sediment structure. Otter trawling, like beam trawling, can result in the capture of a considerable amount of by-catch species, though certain selectivity measures (such as incorporating square mesh ‘windows’ in the top of trawl nets which allow the release of non-target species) are now more readily used. Trawls can sometimes be fitted with rock-hopper gear to enable them to traverse reefs. Otter trawls are mainly used to target lemon sole, whiting and plaice all year round with seasonal variations.

The main season for lemon sole is from December to March, with plaice sometimes supporting a late summer/autumn fishery. Otter trawls may also be used to catch cuttlefish in inshore waters from early spring into summer (pers. comm., N. Downes).

Dredges – Within this Natural Area these are used to catch scallops, with boats operating in inshore and offshore waters. A dredge consists of a cage or coarse-meshed net with a reinforced opening, which is dragged across the seabed. Dredges are used mainly to collect shellfish such as oysters, calms, mussels and scallops. The scallop dredge has a set of teeth along the leading edge to rake out buried scallop; the teeth are spring-loaded to facilitate dredging over rough ground. Within the six-mile limit, scallop dredging is strictly controlled. Outside this limit, boats may operate as many dredges as they wish but 'French' dredges are banned and a strict by-catch control regime by Defra is in place for 'quota' species (pers. comm., N. Downes).

The scallop dredge can be very destructive of habitat and of non-target species (especially corals, sponges and erect bryozoans), which can be damaged or destroyed by the passage of the dredge. Frequently, the areas dredged are close inshore and may be of high habitat and species diversity. Therefore, conflict with marine conservation interests is often inevitable. Destruction of the habitat and associated communities can adversely affect the future of the fishery, as scallop spat settlement occurs in erect epifauna such as bryozoa (Eno 1991). Where scallops are taken from a more mobile seabed, the associated damage is minimal. Likewise, the harvesting of scallops by diving has a negligible effect on the seabed or its marine life.

Within Lyme Bay, scallop fishing takes place all year round, with more effort during the spring and summer months. A Devon Sea Fisheries Committee byelaw prohibits the removal of scallops by dredge from within the six-mile limit during the months of July, August and September. During this time, some boats switch to other methods, whilst others fish outside the prohibited area.

6.1.1.2 Static gear

Gill nets can be set at or below the surface, on the seabed, or at any depth inbetween. This type of gear can result in the incidental capture of marine life, most notably marine mammals and seabirds. They also have the potential to continue fishing if lost or discarded, an effect which has been described as 'ghost fishing' (Kaiser *et al* 1996) (see section 6.1.2). Static gear fishing is practised throughout the Natural Area, its intensity decreasing with distance from the coast. The main target species of set nets are sole *Solea solea* and plaice *Pleuronectes platessa* (mostly using tangle and trammel nets over the summer months), with larger-meshed tangle nets being set for rays, turbot *Scophthalmus maximus* and brill *Scophthalmus rhombus* during this period too. Gill nets are used for cod *Gadus morhua* and whiting *Trisopterus luscus* during the colder period of the year, when shoals appear close inshore, though this region is not renowned for its cod fishery.

Potting, using inkwell or parlour pots, provides the mainstay of many small fishing ports within the Natural Area, with edible crabs, lobsters, spider crabs, crawfish and velvet crabs being taken. Edible crabs make up the bulk of the shellfish landings and are targeted in spring and early summer and again in the autumn before they spawn. Larger boats set up to 2,000 pots up to 30 miles off the north coast and as far into the Bristol Channel as Burnham-on-Sea (Robson 1996). The setting and lifting of pots may affect the life attached to the

seabed only in the immediate vicinity of each pot. This is likely to be of nature conservation concern only if delicate and rare species are damaged by the pots.

6.1.2 Stock depletion

The spawning stock biomass of mackerel has fallen since the mid-1980s and it is estimated that this decline will continue at all fishing mortalities. In order to reduce pressure on juvenile stock in particular, a 'Mackerel Box' was introduced in 1986 within which certain types of gear used to catch mackerel was restricted (see also section 5.5.3.3). ICES recommended limiting catches in 2003 to 113, 000 tonnes for all ICES areas in which mackerel are harvested, including the South Western Peninsula. ICES further recommended that fisheries targeting mackerel, in which juveniles are abundant, should be restricted. Industrial fisheries (large volumes of fish harvested for processing into fishmeal), which occur most frequently off the west coast of Scotland, take mackerel as by-catch. It seems probable, however, that such industrial fisheries could have an impact on those stocks in the South Western Peninsula Natural Area, which would affect local industry. ICES has advised that such fisheries be restricted in order to protect mackerel stocks.

6.1.3 Fishing debris

Fishing activity has been identified as one of the four major sources contributing to litter found on UK beaches (Marine Conservation Society 1999). Items such as fishing nets, fish boxes and buoys from the fishing industry account for 11.2% of the total amount of litter found. One of the consequences of fishing-related debris in the marine environment is 'ghost fishing'. This is where nets or pots, lost either because of bad weather, snagging, towed away by mobile fishing gears, or simply discarded, remain either on the seabed or in the water column and continue to 'fish'. Often though, lost or discarded nets are rolled up on the seabed by the action of currents or wave action and cease fishing relatively quickly. However, floating debris may entangle marine life close to the surface, such as seals, cetaceans, turtles and seabirds.

6.1.4 By-catch

One of the problems associated with most types of fishing gear is that of incidental capture or by-catch of non-target species. This may include other commercial and non-commercial fish, seabirds and sea mammals. Concern has grown over the impact of a number of gill-net fisheries on cetaceans. This method of fishing accounts for the majority of marine mammal by-catch in British waters (Jefferson & Currey 1994). Cetaceans are also captured incidentally in certain trawl fisheries. For example, common dolphins are regularly, albeit inadvertently, killed in some pelagic trawl fisheries for bass, especially those using pair trawling where the net is towed between two separate boats. The impact of incidental capture on porpoise populations around the UK as a whole is not known. However, it has been suggested that incidental by-catch could be a significant contributory factor in the overall decline in abundance of harbour porpoise in European waters (Gislason 1994). This issue is of great concern in the south west, where many small cetaceans are found washed-up dead on beaches and show signs of entanglement in fishing gear. In some areas, Sea Fisheries Committees (SFC), Defra and fishermen have agreed for cetacean observers to accompany boats out to sea, in order to assess by-catch directly. Various methods and devices have been trialled to deter cetaceans from becoming entangled in nets, including the use of 'pingers'. These are acoustic deterrent devices (Reeves *et al* 2001) that can be run with a small battery

pack for periods of months or years. Pingers have been shown to be effective in mitigating small cetacean by-catch in fixed gear, both in controlled experiments and in fishing operations. They have been recommended for use in large mesh nets and wreck nets in certain parts of the North Sea (Defra 2003). However, they have only been tested on a few small cetacean species so far. The Government is developing a small cetacean by-catch response strategy that may include compulsory use of sonic devices and wider use of observers at sea.

Other mitigation measures include the use of 'escape hatches' in nets, making nets more 'reflective' (experiments have been tried by coating nets with a layer of iron oxide or barium impregnated nylon to make them stiffer (Larsen *et al* 2002)).

6.1.5 Ecosystem effects

Intense fishing activity leads to the 'fishing down' of the food web (Pauly and Maclean 2003). This is where the top predators have been removed, leading to modifications in predator-prey relationships and changes in marine food chains. The removal of the top predators has been linked to the growth of industrial fisheries (those fisheries targeting species for non-human consumption), in particular those focused on sandeels. However, these industrial fisheries are also of concern. As species near the base of the food chain are removed in vast quantities this may impact the breeding success of bird species that rely on them as a food source.

6.2 Oil and gas extraction

The UK Government has the right to grant licences to explore and exploit resources such as oil and gas. The UK Continental Shelf is divided into a series of blocks for which licences are granted. However, there are no offshore oil or gas fields in production or under development in the waters surrounding the South Western Peninsula. There are, however, a number of well heads which have now been abandoned (permanently sealed) or suspended (temporarily sealed), having been used for exploratory purposes.

6.3 Aggregate extraction

Very little aggregate extraction activity is taking place within this Natural Area (Figure 6.2). Of the two areas licensed for aggregate extraction falling within this Natural Area, only one lies wholly in the area and only a small proportion of this area is dredged.

Sand and gravel on the seabed are important sources of industrial aggregate for concrete production, road construction, building and, increasingly, for beach replenishment and soft coastal defence. As pressures on land-based sand and gravel sources increases, there is a need to consider alternative sources of supply. Whilst secondary and recycled aggregates play an increasing role there is likely to be an increased demand for marine dredged sand and gravel. The main market for marine-dredged aggregates is in the south east of England.

The Crown Estate license extraction within their areas of jurisdiction. However, Government controls the dredging of marine aggregates and this has historically been exercised through the Government View Procedure, currently administered by the Minerals and Waste Planning Division of the Office of the Deputy Prime Minister. It is anticipated that new Regulations will come into force in the near future. These new Statutory Regulations will apply to

England, Wales and Northern Ireland. Scotland will introduce their own regulations to govern extraction of marine minerals.

Applications for the extraction of marine minerals are currently operating under the Interim Government View Procedures, pending introduction of the Statutory Procedures. Both the Interim and anticipated Statutory Procedures are to be administered by Office of the Deputy Prime Minister in England, DoE(NI) in Northern Ireland, the Welsh Assembly Government and the Scottish Executive, as appropriate. Each application will require an Environmental Impact Assessment and extensive consultation with the fishing industry, relevant government bodies and the general public. Both the Interim and anticipated Statutory Procedures have provision to hold a public inquiry if necessary.

The physical impacts of marine aggregate extraction arise from removing the substrate and altering the seabed topography; creation of a turbidity plume within the water column in the area of activity; and sediment re-deposition. Dredging disturbs the benthic community and can reduce the number and diversity of benthic species (ICES 2001). One fish species considered to be potentially at risk as a result of marine aggregate extraction within the Natural Area is the sole *Solea solea,* whose nursery areas hug the north coast of Devon and Somerset (see Figure 5.3e).

Sediment plumes arising from dredging introduce sediment into the water column in the vicinity of the dredged area. Plumes arise from both the action of the draghead (on the seabed) and also from the hopper overflow and the screening process (from the vessel on the surface). Hitchcock *et al* (1999) found that the bulk of the plume settled out of the water column within 300 metres (sands) to 500 metres (silts) downstream. This corresponded to a time period of 10-15 minutes after release. Coarse sands and gravels settled out virtually instantaneously. It is concluded that, providing the deposit being dredged does not have abnormally high levels of fine material, the spread of turbid water is likely to be limited to within the close proximity of the aggregate extraction site.

John *et al* (2000) identified reduced light penetration, as a result of turbidity, as one of the main water quality issues arising from increased suspended sediment in the water column. High levels of suspended sediments, along with the associated reduced light penetration, can adversely affect primary production within the water column (Iannuzzi *et al* 1996). However, this is likely to be more significant in the suspension of finer material, such as that produced by the deposition of maintenance and capital dredgings (see section 6.5).

Re-deposition of the particles from sediment plumes will also occur and, once settled on the seabed, will be liable to re-suspension or transport over the substrate. The extent and magnitude of this will depend upon the interaction between the local hydrodynamic situation, and the characteristics, volume and particularly the rate of input of the re-deposited sediments. Although this process occurs naturally, the greater loading of sediment can, in severe cases, smother benthic species and fish eggs on spawning grounds (see also section 6.5) on the disposal of maintenance and capital dredged material). Appropriate selection of extraction sites, and possible seasonal restrictions on working the sites, should minimise the risk of this happening.

6.3.1 Maerl extraction

Maerl is extracted for use in animal food additives, water filtration systems and for other purposes, but its main use has been as an agricultural soil conditioner. The maerl bed present in the Fal Estuary is the largest in England and Wales and covers approximately 150 hectares (see also section 4.4.) (Figure 6.2). Maerl has been extracted from this site for over 300 years (there is a reference in Latin dated 1690, cited by Irvine and Chamberlain (1994) which translates as meaning "small white coral… found plentifully in the ouze dredged out of Falmouth Haven to manure their lands in Cornwall").

In the Fal Estuary, three companies are licensed to extract dead maerl from the beds within Carrick Roads (which lies within the Fal and Helford candidate Special Area of Conservation – see Figure 4.5). The Falmouth Harbour Commissioners review the licences annually and the companies in question need to re-apply for them each year. Currently, in the region of 30,000 tonnes of dead maerl are extracted annually by two of these companies (pers. comm., Roger Covey, English Nature). The two species of maerl present within the beds, *Phymatolithon calcareum* and *Lithothamnion coralloides,* are both are listed in Annex V of the EU Habitats Directive, and the maerl bed habitat is a component of the 'Subtidal sandbanks' feature, for which the site was proposed to the European Commission. Maerl beds are also a BAP habitat. Although the extraction companies are targeting dead maerl deposits, these have been dated as being over 2,000 years old and they are known to support rich biological communities in undisturbed areas. Consequently, there is growing concern over the nature conservation implications of pursuing this practice, together with doubts over its long-term sustainability.

6.4 Shipping

6.4.1 Commercial

Many different types of vessel operate in this area, according to the nature of the cargo they are carrying (see Figure 6.3 and Table 6.1). Within this Natural Area the predominant types of shipping vessels are cargo carriers.

Since the mid-nineteenth century the volume of goods transported by sea has grown enormously. The growth of the petroleum industry and the advent of the oil tanker, which is the largest carrier of cargo, had a significant effect on shipping. The carriage of goods by sea inevitably places marine and coastal environments at some risk. Almost any vessel anywhere has the potential to cause a degree of environmental damage, either through routine operations or accidents. The extent of environmental damage following any accident depends on a range of factors, in particular the cargo of the vessel, where the accident occurs, the depth of water, the state of the tides and at what time of year. Within this Natural Area the predominant types of shipping vessels are cargo carriers (see Figure 6.3 and Table 6.1). Despite this, shipping is responsible for a relatively small proportion of all marine pollution in the UK, compared to that from land-based sources. Much of the marine pollution may be traced back to centres of population and to industrial and agricultural operations.

There are four potential areas of concern with commercial shipping:

- **Historical pollution** - for example, the application of TBT has now been banned on vessels of all sizes by the International Maritime Organisation, with a global ban due to come into force in 2008.
- **Operational pollution** – these consist of oil and oily wastes, noxious liquid substances, sewage and garbage.
- **Accidental pollution** – as a result of collision or grounding, which can result in large quantities of pollutant being released into the marine environment. The types of pollutants are similar to those associated with operational discharge.
- **Physical damage** – resulting from the grounding of vessels, anchors dragging along the seabed and disturbance from propellers.

Within recent years a number of shipping incidents involving the release of oil have occurred within and around the boundary of this Natural Area (see Figure 6.4). Of the 32 oil spills that occurred in and around the South Western Peninsula Natural Area during 1989-1998, a total of 1,236 tonnes of oil were released into the environment (Safetec 2000).

One of the first and largest spills of oil of modern times to affect the English coast happened in March 1967, when the oil tanker *Torrey Canyon* ran aground on the Seven Stones reef, some 8 kilometres east of the Isles of Scilly. 100,000 tonnes of crude oil were spilled and over 100 kilometres of the Cornish coastline was affected. Another large tanker, the *Amoco Cadiz*, ran aground off the Brittany coast in 1978, spilling all of its cargo of 220,000 tonnes of crude oil. Though most of the pollution affected the French coast, some lighter fractions reached the south Cornish coast too. More recently, oil from the stricken tanker *Sea Empress*, which ran onto rocks at the mouth of Milford Haven in south west Wales in 1996, spread some distance into this Natural Area. A thin film of oil was detected on the sea's surface close to Lundy some two weeks after the incident (pers. comm., Liza Cole, ex-Lundy MNR Warden).

Attention tends to focus on accidents involving large oil tankers, although smaller vessels carrying other cargoes and large quantities of fuel, together with illegal ship discharges, can also threaten marine environments. Seabirds are most vulnerable to oil spills as many species congregate at high densities to feed, nest and moult. In such situations, a large proportion of the total population is susceptible to local incidents such as oil spillages (RSPB 2000). Species, such as divers and grebes that are found within this Natural Area, moult their feathers simultaneously, becoming temporarily flightless (Tasker *et al* 1990). This makes them particularly vulnerable to oil spills at this time. In addition, the majority of marine birds are long-lived, do not reach breeding condition for many years and have low reproductive rates. As a result, even highly localised incidents can have a significant impact upon a population.

In an attempt to address some of the problems caused by shipping, the Donaldson Inquiry was initiated to 'identify what can reasonably be done to protect the UK coastline from pollution from merchant shipping' (Donaldson 1994). The Inquiry, initiated after the *Braer* disaster, provided an overview of the use of routeing measures aimed at accident prevention and subsequently dangers of pollution and loss of life. Routeing measures ensure that ships are kept outside areas where pollution would cause particular damage to the environment. One of the major recommendations of the inquiry was the establishment of Marine Environmental High Risk Areas (MEHRAs). These are comparatively limited areas of high environmental sensitivity that are at risk from shipping. The idea was that identifying

MEHRAs would give ship's masters with additional information relevant to passage planning, which would result in the usage of the recommended routeing and so reduce pollution risk at these sites. The process of identifying MEHRAs is well advanced, though the timescale for their introduction has not been decided.

6.4.2 Ferries

A proportion of the marine traffic within this Natural Area is ferries that transport cars and passengers across the English Channel to ports in France, Spain, the Channel Islands and the Isles of Scilly.

On average 84 ferries pass through this Natural Area per week (see Figure 6.5). Passenger ferries pose little threat to the marine environment when compared with tankers or cargo vessels, as they tend not to carry hazardous chemicals. However, they are likely to be carrying several thousand tonnes of heavy fuel oil during each sailing, and any grounding incident will have an impact on the marine environment. In shallow water, propellers can also cause disturbance. Information taken from Lloyd's Register Casualty Database (Safetec 2000) shows that over the period 1989-1998, only 3% of grounding incidents for the whole of the UK involved ferries.

6.5 Waste disposal

The disposal of waste or other matter into the sea is prohibited by the OSPAR Convention, with the exception of dredge material, waste from fish processing, inert material of natural origin and, until 2004, vessels and aircraft (OSPAR Commission 2000a). A range of materials, including sewage sludge and industrial waste, were disposed of at sea in the past. However, industrial waste dumping was phased out in 1992, and the disposal of sewage sludge has been banned under the OSPAR Convention since 1 January 1999. The largest sites (historically) for the disposal of sewage sludge within the Natural Area were within Lyme Bay and off Plymouth (see Figure 6.6). There is currently little information on the continuing effects of sewage sludge dumping since it ceased in January 1999. However, data is being collected by CEFAS under the auspices of the National Marine Monitoring Programme from a number of the former dumping sites. This will hopefully provide some insight into the long-term impact of sewage sludge disposal.

As indicated earlier in this section, the disposal of dredged material is still permitted at a number of sites within this Natural Area (see Figure 6.6). Disposal of dredged material in UK territorial waters is controlled under the Food and Environment Protection Act 1985 (FEPA), which requires a licence for the depositing of substances or articles on to the sea bed. Dredged material consists primarily of material removed to keep navigation channels clear (maintenance dredging), or material removed during coastal construction engineering projects, including the digging of new navigation channels (capital dredging). The sediments dredged from some of the UK's port and harbours may be contaminated with heavy metals, nutrients, organic pollutants and other substances. However, there are stringent sediment quality guidelines during the consents procedure, to prevent heavily contaminated material being disposed of to sea.

Open-water disposal of uncontaminated dredged material, if properly handled, appears to cause few problems in the long term (GESAMP 1990). The short-term and localised effects of dumping dredged material at sea are summarised by Posford Duvivier (1992) as:

- Increased turbidity in the dumping area reducing light penetration and affecting filter-feeding organisms.
- Smothering benthos with the result of destroying the communities present.
- Potential change in sediment size distribution that may affect spawning and recolonisation.
- Water quality deterioration if the sediment is contaminated.
- Changes in bathymetry of the seabed that may affect benthic and demersal communities.

Defra's policy on disposal aims to minimise the disposal of clean dredged materials, especially sands and gravels, in favour of identifying beneficial uses such as beach nourishment, saltmarsh restoration or mudflat enhancement. This also helps to reduce the loss of material from coastal cells. The Marine Consents and Environment Unit within Defra tries, wherever possible, to work with licence applicants, nature conservation bodies, coast protection authorities, the Environment Agency and others, to identify potential schemes that use dredged material in a practical and appropriate manner.

Table 6.1 Annual total of number of vessels passing through the South Western Peninsula Natural Area in 1999. (Data taken from COAST database.)

Vessel type	Annual total of number of vessels passing through the Natural Area
Bulk	9,242
Cargo	54,352
Ferry	25,170
Gas carrier	3,434
Ro-Ro	9,424
Standby	0
Supply	0
Chemical tanker	6,742
Oil tanker	11,072
Shuttle tanker	178
All	119,614

6.6 Litter

Despite pertinent laws and regulations, litter is still a considerable problem for the marine environment and coastal communities (OSPAR Commission 2000a). Potential sources of litter are mainly related to waste generated by shipping and tourist/recreational activities. Litter may also be transported into the sea by winds, currents and rivers. Fishing debris, such as nets and buoys, also contribute to the litter found within this Natural Area. One of the consequences of fishing-related debris in the marine environment is ghost fishing, whereby the discarded gear continues to 'fish' (see section 6.1.2). Floating debris may also entangle marine life close to the surface, such as seals, cetaceans, turtles and seabirds. In 1991, the

English Channel (together with the North Sea) was designated a MARPOL Special Area (Annex V), where the dumping of garbage and litter from ships is prohibited.
At a recent OSPAR commission ministerial meeting, the contracting parties agreed to "do their utmost to take measures to eliminate the problem of litter" including through OSPAR's Marine Litter Monitoring Work Programme (OSPAR 2003).

6.7 Submarine cables

A number of submarine communication cables traverse the South Western Peninsula Natural Area (see Figure 6.7). Many run over 3,000 miles across the Atlantic to the Americas, while others link with France, Ireland, the Iberian peninsula and Africa. Submarine cables have been laid on the seabed since before 1900. Cables installed since 1983 are buried beneath the seabed wherever possible, to a depth of 40-90 centimetres, although they can often be scoured out by tide and currents or can be dragged out by anchors and fishing gear. Even though attempts are made to bury new cables, they can still interfere with fishing operations or cause damage if they become snagged in fishing gear. The environmental effects of cable laying, however, are limited (Department of the Environment 1993).

6.8 Recreational uses

This chapter has mainly considered the most important human activities within the Natural Area. There is, however, a range of recreational activities that occur within the Marine Natural Area which have a significant input into the local economy and are of interest to those engaged in coastal planning and management, as well as the users themselves. However, as most of these activities are confined to the coastal and inshore waters, we have not dealt with them in any great detail here. Further information can be found in other publications such as the JNCC's Coastal Directories (eg Barne *et al* 1996a, b, c) and English Nature's regulation 33 packages (English Nature 2000).

Water-based recreation is a very important activity within the Natural Area, particularly in inshore areas along the south coast. The coast of south Devon in particular is one of the most important areas for water-based activity in the UK (Fowler *et al* 1996). With the continued growth of sailing and power boating in southern England, the whole of the south west is experiencing demand for additional mooring and marina facilities. Activities include yachting, motor-boat cruising, power-boat racing, dinghy sailing, canoeing, surfing, windsurfing, diving, water skiing, the use of personal water craft, rowing and tourist boat trips. Whilst sailing has only a limited impact on the marine environment, power-boating, water-skiing and jet skiing cause concern in many coastal locations, as these activities often conflict with quieter traditional beach activities and nature conservation objectives. Other concerns include the impact of moorings and anchors on certain habitats (particularly maerl), and the pressure of large numbers of SCUBA divers at key conservation sites.

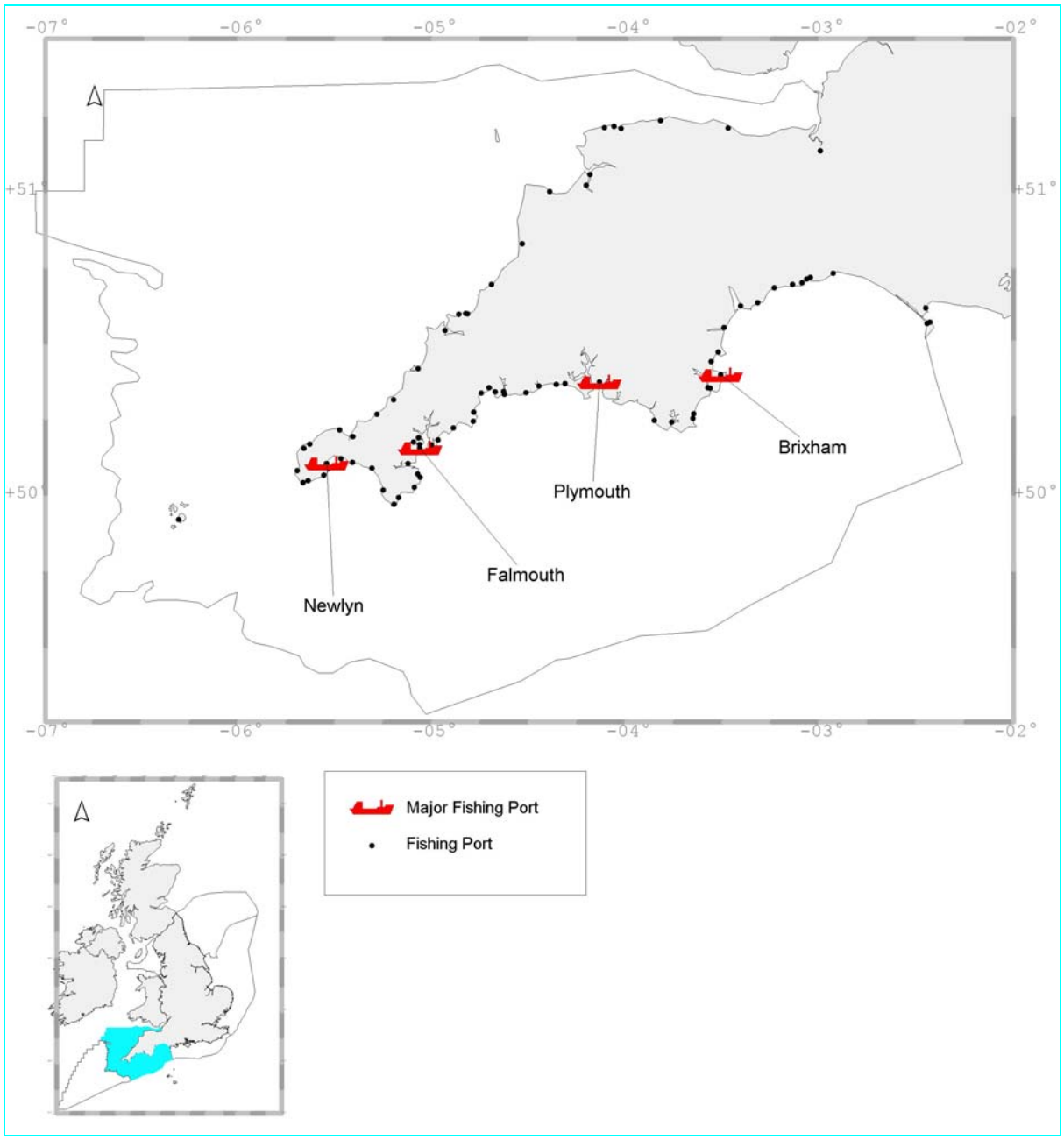


Figure 6.1 Distribution of fishing ports in the South Western Peninsula Natural Area (data provided by CEFAS).

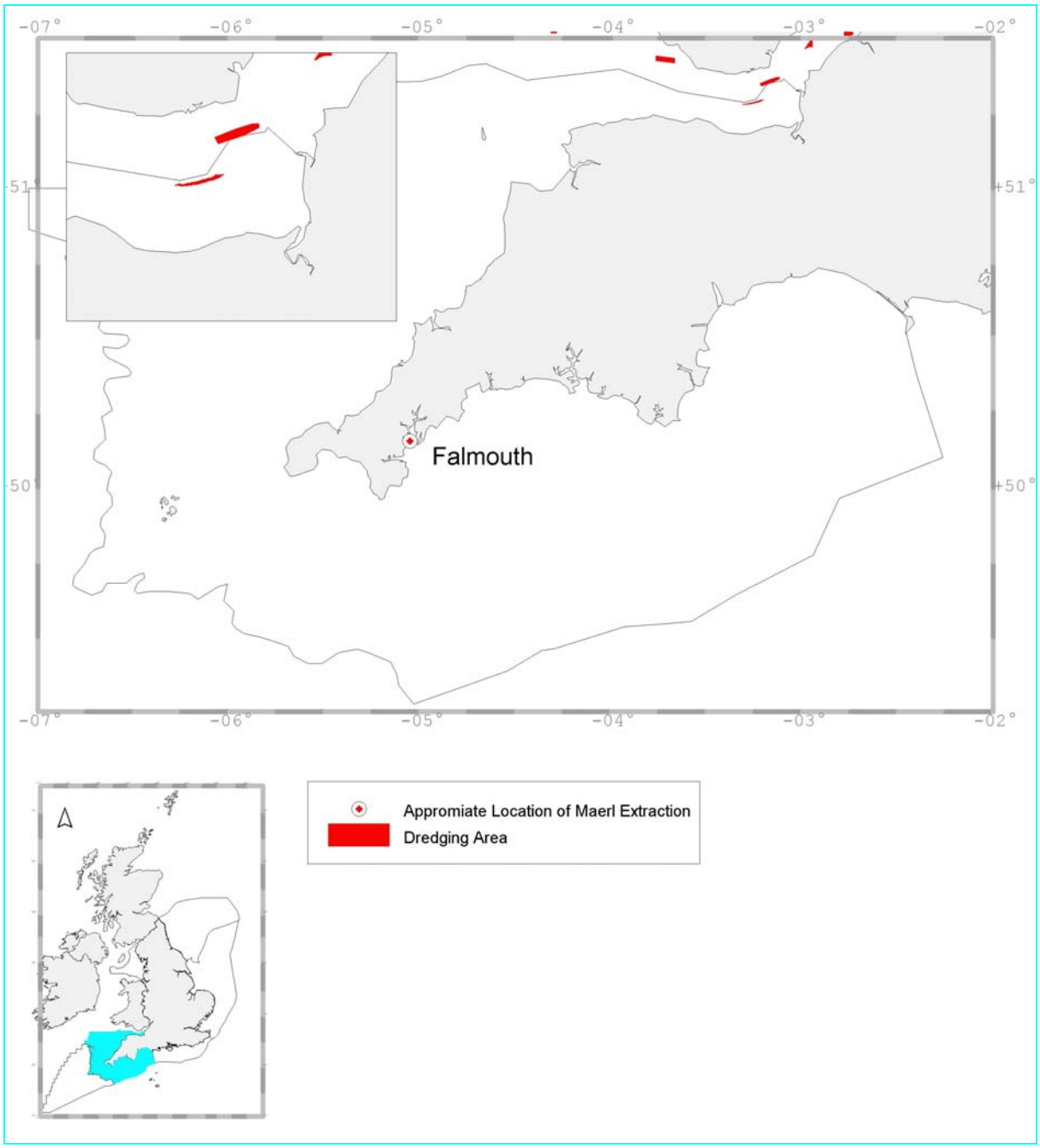


Figure 6.2 Map of licensed aggregate dredging areas in South Western Peninsula Natural Area (data provided by Crown Estates in 2003).

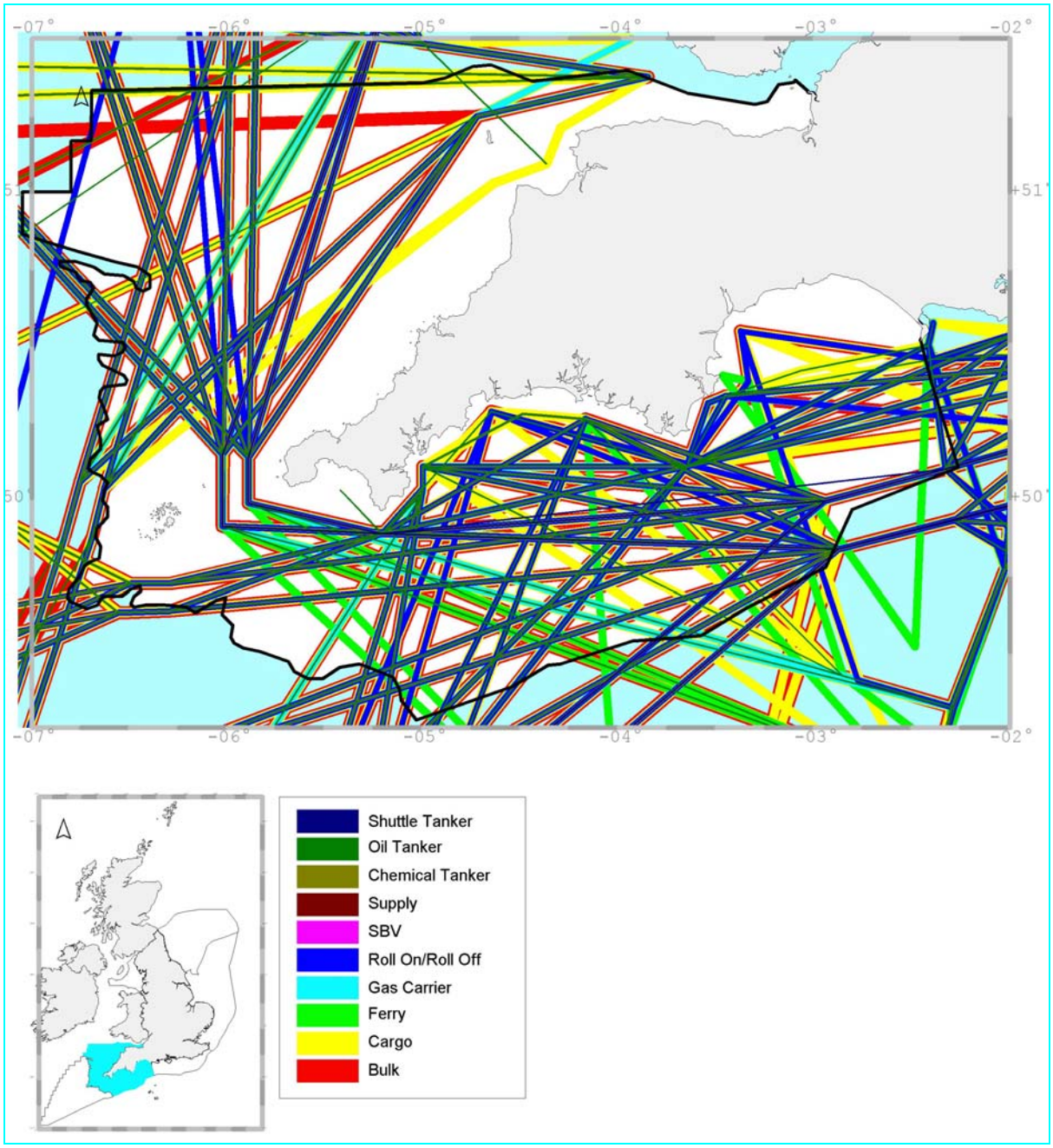


Figure 6.3 Map showing the routes of various types of vessel operating within the South Western Peninsula Natural Area during 1999 (SBV – Standby vessel). (Data taken from COAST database.)

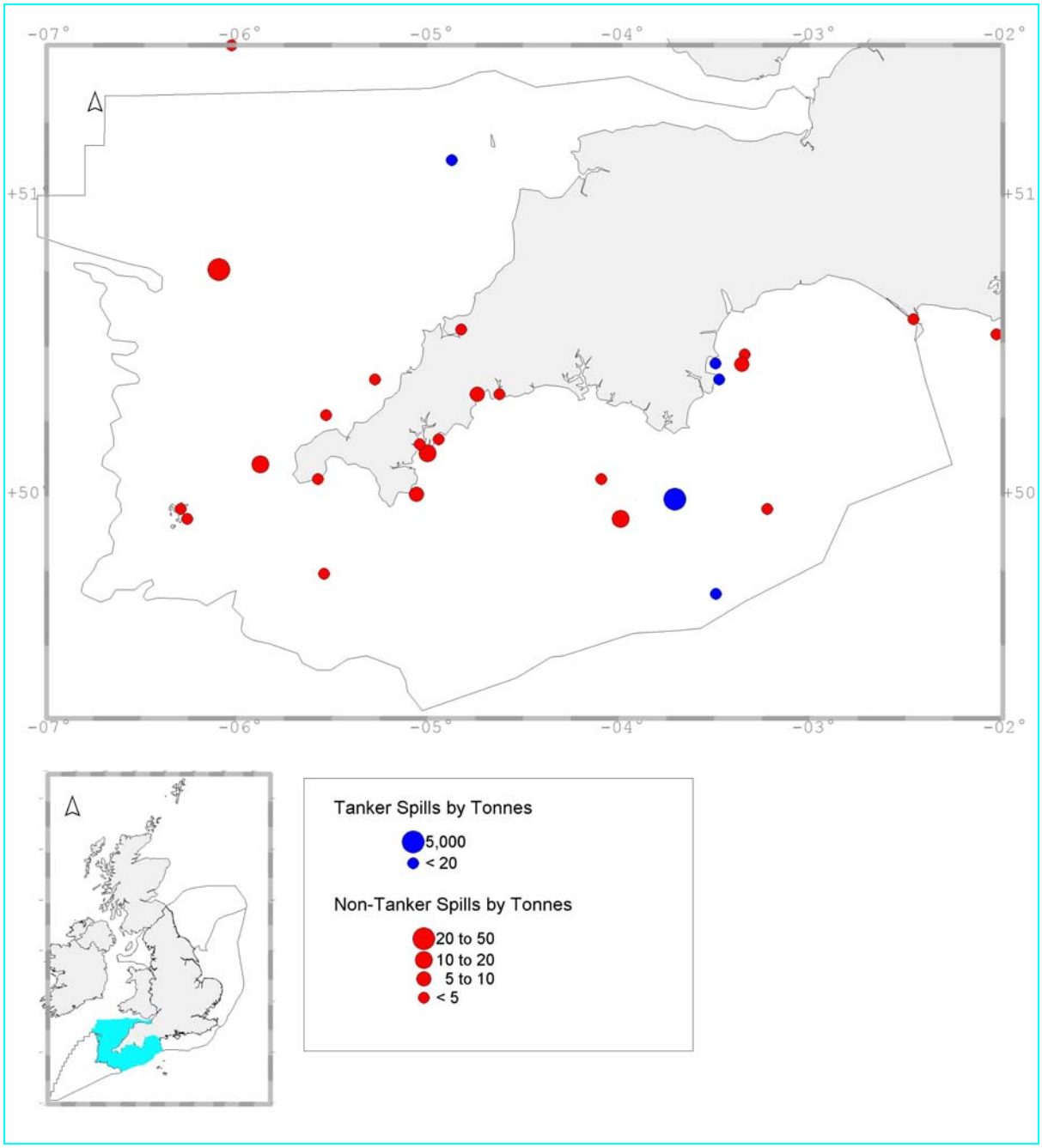


Figure 6.4 The distribution and size of oil spills in the South Western Peninsula Natural Area in the period 1989–1998 (ACOPS data from COAST database).

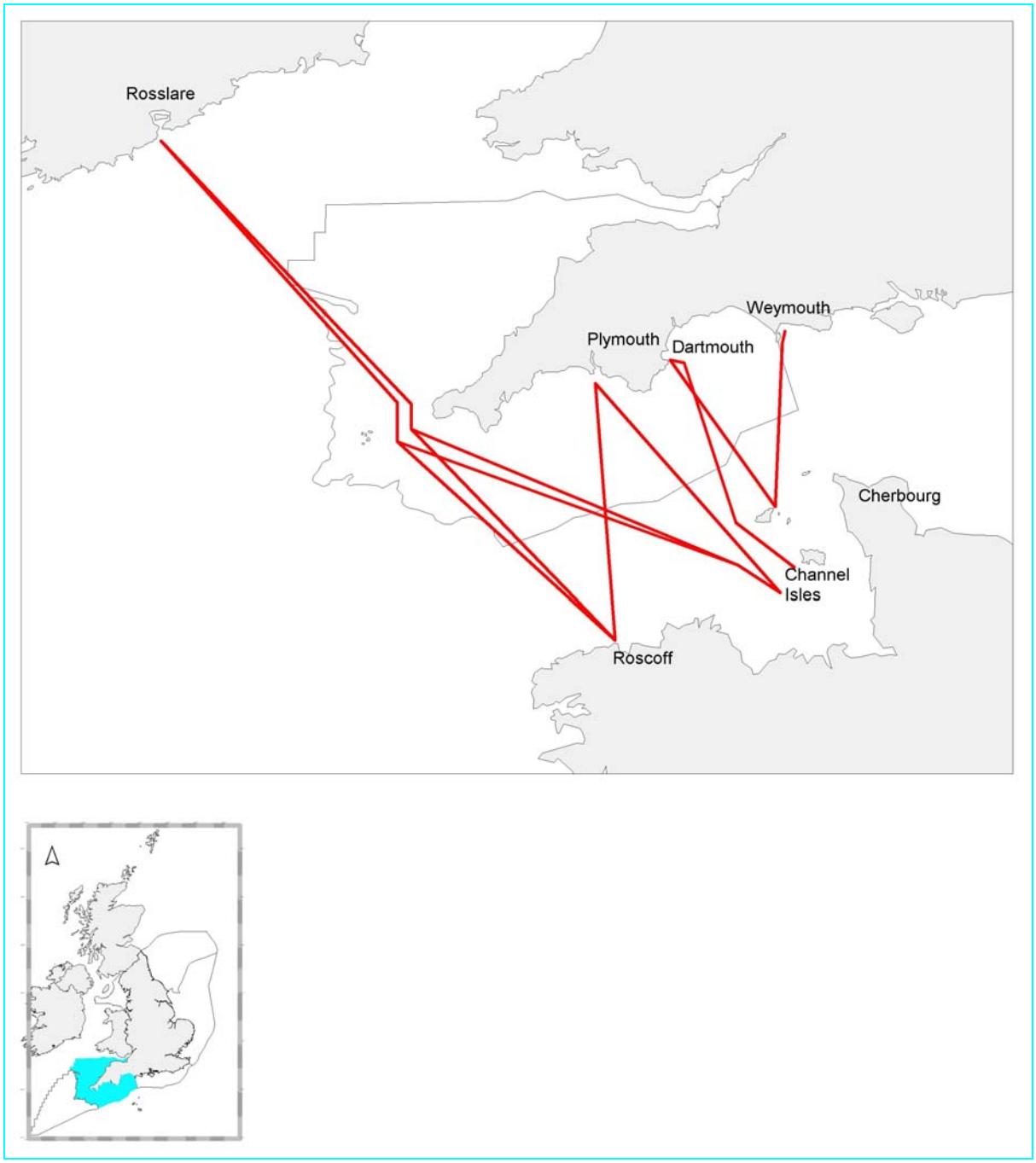


Figure 6.5 Map of ferry routes crossing the South Western Peninsula Natural Area.

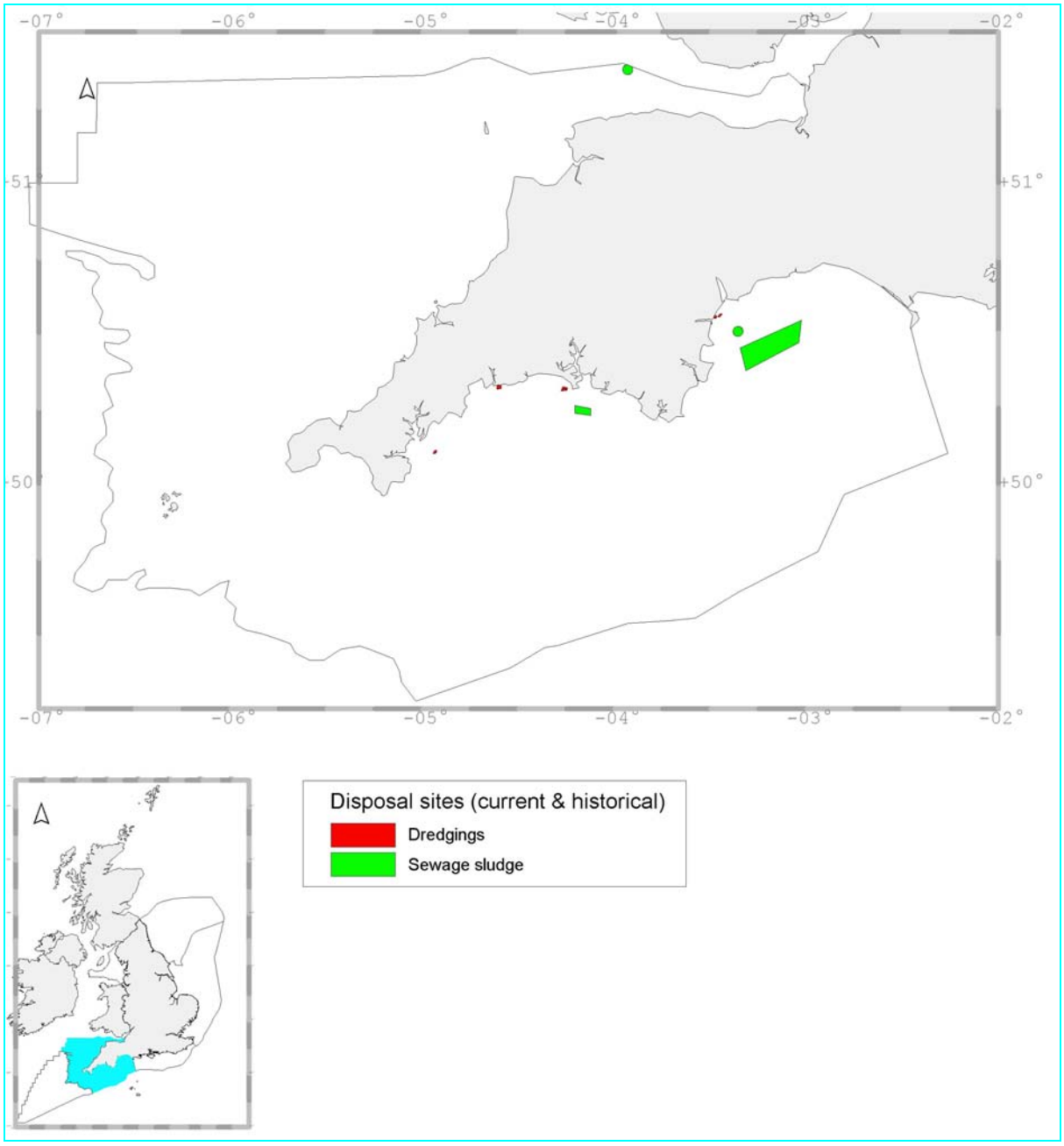


Figure 6.6 Distribution of disposal sites in the South Western Peninsula Natural Area (data provided by CEFAS).

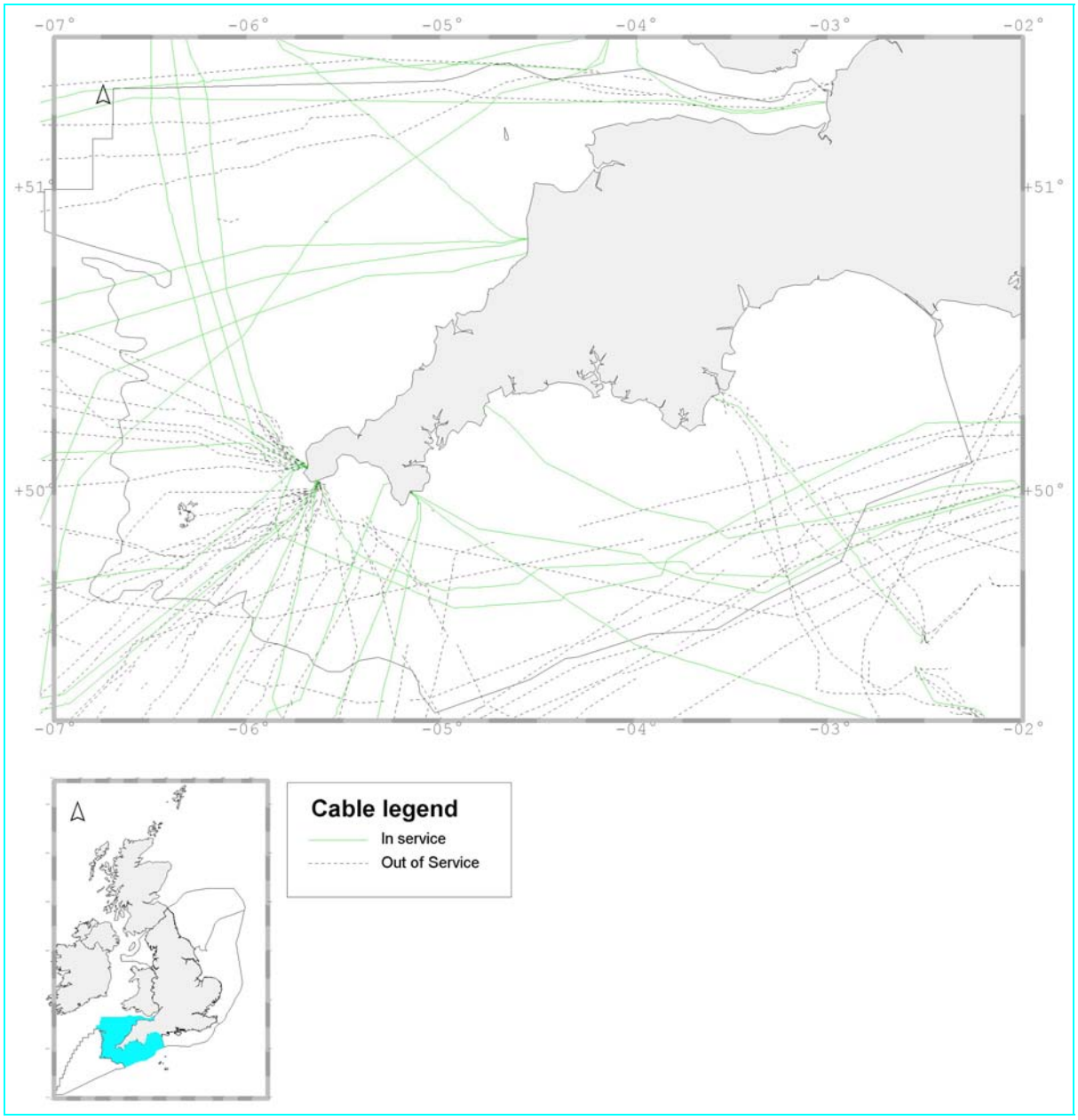


Figure 6.7 Map of submarine cables passing through the South Western Peninsula Natural Area (data provided by Global Marine Systems).

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Appendix 1 Marine Natural Areas and the ecosystem approach

An ecosystem consists of a community of plants, animals and micro-organisms and their physical environment. They are inter-dependent and may be best described as a network or web. In 2000 the Conference of the Parties to the Convention on Biological Diversity (CBD 2000) stated, amongst other things, that:

"The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. Thus, the application of the ecosystem approach will help to reach a balance of the three objectives of the Convention: conservation; sustainable use; and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources."

"An ecosystem approach is based on the application of appropriate scientific methodologies focused on levels of biological organization, which encompass the essential structure, processes, functions and interactions among organisms and their environment. It recognizes that humans, with their cultural diversity, are an integral component of many ecosystems."

The following table provides a brief outline of the relevance of Marine Natural Areas to taking forward the ecosystem approach.

12 principles recommended by the Conference of Parties of the Convention on Biological Diversity in 2000 to guide signatory countries in the practical application of the ecosystem approach	**Relevance of Marine Natural Areas**
The objectives of management of land, water and living resources are a matter of societal choice.	English Nature believes that all key stakeholders should be involved in the management of the marine environment. The degree to which the ideas and information presented in these Marine Natural Area profiles are taken forward should be decided through dialogue amongst those stakeholders.
Management should be decentralised to the lowest appropriate level.	The better management of many marine activities around England, such as fisheries, aggregates and energy generation, requires a regional rather than simply a national approach. We feel that the Marine Natural Areas framework is at a scale that is appropriate for managing and governing the seas around England.
The ecosystem approach should be undertaken at the appropriate spatial and temporal scales.	Marine Natural Areas are a broad scale, ecologically meaningful framework. Although some boundaries of individual Marine Natural Areas may need further refinement, we feel that this initial framework provides a good basis for testing and applying the ecosystem approach at an appropriate, ie regional, scale.
Recognising the varying temporal scales and lag-effects that characterise ecosystem process, objectives for ecosystem management should be set for the long-term.	Marine Natural Areas reflect broad scale factors and processes, some of which change only in the long-term, eg current patterns. Consequently objectives to guide management of human activities in Marine Natural Areas should consider a long-term as well as short-term perspective.

12 principles recommended by the Conference of Parties of the Convention on Biological Diversity in 2000 to guide signatory countries in the practical application of the ecosystem approach	Relevance of Marine Natural Areas
Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems.	The emphasis on the key processes that help to define the Marine Natural Areas highlights the need to consider the interconnections both within the sea and also between Natural Areas. Consequently there is a need for a more integrated, holistic view of the effects of individual activities, including the cumulative effects over broad areas and adjacent waters.
Recognising potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem-management programme should: reduce those market distortions that adversely affect biological diversity; align incentives to promote biodiversity conservation and sustainable use; and internalise costs and benefits in the given ecosystem to the extent feasible.	Although Marine Natural Areas focus on defining ecological units and describing their biodiversity and nature conservation values, the descriptions also recognise key economic activities. Marine Natural Areas provide an ecologically relevant framework for management, including sustainable use, and offer a potentially common framework for aligning economic with environmental concerns. We appreciate the challenges this brings. We also recognise that the basis of 'regional seas' is likely to evolve and boundaries may be refined as interest in a potential regional approach to the marine environment gathers momentum.
Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach.	Marine Natural Areas are based on both functional processes and structure and the link between them. Both should be reflected in conservation objectives for Marine Natural Areas.
Ecosystems must be managed within the limits of their functioning.	We must manage human use of the coasts and seas so that they do not damage the way the ecosystem works. For example, we should seek to ensure that particular activities do not affect the productivity of the marine environment. The development and application of conservation objectives for Marine Natural Areas will help towards identifying such limits.
Management must recognise that change is inevitable.	The marine environment is dynamic and responds to both man-made and natural changes. The profiles do not describe changes that have occurred within each Marine Natural Area in detail but change is implicit in an approach which emphasises functional processes and the link between these and structure.The development of conservation objectives and management for Marine Natural Areas should reflect the fact that change is often inevitable.
The ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity.	Marine Natural Areas provide an ecologically relevant framework at a scale appropriate for managing the use of biological diversity (such as fisheries) in a way that maintains wildlife. This will be addressed further through the development of conservation objectives and management for Marine Natural Areas, in conjunction with key stakeholders and government.
The ecosystem approach should consider all forms of relevant information including scientific and indigenous and local knowledge, innovations and practices.	The definition and description of Marine Natural Areas has drawn on a wide range of information but this has been largely technical in nature. Other relevant information is likely to be drawn on in the process of developing management for regional seas in partnership with other stakeholders, building on Marine Natural Areas as appropriate.

12 principles recommended by the Conference of Parties of the Convention on Biological Diversity in 2000 to guide signatory countries in the practical application of the ecosystem approach	Relevance of Marine Natural Areas
The ecosystem approach should involve all relevant sectors of society and scientific disciplines	A number of organisations have been consulted in defining and describing Marine Natural Areas including relevant regulatory authorities, industry, agencies and scientific institutes. However, this has been limited to those with relevant technical information. It is hoped that Marine Natural Areas will help to inform and structure a wider debate involving all relevant stakeholders in developing management for regional seas.

Appendix 2 Biodiversity Action Plan and Habitats Directive Classifications

Broad habitat types	Priority habitats
Inshore sublittoral rock	Sublittoral chalk *Sabellaria spinulosa* reef *Modiolus modiolus* beds
Inshore sublittoral sediment	Seagrass beds (*Zostera marina*) *Maerl* beds Mud in deep water Sublittoral sands and gravels
Offshore shelf sediment	Sublittoral sands and gravels

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EC Habitats Directive – Annex I Habitats (relevant to Marine Natural Areas)

Physiographic features	Habitats
Large shallow inlets and bays	Sandbanks which are slightly covered by seawater all the time
	Mudflats and sandflats not covered by seawater at low tide
	Reefs
	Submerged or partially submerged seacaves

Appendix 3 Wentworth and Folk sediment classifications

SEDIMENT SIZE				
phi value	milli-metres	SIZE CLASS		
		WENTWORTH		FOLK
-8	256	Boulder		Gravel
		Cobble		
-6	64	Pebble		
-2	4			
-1	2	Granule		
-0.5	1.41	Very Coarse	Sand	Sand
0	1			
0.5	0.71			
1	05	Coarse		
1.5	0.35			
2	0.25	Medium		
2.5	0.17			
3	0.125	Fine		
3.5	0.088			
4	0.0625	Very fine		
8	0.0039			
		Silt		Mud
		Clay		

Appendix 4 Glossary and abbreviations

Definitions based largely on:
Covey & Laffoley (2002), Ellis *et al* (1996) and Hiscock (1996).

Anadromous (of fish)
Upward-running: spending part of their life in the sea and migrating up rivers in order to breed (eg salmon) (cf. "catadromous").

Bathymetry
Measurement of ocean or lake depth and the study of floor topography (Lincoln & Boxhall 1987).

Benthos
Those organisms attached to, or living on, in or near, the seabed, including that part which is exposed by tides as the littoral zone.

Bioaccumulation
The accumulation of a harmful substance such as a radioactive element, a heavy metal, or an organochlorine in a biological organism, especially one that forms part of the food chain.

Biodiversity (biological diversity)
"The variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems." (UN Convention on Biological Diversity 1992).

Biogeographic region
A region which is separated from adjacent regions by barriers or a change in environmental conditions which limits the movement of species or prevents their establishment outside their natural geographical range.

Biota
Any living organisms, both animals and plants.

Biotope
The physical "habitat" with its biological "community"; a term which refers to the combination of physical environment (habitat) and its distinctive assemblage of conspicuous species. MNCR uses the biotope concept to enable description and comparison.

The smallest geographical unit of the biosphere or of a habitat that can be delimited by convenient boundaries and is characterised by its biota (Lincoln, Boxhall & Clerk 1982).

Boreal
(Biogeographical) Pertaining to cool or cold temperate regions of the northern hemisphere. In marine zoogeographical terms, Ekman (1953) states that the centre of the Boreal region lies in the North Sea. It is bounded by the subarctic transitional zone to the north between Shetland, the Faroe Islands and Iceland, and in the south west of Britain by a transitional zone with the Mediterranean-Atlantic Lusitanean region.

Catadromous (of fish)
Downward-running: spending most of their life in rivers and migrating downstream to the sea in order to breed (eg eels) (cf. "anadromous").

Coastal zone
The space in which terrestrial environments influence marine (or lacustrine) environments and vice versa. The coastal zone is of variable width and may also change in time. Delimitation of zonal boundaries is not normally possible; more often such limits are marked by an environmental gradient or transition. At any one locality, the coastal zone may be characterised according to physical, biological or cultural criteria, which need not, and rarely do, coincide.

Cobble
A rock particle defined in two categories based on Wentworth (1922): large (128-256 mm); small (64-128 mm) (from Hiscock 1990).

Common Fisheries Policy (CFP)
A 20-year programme agreed in 1983 by EC Member States for the management and conservation of fish stocks, the maintenance and improvement of the market structure associated with the fishing industry, and international fisheries agreements.

Continental shelf
The seabed adjacent to a continent to depths of around 200 metres, or where the continental slope drops steeply to the ocean floor. Defined in law as "the seabed and subsoil of the submarine areas adjacent to the coast… to a depth of 200 metres"; the legal landward limit is set at the outer limit of territorial waters (q.v.) (Geneva Conference on the Law of the Sea, Convention on the Continental Shelf, 1958).

Controlled waters
In the UK, for the purposes of pollution control and other regulations, all rivers, streams, lakes, groundwaters, estuaries and coastal waters to a distance of three nautical miles (5.5 km) offshore (12 nautical miles (22 km) for migratory fish). The term is also used to refer to the area extending to 200 km from baselines (or to the midline between countries where less than 200 km) where a country has rights in relation to utilisation of resources and control of pollution but where the area is not described as an "Exclusive Economic Zone" (q.v.).

Current
Horizontal movement of water in response to meteorological, oceanographical and topographical factors (see also "tidal stream") (from Ministry of Defence 1987); a steady flow in a particular direction. "Current" refers to residual flow after any tidal element (ie tidal streams) has been removed.

Demersal
Living at or near the bottom of a sea or lake, but having the capacity for active swimming.

Diadromous
Fish that spend part of their life in freshwater and part in saltwater; eg anadromous salmon and catadromous eels.

Ebb tide
Outgoing or falling tide.

Ecosystem
A community of organisms and their physical environment interacting as an ecological unit (from Lincoln, Boxhall & Clerk 1982). Usage can include reference to large units such as the North Sea down to smaller units such as kelp holdfasts as "an ecosystem".

Ecosystem approach
The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way (Convention on Biological Diversity). There have been various elaborations on the definition, eg in a marine context as "the comprehensive integrated management of human activities based on best available scientific knowledge about the ecosystem and its dynamics, in order to identify and take action on influences which are critical to the health of the marine ecosystems, thereby achieving sustainable use of ecosystem goods and services and maintenance of ecosystem integrity" (definition being discussed under the developing EU Marine Strategy).

Eddy
Motion of a fluid in directions differing from, and at some points contrary to, the direction of the larger-scale current (from Allaby & Allaby 1990); a circular movement of water, the diameter of which may be anything from several cm to several km, caused by topographical features or sudden changes in tidal or tidal stream characteristics. (Based on Ministry of Defence 1987). Cf. "gyre".

Endocrine disruptor
An endocrine disruptor is an exogenous substance or mixture that alters the function(s) of the endocrine system and consequently causes adverse health effects in an intact organism, or its progeny, or (sub) populations.

Eustatic
Local sea-level changes deriving from global changes in sea level, which have been estimated as rising at between 1.5 and 2 mm per year.

Eutrophication
The enrichment of water by nutrients, especially compounds of nitrogen and/or phosphorus, causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned (UWWTD, 1991).

Exclusive Economic Zone (EEZ)
A legal concept introduced by the United Nations Conference on the Law of the Sea III (UNCLOS III) (1967-82), giving coastal states certain sovereign rights and jurisdictions for economic purposes over an area of sea and seabed extending up to 200 nautical miles (370 km) from a baseline (normally low-water line) (based on Baretta-Becker, Duursma, & Kuipers 1992). Cf. "controlled waters".

Flood-tide
Incoming or rising tide.

Front, frontal system
An interface between two fluid bodies with different properties (based on Baretta-Becker, Duursma, & Kuipers 1992).

Graben
A fault-bounded crustal block, generally elongate, that has been depressed relative to the blocks on either side.

Gravel
Sediment particles 4-16 mm in diameter, based broadly on Wentworth (1922), which may be formed from rock, shell fragments or maerl (based on Hiscock 1990).

Gyre
A circular or spiral motion of fluid.

Gulf Stream
A relatively warm ocean current flowing north-eastwards off the Atlantic coast of North America from the Gulf of Mexico. It reaches north eastern Atlantic waters off Europe as the North Atlantic Drift.

Igneous [rocks]
Rocks formed from molten rock (magma). They usually consist of interlocking crystals, the size of which is dependent on the rate of cooling (slow cooling gives larger crystals; rapid cooling produces smaller crystals).

Irish Sea
The area of sea between Great Britain and Ireland north of a line across St George's Channel from St Annes Head to Carnsore Point in the south, and south of a line across the North Channel from Mull of Kintyre to Fair Head in the north, including all estuaries except the Firth of Clyde (Irish Sea Study Group definition, based on Shaw (1990)).

Isostatic
Changes in sea level deriving from the effect of local crustal movements which result in Scotland rising and southern England sinking, due to the removal of the weight of ice since the last glacial period.

Lusitanean
(Biogeographical) Referring to a biogeographical region centred to the south of the British Isles and influencing the extreme south west of the British Isles.

Maerl
Twig-like unattached (free-living) calcareous red algae, often a mixture of species and including species which form a spiky cover on loose small stones - 'hedgehog stones'.

Marine
Pertaining to the sea.

Marine Nature Conservation Review (MNCR)
A project initiated by the Nature Conservancy Council (NCC) in 1987 to consolidate the information already collected on British marine ecosystems, particularly the extensive data collected from marine survey projects commissioned by the NCC since 1974, and to complete survey work and the interpretation of the data. Since 1991, the MNCR has been undertaken within the UK's Joint Nature Conservation Committee. The area included in the MNCR is the coastline of England, Scotland and Wales (excluding the Isle of Man and the Channel Isles) extending from the lower limit of terrestrial flowering plants out to the limit of British territorial seas, and into estuaries and other saline habitats to the limits of saltwater influence. The MNCR concentrates on the benthos, and is based on descriptions of habitats and the recorded abundance of conspicuous species.

Maritime
Situated, living or found close to, and having a special affinity with, the sea.

Mean Low Water Springs (MLWS)
The average of the heights of two successive low waters during those periods of 24 hours when the range of the tide is greatest (from Ministry of Defence 1980).

Mud
Fine particles of silt and/or clay, <0.0625 mm diameter (from Hiscock 1990, after Wentworth 1922). Sediment consisting of inorganic and/or organic debris with particles in this category.

Natura 2000 site(s)
The European Community-wide network of protected sites established under the Birds Directive and the Habitats Directive.

Natural Areas
A concept, introduced by English Nature, for defining areas based on their landscape features, geology and biota and resulting in the definition of 92 terrestrial and 24 coastal/maritime Natural Areas in England (English Nature 1994). Maritime Natural Areas are based on coastal cell boundaries.

Nautical Mile
A unit of distance used in navigation, equivalent to 1° of latitude. The standard, or international, nautical mile is 1852 metres; the true nautical mile changes with latitude, from 1861.7 metres at the equator to 1842.9 metres at the poles.

North Atlantic Drift
A north easterly continuation of the warm Gulf Stream current into the eastern North Atlantic.

North Sea
As defined for the purposes of the North Sea Conferences it is southwards of 62°N, eastwards of 5°W and northwards of 48° 30'N and includes the Kattegat defined by lines between coastal features (Oslo and Paris Commissions 1994 where it is described as the "Greater North Sea"). For the British coast, these are the seas to the east of Cape Wrath, and of Falmouth. This is the definition used by the JNCC for the *Directory of the North Sea Coastal Margin* (Doody, Johnson & Smith 1993) and elsewhere.

OSPAR
OSPAR (or Oslo and Paris) Commission for the Protection of the Marine Environment of the North East Atlantic. The UK is one of the sixteen contracting parties to the OSPAR convention.

Pebble
Rock particle 16-64 mm in diameter (from Hiscock 1990, after Wentworth 1922).

Pelagic zone
The open sea and ocean, excluding the sea bottom. Pelagic organisms inhabit such open waters.

Phytoplankton
Planktonic plant life: typically comprising suspended or motile microscopic algal cells such as diatoms, dinoflagellates and desmids.

Precautionary principle
A principle underlying the concept of sustainable use of resources, which implies that:
prudent action be taken in the absence of scientific certainty; the balance of the burden of proof should be to show that no irreversible harm will occur rather than to prove that significant damage will occur; environmental well-being will be given legitimate status and best-practice techniques will be developed. (From *WWF Marine Update* No. 14, April 1994.)

SAC (Special Area of Conservation)
A site of [European] Community importance designated by the [EU] Member States through a statutory, administrative and/or contractual act where the necessary conservation measures are applied for the maintenance or restoration, at a favourable conservation status, of the natural habitats and/or the populations of the species for which the site is designated (Commission of the European Communities 1992). This status is achieved by sites adopted by the European Commission.

Sand
Particles defined in three size categories based on Wentworth (1922): very coarse sand and granules (1-4 mm); medium and coarse sand (0.25-1 mm); very fine and fine sand (0.062-0.25 mm) (from Hiscock 1990).

Seagrasses
Higher plants (angiosperms) that are adapted to living submerged in seawater. They are not true grasses, but belong to the order Helobiae, and are related to pondweeds. Two genera are present in British coastal waters: *Zostera* (eelgrass) and *Ruppia*, a brackish-water genus.

SPA (Special Protection Area)
A site of European Community importance designated under the Wild Birds Directive (Commission of the European Communities Council Directive 79/409/EEC of 2 April 1979 on the Conservation of Wild Birds).

Sublittoral
The zone exposed to air only at its upper limit by the lowest spring tides. The sublittoral extends from the upper limit of the large kelps and includes, for practical purposes in nearshore area, all depths below the littoral.

Territorial waters
The seas over which a nation exercises jurisdiction and control, but within which other states have certain rights, notably for innocent passage of vessels. In UK law, the landward limit of UK territorial seas is defined as "the low water line around the coast" (Territorial Waters Order in Council 1964); the seaward limit is 12 nautical miles offshore from the landward limit.

Wentworth Scale
A scale of sediment particle size categories described by Wentworth (1922), based on a doubling above or halving below, a fixed reference diameter of 1 mm, and with descriptive class terms ranging from boulder (> 256 mm) to clay and colloid (<0.004 mm). This scale is used as the basis of the MNCR and most other sediment classifications. The Wentworth Scale is transformed to the phi (Φ) scale for statistical analysis of sediments.

Zooplankton
The animal constituent of plankton consisting mainly of small crustacea and fish larvae.

Abbreviations and acronyms

ACOPS	Advisory Committee on Protection of the Sea
ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas
BAP	Biodiversity Action Plan
BGS	British Geological Survey
BMAPA	British Marine Aggregate Producers Association
BOD	Biological Oxygen Demand
c	(as prefix, eg cSAC) candidate
CCW	Countryside Council for Wales
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CFP	Common Fisheries Policy
CITES	Convention on the International Trade in Endangered Species of Wild Fauna and Flora
CROW	Countryside Rights of Way Act 2001
cSAC	Candidate Special Area of Conservation
Defra	Department of Environment, Food and Rural Affairs
DoE	Department of the Environment (now subsumed by Defra)
DTI	Department of Trade and Industry
EEC	European Economic Community (later the European Community, now the European Union)
EEZ	Exclusive Economic Zone
EQS	Environmental quality standards
EU	European Union
GESAMP	Joint Group of Experts on the Scientific Aspects of Marine environmental Protection (until about 1991, the Joint Group of Experts on the Scientific Aspects of Marine Pollution) (an advisory body to the Heads of eight organisations of the United Nations System).
GIS	Geographic Information System(s)
ICES	International Council for the Exploration of the Sea
IUCN	International Union for the Conservation of Nature and Natural Resources (now IUCN – The Conservation Union)
JNCC	Joint Nature Conservation Committee
MAFF	Ministry of Agriculture, Food and Fisheries (now subsumed by Defra)
MAGP	Multi-annual Guidance Programme
MARPOL	International Convention for the Prevention of Pollution of the Sea from

	Ships
MCS	Marine Conservation Society
MEHRA	Marine Environmental High Risk Area
MS	Minimum Size
MLW	Mean Low Water
MNA	Marine Natural Area
MNCR	Marine Nature Conservation Review
MSC	Marine Stewardship Council
mSPA	Marine Special Protection Area
m/g	Milligrams per litre
m/s	Metres per second
n/l	Nanograms per litre
µg/l	Micrograms per litre
NMMP	National Marine Monitoring Programme
NVZ	Nitrate Vulnerable Zone
OSPAR	Oslo and Paris Convention (short title for the 1992 International Convention for the Protection of the Marine Environment of the North-East Atlantic).
PAHs	Poly-cyclic Aromatic Hydrocarbons
PCBs	Poly-chlorinated biphenyls
Ro-Ro	Roll on - Roll off ferry
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SFC	Sea Fisheries Committee
SMRU	Sea Mammal Research Unit
SNH	Scottish Natural Heritage
SPA	Special Protection Area
STW	Sewage treatment Works
TAC	Total Allowable Catch
TBT	Tri-butyl tin
UWWTD	Urban Waste Water Treatment Directive
W& C Act	Wildlife and Countryside Act 1981

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Bottom left: Seawater surface temperature for all Natural Areas in June 1997. © Natural Environment Research Council (NERC) & Plymouth Marine Laboratory (PML) 2004
Main: Suset cup coral recorded for Isle of Scilly, and Lundy where it is at its northern most limit of distribution in this Natural Area.
Keith Hiscock/English Nature