SEA8 Technical Report: Marine Archaeological Heritage




Maritime Archaeology Ltd.

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1. Non Technical Summary

This report has been commissioned by Geotek on behalf of the DTI, it provides baseline data that will inform our understanding of the potential of the submerged cultural heritage within the SEA8 marine zone. The methodology used to collate and review the data is set out, and the international, national and regional legal framework is outlined. The legal framework identifies the responsibilities of principal stakeholders and sectors with an interest and involvement in maritime heritage. Proposed legislation and policies that may effect future change have been highlighted.

Consideration of the known archaeological and environmental evidence is vital to understand the potential for discovery and impact of sites and deposits during Oil and Gas Activities. The following summaries demonstrate the state of current knowledge and potential for the discovery of prehistoric and maritime archaeology within the SEA8 area.

1.1 Prehistoric Archaeology Summary

The archaeological record for the British Isles extends back at least 700,000 years. During this time the Atlantic continental shelf was periodically exposed to glacial cycles which lowered sea levels while large ice sheets built up in the northern hemisphere. The SEA8 area is now underwater but for most of the Pleistocene it would have been part of the terrestrial landscape. These multiple inundations and changing environmental conditions had an impact on the potential for human occupation. The analysis and interpretation of currently available archaeological, geological and palaeoenvironmental evidence enables the assessment of the potential for encountering cultural remains of occupation.

In the course of each interglacial the environment on the British mainland ameliorated making it habitable. As the climate warmed the ice sheets melted causing a rise in sea level. This process would have taken thousands of years during which time the SEA8 area would have been suitable for occupation.

- The archaeological material from Boxgrove, Clacton, Swanscombe, Purfleet and Crayford was recovered from deposits that were laid towards the onset or concluding stages of an interglacial. These were times when sea level was rising or falling and was not at its maximum height. Parts of the SEA8 area would have been dry and habitable, potentially for long periods before rising waters or a deteriorating climate forced people to move.

- Lower Palaeolithic cultural variation during interglacial phases is witnessed at Clacton, Swanscombe and Purfleet (c 500,000 BP to 300,00 BP). Well defined stratigraphic layers containing Clactonian tools beneath Acheulian hand axes suggest two waves of hominins. Environmental analysis reveals that the first wave arrived when the climate was cooler. During this time large areas of the Atlantic continental shelf would have been dry and this would have provided the closest refugium to the peninsular that was to become Britain. If early populations did not live on the shelf during the glacial maxima, they would have migrated through it as they worked their way north.

- Middle Palaeolithic activity during cold phases of the glacial oscillation is found in La Cotte de St Brelade Jersey, Harnham near Salisbury and Fermanville, France (c.2500,000 BP to c.40,000 BP). This demonstrates that the middle Palaeolithic had developed strategies that enabled them to endure

a harsher climate. An ability to survive in the cold extends the window of opportunity for exploitation of SEA8 areas by *Homo Neanderthalensis*.

- The arrival of distinct Upper Palaeolithic technologies to mainland Britain may have followed a similar pattern to that which has been postulated during the Upper and Middle Palaeolithic. The concept of a steady colonisation by different peoples is endorsed by studies of Mitochondrial DNA dispersal which identified a distinct western 'Celtic' population that originated from the Basque region and another from refugio to the east. The colonisers from the south migrated along the Atlantic margin and reached Britain first. Throughout this process there may well have been populations occupying the continental shelf which in turn acted as a spring board into the UK. Migration routes would have incorporated the SEA8 area.

- The final and current interglacial; the Holocene brought with it an influx of the Mesolithic or middle Stone Age (c.11,000 BP to c.6,000 BP). Sea levels rose about 30m during this period and large areas of SEA8 were finally inundated. The Mesolithic came to a close about the same time as sea level reached comparable levels to those we see today. Coastal and riverine resources were exploited extensively during the Mesolithic, and these landforms were the first to be impacted as the sea rose. Studies of submerged in-filled estuaries have revealed deposits that are suitable for the preservation of archaeological material. The stratified Mesolithic site 11m underwater within Bouldnor Cliff demonstrates the archaeological potential of locations with similar characteristics within the SEA8 area.

- Europe's north-west peninsula was severed for the last time when the English Channel met the North Sea as the Mesolithic Age was drawing to a close. Water transport was now necessary to reach the British Isles and it appears to have been used extensively. The Neolithic saw an ingress of people with new technological skills that was sufficient to cause an agricultural revolution across the whole country. However, cultural influences are seen to differ between the far west and the east of the United Kingdom. In the east settlement favoured waterways which enabled transport deep inland while in the west, strong maritime links saw the development of a well-defined culture along the Atlantic coastline. Comparable traditions can be seen around the coastal fringe from Brittany, via Cornwall, Wales and Ireland to Scotland. Recoveries of Neolithic material are particularly rich within the submerged coastlines of protected shorelines on the SEA8 periphery.

Archaeological remains are likely to have existed across the whole of the SEA8 area at some time in the last 700,000 years. However, the potential survival of material from the prehistoric period is very much dependant on taphonomy, sedimentation, erosion and ongoing coastal / marine geomorphological processes.

Factors favourable for the survival of archaeological strata in the original area of deposition. These can include:

- Very low beach gradient and offshore gradient so that wave action is attenuated and is constructional in the surf zone.
- Minimum fetch so that wave amplitude is minimum, wavelength is short, and wave action on the seabed is minimum.

- Original deposit to be embedded in peat or packed lagoonal deposits to give resistance and cohesion during marine transgression. Drowned forests and peat are good indicator environments.
- Where deposits are in a cave or rock shelter, roof falls, accumulated debris, concretions, breccia, conglomerate formation, indurated wind-blown sand, all help to secure the archaeological strata.
- Local topography contains indentations, re-entrants, bays, estuaries, beach-bars, lagoons, near-shore islands, or other localised shelter from dominant wind fetch and currents at the time of transgression of the surf zone.
- Frozen ground or permafrost enclosing archaeological deposit at time of inundation.
- Braided river pattern or deltaic islands provide numerous lee environments protected locally from wave action from the west and south-west.

The factors above are those which promote survival of the original deposit *in situ*. However, if an archaeological deposit is buried under 5-10m of mud or sand it is unlikely to be discovered, except in very unusual circumstances. Thus the final requirements for survival and discovery are:-

- Low net modern sediment accumulation rate so that the artefacts are not buried too deeply.
- No fields of sand waves or megaripples over the site.
- Ideally, a slight change in oceanographic conditions so that the site is being gently eroded to expose deposits when visited by archaeologists. (This factor is sufficiently common in known sites to be a serious factor, and should not be regarded as an unlikely fluke).
- Absence of heavy and continuous erosion which could remove the deposit completely.
- Absence of accumulation of successive layers of sediment during successive glacial cycles which would bury the archaeological material completely.

1.2 Maritime Archaeology Summary

The final rise in global sea levels over the last 10,000 years or so separated Britain from mainland Europe. Britain became an island in the latter part of the Mesolithic (c.9,000 – 4,000 BC) after which access to and from the continent was only possible using watercraft. From 3000 BC onwards the sea level was only a few metres below that which we see today and vessels now become the dominant component of the submerged maritime cultural resource within the SEA8 area. Along the coastline of England and Wales sites include relic shores, maritime instillations and settlements. This was a time when populations were expanding and human groups coalesced to form sophisticated civilisations with developing seafaring abilities. The ship was ultimately to become vital for trade and protection, with military vessels reflecting Britain's aspirations, ambitions and technological achievements. This legacy is reflected in the wrecks within the SEA8 area.

Review of historical records, plus national and regional data sets for known archaeological sites on the seabed has identified many wrecks. The vast majority of these are modern as older wooden wrecks will invariable degrade or become protected and hidden beneath seabed deposits. The shipwreck data sets have been classed by period, region and activity. The report also looks at the known archaeological sites on land and their relationship with trade routes and hazards to target areas with a high potential for maritime archaeological remains. This is

particularly pertinent for early vessels which may have sunk before detailed records were kept.

Britain's island status has resulted in a maritime cultural heritage that is interwoven into all aspects of social, economic, political and technical development. With trade and transport links with continental Europe established from the Bronze Age a reliance of seafaring is a factor which continues through to modern day. Alongside the use of the marine zone for trade it has been necessary to develop and rely on technologies and techniques for maritime warfare. These activities and their associated shore side infrastructure have left us a rich legacy of maritime archaeology.

- The prehistoric period is relatively poorly represented in terms of maritime archaeological discoveries. There is some evidence of Bronze Age trade through sites discovered in the marine zone and a range of imported goods from terrestrial archaeological sites. Maritime trading networks were well established through the Iron Age and Roman periods, maritime archaeological evidence includes a range of ship finds and a wealth of imported goods.
- During the Medieval period some of Britain's most prosperous ports were established. This was also a period where warfare at sea was developing and purpose built warships were constructed. Ship and boat remains from early in this period are sparse, however, more physical evidence is preserved from later periods, examples of which include the remains of Henry V's warship the *Grace Dieu*, and Henry VIII's *Mary Rose*. Allied to the archaeological evidence there are more extensive documentary records of ship movements and losses.
- The Post Medieval period was a boom time for shipping and the wealth and prosperity of Britain thrived. This is the era of 'Empire building' and the resulting periods of warfare between western powers heavily influenced the design and development of ship technology. The greater diversity of ship types and the higher density of shipping is clearly reflected within the archaeological record with a wide range of sites identified and investigated within the SEA8 area.
- From the industrial revolution through the world wars the reliance on maritime trade and defence continued. This helped fuel the development of larger vessels, particularly with the move to iron and steel construction which eventually replaced the wooden vessels. The two World Wars of the early 20th century have bequeathed a vast inheritance of both military and merchant vessel remains on the seabed under review.

Ports, Harbours and Anchorages: The archaeological remains and traces of these sites and features are directly related to the density and location of shipping activity. Traces of landing places and harbours from early periods are often ephemeral, this changes through time as shore side infrastructure and facilities have developed to keep pace with ship technology and the needs of industry and defence.

Aviation Archaeology Underwater: From the earliest developments of aircraft there has been a high density of aviation activity in and around the UK. This activity was at its most intense within the SEA8 area during the second world war. There are a large number of documentary records of aircraft losses at sea, however, to date very few aircraft crash sites have been identified on the seabed. The preservation potential for aircraft within the marine environment is high when the nature of the crash and

seabed composition are favourable. Future developments in this field are likely to include the discovery of well preserved remains.

Preservation of the submerged cultural heritage: Factors favouring high potential for the preservation of maritime archaeological remains are dependant on both the incidence of wrecking and post wrecking influences.

The areas in which there is a higher occurrence of shipping losses are:

- Areas where environmental factors have created navigational hazards. Such hazards would include submerged reefs, shallow sand banks or windward shores.
- Areas where anthropogenic factors have contributed to a higher incidence of loss. These would include the location of sea battles or water-ways where the loss of shipping during the two World Wars has been caused by mines, submarines or other discrete enemy action. These losses show less patterning in their number and distribution.

Those factors which favour the preservation of maritime archaeological material are dependant on several interrelated conditions. One or more conditions may be present to provide protection for remains. The additional factors listed below are extra to those outlined above for prehistoric material:

- Areas of readily erodable geology, this would favour the burial of material
- Muddy, sandy sediments, areas in which these sediment exist provide the highest preservation potential for archaeological material
- Minimal sediment movement, areas in which sediments remain relatively static would favour burial and preservation
- Minimal wave and tidal movement, these factors would influence the dynamics of sediment movement causing scouring
- Depth, the depth of a site influences its preservation potential in terms of the lack of sediment movement on the seabed and lack of aerobic conditions favouring biological interference

1.3 Oil and Gas Activity

Industrial activity offshore has the potential to impact cultural heritage, both through physical disturbance of sites. More positively, however, the collection of data from the marine environment during industrial activity can be used to identify new sites and investigate others.

Opportunities: Oil and gas activities on the seabed can provide opportunities for archaeologists to understand the nature and extent of marine archaeological resource. Using a range of survey techniques including remote sensing, magnetometry, seismic or acoustic survey the seabed and sub-surface stratigraphy can be imaged. More direct methods such as borehole sampling and visual inspection using divers and remote operated vehicles can gather higher resolution data to qualify interpretation of the less immediate survey methods. All the information collated can help understand the nature of the marine archaeological resource.

Impacts & mitigation: Potential impacts on marine cultural heritage are dependant on the nature of the activity undertaken during exploration, production and de-commissioning phases. Where physical disturbance of the seabed corresponds to areas where there is potential for archaeology then there is a high chance of negative impacts. However, such impacts should be mitigated where established archaeological procedures for evaluation prior to development are conducted.

Investment in archaeological services can reduce the risk of impacting cultural material or a protected site. This may result in changes in scheme design to avoid impacts to heritage. If this is not possible excavation or site survey and preservation by record may be required. The information gained from archaeological investigations is of high public interest and the dissemination and archiving of these results optimises public relations and the long-term security of the nations marine cultural heritage.

2. Introduction

Maritime Archaeology Limited (MAL) have been commissioned by Geotek Ltd to undertake a Strategic Environmental Assessment of Marine Archaeological Heritage within the SEA8 area. This work is being undertaken on behalf of the UK Government Department of Trade and Industry (DTI).

"Strategic Environmental Assessment (SEA) is the process of appraisal through which environmental protection and sustainable development may be considered, and factored into national and local decisions regarding Government (and other) plans and programmes – such as oil and gas licensing rounds. The process aims to help inform Ministerial decisions through consideration of the environmental implications of the proposed action." (www.offshore-sea.org.uk).

The DTI have taken a proactive approach to the development of SEA in relation to the oil and gas industry. This process looks at the best ways of balancing the economic development of offshore oil and gas resources with protection of environmental areas and assets which can be of local, national or international importance.

Marine archaeological heritage is one of the environmental factors to be considered during this process. The term 'marine archaeology' is taken to include all traces of the human past and associated deposits and settings.

Definitions of Cultural Heritage

The archaeological heritage is comprised of "all remains and objects and any other traces of mankind from past epochs..... The archaeological heritage shall include structures, constructions, groups of buildings, developed sites, moveable objects, monuments of other kinds as well as their context, whether situated on land or under water" *(European Convention on the Protection of the Archaeological Heritage)*

"Ancient monument" means any structure, work, site (including any site comprising, or comprising the remains of, any vehicle, vessel, aircraft or other movable structure or part thereof) or area which is, or may be, of historic, architectural, traditional, artistic or archaeological interest. (*Ancient Monuments & Archaeological Areas Act 1973*)

Types of sites and finds commonly discovered in the marine zone include prehistoric stone tools and landscapes from times of lower sea level, a wealth of shipwreck remains spanning thousands of years, anchorage sites and maritime debris, coastal ports and maritime infrastructure and sites of crashed aircraft.

The SEA8 area encompasses the south and south west coast of the UK and the English Channel (Figure 2.1). SEA8 is the last SEA area to be completed. The process began with SEA2 and has developed over the past eight years.

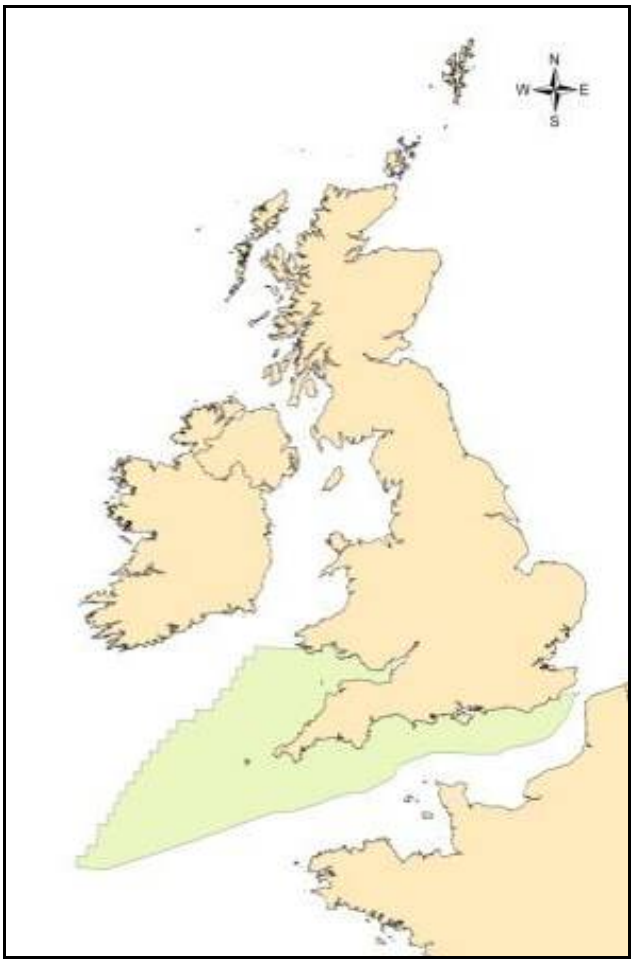

Figure 2.1 – The SEA8 area

This report contains the results of an assessment which combined evidence from known archaeological sites and finds, current knowledge of cultural processes and practices, and understanding of the human environment and activities in the past. These were analysed in order to comment on areas of particular marine archaeological potential.

This report contains the following sections:

- Project methodology and approach
- Overview of legislation and guidance
- Sea level change and human movement across SEA8
- Prehistoric marine archaeology
- Environmental factors affecting the preservation of prehistoric marine archaeology
- Maritime archaeology
- Environmental factors affecting the preservation of maritime archaeology
- Oil and gas activity

3. Methodology

The SEA8 area is the first to consider the prehistoric and maritime cultural heritage within a single technical report. Despite the differing characteristics of the archaeological resource, it is entirely appropriate to bring them together in terms of the assessment of data, consultations and the range of factors that affect them such as legislation, guidance and most aspects of archaeological approach and practice.

3.1 Project Data

The principle sources of data utilised and consulted for the project have been summarised below.

3.1.1 Historic Environment Databases

Nationally held sites and monuments record databases provide the most easily accessible information on the historic environment resource. This includes data from the English Heritage National Monuments Record and the Royal Commission on the Ancient and Historical Monuments of Wales, both of which hold records which span the terrestrial and marine zones.

A data request for the SEA8 area was submitted to both national databases, this included the offshore area and a coastal buffer zone to provide continuity across the marine, coastal, inter-tidal and terrestrial zones. The data search revealed a total of 19,257 records. Inevitably not all of these records were scrutinised in detail, however, a number of searches extracted data to accompany sections 6 and 7 of this report, with key sites being highlighted for inclusion.

Details of key sites have been included in appendix 10.2; these are referenced within the text with three figure numbers prefixed by ‘MA’.

3.1.2 Publications and research results

A range of publications was consulted for the project, this included texts from areas of study relevant to cultural heritage, geology, geomorphology and environmental factors within the SEA8 area.

Where current research was being undertaken direct contact with a number of individuals and institutions was established. This provided access to the results of recent work. Internet resources, which are recognised as a method for the rapid dissemination of research results, were also consulted.

3.1.3 Dates and Time Periods

The combining of the prehistoric and historic cultural heritage within a single report inevitably requires referencing of periods in human history that span a considerable time – in this case over 700,000 years. Within this timescale human development has been influenced by a range of environmental factors, such as geology, glaciations and ‘ice ages’ where the different disciplines often use different terminology from that used by archaeologists and historians. We have presented the relationship between all the inter-related terminology and time periods in Figure 3.1.

For archaeology there are two main ways that dates are expressed.
BC/ AD (Before Christ and *Anno Domini*) – this familiar system is based on the Christian Calendar and indicates years either before or after the birth of Christ.
BP stands for Before Present and is frequently used when discussing periods in early human history and by scientific disciplines. This is a neutral international system which uses 1950 as its fixed reference point.

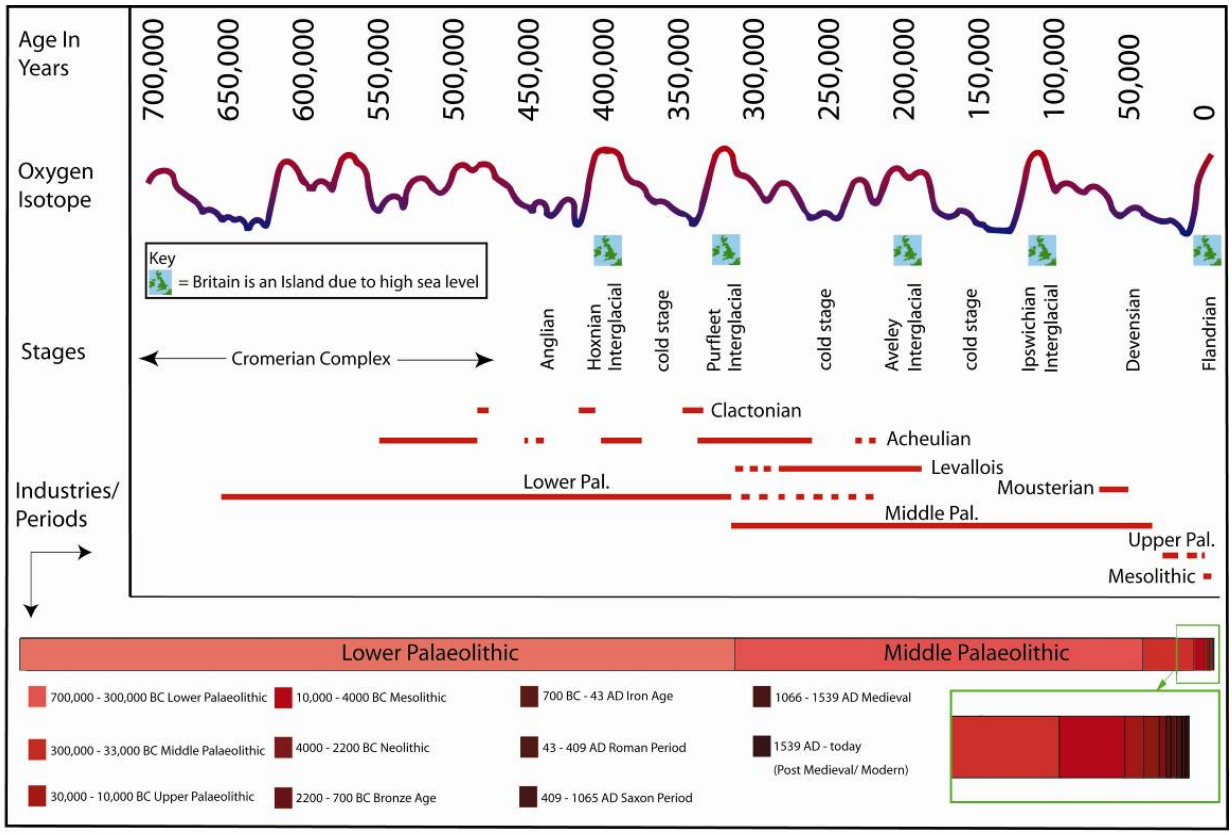

Figure 3.1 – Timeline of dates and periods

3.2 Project approach

The project has largely concentrated on archaeological sites and finds, scientific and physical data from within the SEA8 area. However, where necessary information and sites from outside of the area have been considered. This document considers the current state of knowledge and research within differing sectors of marine archaeology, or signposts sources of further information.

Prehistoric landscapes and physical evidence: Due to the huge time periods included within the study of human prehistory and the sparse nature of the archaeological resource Sections 5 (Sea Level Changes and Human Movement) and 6 (Prehistoric Marine Archaeology) have utilised data from the English Channel and bordering terrestrial areas. As Britain was not an Island for much of this time this approach provides continuity of evidence and physical setting.

During later prehistory there is more available archaeological evidence. This data begins to show patterning and distribution within the SEA8. To reflect this areas of the coastline based on shipping forecast sea areas have been used to analyse and reveal regional trends.

Maritime data: In contrast to the data available on prehistoric landscapes the amount of data for shipwrecks and maritime losses is often substantial. In general these records date from 1600 onwards, with most records dating from the mid to late 18th century. Maritime records can be divided into 'known sites' – those for which physical remains have been located, although their identity may or may not be established, and 'documentary losses' – the historical accounts of the sinking,

wrecking or stranding of vessels, for which no physical traces have yet been identified. In the latter case the positions given by these accounts can often be highly inaccurate.

Due to the large number of maritime sites and shipping losses recorded the SEA8 area was divided into sections based on the shipping forecast sea areas. These are Dover, Wight, Portland, Plymouth and Lundy. To enable the full diversity and potential of the maritime cultural resource to be demonstrated 'maritime archaeology' was further divided into 'Trade and Transport' (section 7.2) and 'Warfare and Defence' (Section 7.3). Subsequent sections examine 'Ports, Harbours and Anchorages', which are intrinsically linked to the shipwreck resource; and 'Aviation Archaeology Underwater', the study of aircraft crashed at sea.

Preservation potential: The knowledge and study of the preservation potential of the marine environment is a developing area of the discipline. To date archaeological investigations have often focused on specific site investigations rather than taking a more broad view of the physical and environmental factors which favour preservation. There are, of course, some notable exceptions to this, and recent work is expanding knowledge in this area.

The preservation potential of the marine environment has been considered both for prehistoric marine archaeology and maritime archaeology. While there are some factors which influence both types of evidence, there are many which have a more important effect in one area. For prehistoric submerged landscapes the effects of sea level rise, changing climate and geomorphological processes are often the dominant influencing factors. Whereas for shipwrecks and remains which have essentially landed 'on' a landscape, rather than being 'within' it, the dominant effects are sediments and oceanographic conditions.

4. Overview of Legislation and Guidance

This overview of the legal, regulatory and guidance regimes seeks to demonstrate those obligations which are relevant to the underwater marine cultural heritage within the SEA8 area at an international, national and regional level.

4.1 International

International conventions and directives where ratified by the UK have been enacted in national and local legislation while those conventions or directives which have not been ratified tend to be used as guidance and codes of conduct for best practice.

4.1.1 The United Nations Convention on the Law of the Sea (UNCLOS)

The United Nations Convention on the Law of the Sea (UNCLOS) became recognised as international law in 1982 and was ratified by the UK on 25 July 1997. UNCLOS entitles a coastal state to declare an Exclusive Economic Zone out to about 200 nautical miles from the coastal baseline, and to declare an extra 12 nautical mile Contiguous Zone outside the 12 nautical mile territorial sea (Oceans and Law of the Sea). The UK, however, has decided not to opt for either of these legal rights.

Within the UNCLOS there are only two Articles (Article 149 and 303) concerning archaeological and historical objects. Article 149 applies only to those archaeological and historical objects which lie outside national jurisdiction and states,

"All objects of an archaeological and historical nature found in the Area shall be preserved or disposed of for the benefit of mankind as a whole, particular regard being paid to the preferential rights of the State or country of origin, or the State of cultural origin, or the State of historical and archaeological origin."

Since the SEA8 area is defined as part of the Department of Trade and Industry (DTI) UK Continental Shelf Designated Area, Article 149 would not apply although it should be borne in mind for activities which are likely to impact areas outside the continental Shelf Area.

Article 303(1) states that,

"States have the duty to protect objects of an archaeological and historical nature found at sea and shall cooperate for this purpose."

Although Article 303 provides for coastal states to exert a degree of control over the archaeological heritage to within 24 nautical miles (which SEA8 extends far beyond), the UK has not to date introduced any measures to implement this right (Marina 2005).

4.1.2 The United Nations Educational, Scientific and Cultural Organisation (UNESCO) Convention on the Protection of the Underwater Cultural Heritage, 2001

The UNESCO Convention on Underwater Cultural Heritage was approved at the plenary of the UNESCO General Conference in 2001. This convention furthers the idea of protection for "objects of an archaeological and historical nature" which has been codified under Articles 149 and 303(1) of UNCLOS through a comprehensive set of provisions that cover both finds and geography. Although it has not been ratified by a sufficient number of countries to become international law it is generally recognised as an important way forward for the protection of the underwater cultural heritage.

Although the UK did not ratify the convention it did publicly endorse it. The DCMS has also indicated that it approves of virtually all of the Articles set out in the Annex to the Convention and it is believed that these will be used as a bench mark for any development outside of the twelve mile limit of territorial seas.

In October 2005 the Burlington House Declaration called on the UK government to re-evaluate its position on the UNESCO Convention on the Protection of the Underwater Cultural Heritage 2001. In the declaration it calls upon the government to consider how its specific reservations to that convention may be overcome.

Whilst in the interim it calls upon the UK government to pursue the general principles and objectives of the 2001 Convention to the maximum extent possible within the confines of existing international law.

4.1.3 The European Convention on the Protection of the Archaeological Heritage (Revised) (The Valetta Convention), 1992

The European Convention on the Protection of the Archaeological Heritage (Revised) was signed at Valletta in January 1992 and replaced the 1969 European Convention for the Protection of the Archaeological Heritage. The Valletta Convention was ratified by the UK Government in 2000 and came into force on 21 March 2001.

The Convention defines the notion of archaeological heritage very broadly as comprising “all remains and objects and any other traces of mankind from past epochs”. Furthermore the archaeological heritage is said to include “structures, constructions, groups of buildings, developed sites, moveable objects, monuments of other kinds as well as their context, whether situated on land or under water.”

The Articles of the Convention tackle various aspects. Article 1 deals with the inventorying and protection of sites and areas, Article 2 deals with the mandatory reporting of chance finds and providing for “archaeological reserves” on land or underwater. Article 3 promotes high standards for all archaeological work which should be carried out by suitably qualified people and Article 4 requires the conservation of excavated sites and the safe-keeping of finds. Article 5 is concerned with consultation that should take place between planning authorities and developers to avoid damage to archaeological remains.

This convention binds the UK to implement protective measures regarding the archaeological heritage within its jurisdiction, which would include the Continental Shelf. The implementation of the Valetta Convention is the responsibility of the Home Country Heritage Agencies each within their area of authority. In the SEA8 area this English Heritage and CADW.

With regards to the more general agency responsibilities for the underwater archaeological heritage, a discussion meeting on submarine prehistoric archaeology hosted by English Heritage in May 2003 concluded that the Home Country Heritage Agencies should also be encouraged to accept responsibility for the care of the submarine landscape out to the limit of the UK Continental Shelf (Flemming 2004: 119). This would be in line with the application of the Valetta Convention which specifies the protection of the underwater archaeological heritage.

4.1.4 The Environmental Impact and Assessment (SEA) Directives

The Strategic Environmental Assessment Directive (2001/42/EC) is European wide legislation which was transposed into UK Law in 2001 and requires environmental assessments to be undertaken ahead of development. The SEA Directive requires environmental impact assessments (EIA’s) for individual developments to be

addressed and mitigation proposed. While EIA's are already established practice for many types of plans and programmes in the UK, specific requirements and approaches vary. The SEA Directive places particular emphasis on specific stages within the environmental assessment namely:

- Stage A: Setting the context and objectives, establishing the baseline and deciding on the scope. This involves identifying other plans and programmes, the collection and presentation of information on the environmental baseline and current problems, and their likely evolution.
- Stage B: Developing and refining alternatives and assessing effects through the prediction of significant environmental effects of the plan and programme, including strategic alternatives.
- Stage C: Preparing the Environmental Report
- Stage D: Consulting on the draft plan or programme and the Environmental Report. This includes consultation of the public and authorities with environmental responsibilities, assessing significant changes and making decisions and providing information.
- Stage E: Monitoring the significant effects of implementing the plan or programme on the environment. This involves tracking the environmental effects of the plan or programme to show whether they are as predicted and to help identify adverse effects.

Those issues which need to be addressed within these stages according to the SEA Directives have been given as,

"the likely significant effects on the environment, including on issues such as biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape and the interrelationship between the above factors".

For marine cultural heritage this would include obtaining relevant data to enable the assessment of significant effects to be determined. Further monitoring of sites may also be required to assist in the identification of adverse effects over time.

4.1.5 The World Heritage Convention, 1972

The World Heritage Convention Concerning the Protection of the World Cultural and Natural Heritage is an international agreement that was adopted by the General Conference of UNESCO in 1972 and ratified by the UK in 1984. The Convention is a treaty that has become a prominent international legal tool in support of the conservation of the world's cultural and natural heritage. Today, 178 countries (States Parties) have ratified the Convention, making it an almost universally accepted set of principles and framework of action.

The Convention sets out the duties of the States Parties in identifying potential sites and their role in protecting and preserving them. By signing the Convention the States Parties pledge to conserve not only the World Heritage sites situated on its territory, but also to protect national heritage and to integrate the protection of the cultural and natural heritage into regional planning programmes.

The most significant feature of the 1972 World Heritage Convention is that it links together in a single document the concepts of nature conservation and the preservation of cultural assets.

Within the SEA8 area there are two World Heritage Sites, the Cornwall and West Devon Mining Landscape added to the World Heritage List in 2006 and the Dorset and East Devon Coast, which was added to the List in 2001. Coastal developments within the Dorset and East Devon World Heritage Sites would be subject to a series of national legislative requirements.

4.1.6 International Council on Monuments and Sites (ICOMOS)

The International Council on Monuments and Sites, a non-governmental organisation, was founded in 1965 after the adoption of the Charter of Venice, in order to promote conservation. ICOMOS is named in the 1972 UNESCO World Heritage Convention as the professional and scientific advisor to the World Heritage Committee on all aspects of the cultural heritage. It takes part in the work of the World Heritage Committee and in the implementation of the Convention.

ICOMOS is concerned with furthering the conservation, protection, rehabilitation and enhancement of monuments, groups of buildings and sites, at the national and the international level. Regarding underwater cultural heritage ICOMOS has published the *Charter on the Protection and Management of Underwater Cultural Heritage 1996 (the Sofia Charter)*. The Sophia Charter is intended to encourage the protection and management of underwater cultural heritage in inland and inshore waters, in shallow seas and in the deep oceans. It focuses on the specific attributes and circumstances of cultural heritage under water and includes a series of statements regarding best practice, intending 'to ensure that all investigations are explicit in their aims, methodology and anticipated results so that the intention of each project is transparent to all'. The Sophia Charter is intended as a supplement to the ICOMOS *Charter for the Protection and Management of Archaeological Heritage, 1990*.

4.2 National

Throughout the UK there are several legislative acts which cover the wealth of underwater heritage from shipwrecks and aircraft to submerged prehistoric remains. Protection is mainly focused on shipwrecks of archaeological, historic or artistic importance which can be designated under the Protection of Wrecks Act 1973. Further designation within England, Scotland and Wales is also possible under the Ancient Monuments and Archaeological Areas Act 1979 by which submerged archaeological remains can be protected. Several guidance notes and codes of practice outline recommendations relevant for, or explicitly targeted at, marine cultural heritage.

4.2.1 Merchant Shipping Act 1995

The Merchant Shipping Act 1995 states that any wreck material which comes from UK territorial waters and any wreck which is landed in the UK from outside UK territorial waters must by law be declared to the Receiver of Wreck (Section 236 of the Merchant Shipping Act 1995). This legislation is intended to protect the rights of owners of material lost due to wrecking and has its basis in the 19th century. Heritage management or protection does not feature within this legislation, however, due to the technical definition of 'wreck' historic material falls within its remit.

Wreck has been defined within the Act as, flotsam, jetsam, derelict and lagan found in or on the shores of the sea or any tidal water. It includes ships, aircraft and hovercraft, parts of these, their cargo and equipment.

All material which is recovered is considered to have an owner. The Receiver of Wreck will seek to identify the owner and any unclaimed wreck within UK Territorial Waters will become property of the Crown, or a person to whom the right of wreck

has been granted. The Receiver of Wreck (ROW) has a duty to ensure that finders of reported wreck receive an appropriate salvage award.

The Receiver of Wreck defines any material over 100 years old as 'historic'; when such material is recovered a suitable museum will often be approached to purchase the item.

4.2.2 Protection of Military Remains Act 1986

The Protection of Military Remains Act 1986 makes it an offence to interfere with the wreckage of any crashed, sunken or stranded military aircraft or designated vessel without a valid licence irrespective of loss of life or whether the loss occurred during war or peacetime.

Under the Protection of Military Remains Act 1995 there are two levels of protection afforded wreckage. They can be designated as,

- A Controlled Site, which is a restrictive designation, requiring licensing of certain activities within the exclusion zone and knowledge of precise co-ordinates
- A Protected Place, which is where activities are permitted in the vicinity of a vessel, on a look but don't touch basis. Knowledge of precise co-ordinates is not required, only the name of the vessel

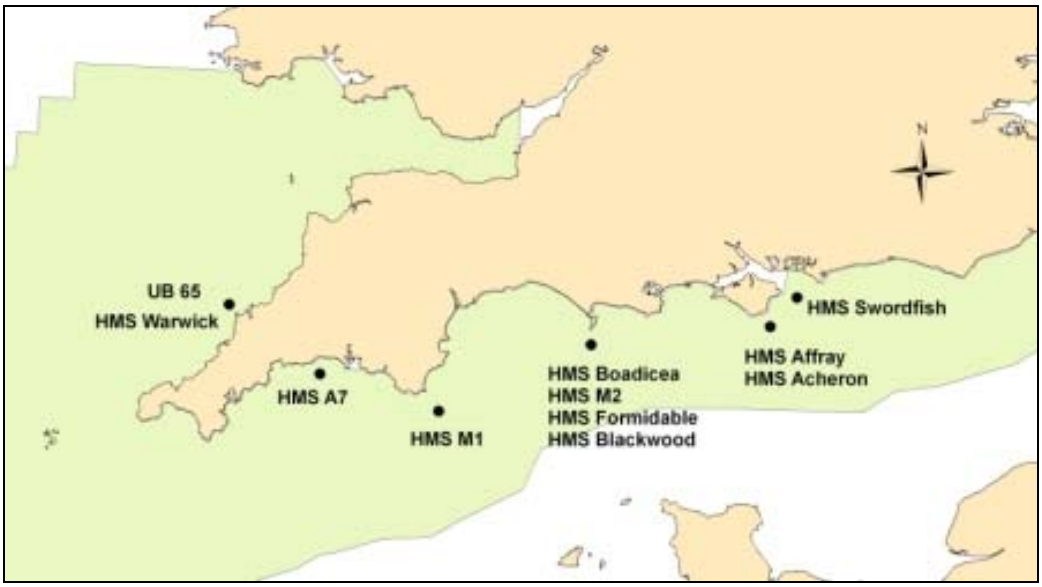

Figure 4.1 – The location of wrecks designated under the PMRA in the SEA8 area

The provisions of the Protection of Military Remains Act 1986 in respect of Controlled Sites are applicable in international waters and would include the UK Continental Shelf, although they are enforceable only in respect of British-controlled ships, British citizens, and British companies.

The 1986 act also prohibits the excavation of any place for the purpose of discovering whether it comprises of an aircraft or vessel lost in military service, unless an appropriate license is obtained beforehand.

The Protection of Military Remains Act also deals with military remains of aircraft. All aircraft lost in military service are automatically designated as Protected Places

under this legislation. For the purposes of designation it is not necessary to demonstrate the presence of human remains.

4.2.2.1 Aircraft

As mentioned above, all aircraft lost while on active service are protected under the Protection of Military Remains Act 1986 and are subject to the provision on reporting under the Merchant Shipping Act 1995.

Additionally an archaeological guidance note regarding aircraft has been produced by English Heritage on *Military Aircraft Crash Sites* (English Heritage 2002). This has provided clarification of the protection afforded aircraft remains through the following statement,

"All crashed British aircraft in the UK or its coastal waters are deemed Crown property, all Luftwaffe crash sites are considered captured property surrendered to the crown, and for US aircraft the MoD acts as the representative for the US government".

The Royal Air Force Central Casualty Section is responsible for a number of issues that relate to aircraft crash sites. They respond to enquiries into historical records concerning RAF casualties and deal with proposed excavations/interference with aircraft wreck sites. Proposed interference to military aircraft crash sites requires a licence issued by the Royal Air Force Central Casualty Section. This licence will normally only be issued when the MoD can demonstrate that no human remains or unexploded ordnance is located within the wreckage.

4.2.3 Protection of Wrecks Act 1973

The Protection of Wrecks Act 1973 consists of two sections that deal with designation of wreck sites namely:

4.2.3.1 Protection of Wrecks Act 1973 (Section 1)

The Protection of Wrecks Act 1973 (Section 1) enables the Secretary of State to protect wreck sites within UK territorial waters from unauthorised interference if they are of historic, archaeological or artistic importance. Diving is prohibited on wrecks protected under this legislation, and there is an exclusion zone around the designated site. To undertake any activities on a protected site a licence must first be obtained from the Government. If a wreck or wreck material is encountered during development, which is considered to be of historic, archaeological or artistic importance, it is possible for such a site to be designated in an emergency. Administration of this act within the SEA8 area is undertaken by the Welsh Historic Monuments (CADW) for Wales and English Heritage for England.

Within the SEA8 area there are currently 38 designated historic wrecks sites ranging in date from the Middle Bronze Age to the 20th century. Details of these Protected Wreck Sites are given in Appendix 10.1.

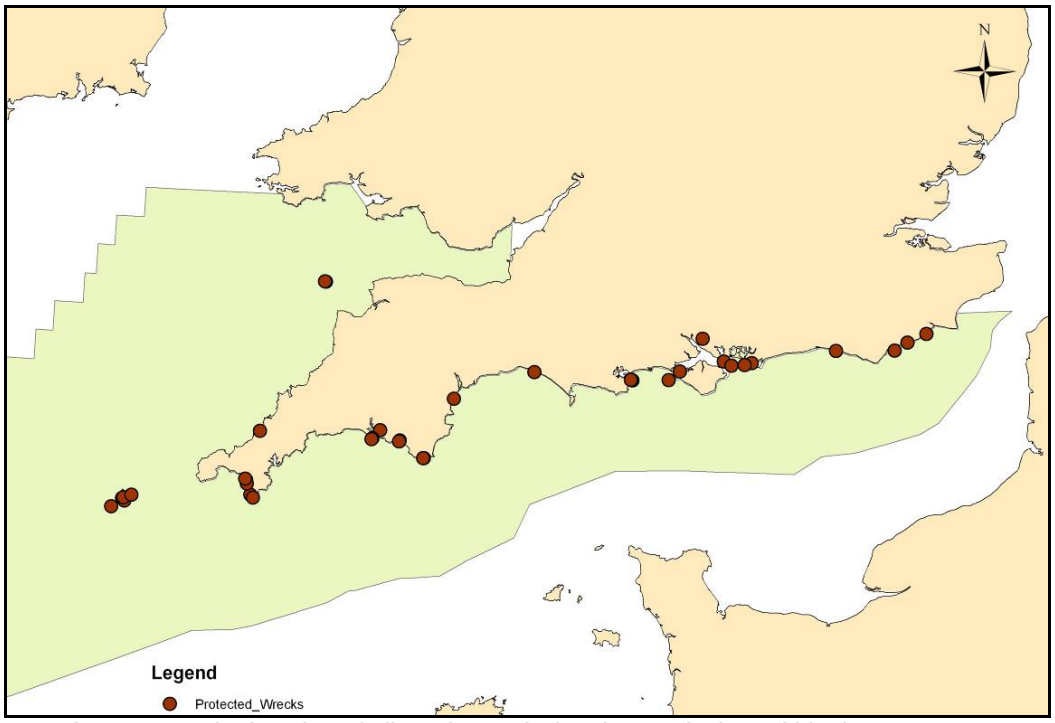

Figure 4.2 – The location of all Designated Historic Wreck sites within the SEA8 area

4.2.3.2 Protection of Wrecks Act 1973 (Section 2)

The Protection of Wrecks Act 1973 (Section 2) provides protection for wrecks that are designated as dangerous due to their contents. Although Section 2 is not used to designate sites because of their archaeological interest, it is possible that a dangerous wreck designated under this section might also be of archaeological or historic interest. This section of the Act is administered by the Maritime and Coastguard Agency (MCA) through the Receiver of Wreck. Within the SEA8 area there are currently no wrecks under this designation.

4.2.4 Ancient Monuments and Archaeological Areas Act 1979

The Ancient Monuments and Archaeological Areas Act 1979 is the main legislation concerning archaeological remains within the United Kingdom. Although this Act primarily deals with sites on land there is provision in Section 53 to extend the designation to monuments situated in, on or under the seabed within UK territorial waters that is out to three nautical miles from the coastal baseline.

The Act enables the Secretary of State for Heritage to maintain a schedule of nationally important sites on which it is an offence to carry out any work that would have the effect of damaging, demolishing, destroying, removing, repairing, altering, adding to, flooding or covering up a monument. Scheduled Monument Consent is required prior to conducting any works. For the purposes of the Act a monument is defined in Section 61 (7) as:

"a) any building, structure or work, whether above or below the surface of the land, and any cave or excavation;
b) any site comprising the remains of any such building, structure or work or of any cave or excavation; and
c) any site comprising, or comprising the remains of, any vehicle, vessel, aircraft or other moveable structure or part thereof which neither constitutes nor forms part of any work which is a monument as defined within paragraph a) above;

d) and any machinery attached to a monument shall be regarded as part of the monument if it could not be detached without being dismantled."

Within the SEA8 area there is currently one wreck designated under the Ancient Monuments and Archaeological Areas Act, *The Louisa*, a 19th century seagoing merchant vessel found in Grangetown, Cardiff. This scheduled wreck is a rare example of a merchant vessel of the mid 19th century which demonstrates the transition from timber to iron in ship construction. It now forms part of the Cardiff land reclamation scheme.

4.2.5 Burial Act 1857

The Burial Act 1857 makes it illegal to disturb human bodies without a licence whether on land or in a maritime context and also applies to territorial waters. If human remains are encountered, including cremated remains, they must not be exhumed unless a license has been obtained from the Department of Constitutional Affairs.

4.2.6 The Coastal Protection Act 1949

The Coast Protection Act 1949 provides maritime Councils with permissive powers to carry out coastal defence works. Coastal defence encompasses both coastal protection and sea defence. The Act also allows maritime Councils to protect their assets against coastal erosion and inundation from the sea by encouraging the provision of technically, environmentally and economically sound and sustainable defence measures along the coastline. Under the terms of the Act maritime Councils can regulate the coastline to provide protection for the historic environment as long as those works do not contravene the Ancient Monuments and Archaeological Areas Act 1979.

4.2.7 The Joint Nautical Archaeology Policy Committee (JNAPC) Code of Practice for Seabed Development

In 1995 the JNAPC published a *Code of Practice for Seabed Developers* with the aim of defining best practice in terms of co-operation and discussion between archaeologists and seabed developers. Although this was revised in 1998, significant changes have since taken place in the use, legislation and knowledge of the marine environment since this time, consequently a revised (JNAPC) Code of Practice was published in June 2006.

The new code builds on the principles set out in the original Code and offers guidance to developers on issues such as risk management and legislative implications. A list of contacts for further advice is also provided. The code also highlights the responsibility of developers in protecting the UK's marine heritage. While the general principles can be applied throughout the UK, specific arrangements for consultation may vary. Consultations within the SEA8 area would include local archaeological curators and either English Heritage for England or CADW for Wales.

4.2.8 Legislative Consultations

The UK government has recognised that current legislation and guidance for the marine environment requires updating. Consequently the UK government and devolved administrations are working together to devise the best means for managing the marine area. A number of government consultations aimed at drafting new primary legislation have recently been undertaken.

4.2.8.1 Marine Heritage Protection Review, 2005

The Department for Culture, Media and Sport (DCMS) is in the process of considering changes to marine heritage protection. As part of this consideration, DCMS in conjunction with the Welsh Assembly Government, the Scottish Executive, and the Department for the Environment, Northern Ireland has publish a consultation paper on changes to the system for protecting the marine historic environment (DCMS 2004).

At the closure of the consultation period in 2004 an analysis of responses was published, *Protecting our Marine Historic Environment – Making the System Work Better Analysis of Responses,* July 2005.

Proposals put forward in the report sought to provide,
"a positive approach to managing the marine historic environment, which will be transparent, inclusive, effective and sustainable and central to social, environmental and economic agendas at a local as well as national level; and
a legislative framework that protects the marine historic environment but enables appropriate management approaches to be applied and to evolve" (DCMS 2005: 4).

4.2.8.2 Heritage Protection for the 21st Century, White Paper

On the 9th March 2007 a White Paper on Heritage Protection was launched. "Heritage Protection for the 21st Century" outlines several proposals based around three core principles namely:

"• Developing a unified approach to the historic environment;
• Maximising opportunities for inclusion and involvement; and
• Supporting sustainable communities by putting the historic environment at the heart of an effective planning system" (DCMS 2007).

The White Paper covers the legislative change and implementation arrangements for England, Wales and the marine historic environment across the United Kingdom. It also sets out plans for a UK-wide system of marine heritage protection that can work effectively alongside the terrestrial protection systems of the devolved nations. Proposals set out for the maritime historical environment include the following commitments:

"• We will broaden the range of marine historic assets that can be protected.
• Designation decisions will be made on the basis of special archaeological or historic interest.
• We will make designation decisions easier to understand by publishing new selection criteria for marine designation.
• We will introduce simpler and clearer designation records.
• We will introduce interim protection for marine historic assets.
• We will consider the scope for a new, flexible consents system, including provision for voluntary management agreements.
• We will introduce a new statutory duty on the Receiver of Wreck to inform heritage bodies about marine historic assets" (DCMS 2007).

4.2.8.3 The Marine Bill, 2006

Marine heritage issues are currently included within a separate joint review between the Department of Environment, Food and Rural Affairs (DEFRA) and the devolved administrations. Proposals for the Marine Bill aim to recognise and take account of the UK Government's strategic goals for the marine environment, namely to:

"increase our understanding of the marine environment, its natural processes and our cultural marine heritage and the impact that human activities have upon them;
promote public awareness, understanding and appreciation of the value of the marine environment and seek active public participation in the development of new policies;"

A new system of spatial planning will be based on a number of broad objectives or principles which aim to:

"a. clearly articulate UK Government policy for the marine area and the activities that take place there, and improve the integration of our marine objectives, in order to provide a co-ordinated and consistent driver for sea-users and managers;
b. achieve a fair balance between economic, social, cultural and environmental needs in the marine area, in line with wider joint Government sustainable development policies;
c. adopt a strategic, plan-led approach to managing marine activities, which would enable more efficient decision making, offering benefits to marine regulators, developers and users. To balance these benefits with the administrative and financial burden of establishing such an approach;
d. adopt a more strategic and efficient, and therefore cost-effective approach to information gathering, reducing the burden and duplication of effort between individual sectors and, where possible, individual projects which may collate information separately and to encourage greater data availability than at present;
e. take note of existing marine uses, including commercial and recreational shipping areas, fisheries and oil and gas infrastructure, alongside the location of important natural resources or heritage sites;"

Furthermore the marine planning policy statement along with any accompanying guidance, will:

"a. provide a clear statement of UK Government policy for the marine area as a whole;
b. include, where appropriate, sectoral policy statements, setting out priorities for particular groups of activity, e.g. marine renewable energy, fisheries, shipping and port activities, heritage etc. and consider the spatial requirements of national sectoral policies, e.g. the 'UK Offshore Renewable Energy Atlas' (32) which maps the wind, wave and tidal resources in UK waters;"

It has also been recognised that as licensing of activities in relation to marine heritage sites and the designation of protected wrecks have consequences both on marine activities and the marine environment, it is important that these issues are taken into account in any reform of the licensing system as a result of the proposals in this consultation.

4.2.9 Guidance Notes

The higher profile of marine cultural heritage and the need to ensure its appropriate management is reflected in the number of guidance notes and documents produced over the past four years. While not specifically targeted at Oil and Gas related development, there are number of principles included with these documents which set out Best Practice for consideration of marine heritage for potentially intrusive offshore works. Documents relevant to the SEA8 area include:

The Marine Aggregate Dredging and the Historic Environment: Guidance Note, 2003 - provides practical guidelines on assessing, evaluating, mitigating and monitoring archaeological impacts of marine aggregate dredging in English marine waters. The

principles outlined apply throughout the UK Continental Shelf although, a range of specific arrangements apply in respect of marine aggregate dredging in Scottish, Welsh and Northern Irish waters.

Protocol for Reporting Finds of Archaeological Interest, 2005 - this protocol was developed by Wessex Archaeology for the British Marine Aggregate Producers Association (BMAPA) and English Heritage for dealing with archaeological finds being made by members of staff employed by aggregate dredging companies. The protocol deals with the reporting of finds made by staff on board dredging vessels, and at wharves.

Historic Environment Guidance Note for the Offshore Renewable Energy Sector: Guidance Note, 2006 - This guidance note was produced for the Collaborative Offshore Windfarm Research into the Environment (COWRIE/ Wessex Archaeology 2006). This guidance note promotes best practice in relation to the marine historic environment for the offshore renewable energy sector. It promotes understanding of the conservation issues arising from the impacts of such projects on the historic environment.

Ports: the impact of development on the maritime historic environment, 2006 - is intended to inform developers on the importance and relevance of the historic environment in relation to ports and how development proposals should take into this into account. The main focus is on the marine aspect of new developments, but also deals with the development of existing ports and inland impacts of development. It provides references for useful policy documents.

Identifying and protecting Palaeolithic remains, Archaeological guidance for planning authorities and developers, 1998 - outlines the value and national importance of Palaeolithic remains in Britain and how development proposals should take this into consideration. This guidance note also sign posts sources for further advice.

4.3 Regional

SEA8 includes those areas of seabed which come under the jurisdiction of England and Wales, both of which have slightly different administrative arrangements for the management of archaeology. Both of these heritage agencies (English Heritage and CADW) have a formal responsibility for maritime archaeology out to the 12 mile limit off their respective coasts. Although in practice they take an interest in the maritime potential of the UK Continental Shelf beyond the 12-mile limit of territorial waters (Flemming 2004: 119).

4.3.1 England

Prior to the National Heritage Act 2002, English Heritage's responsibilities had been limited to the coast up to the Low Water mark. During this time English Heritage and the Royal Commission on the Historic Monuments of England published *England's Coastal Heritage: a statement on the management of coastal archaeology* (EH/RCHME 1996), which set out a number of key management principles, namely:

- "The coastal zone of England includes a finite, irreplaceable, and, in many cases, highly fragile archaeological resource which by virtue of its value, variety, and vulnerability justifies a presumption in favour of the physical preservation *in situ* of the most important sites, buildings, and remains.

- Although archaeological remains situated within inter-tidal and sub-tidal areas may be less visible and accessible than remains on dry land, this

does not affect their relative importance and they should be managed in accordance with the principles which apply to terrestrial archaeological remains.

- As historic landscapes can extend seamlessly from dry land, through the intertidal zone, and into sub-tidal areas, effective management of the coastal archaeological resource cannot be achieved without due consideration of marine as well as terrestrial archaeological remains.

- Where economic development in the coastal zone is likely to impact on important archaeological remains, decisions should be taken with regard to the best available information and the precautionary approach should be adopted wherever possible".

In addition a number of specific statements that provided detailed recommendations were given including one specifically addressing oil and gas,

- "Appropriate consultation procedures should be established prior to the approval of consent for development, production and pipeline works and controlled pipeline authorisations which may affect important archaeological remains. Where appropriate, provisions relating to archaeology should be included in conditions and restrictions applied to future rounds of licensing" (EH/RCHME 1996: 14).

And a further general recommendation on development control and environmental assessment which also includes specific reference to oil and gas,

- "Coastal archaeological interests should be… consistently and comprehensively included in Environmental Assessment procedures for coastal and marine developments (including harbour works, mineral extraction, oil and gas activities, capital dredging projects, and waste water treatment and disposal) and other activities requiring sectoral consent" (EH/RCHME 1996: 13).

4.3.1.1 National Heritage Act, 2002

The National Heritage Act (2002) saw the extension of English Heritage's responsibilities for archaeological sites to the limit of the territorial waters of England. This Act modified English Heritage's functions to include securing the preservation of ancient monuments, promote public enjoyment and advance the knowledge of ancient monuments in, on, or under the seabed.

This Act amended the definition of an Ancient Monument to include sites below the low water mark and can be applied within the marine zone.

In light of their new responsibilities English Heritage published: *Taking to the Water: English Heritage's Initial Policy for the Management of Maritime Archaeology in England* (English Heritage 2002). The document discusses the broad characteristics of the maritime archaeological resource within English territorial waters, the character of inventories pertaining to marine archaeological sites and the role and relationships between professional maritime archaeologists, amateur maritime archaeologists and recreational divers. It also discusses the legislative framework for maritime archaeology and identifies areas in need of change, and makes broad proposals for a new legislative framework for England. Furthermore it proposes the promotion of greater local accountability in decision making on maritime archaeology through the

involvement of local government archaeological officers and the establishment and enhancement of locally based marine Sites and Monuments Records and describes the areas of research that will be accorded highest priority by English Heritage.

4.3.1.2 Planning Policy Guidance 16: Archaeology and Planning (PPG16)

The fundamental principles of PPG16 include: archaeology being a material consideration in development control, preservation *in-situ* of nationally important remains, developer funded investigation of remains that cannot be preserved *in situ* and planning consents being subject to applications being accompanied by sufficient information on archaeological impacts.

Although PPG16 is central to the regulation of development-led archaeology on land and applies only down to the low water mark a statement within England's Coastal Heritage mentions how,

"Although it remains government policy not to extend the Town and Country Planning system to the territorial sea, the principles set out in PPG 16: Archaeology and Planning should be applied to the treatment of sub-tidal archaeological remains in order to secure best practice".

4.3.1.3 Planning Policy Guidance 20: Coastal planning (PPG20)

PPG20 covers the character of the coast, designated areas, heritage coasts and the international dimension. It discusses types of coasts, policies for their conservation and development and policies covering risks of flooding, erosion and land instability, as well as coastal protection and defence. Furthermore it outlines policies for developments which may specifically require a coastal location, including tourism, recreation, mineral extraction, energy generation and waste water and sewage treatment plants.

4.3.2 Wales

CADW administers the responsibilities of Ministers from the National Assembly of Wales for archaeological and built heritage matters which extend to the 12 mile territorial limit, although they take an interest in archaeology beyond this limit. CADW's responsibilities also include the implementation of the Protection of Wrecks Act 1973, the Ancient Monuments and Archaeological Areas Act 1979 and the Valetta Convention 1992 within the 12-mile limit.

4.3.2.1 Planning Guidance (Wales) Welsh Office 1996

The Planning Guidance 1996 lays out detailed advice on guidance related to the natural and built environment especially with regards to archaeology which is mentioned in, paragraph 146 and paragraph 134 respectively. A Technical Advice Notice (TAN) provides guidance for developments along the coastline and potential impacts on the historic maritime environment.

4.3.2.2 Welsh Office Circular 60/96 Planning and the Historic Environment: Archaeology

The Welsh Office Circular 60/96 sets out the Government's land use planning policies as they apply to Wales. It provides detailed advice and guidance on best practice and also explains the criteria for scheduling. It also recommends procedures for the assessment, evaluation, preservation, and mitigation with regards the historic environment. This circular also sets out advice on legislation and procedures relating to archaeological remains in the development process.

4.3.2.3 Welsh Office Circular 61/96 Planning and the Historic Environment: Historic Buildings and Conservation Areas

This provides detailed advice and guidance on best practice in relation to planning and the historic environment. Development plans for each local authority area and national park will contain policies to protect archaeology, historic buildings, and historic landscapes. In many areas the policies in the former local plans have been adopted.

4.3.2.4 Seas, Shores and Coastal Areas: Maritime policy (Countryside Council for Wales 1996)

This maritime policy covers cultural heritage, historic landscapes and amenity issues. It also stresses the need for sustainable development and holistic management regarding the coastal zone and outlines best practice guidelines for developers.

4.4 Summary

Maritime archaeology is subject to a large variety of jurisdictional divisions and legal frameworks some of which exist for the protection of the maritime heritage. Outside territorial waters the situation is complex, although guidance on the management of this area is provided through the UNESCO Convention on the Protection of the Underwater Cultural Heritage. Within territorial waters it is currently a time of change, the need for a more strategic approach to the marine environment has been recognised both in terms of broader marine planning – through the proposed Marine Bill, and in terms of heritage protection – through the White Paper 'Heritage Protection for the 21st century'. Proposed changes indicate that the marine cultural heritage is taking a more prominent position within marine management.

5. Sea Level Changes and Human Movement across SEA8

5.1 Introduction

People, that is anatomically modern humans (AMH) and our evolutionary precursors (hominins, *Homo heidelbergensis*, *Homo neanderthalensis*, etc) have been crossing the English Channel either on foot or by floating craft for the last 700,000 years (Stringer 2006; Oppenheimer 2006). During this time the British Isles were abandoned and de-populated several times (Stringer 2006). The modern population arrived about 16,000 years ago. Floating craft have been used for sea crossings in other parts of the world for the last 30,000-40,000 years, and possibly earlier (Birdsell 1977; McGrail 2004).

This section will deal with the manner in which prehistoric peoples crossed the area of SEA8, or lived on it, over a period of hundreds of thousands of years, taking into account the terrain and shoreline, with a brief reference to the prehistoric use of canoes and log boats. For the analysis of modern historic types of ships and transport, see Section 7.

In the context of crossing the SEA8 area on foot, or living there with a stable population, the situation has to be studied in terms of global sea level change, and local changes of land level due to tectonic earth movements, local faulting, erosion, and isostatic compensation to the loading and unloading of the weight of ice-caps. These factors are less relevant when considering maritime transport during the last 5000-6000 years, although slight isostatic changes of land level, combined with erosion and deposition, have significantly changed the access to some ports and estuaries.

In previous SEA reports on the prehistory of the sea floor the timescale has been largely restricted to the later part of the last glacial cycle (Devensian), that is, the rise of sea level after the last glacial maximum at about 22,000 years Before Present (BP), with occasional reference to possible sites just before the glacial maximum. In all SEA areas other than SEA8 the ice sheets of each successive glaciation during the last million years covered most of the continental shelf as well as the adjacent area which is at present land. Thus it would be difficult, but not impossible, for archaeological remains to survive from before the glaciation.

SEA8 was never glaciated, other than where the southernmost limit of the Anglian ice sheet about 450 ka BP reached the southern Irish Sea, south Wales, and the Bristol Channel. Since the southern North Sea also was not glaciated south of the Thames, there is an extensive area from the Celtic Sea, through the Channel, the Straits of Dover, and the southern North Sea which could preserve prehistoric remains from the earliest times of human occupation, that is about 700 ka BP, both on land and in the sea. Multiple inundation over successive glaciations, combined with river erosion and down-cutting at times of low sea level, is likely to erode many of the early deposits in the SEA8 area, but preservation of a few sites and scattered artefacts over more than one complete glacial cycle, say the last 125,000 years or more, is definitely possible.

This chapter will present changes of land and sea level in three stages: 700 ka BP to 125 ka BP (Section 5.2); 125 ka to 6 ka BP (Section 5.3); and 6 ka BP to the present (Section 5.4). For reasons of archaeological continuity and logic we will often consider the English Channel as a whole up to the French coast.

5.2. 700 ka to 125 ka BP: Geology and the early glaciations

On this timescale there are four processes at work:

i) Plate tectonics, margin tectonics, distortion of the continental margin, local faulting and down-faulting of the central Channel.

ii) Global sea level change, called eustatic change, due to the change in the total amount of ice on land anywhere in the world.

iii) Depression and uplift of the land locally due to the weight of ice accumulated on the British Isles, or removed from it by melting.

iv) Erosion and down-cutting of rivers, particularly the great "Channel River", and erosion of the chalk barrier between Dover and Calais.

5.2.1. Geological changes in SEA8

The bedrock geology of SEA8 is summarised by Evans (1990) for the western approaches and Hamblin *et al.* (1992) for the UK sector of the Channel itself. The geology of the Bristol Channel is outlined by Tappin *et al* (1994). Gibbard (1988) describes the background of tectonic processes which have formed the depressions of the English Channel and the North Sea over many millions of years, and influenced the courses of the great rivers flowing onto and across the continental shelf.

The two dominant processes are the East-West extensional forces caused by the break-up of Europe from America, and the North-South compressional forces caused by the Alpine orogeny. Although very slow, these forces involving faulting and changes of level have continued to apply during the Pleistocene, and because of the long timescale relevant to SEA8, need to be recognised.

Evans (1990: 4) shows the fault-bounded Western Approaches Trough which forms a sedimentary basin between the Armorican Massif in Brittany and the Cornubian Massif in Cornwall. The planation of the sea floor in the western approaches and Celtic Sea was probably mid-Tertiary (Evans 1990: 11) and several submerged cliff and terrace features have been eroded into the southern offshore region of Cornwall and Devon at depths of 38-69m (Evans 1990: 11) during the Miocene and Pliocene.

A special issue of the Journal of Quaternary Science was published in 2003 devoted to the Quaternary History of the English Channel (Gibbard and Lautridou 2003). Further details of regional and local geology of the coast and the seabed are given by a number of papers in that journal (e.g. Lagarde *et al*. 2003; Bourillet *et al*. 2003; Reynaud *et al.* 2003). Figure 5.1 which shows the major Pleistocene river systems of the western and eastern English Channel has been reproduced from this volume.

Britain was joined to the mainland of Europe between 1 million years ago and 400 ka BP notwithstanding glacially controlled fluctuations of sea level (Gibbard 1988; Stringer 2006). A high chalk plateau, the Weald-Artois anticline, from southern Kent across to northern France provided a solid link, even at times of interglacial high sea level. Some time between 400 ka BP and 200 ka BP this chalk ridge was eroded through, and at subsequent times of interglacial high sea level Britain and Ireland was cut off from Europe (see 5.2.4 below). While the extent of glaciation defined the areas which were uninhabitable and the actual sea level, and hence coastline, major factors in the period 1 million to 400 ka are therefore geological.

The unconsolidated sediment cover in the Channel is thin compared with the North Sea, which is a net area of accumulation. There are recent sediments in shallow water including peat deposits dating to the last post-glacial transgression (see Section 6.3). The sediment cover is plotted on the BGS Bottom Sediment map series (BGS, 1:250,000). The thickest sediment deposits are in the over-deepened troughs of the Hurd Deep, the Fosse de L'Ile Vierge and the Fosse d'Ouessant. The Hurd Deep is analysed by Evans (1990: 75-76) and it is a narrow graben (Antoine *et a*l.

2003: 229) which has been successively infilled at periods of low sea level and then partially scoured out by tidal currents during and after marine transgressions. It is well south of any phase of ice scour. The incision reaches a maximum depth of 240m with a sediment infill thickness of 80m, while the surrounding sea bed is rather flat at a depth of 70-90m, with a sediment cover often less than 0.5 m.

For the influence of modern seabed sediments and outcrops on the preservation and taphonomy of prehistoric archaeological deposits, see Section 6.4.

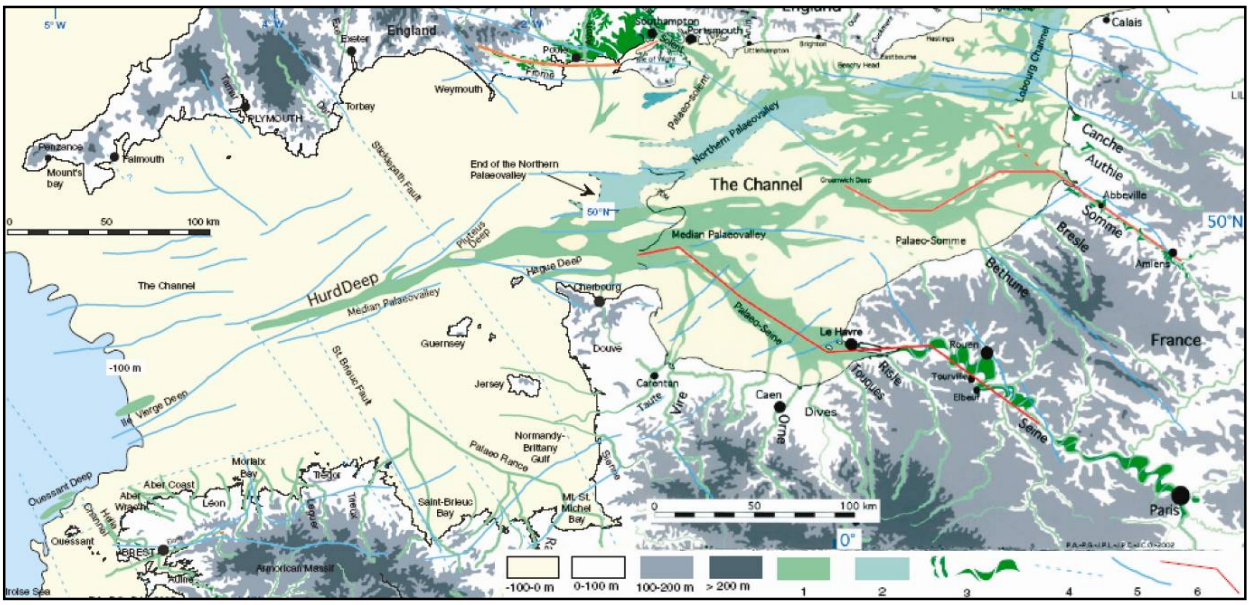

Figure 5.1 – Images showing major Pleistocene River systems in western and eastern English Channel (Pleistocene marine and periglacial deposits of the English Channel, Martin, R. Bates; David H. Keen and Jean-Pierre Lautridou. 2003. Copyright John Wiley & Sons Limited. Reproduced with permission.)

5.2.2. Global sea level

One of the best estimates of sea level fluctuation for the last 600ka is demonstrated in Rohling *et al* (1998: 163, fig1), see also Siddall *et al* (2003) and Lambeck and Chappell (2001). The global sea level is controlled by the sum total of continental ice in the world, not the local volume of ice in North West Europe. Thus the British ice cap may melt before the larger ice sheets in North America and Scandinavia. The sea level rise therefore lags behind the land uplift which is caused by the retreat of the local ice. As a result, the land area actually increases for several thousand years after the British ice melts, and eventually the global sea level then rises fast, and floods the land again. A reconstruction of palaeoshorelines between 500ka to 100ka are shown in figure 5.2. However, this process is best understood for the last phase of melting after the Last Glacial Maximum at 22 ka BP (see figures 5.7, 5.8 and 5.9) (Lambeck 1995; Shennan *et al*, 2000a, 2000b).

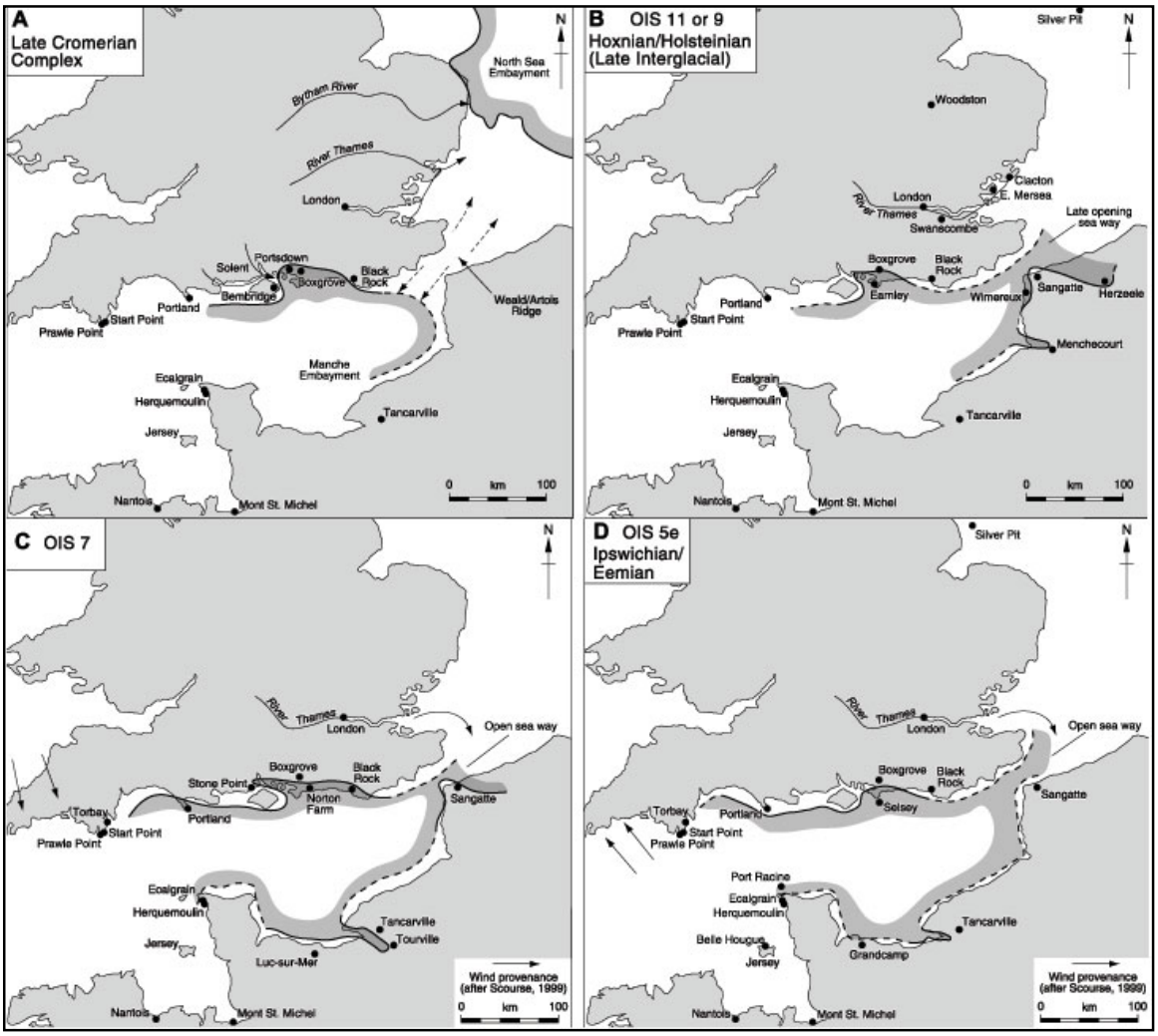

Figure 5.2 – Palaeoshorelines between 500ka to 100ka (The Pleistocene rivers of the English Channel region, Pierre Antoine, Jean-Pierre Coutard, Philip Gibbard, Bernard Hallegouet, Jean-Pierre Lautridou and Jean-Claude Ozouf. 2003. Copyright John Wiley & Sons Limited. Reproduced with permission.)

It is not certain as to the rate of formation of the British ice cap in relation to the falling sea level during the onset of glaciation. Since there are many minor advances and retreats within the major glacial cycles, the exact timing of these events, and the interaction or time lag between land depression due to ice loading and global sea level, are critical to understanding the area of dry land, and the pattern of river drainage. The details of the phases and lags for these processes are not known for periods before the last interglacial at 125 ka BP, but a sea level reversal has been described during the melting of ice just before that event (Rohling *et al* 2003).

5.2.3. Isostasy

After the rocky chalk barrier was lowered by erosion at the Straits of Dover the key factor in determining whether Britain was an island or a peninsula was the balance between global sea level change and the local weight of the ice sheet. At times of maximum glaciation the weight of the ice was centred on Scotland and Northern Ireland, and this depressed northern Britain, but caused a slight compensatory uplift outside the limits of the ice sheet. Conversely, when the ice melted, the land of Scotland and northern England rose most rapidly, while southern England subsided,

and that subsidence continues to this day as a consequence of the LGM. Thus the south coast of England is still submerging slowly, which has an impact on the coastal ports (Crawford 1927; Rossiter 1967; Flemming 1982; Thomas 1985; Carter 1988: 263).

The timing and phasing of these processes has been analysed for the last ice retreat and marine transgression, but not for earlier glaciations. Glaciations were clearly of different extent, and the maximum southern ice boundary varied, so that it is an over-simplification to treat previous glaciations as having identical effects on dry-land area and accessibility as the Devensian did. However, at present, that is the best approximation which can be made, with the obvious proviso of working with the different known ice limits.

Stringer (2006) provides a series of sketch maps designed to show the general outline of the land area, coastline, and ice extent at 700 ka BP, 450 ka, 200 ka, 50 ka, and 15 ka BP. These are extremely valuable as a means of understanding the broad parameters of the landscape at these periods and the contemporary Palaeolithic sites, and are based on best available data, but the details are still very uncertain.

5.2.4. River erosion and barrier removal

The gradient of the Channel River from the Straits of Dover to the shelf edge is of the order of 1:5000, comparable with the present day Rhine from the border of Switzerland to the North Sea. Before the Rhine was constrained by modern engineering works it meandered through massive bends and oxbow lakes, wandering many kilometres either side of the main course of the river. Given the southward flow of the Thames and Rhine through the Channel, and the addition of tributaries from the Somme, Seine, and southern English rivers, one would therefore expect frequent changes of channel course, with meanders and braids. The incised and submerged valleys of the various rivers on the floor of the English Channel are shown on the BGS Bottom Sediment Maps, and are analysed by Hamblin *et al*. (1992: 78-79). Figure 5.3 shows the complex network of buried and infilled channels which has resulted from this process.

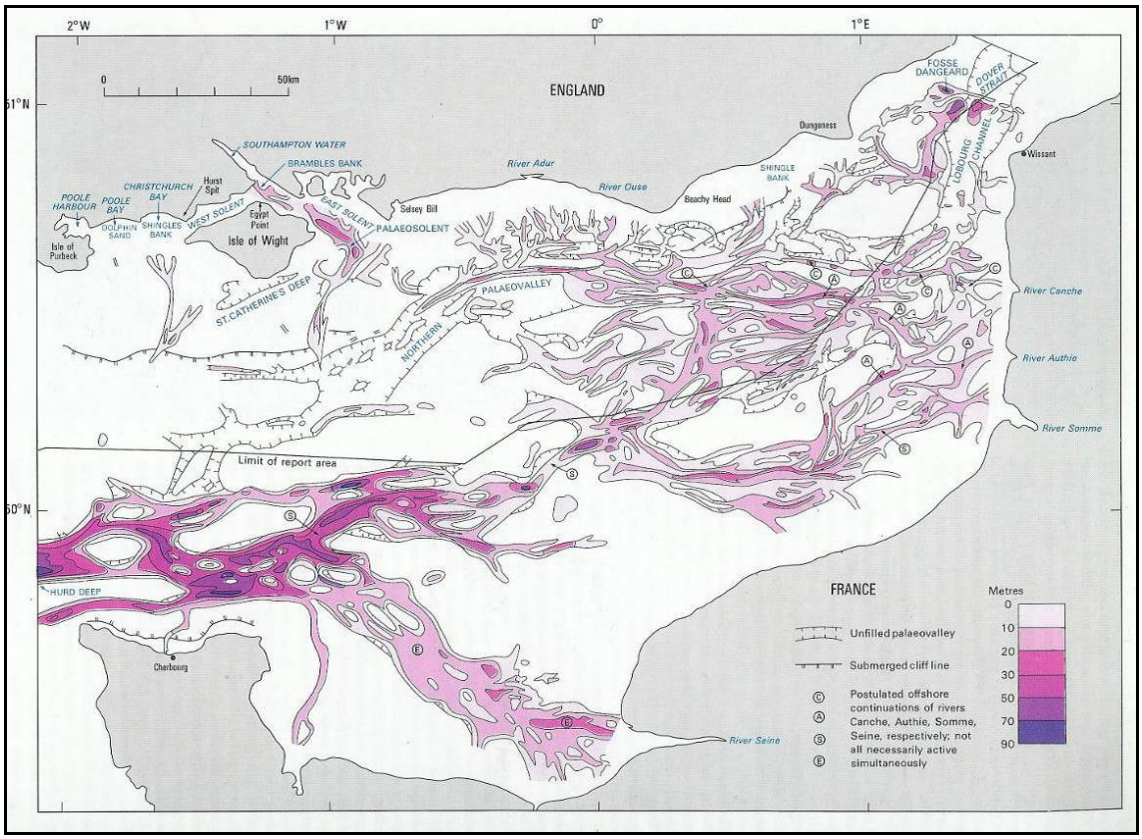

Figure 5.3 BGS map showing network of buried and infilled channels (Copyright British Geological Survey)

The pattern of rivers at any given date, the associated shoreline, and the intermediate wetlands and marshes, are important indicators of the probability of human occupation and the survival of remains. Future work to detect and preserve the prehistory of the seafloor in the SEA8 area therefore depends critically upon understanding the river drainage pattern. Work by Gibbard (1988), Gibbard and Lautridou (2003), Antoine *et al*. (2003) Lericolais *et al.* (2003) is the essential starting point for such study. The details of the Solent River have been studied in a conference volume edited by Wenban-Smith and Hosfield (2001) and are an important factor in the neighbourhood of the Isle of Wight.

The shoreline at the eastern terminal of the English Channel prior to the erosion of the Weald-Artois ridge was approximately from Brighton to Le Crotoy (Bates *et al*. 2003: 325, Fig 4A). The ridge was over 100km wide, providing a permanent land connection, even at times of high sea level, and any archaeological deposits on that area from before the breaching of the barrier will have been completely destroyed and scattered. However, at times of intermediate sea level and intermediate climate, crossings are just as likely to have been on the high ground of the ridge, or further west on the floor of the Channel, or further north in what is now the North Sea.

For the Mesolithic period the association between wetlands, estuaries and human occupation is well-established (see for example, Peeters 2007: 13-17). Bailey (2004) has made the case that Palaeolithic cultures at least as far back as the last interglacial were capable of exploiting marine resources, and it is note-worthy that both Boxgrove and Pakefield are situated in coastal plain environments, even if there is no direct evidence of exploiting marine species for food. Sites such as

Pontnewydd, La Cotte de St Brelade, and Paviland are deposits in caves, and such deposits in a sheltered location underwater could survive, especially if consolidated in rock-falls. Many of the Palaeolithic sites discovered on land are associated with river gravels, and have frequently been studied in gravel quarries. Thus the potential for pre-LGM sites in SEA8 is influenced both by possible association with rivers and/or coastlines, and with caves.

Erosion of rivers and deepening of estuaries and rias would permit the sea to penetrate further inland and eastwards, millennium by millennium, and serve as an obstacle or delaying factor, even if temporary, to migration. Stringer (2006: 163) notes the paradox of the apparent absence of human occupation of Britain during the last interglacial and the tens of thousands of years after it when the climate was still suitable, and the only apparent obstacle to occupation was the Channel River. However, this explanation does not seem sufficient, since occupation of central Europe extended north of the Rhine, and thus it should have been possible to cross into England via the North Sea, even if the Channel River itself was uncrossable. Other factors may have contributed to the reason for apparent human absence on the present dry land area of southern England.

The pattern of rivers, tributary junctions, deltas, braids, and over-deepened channels which is seen now on the Channel floor has been influenced by successive retreats and re-advances of the sea level over the fluvial and deltaic features. Dix *et al.* (2006) have submitted a report to English Heritage on the changes which occur when such sedimentary and alluvial features are exposed to marine transgression. These processes need to be taken into account when assessing archaeological potential.

It has been suggested that the lowering of the chalk barrier at the Straits of Dover could have been a catastrophic rupture, followed by a colossal torrent which swept down the English Channel, draining the southern North Sea, and eroding uniquely vast valleys. For a discussion of this proposition see Gibbard (1988: 588-591), Hamblin *et al*. (1992: 80-81), and Stringer (2006: 162-163). Although Noah-like floods are always attractive to the public and journalists, the evidence for a catastrophic flood is not convincing. Examples from other peri-glacial events, for example from North America, refer to collapse of ice-dams and unconsolidated morainic sediments, whereas the barrier at Dover Straits is a bedrock chalk ridge. When the level of the glaciolacustrine water body trapped in the southern North Sea between the ice sheet to the north and the Dover ridge to the south overtopped the ridge, the flow out would be identical to the input to the lake. The erosion may have been rapid, combined with frost shattering, but would not be catastrophic, and the progressive widening and lowering of the sill may have been the result of several different events.

5.2.5. Summary notes

It could be argued that the combination of meandering rivers, intermittent periglacial climate, and multiple marine transgressions and regressions would erode, scatter, or bury all archaeological deposits before the LGM. This however is not true of the Fermanville site (see case study box, Section 6.2.3), nor of deposits in the Solent in the shelter of the Isle of Wight. Given the enormous variety of palaeo-landscape and coastal and fluvial features it is probable that there are some locations where combinations of favourable conditions for occupation combine with favourable taphonomic circumstances.

The extensive Palaeolithic deposits on the island of Jersey, especially at La Cotte de St Brelade, (Callow 1986; Stringer 2006: 157-159), show that people were living there about 150 ka BP, and were subsisting in spite of the cold, and were burning bones as a source of heat. This suggests that other deposits could exist from similar

dates, but below present sea level. It also suggests an Inuit-style of survival in a cold climate, with the benefit of access to megafauna as a food source. For discussions of other sites where people were living in sub-Arctic conditions before the LGM see Pavlov *et al.* (2001) and Pitulko (2001) and Pitulko *et al.* (2004).

The evidence deduced from known land-sites in the British Isles and the mainland of Europe indicates that people did cross from the mainland, but it does not provide any evidence for or against prolonged residence on what is now the seabed. The evidence from La Cotte de St Brelade confirms that at least some proportion of the previous population were able to exploit the cold climate conditions, and this may have been true for other locations which are now submerged. Cave locations could be a favoured type.

5.3 125ka- 6ka: The last glacial cycle, Neanderthals, and the final occupation of the British Isles

5.3.1. Evidence from land sites, coastal sites, and DNA data

There are no known archaeological sites on land in England that show a hominin presence during the last interglacial high sea level, or from that date until about 60 ka BP. In the period from 60 ka BP to 25 ka BP, shortly before the LGM, Neanderthals were in Britain briefly, and then Anatomically Modern Humans (AMH). After the glacial maximum AMH returned again from 16 ka BP to the present day. The presence of a submerged Levallois-Mousterian site at a depth of 20m off the French coast near Cherbourg is an important testimony to the occupation of the SEA8 area and the southern margin of the English Channel at this period.

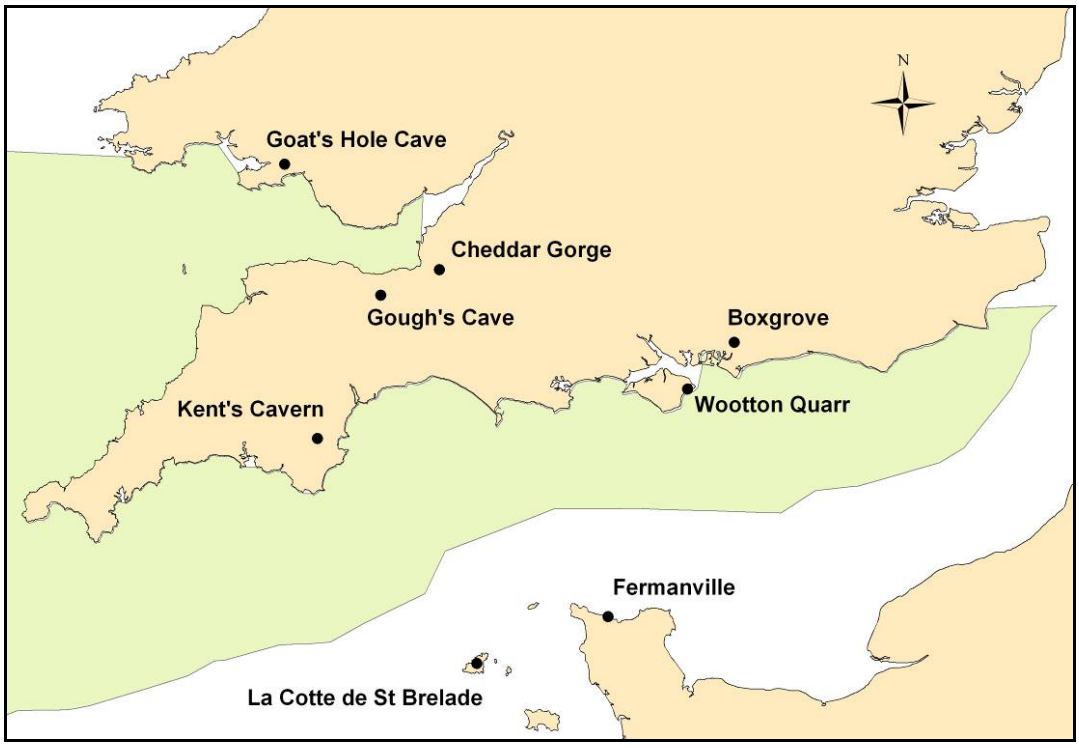

Figure 5.4 Distribution of prehistoric sites referenced in Section 5

Oppenheimer (2006) provides evidence based on Mitochondrial DNA for the maternal line and Y-Chromosome genetic markers for the male line, showing dramatically how tribes from the area of the Basque country, Pyrenees, and south-west France migrated northwards after 16 ka BP and occupied Brittany, Cornwall, Wales, Ireland, and western and northern Scotland. The fact that the genetic types dominate in these areas indicates very strongly that they migrated along the Atlantic margin at times of low sea level, and when most of the ice had melted. For the post-glacial period the maps provided by Oppenheimer (2006, figs 5.5 & 5.6) are a powerful suggestion as to what archaeological remains might survive on the seabed in the Western Approaches and western Channel.

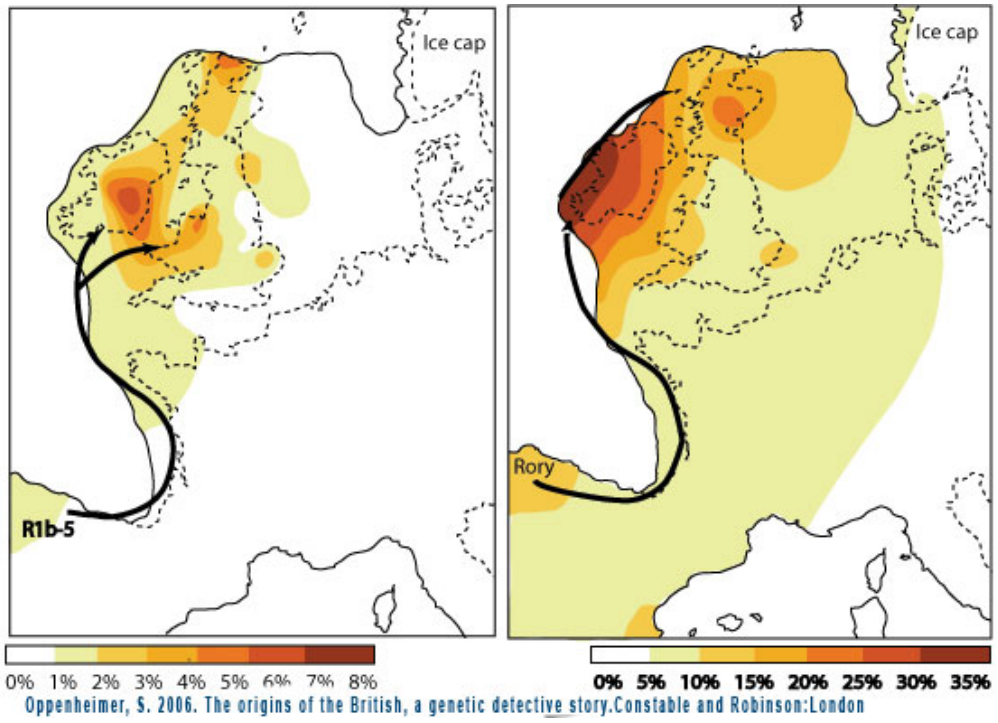

Figure 5.5 – Oppenheimer's models for re-occupation of Britain 15,000 – 13,000 years ago based on male gene clustering (Oppenheimer, S. 2006. The origins of the British, a genetic detective story. Constable & Robinson Ltd: London. Reproduced with permission.)

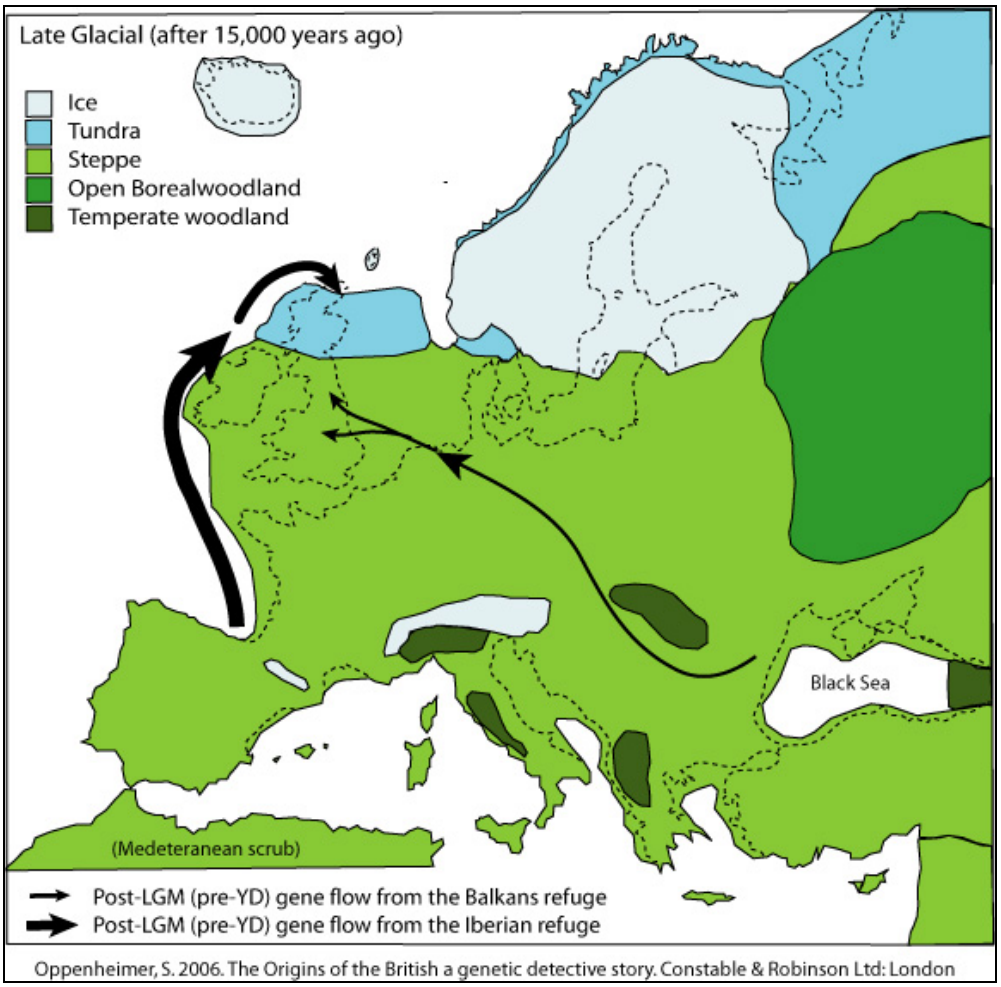

Figure 5.6 – Oppenheimer's model 'Colonising 'Greater Britain' after the ice: a summary map of early recolonizing gene flow into Northern Europe and the British Isles 15,000 – 13,000 years ago' (Oppenheimer, S. 2006. The origins of the British, a genetic detective story. Constable & Robinson Ltd: London. Reproduced with permission.)

The full process of the re-occupation of the British Isles after the Devensian glaciation cannot be understood unless we can unravel the prehistoric archaeology of SEA8. It should be stressed that Oppenheimer's model of events assumes that the continental shelf itself was abandoned at the glacial maximum. However, the site of La Cotte de St Brelade on Jersey in the Channel Islands (Callow 1986) was occupied at 150,000 BP (Stringer 2006: 157), during a cold phase, and thus a sparse population may have existed in the SEA8 area shortly before and after the LGM, and before the re-occupation of the present land area.

The last glacial cycle has been studied intensively for global eustatic sea level change (Fairbanks 1989; Lambeck 1997; Lambeck and Chappell 2001; Van Andel and Davies 2003) and the regional British ice loading and isostatic response (Shennan et al. 2000a, b; Lambeck 1995; Smith et al. 1999). Figures 5.7, 5.8 and 5.9 provide a graphic interpretation of current knowledge of palaeoshorelines.

The British Isles were occupied from 60 ka to 25 ka BP (Stringer 2006: 174), and then unoccupied (Stringer 2006: 199) from 25 ka BP to 16 ka BP during the peak of the last glaciation. The earlier phase is supported by the Fermanville site (Scuvée

and Veragues 1988) (See Section 6.2.). Oppenheimer (2006: 102 - 172) shows that the DNA of the modern population of the British Isles can be explained by a migration of people along the Atlantic coastline from France and Spain across the floor of the Celtic Sea and the western Channel, and into western England, Wales and Ireland at about 16 ka BP, with later migrations from Germany across the North Sea. At this time the continental shelf was maximally exposed, as the British ice sheet had retreated substantially, the southern parts of Britain had risen isostatically, and global sea level had not risen much. The actual rate of migration, and the traces which would be left behind, are uncertain. If the total migration from south-western France to Wales or Scotland took 1000 years, the rate of migration was about 1km per year. If the migration rate was 20km per year, the distance would be covered in only 50 years. Either model is plausible on present evidence.

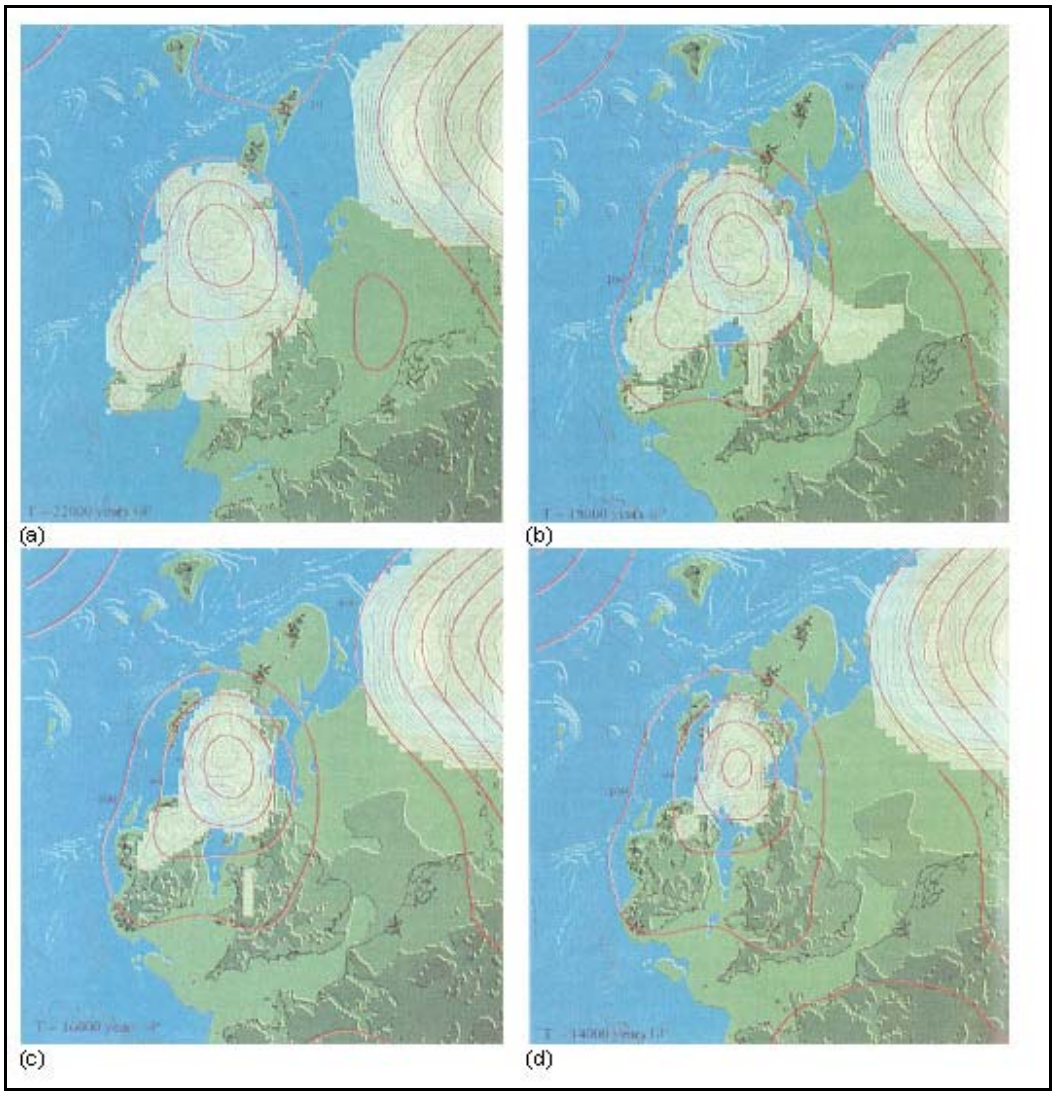

Figure 5.7 Isobase maps of predicted shorelines, shoreline locations and ice sheet limits for selected epochs. (a) 22,000 years BP corresponding to the adopted time of maximum glaciation over the British Isles (b) 18,000 years BP corresponding to the time of the onset of deglaciation of the large ice sheets (c) 16,000 years BP (d) 14,000 years BP. (After Lambeck 1995).

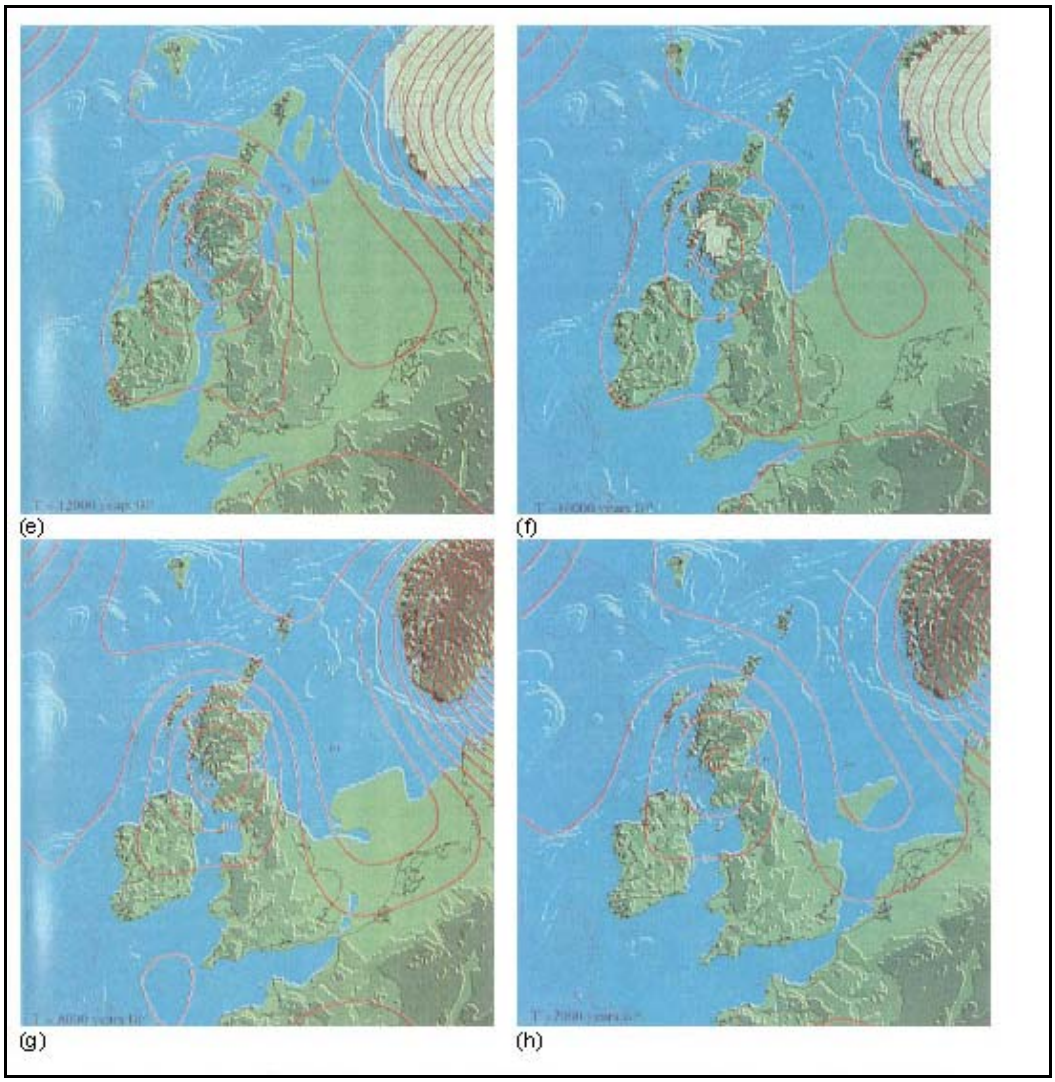

Figure 5.8 Isobase maps of predicted shorelines, shoreline locations and ice sheet limits for selected epochs. (e) 12,000 years BP (f) 10,000 years BP (g) 8,000 years BP (h) 7,000 years BP. The maximum ice heights for these epochs are: 1500m at the time of the glacial maximum at 22,000 years BP; 1,400m at 18,000 years BP; 1,300m at 16,000 years BP; 1,000m at 14,000 years BP and 400m at 10,000 years BP. Palaeowater depths are also indicated with contours 50, 100, 150 and 200m. Isobase contour intervals are 50m for (a) to (d), 25m for (e) and (f) and 10m for (g) and (h). (After Lambeck 1995).

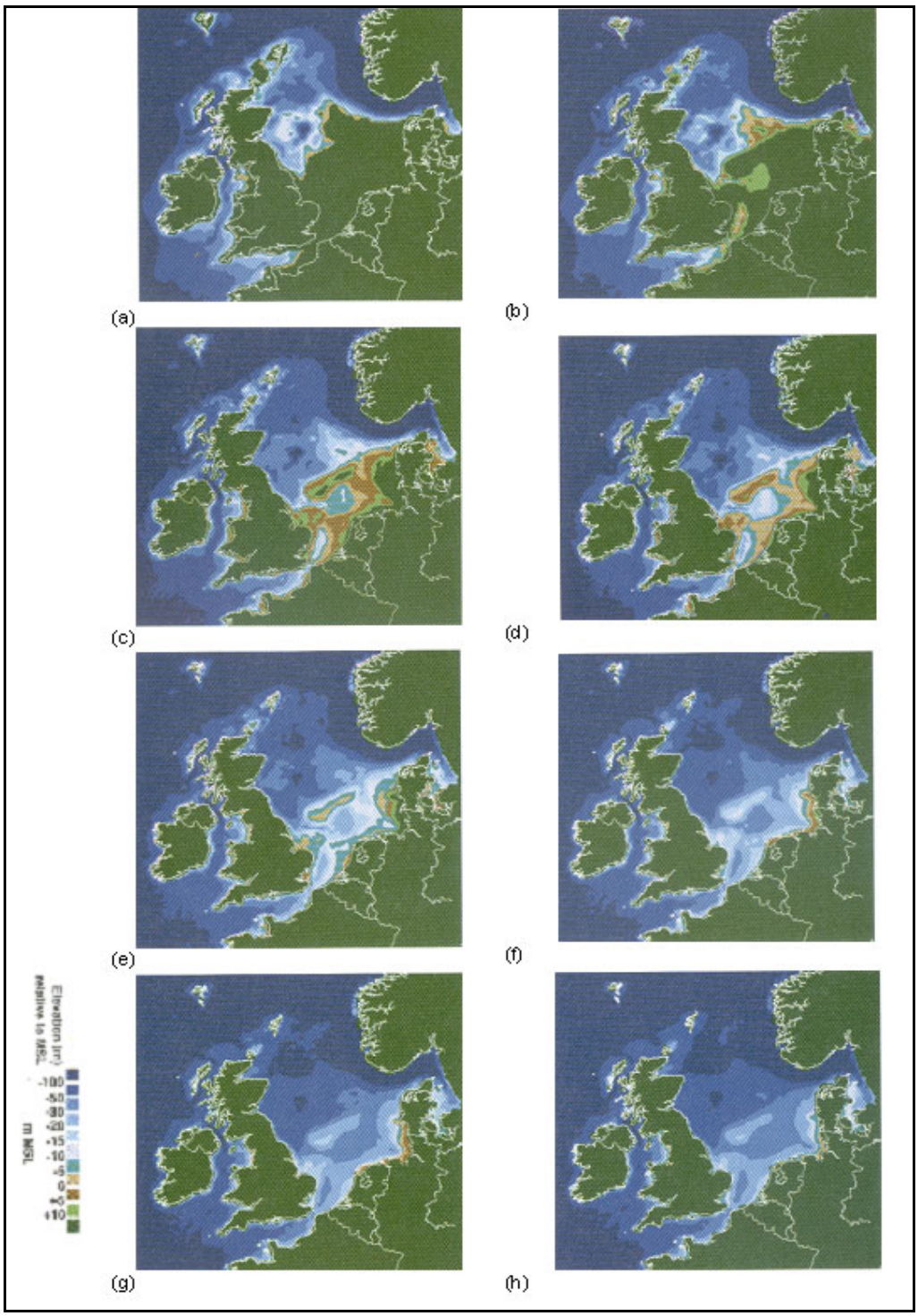

Figure 5.9 Palaeogeographic reconstructions of Northwest Europe (a) 10,000 years BP, (b) 9,000 years BP, (c) 8,000 years BP, (d) 7,500 years BP, (e) 7,000 years BP, (f) 6,000 years BP, (g) 5,000 years BP, (h) 4,000 years BP. Elevations (metres) relative to MSL, depths below MSL are given as negative (After Shennan et al *2000)*

5.3.2. Records of submarine peat deposits

Peat deposits dating between 12,650 to 7000 BP exist in the Dover Straits area, Solent, and off the south coast of Devon and Cornwall. These are described in more detail below (Section 6.3). The Fermanville site near Cherbourg is also associated with peat from before the LGM. Prehistoric archaeological discoveries in the North Sea, and in SEA8 are frequently associated with submerged peat and drowned forests. While there is circumstantial evidence that prehistoric settlements, especially in the Mesolithic, were often coastal or close to rivers and marshes, this association should not be exaggerated. More logically, if a settlement is in a location which is a wetland, or which subsequently becomes a wetland, with peat formation, the archaeological materials are likely to become embedded in the cohesive sediments, and thus to survive.

5.3.3. Climate change and oscillations

The trends of cooling and warming as the climate oscillated after the last interglacial, the Ipswichian, can be followed through the detailed curves showing temperature and sea level in the successive Marine Oxygen Isotope periods (Fig 3.1). The mainland of Europe was occupied throughout the last glaciation, although people retreated progressively southwards.

As suggested above (Section 5.3.1) we cannot be sure that people were completely absent from SEA8 purely on the basis of apparent absence from the mainland of Britain in the period 125-60ka BP. Murton and Lautridou (2003: 304) cite a number of authors to indicate the probable limits of continuous permafrost at different dates (Figure 5.9). Most models show continuous permafrost hardly extending south of the English coastline. Even the coldest estimate shows Cornwall and Britanny free of continuous permafrost at the peak of the LGM at 22 ka BP. Thus the western Channel and Western Approaches may have served as a refugium for some hardy tribes.

Van Andel and Davies (2003) have published a multi-disciplinary analysis of the climatic fluctuations during Oxygen Isotope Stage 3, approximately 60-20 ka BP, and the consequent effects on the distribution of Neanderthal and anatomically modern humans (AMH). The study consists of a concatenated sequence of models describing the temporal and regional variation of temperature, precipitation, seasonal variability and extremes, snow cover, wind speed, vegetation, fauna, wind-chill factor, and habitability for hominins. During OIS-3 the Greenland ice core data GISP2, (Meese et al. 1997; Johnsen et al. 2001) show rapid fluctuations of temperature of the order of 5-10^{0}C every few thousand years, the so-called Dansgaard/Oeschger oscillations. The models are run on a 60 x 60km grid resolution (Van Andel and Davies 2003: 58) and this necessarily limits the accuracy, as well as there being some uncertainties as to how one model output relates causally to the next model. Nevertheless, the sequence of calculations and plotted maps, correlated with summaries of known major archaeological sites, provides a thought-provoking analysis. The maps and calculations could be used in future as a starting point in studies which attempt to understand where people would have been living on the sea floor at times of low sea level. Unfortunately Van Andel and Davies (2003) do not take into account archaeological data from the seabed, or the known occurrences of fossil fauna or human occupation sites on the sea floor of North West Europe (Loewe Kooijmans 1970-71).

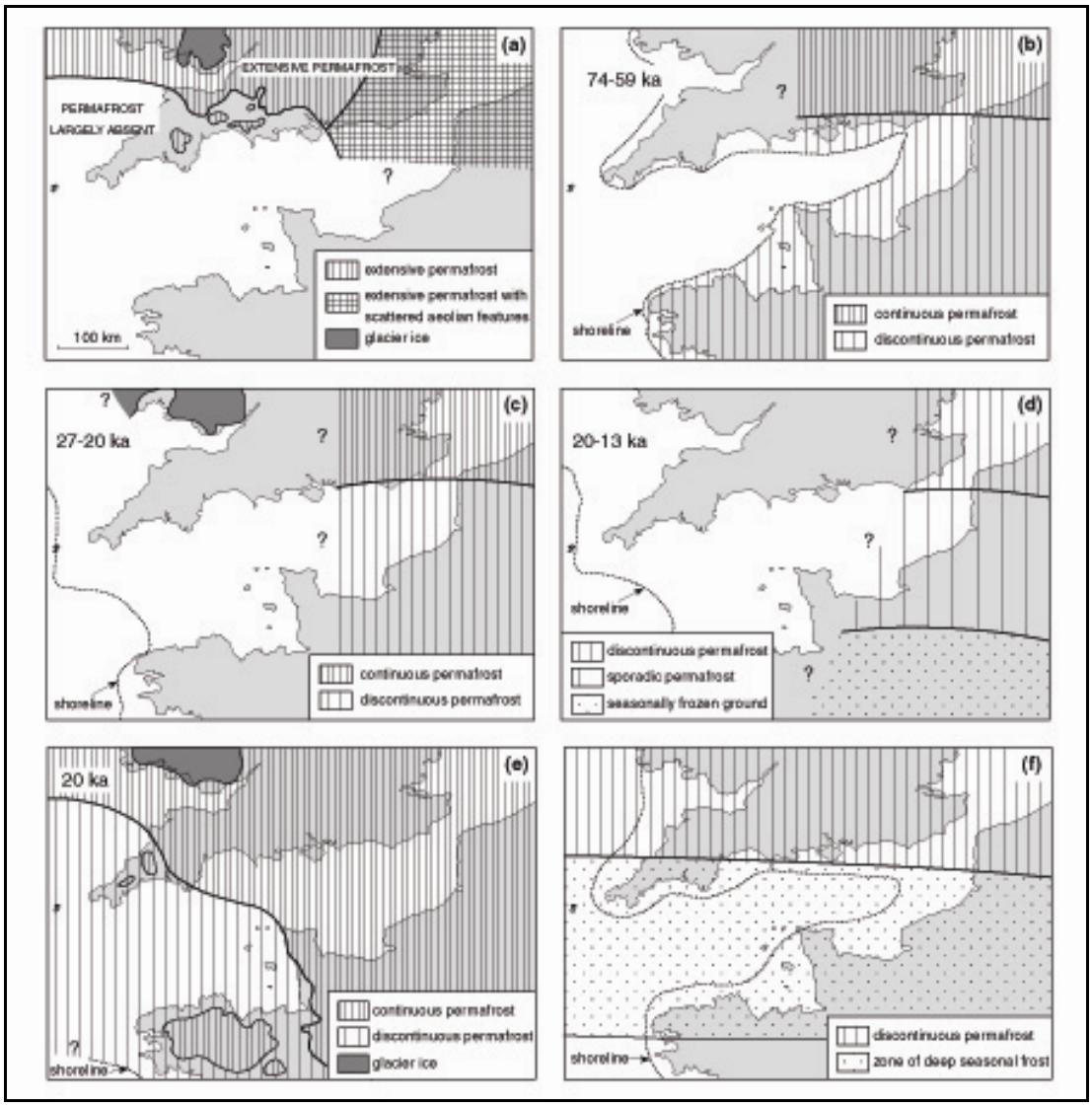

Figure 5.10 – Map showing various reconstructions of permafrost distribution during the Devensian/Weichselian. Based on: (a) Williams (1969); (b)–(d) Huijzer and Vandenberghe (1998); (e) Van Vliet Lano¨e (2000); (f) Isarin (1997) for the Younger Dryas (Copyright John Wiley & Sons Ltd, Reproduced with permission)

5.4. 6ka to present

Global eustatic sea level reached within a very few metres of the present level around 5-6ka BP (Shackleton 1987; Lambeck 2001), although this generalisation is complicated by local and regional earth movements and hydro-isostatic readjustment. The key point is that the global sea level effectively ceased rising from the reduction in volume of the major continental ice caps. Since that date southern England has continued to sink in an irregular manner as a result of British post-glacial isostatic recovery. Lambeck (1993: 27) shows relative sea level curves for different parts of the British coast indicating submergence over the last 6000 years along the Channel coast and domed uplift in Scotland. Waller and Long (2003: 357) compare curves of sea level indicators for the south coast, indicating a general submergence of the order of 4-5m in the last 6000 years, with indicators from the south-east coast plotting lower than those from the central and south west coast. Carter (1988: 263) cites tide gauge data from a number of authors to illustrate a range of submergence rates from 1.7 to 5.4 mm per year along the south coast, but

this may contain a factor due to modern sea level rise from thermal expansion of the oceans and global warming.

Steers (1948) reviews the coastal geomorphology along the whole length of the English coast, describing historical changes, alluviation, the growth of Dungeness, erosion of parts of the coastline, the existence of drowned forests, rates of cliff retreat, etc. These processes are reviewed in a more technical way by Carter (1988). There is not space in this report to examine in detail the coastal morphodynamics kilometre by kilometre throughout the coastline of SEA8 from Pembroke in South Wales to Dover in Kent. Numerous changes have taken place, and continue now, affecting access to estuaries and bays, silting of harbours, growth of headlands and spits, or erosion of cliffs and flooding of marshes. A recent literature review by Cracknell (2006) considers the impact of storm floods and coastal erosion during the last 1200 years. The analysis is somewhat anecdotal, but the book is useful in that it contains a mass of citations to regional and local literature describing historical coastal changes which would otherwise be difficult to find.

The coastline was quite different when the first Mesolithic or Neolithic boats crossed from France and Holland to England. This has two consequences: (a) structures on the shore associated with boats and coastal settlements are now below high tide level, if not actually underwater; and (b) there are log boats and canoes from this period, including their cargoes, either lost on the seabed, or found in coastal sediments.

The coastal subsidence of southern England including parts of the Severn Estuary and Bristol Channel has caused submergence of several archaeological sites which are important in broad terms, and which need protecting from coastal development. These include intertidal Mesolithic footprints in clay below a peat dating from 6260+/-90 BP (CAR-1178) in the Severn Estuary (Bell 1991); Bronze Age walls in the shallow water between the Isles of Scilly (Crawford 1927; Thomas 1985); numerous intertidal sites in the Solent such as Bronze Age occupation and burial evidence from Langstone Harbour (Allen & Gardiner 2000) and Neolithic Trackways from Wootton Quarr (MA 400) (Loader et al. 1997).

In summary, the last 6000 years have seen active seafaring in the region, with many changes on the coastline due to erosion, redeposition of sediments, and slight subsidence. Due to the density and local distinctiveness of sites in the late prehistoric and historic periods each site needs local evaluation at a sub-km resolution.

5.5 Summary of Periods when Hominins must have Crossed the Continental Shelf

The review of the available literature and research associated with the human occupation of Britain and associated climate changes has highlighted how essential it is to understand the changing landscape for human occupation in order to provide context for the often sparsely scattered archaeological remains that have been discovered to date. The development of cultural traditions and associated archaeological evidence from the prehistoric period is presented in section 6. To provide the context for this evidence in relation to warming and cooling environmental conditions the following summary is presented, this should be considered alongside figure 3.1 which provides the framework for human occupation.

5.5.1. Stages of occupation and abandonment

There are typically four phases when people may or may not have been living on the shelf associated with a glacial cycle:

a) A migration into the British Isles. During this phase, after a period of abandonment, it is logically necessary that people migrate across the shelf for a few years or a few hundred years as the ice retreats, and they move into UK. Occupation would be necessary, but could be short-lived. A full breeding population must cross, or inter-breeding must continue across the shelf with the rest of Europe, to sustain occupation.

b) Mainland British Isles is proven to be occupied. The shelf area may have been exposed and dry land during a warm phase if the Channel and Straits were still high enough; but must have been abandoned if the shelf is inundated by high sea level in an interglacial. In practice, Stringer (2006, pg 300) shows Britain as a Peninsula almost all the time. So this area could have been occupied. This occupation could have been sustained, but this is not necessarily the case. The major determinant of the length of occupation period is geology and inundation.

c) Climate worsening, ice increasing and population declining. The population may have retreated across the shelf, but might have died out *in situ*. In these conditions occupation of the shelf is possible, but did not necessarily occur.

d) Cold periods, maximum shelf area exposed, but peri-glacial tundra environment. Inuit-type occupation of the shelf would be possible, but did not necessary occur.

6. Prehistoric Marine Archaeology

The potential for prehistoric archaeological material in drowned landscapes can only be realised by extending our knowledge of terrestrial occupation patterns to regions that are now underwater. The previous chapter looked at the geological, geomorphological and climatic changes that transformed the landmass and provided opportunities for the peopling of the UK and the SEA8 area. It made it clear how temperature changes throughout the Quaternary have had a dramatic impact on the magnitude and location of habitable land around Britain. During glacial peaks, vast tracts of land were exposed on the continental shelf as swollen glaciers trapped frozen water reducing sea levels by over 100 metres. At these times Britain appears to have been abandoned, however, the climate was in a continual state of flux with warm interglacials every 100,000 years or so. There were long periods of low sea level when the SEA8 area would have been very bleak, but, there were also periods lasting thousands of years when sea level rise lagged behind a warming climate; making the north-west European landscapes attractive for occupation.

Although few prehistoric finds have been recovered from within the SEA8 offshore zone, it is inconceivable that lands from these periods which are now underwater would not have been exploited. This section identifies the early hominins and anatomically modern humans that have left their mark in lands that border the area during the changing climatic phases of the last 700,000 years.

6.1 Context for Prehistoric Marine Archaeological Remains

6.1.1 History of Study

The concept of a land bridge between Britain and continental Europe was postulated as far back as 1605 by the English scholar Richard Rowlands. He could not conceive how anyone would willingly bring wolves to Britain. Instead be believed they must have found their way on foot over a land passage that has now drowned. In 1650 Dr James Ussher, the Bishop of Armagh, published *The Annals of the Old Testament* in which he reviewed Adam's biblical lineage detailed in the Old Testament to fix the beginning of creation. He concluded that 4004 years had passed. This tainted the view of prehistory for over two centuries. The discovery of fossilised plants or animals or well-preserved artefacts recovered from apparently inexplicable circumstances were therefore attributed to the great flood. Accordingly, Mesolithic hazelnuts uncovered in cliffs on the south of the Isle of Wight at the beginning of the nineteenth century were claimed to be 'Noah's Nuts' (Webster 1816) while submerged forests around the British coastline were affectionately referred to as 'Noah's Woods' (Godwin, 1943). The inadequacy of biblical timescales was brought into focus by the publication of Charles Lyell's 'Principles of Geology' in 1830. Lyell demonstrated that the changes which moulded the landscape around us were part of a much longer process. This acceptance of a greater temporal framework helped to explain the relationship of the nineteenth century archaeological discoveries at sites such as Kent's Cavern (MA 401), Goat's Hole Cave (MA 402) and Gough's Cave in Cheddar Gorge. In particular, consideration of long-term sea level fluctuations could now be entertained without the need for miraculous floods.

After the hiatus induced by religious theology, the drowned landscapes hypothesis was addressed with more scientific rigour by Clement Reid who spent many years recording submerged forests that had now become inundated by rising waters (Reid, 1913). His work help set the intellectual foundations upon which a raft of discoveries in the twentieth century could now be justifiably attributed to changes in sea level. It was upon this premise that archaeological discoveries were able to attract a more prominent role.

The history of submerged prehistoric archaeology in the SEA8 area, including the extension to the full width of the Channel and southern Ireland, is now substantial. Submerged Bronze Age walls between the islands of Scilly were described by Crawford (1927) and more fully by Thomas (1985). In France Pierre-Roland Giot published a series of research papers (e.g. 1968; 1979) on the coastal megaliths and intertidal monuments on the coast of Brittany. In these he provided an overview of the known submerged prehistoric structures on the Brittany coast, with an emphasis on standing stones, gallery graves, and the submerged standing stone circle at Er Lannic, in the Golfe de Morbihan. Collectively these showed a relative inundation of the land of 5m in the last 5000 years (Prigent *et al*. 1983: 310).

In recent decades the area has continued to reveal some of the most important submerged prehistoric sites in NW Europe. One of these is the submerged Palaeolithic site at a depth of 20m in the Anse de La Mondrée near Fermanville, east of Cherbourg (Scuvée and Verague 1988). The location of the site is shown in Figure 6.5. At the date of occupation, about 45ka BP, the site strategically overlooked the confluence of the extension of the Seine River and the Great Channel River, which met 15km to the North. Other artefacts have been found in the sheltered waters of the Solent. Here, material spanning the lower Palaeolithic to Neolithic has been recovered from the sea floor by oyster fishermen. These finds emanated from fluvial deposits associated with Pleistocene periglacial river systems and from below peat laid down during the Flandrian Transgression. Recent excavations 12m below sea level have revealed stratified Mesolithic occupation sites c.8, 000 years old.

6.1.2 Climate change and Human Habitation: understanding Pleistocene climatic opportunities

For much of the Pleistocene, the hills, valleys and caves of Eurasia's north-west peninsula constituted a remote and desolate territory dominated by ice and snow. During the cold times, lower sea level revealed expanses of low lying lands stretching across the Atlantic continental shelf. These would have become progressively warmer and more hospitable to the south. The Palaeolithic people relied on wild plants and animals to live. The habitat that supported these resources would have been sensitive to environmental change. If the habitat shifted, the ecosystem it sustained would also have to shift. Our forbears, *Homo Heidlebergensis, Homo Neanderthalensis* and *Homo Sapiens* would have been dependent on these ecosystems to survive. The earliest occupation by hominins in Britain coincided with the warmest climatic stages; however, archaeological evidence suggests they developed survival strategies for a wider range of environments as the millennia passed. Despite evidence of human activity on island Britain being absent for large parts of the glacial periods, this should not preclude occupation of adjacent lands which are now underwater. Environmental conditions towards the south would have been suitable for exploitation at times when the north was not. Accordingly, the now submerged SEA8 area may have been occupied many times and over longer periods than island Britain.

6.2 Prehistoric archaeological sites and finds in the SEA8 area

The SEA8 zone is now inundated and relatively little Palaeolithic archaeology has been knowingly recovered from the extensive drowned landscape it conceals. If we are to gain an insight into the archaeological material that could remain we need to review the pattern of human occupation in the region during successive interglacials.

6.2.1 Lower Palaeolithic

The earliest evidence for human activity in Northern Europe is found on British soil at Pakefield (MA 403), Suffolk (Danison 1995). Knapped flint tools have been identified eroding from the sediments of ancient river estuary deposits that were laid during the

Cromerian Complex over 700,000 years ago. Anthropogenic evidence has also been recorded from the same period in Westbury, Somerset demonstrating dispersion across a wide area (Andrews et al. 1999). The location of these sites and other key Lower Palaeolithic sites are shown in figure 6.1. The temperatures were estimated to have been several degrees higher than today and conditions along the south coast of the UK would not have been dissimilar to Suffolk. When the temperatures dropped with the onset of the following glacial period sea levels would have fallen permitting access to dry land in the SEA8 area. These lands may have witnessed activity by early hominins until the deteriorating climate made occupation untenable. During this period, the Weald-Artois chalk ridge ran across the Strait of Dover retaining an unbroken link with France. This would have enabled movement across the peninsula by fauna and hominins without the need to cross large expanses of open water.

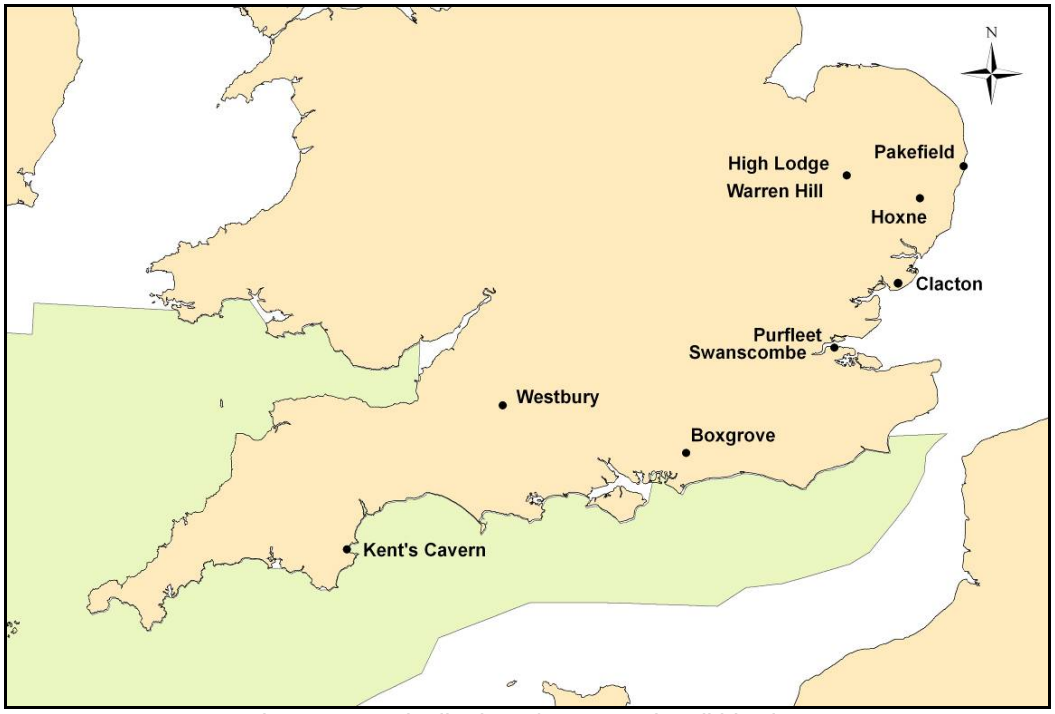

Figure 6.1 – Distribution of Lower Palaeolithic sites

Towards the end of the Cromerian Complex, 200,000 years later, discoveries from Boxgrove (MA 404), West Sussex demonstrate that organised groups of hunters were well established on the borders of the SEA8 area (Roberts & Parfitt 1999). Bones of *Homo Heidlebergensis* have been uncovered along with their flint tools and butchered animal remains next to a stream on raised beach deposits near the coast. Fine Acheulian hand axes were found along with flint debitage scatters distributed during knapping. The site dates toward the end of the Cromerian Glacial complex about 480 to 500 thousand years ago, at part of the climatic cycle when sea levels were falling. Other well known sites from this date include Warren Hill and High Lodge in the East Anglian region. Warren Hill boasts an assemblage of Acheulian (biface) hand axes while High Lodge is characterised by scrapers, suggesting dual cultural influences.

The next 100,000 years were dominated by the Anglian Glaciation during which time the ice sheets reached South Wales and London. Human activity is not detected in the archaeological record across the UK or Northern Europe for this period. It was towards the end of this glaciation that the Weald-Artois chalk ridge was believed to

have been broken through, releasing water into the English Channel possibly when an ice dammed lake breached (Gibbard 1995; Keen 1995). Britain would become an island during warm phases from this point on.

Sedimentary and palaeo-environmental evidence suggests island status was the case in the early Hoxnian about 410,000 years ago, possibly due to sea level rise outstripping isostatic rebound (Meijer, & Preece, 1995; White & Schreve, 2000). Archaeological sites in Britain are well represented during the Hoxnian and include; Hoxne, Suffolk; Clacton, Essex, Swanscombe, Kent and Kent's Cavern in Devon. Clacton and Swanscombe contain Clactonian tools in well-defined stratigraphic units and relate to an early part of the interglacial (Bridgeland, 1996; Brigland *et al* 1999). In the case of Swanscombe they underlie Acheulian contexts. The Archaeological archive demonstrates that differing stone tool technologies were introduced during successive interglacials and that technologies could vary during the course of a single warm period. It should be remembered, however, that occupation of Britain was not the result of episodic invasion but more the culmination of hundreds, if not thousands of years which resulted from expansion across successive swathes of land as it became habitable and hunting territories could expand. Kent's Cavern, Swanscombe, Hoxne and other Hoxnian sites contain Acheulian hand axes (Figure 6.2) deposited when Britain was probably an island. Clactonian sites are associated with cooler periods either side interglacial maximum when sea level would have been lower.

Figure 6.2 – Acheulian hand axe

It is possible that hominid migrations into Britain arrived from different directions, bringing with them the different technologies. White *et al* suggests that the first arrivals to Britain during interglacials may have arrived from the south rather than the east. The populations would have been geographically closer. A second wave of colonisation would have followed from the east once the mid-southern European population had expanded north (White & Schreve 2000). This being the case, the SEA8 zone would have played a significant role as a spring-board for the repopulation of the land along its northern boundary and would have acted as a refuge when developing artic conditions forced people south.

Hominid occupation during the 30-40,000 years of the Hoxnian warm stage became well established, but a foothold does not appear to have been maintained for long into the following cold period. However, humans reassert themselves as the next, 'Purfleet' interglacial takes place about 340 - 300,000 years BP. Purfleet is the most significant site of the relative few that survive from this period, particularly as it reflects a sequence of archaeological technologies. The lowest stratigraphic unit contains hand axe free Clactonian deposits. This is covered by a layer rich in hand axes indicating Acheulian cultural influences. Environmentally, a wooded landscape succumbed to more open grassland between the two phases. By the peak of the Purfleet interglacial sea levels were many metres higher than today and Britain would have become an island. As the Purfleet interglacial begins to draw to a close, a new technology is introduced to the archaeological record, this is the Levallois technique where large flakes are prefabricated and separated from a core (Figure 6.3). An assemblage of Levallois tools were found in Purfleet above the hand axe layer. The new method of working with tools was introduced from Europe and spells the beginning of the Middle Palaeolithic about 300,000 years ago.

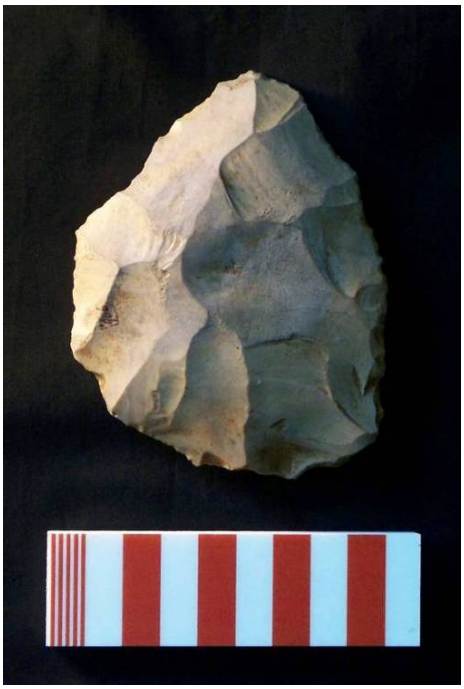

Figure 6.3 Levallois core tool

6.2.2 Middle Palaeolithic

Occupation in the UK following the Purfleet interglacial is very sparse. Figure 6.4 shows the location of the most significant sites yet discovered from this period. A discovery at Harnham near Salisbury has demonstrated that hunting ranges would move north and west when conditions allowed (Whittaker *et al* 2004). The site was occupied about 250,000 years ago and dates towards the end of a particularly cold phase of the glacial cycle prior to the Aveley interglacial. The date is not dissimilar to Lower Palaeolithic finds recovered from La Cotte de St Brelade in Jersey. Here stone tools associated with a sequence of technologies spanning over 200,000 years from the Lower to the Upper Palaeolithic were used to process woolly rhino and mammoth after they had been stampeded over a cliff. The earliest sequences were devoid of hand axes (Patton, 1987). At the time, Jersey would have been an elevated hillock on the edge of a large plain that stretched into and through the SEA8 area. To the north, Pontnewydd Cave, Denbighshire, Wales was occupied about 25,000 years

later when the climate had warmed (Murphy, 2002). Artefacts were discovered in a cave above a valley and included hand axes associated with Neanderthal teeth. Archaeology that was not protected in this way would have been stripped from the land surface during successive glaciations. The SEA8 area was never subject to scour by glaciers.

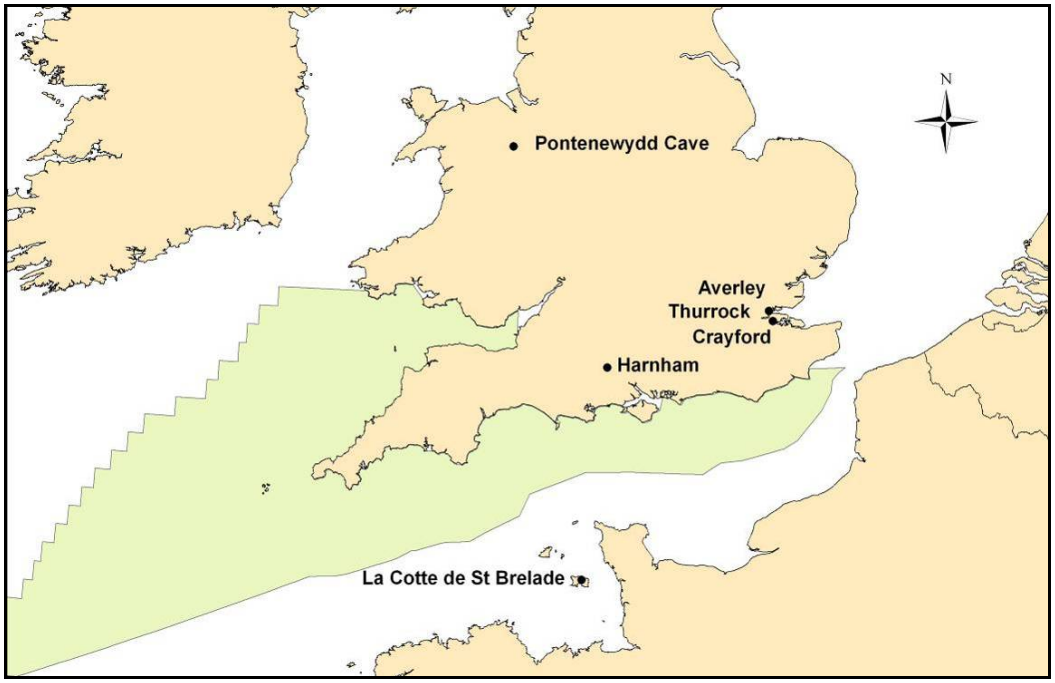

Figure 6.4 Distribution of Middle Palaeolithic sites

In the south, Middle Palaeolithic archaeological material with the trademark Levallois prepared cores is well represented in a number of sites including Averley and Thurrock. Occupation from about 230,000 BP to 200,000 BP occurs across two warm phases which were interrupted by a cold interlude. The sea level fluctuated considerably during this period, first isolating Britain from Europe before dropping to expose a wide coastal shelf which joined the continent before rising again only to drop at the onset of the next glacial. Prepared flints flakes of the Levallois technique were found at Crayford in Kent alongside woolly rhino and musk ox. This was a time when the glaciation was beginning to bite and the climate, along with the sea level was considerably lower; yet it seems people were now managing to survive in harsher climates.

The final abandonment of Britain at the close of the Averley interglacial was followed by a period of well over 100,000 years before human remains are next discovered. This is a period dominated by a cold glacial climate yet it is one that sees an increased level of Neanderthal endeavour. La Cotte de St Brelade in Jersey witnesses ongoing, albeit periodic, activity throughout the colder parts of this phase. Middle Palaeolithic technology was employed to butcher woolly rhino and mammoth after sending them to their death in the same manor as their predecessors. The bones were broken and burnt to provide heat and light in the barren landscape. It was clear *Homo Neanderthalensis* were adapting to the cold which allowed then to exploit the extensive mega-fauna that roamed the chilly zones of the northern hemisphere. The archaeological record for the previous 400,000 years infers migrations to Britain from the east and south when conditions allowed, yet there is no evidence of a human presence on the south coast of England and Wales despite its

proximity to the 'Channel Islands plain' where the Jersey Neanderthals were active. This was regardless of an increase in temperatures during the Ipswichian interglacial c.120,000 years ago. As the climate warmed, peninsular Britain must have reached island status before people found themselves on its shores.

6.2.3 Early Upper Palaeolithic

50,000 years ago the last Ice Age was mid cycle and the Devensian cold stage had begun. The environment was harsh with winters averaging well below -10ºC. This was less severe than the glacial maxima but not harsh enough to dissuade the more resilient Neanderthals who now returned to Britain and maintained a presence in England and Wales for the next 15,000 years. The oldest discoveries were in Lynford, where worked flint tools were associated with remains of mammoth (Boismier *et al* 2003). Similar remains are found in the Creswell region, Pin Hole and Robin Hood Cave in the Midlands. Towards the SEA8 area, evidence was uncovered in Wookey Hole, Somerset, Coygan Cave, Carmarthanshire, Kent's Cavern in Devon and Paviland, Gower Peninsular, South Wales (see figure 6.5 for site locations).

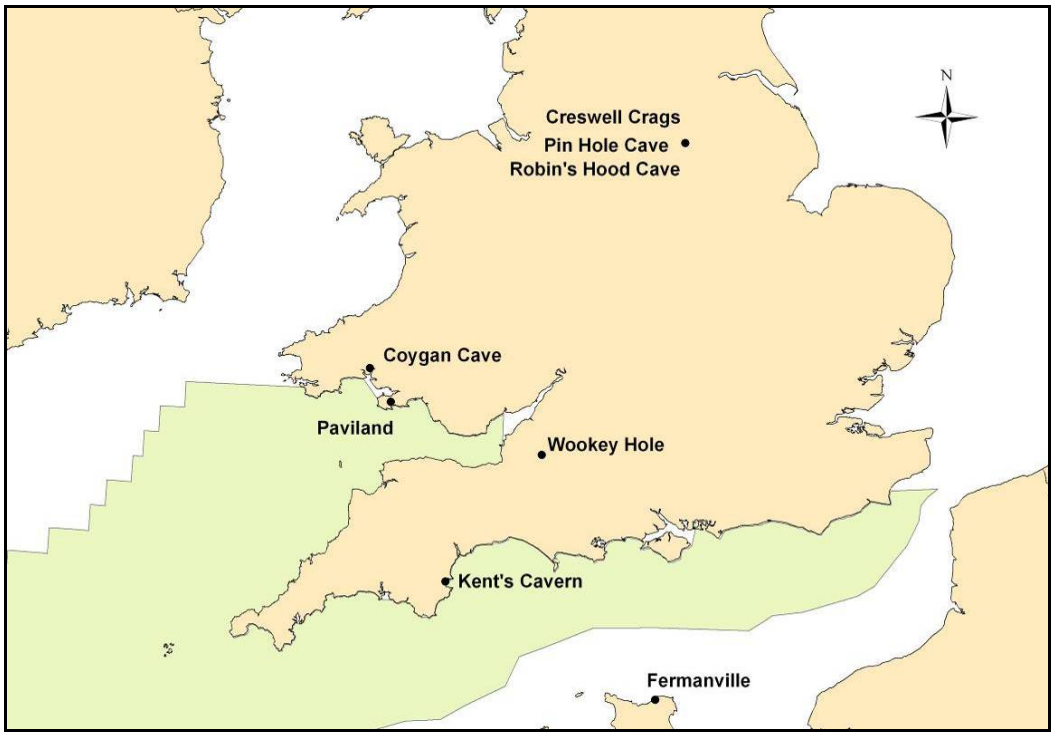

Figure 6.5 Distribution of Early Upper Palaeolithic sites

Across the channel, discoveries at Fermanville, on the Cherbourg peninsula, confirmed occupation of land bordering the SEA8 area that is now 20m below sea level. The site dates to c.45,000 BP, predating the last glacial maximum. It is unique in Europe as it contains primary context archaeological material embedded in peat and clay within a submerged ria that pre-dates the last glacial maximum. Not only did it survive the periglacial worsening conditions as the climate deteriorated, but the artefacts survived the peak glaciation, the transgression by the rising sea level at about 7-8 ka BP and modern oceanographic conditions of coastal currents and waves. The site demonstrates both the potential of the prehistoric archaeological resource within the SEA8 area and the ability for such sites to withstand the climatic and evidence for marine transgressive / regressive events witnessed during past glacial cycles.

Case Study: Fermanville – preservation of Palaeolithic archaeology 20m below sea level

In 1968 an engineer responsible for constructing a waste outfall reported a large bed of peat at 15-17m. The area of the bay of La Mondrée is a submerged ria. Trial dives produced no archaeological data at first. Exploratory dives in the area in 1970 revealed that the seabed at the base of a submerged granite cliff had been swept clear of sand by localised eddy currents around Cap Levi. Prehistoric tools were scattered on the bottom. The eroded depression was 180 x 50m (Scuvée and Verague 1988: 19).

Further inspection showed hundreds of worked flint objects, and the excavation was formally authorised in 1971, by which time 370 flint items had been catalogued none of which could have been washed into this location from a deposit on land. The assemblage of flints contained many fragile and sharp pieces, as well as some which were very massive that could not have been transported far by the currents (Scuvée and Verague 1988: 24).

Work continued sporadically for 15 years, mostly with volunteer divers, and with some assistance from navy divers. The working conditions underwater were difficult, with visibility low, and some work being done almost by feel. In total divers obtained more than 2500 worked flint objects of a good size, the great majority of these were tools. The full extent of the site was not explored, due to lack of coring or dredging facilities. The presence of so many tools, and so many nuclei in all stages of development and exploitation, indicates that this was not a place for manufacturing tools to be transported somewhere else, but an occupation site. The density of finds was sometimes 10 items of flint per square metre.

The flint objects were completely free of any signs of erosion or abrasion, and had sharp edges, which seemed to preclude any transport by water, or even abrasion by wind-blown sand on land. Many tools were of the Levallois and Mousterien type (Scuvée and Verague 1988: 63). They included retouched points, blades and cores. 39 bifaces were found, and 254 pieces were classed as nuclei. There was enough debitage to study the forms and 778 items had been retouched. A thorough analysis of regional coastal geology, modern oceanographic conditions and coastal geomorphology lead Scuvée and Verague to conclude that the site could only have been occupied when the sea level was at least 25m below present level, and before the last glacial maximum and more probably when it was 40-50m lower (Scuvée and Verague 1988: 112), that is, about 40-50ka BP.

This well preserved Palaeolithic site at a depth of 20m confirms that there is potential for the survival of pre-LGM sites. Within the SEA8 area this potential should not be ignored.

Unfortunately the site was not classified or protected, and amateur divers sometimes dived for souvenirs, and fishermen trawled across the site causing a great deal of damage comparable to a plough on land.

The Fermanville site is unique in NW Europe, since it is the only submerged site which pre-dates the last glacial maximum. Not only did it survive the periglacial worsening conditions as the climate deteriorated, but the artefacts of the abandoned site survived the climate of the peak glaciation, and the transgression by the rising sea level, which would have inundated the material 18-20m below present sea level at about 7-8 ka BP. Having survived inundation, embedded in peat and clay, the

archaeological material then survived the modern oceanographic conditions of coastal currents and waves. It is now being steadily eroded.

The site was found by chance and can be seen as an example of similar sites that could remain in the SEA8 area. It was only researched due to the quick reactions and perceptiveness of local archaeologists at a date when such a find might have been ignored completely. In spite of limited resources, the deposit was studied thoroughly and seriously for more than a decade, although it was not formally protected by law. It proves that Palaeolithic deposits can survive both extreme periglacial conditions and marine inundation. It also provides a unique opportunity to re-assess the potential for Palaeolithic occupation of the Channel basin in relation to the Channel River and its tributaries. The exact location of the preserved material is interesting from a taphonomic point of view, since it is protected from westerly storms by a submerged granite cliff, and the artefacts are embedded in a marsh peat and silt. Probably there were thicker layers of terrestrial or wind-blown sediments covering the site during the final phase of inundation by the Flandrian transgression. Confirmation that relatively exposed prehistoric sites can survive one or more marine transgressions is provided by the survival of Acheulean handaxes *in situ* in oxidized soil in Table Bay, South Africa (Werz and Flemming 2002)

35,000 years ago, Neanderthals fade from the archaeological record giving way to *Homo Sapiens;* anatomically modern humans with new flint tools and a new blade technology. The first systematic excavation of such an Upper Palaeolithic human took place in Goat's Hole Cave, Paviland (Alderhouse-Green, 2000). In 1823 William Buckland unearthed a six foot tall man, buried 27,000 years ago and covered with red ochre. These were characteristics identified in the Cro-Magnons of the European Gravettian culture. The site was a cave next to the sea today, but, at the time of the burial it would have overlooked a large coastal plain which is now part of the SEA8 area.

The presence of *Homo Sapiens* was relatively short lived as it appears they were driven from the high ground of peninsula Britain within the next 2,000 years while the Devensian Glacial increased in severity. Archaeological remains are absent from 25,000 BP to 15,000 cal BP. This appears to be a similar pattern to that seen before in the archaeological record when climatic deterioration was followed by abandonment. However, the Middle Palaeolithic Neanderthals were demonstrably becoming more capable of tolerating harsher environments as they pursued mega fauna on the north European steppe and the Atlantic Continental shelf (Barton & Roberts, 1996; Patton, 1987). This resilience was also demonstrated by anatomically modern humans who utilised a sophisticated and diverse tool kit which enabled then to extract more from the available resources. An ability to deal with colder climates would have enabled them to retain a foothold further north for longer than the earliest hominins. Unfortunately we do not know how far they migrated and at what phases of the glacial cycle they found themselves forced to move with the environment. All of the land due south is now underwater, but a large section of it would have been around the braided rivers of the English Channel that would have seen long periods of occupation by *Homo Neanderthalensis* and *Homo Sapiens* before finally succumbing to the Flandrian transgression.

6.2.4 Late Upper Palaeolithic

When *Homo Sapiens* did arrive back in the UK, they came with the Bølling warm spell about 15,000 cal BP. The cultural characteristics of these new arrivals differed from the Cro-Magnons. They brought with them a new range of flint and bone tools typified by the 'Creswellian' discoveries in Creswell Crags and they showed a strong cultural link to counterparts in northern Europe as demonstrated by the

archaeological collection from the 'Trou des Blaireaux' caves of Belgium (Bellier & Cattelain 1984) and Tou de l'Ossuaire (Léotard & Otte 1988) (Figure 6.7). Finds attributed to the Creswellian technology are focussed around caves and rock shelters. The largest and most diverse find of this date was, in Gough's Cave in Cheddar George, not too far from the Severn Estuary. Finds were also excavated from Aveline's Hole in Cheddar and Kent's Cavern in Devon (see figure 6.6 for site locations). These people hunted horse and the now extinct giant ox which would have roamed the plains to the south which extended well into the SEA8 area when the sea was lower.

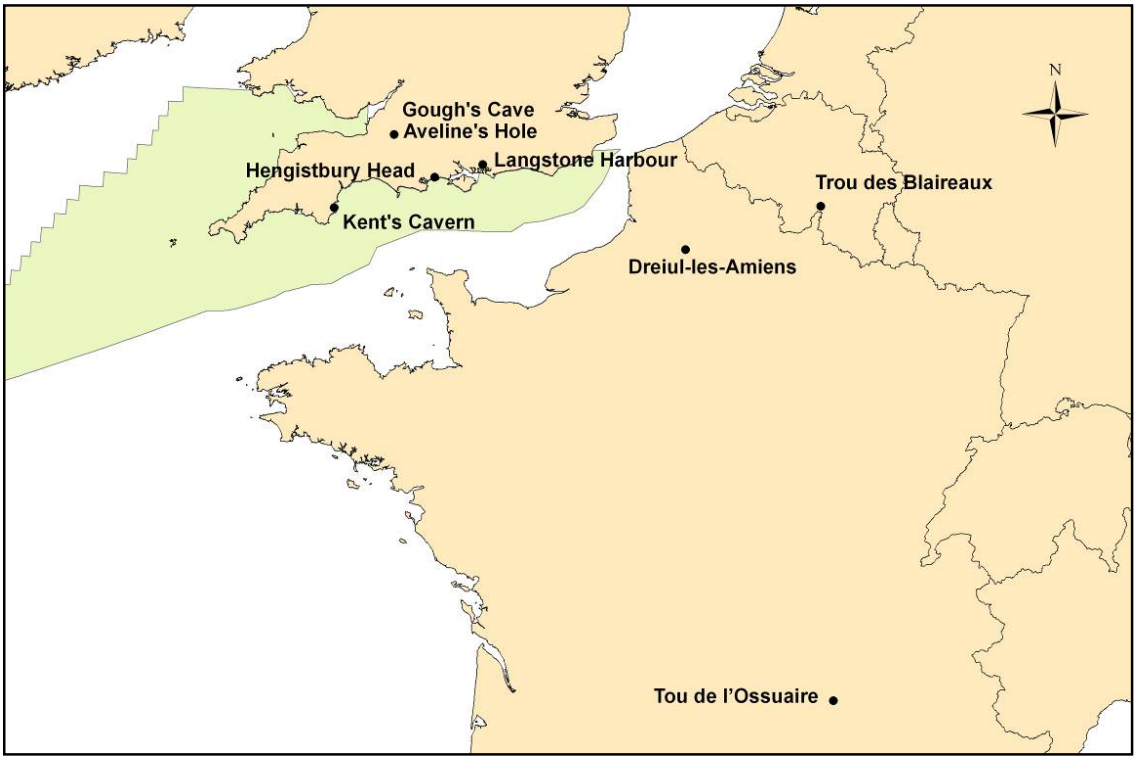

Figure 6.6 Distribution of Late Upper Palaeolithic sites

A sudden relapse in the climate shortly after 13,000 BP known as the Younger Dryas put pressure on human subsistence. The peak severity of this mini glaciation appears to have forced people from Britain for a final time as the archaeological record weakens. Genetic evidence however, suggests Britain may not have been completely abandoned, retaining a continuity of DNA that is reflected in the British population today.

Figure 6.7 Examples of Upper Palaeolithic Creswellian tools and long blades

Oppenheimer (2006) uses Mitochondrial DNA based on for the maternal line and Y-Chromosome genetic markers for the male line to show how tribes from the area of the Basque country, Pyrenees, and south-west France migrated northwards c15,600 BP and occupied Brittany, Cornwall, Wales, Ireland, and western and northern Scotland (section 5.3.1 & figure 5.5). These DNA characteristics were notably different from the east side of the UK where the genetic characteristics are more closely aligned with descendants from refugia in south east Europe (Oppenheimer 2006: 129 & 134). The DNA footprint established by the migrants in the west has been analysed and it is calculated that 27% of modern British males contain DNA originating from this pioneering phase of settlement (Oppenheimer, 2006: 123 &124). The fact that the genetic types dominate in these areas indicates very strongly that they migrated along the Atlantic margin at times of low sea level, when most of the ice had melted.

Archaeological evidence during and around the Younger Dryas is sparse but not totally missing. Anthropogenic and archaeological material recorded in north west Europe and Britain may relate to short term climatic ameliorations during the course of the cold phase (Barton *et al.* 2003). The Upper Palaeolithic site at Gough's Cave contains evidence of human occupation at about this time as does Hengistbury Head which saw habitation towards the end of the Allerød warm spell, just prior to the Younger Dryas. The site lies on the modern coastline immediate to the SEA8 area (Figure 6.8). It is an open site positioned on a hill which had an ideal vantage point to view the plains to the south and is dated to 12500 BP + or – 1150 years by thermoluminesence dating (Barton 1992). The long blade assemblage recovered from the site differs from the Creswellian but mirrors other open sites such as Brockhill and Long Island in Langstone Harbour in southern England and Dreiul-les-

Amiens in the Paris Basin (Fargnat 1984). The Paris Basin sites lie directly across the SEA8 area, a landscape that would have been mostly dry during the last glacial oscillation and for thousands of years thereafter (Barton 1999). The relatively rapid and short lived appearance of people in Britain in response to more temperate conditions suggest that the refugio to which the Upper Palaeolithic retreated were not as remote from Britain as those entertained by their predecessors. The plains, shores and riverine environments of SEA8 would have been dry and attractive areas for settlement during climatic phases before during and after the Younger Dryas. Indeed, these areas may have harboured the gene pool identified by Oppenheimer that expanded across the Atlantic continental shelf, able and ready to move onto higher land as the climate warmed and sea level rose.

Figure 6.8 The Scheduled Ancient Monument site of Hengistbury Head

Climatic amelioration that brought the Younger Dryas to a close about 11,500 cal BP enabled a re-colonisation of Britain that has continued to this day. Analysis of ice core GISP2 from Greenland suggests the event happened swiftly, warming 5 to 10 degrees Celsius in just a few tens of years (Taylor *et al. 1997;* Alley 2000; Alley et al. 1993). This sudden increase in temperature would have drawn ecosystems north into the SEA8 area facilitating rapid colonisation by flora, fauna and people. It would be another 6,000 years until the area was fully submerged.

6.2.5 The final inundation of SEA8

The end of Younger Dryas about 11,500 years BP marked the close of the Pleistocene and beginning of the Holocene. In the west, the cave sites of Paviland and Cat Hole Cave contain Creswellian tools from this period as do Gough's Cave and Kent's Cavern. To the east, the major sites include Hengistbury Head (MA 405) as well as inland sites such as Thatcham and Avington located along the Thames corridor (Chisham 2006). The position of these sites is shown in Figure 6.9.

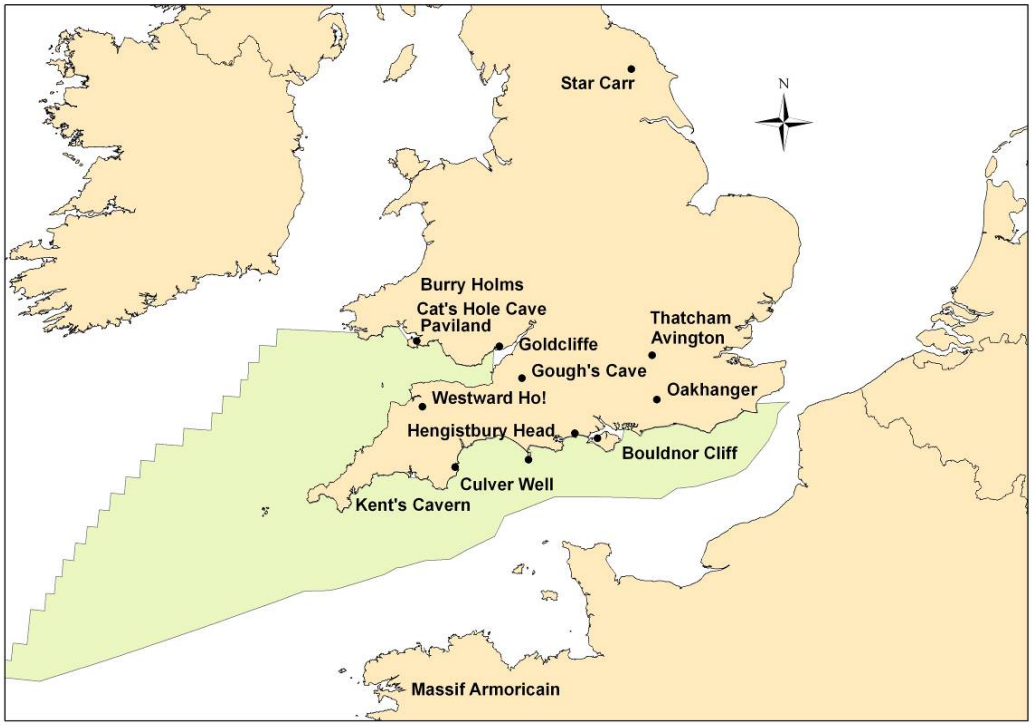

Figure 6.9 Distribution of Mesolithic sites

The Holocene also saw the introduction of the Mesolithic which used a multitude of small tools and blades that soon replaced the Upper Palaeolithic technologies (Figure 6.10). Evidence that Mesolithic peoples made use of the resources along the coastline is clearly demonstrated by the extensive archaeological finds excavated around the Danish Archipelago (Fisher, 1997; Rowley Conway, 1983), Wismar Bay, north Germany (Lübke, H. 2002) and on the coast of the Massif Armoricain in France where substantial sites have been identified (Pringet 1983). Gathering and eating shellfish was also practised as far north as the western Isles off Scotland (Mellors 1987; Wickham-Jones *et al.* 1998; Mithen 1999). Along the south coast of Britain, marine exploitation is attested by the shell middens at Westward Ho! (MA 406), Devon (Churchill 1965) and Culver Well (MA 407) on Portland Bill (Palmer 1990), and by relic Mesolithic footprints in the inter-tidal zone at Goldcliffe (MA 408) on the Welsh Severn Estuary (Bell et al. 2000; Wilson 1998). These sites, however, date to a period when the sea level was not much lower than today. The vast majority of other Mesolithic sites across the region under study, including the coastal sites of Powell on Hengistbury Head and Burry Holms on the Gower peninsula were land sites; occupied when the coastline was further offshore.

Figure 6.10 Example of Mesolithic blade

Many Mesolithic sites were located close to water. Rivers and streams acted as ideal access routes inland as well as being foci for wildfowl and game hunting. In southern England, some of the most extensive Mesolithic sites are located on the greensands at Oakhanger. The site, first occupied from over 11,000 years BP is one of many similar sites from Hampshire, Sussex and Surrey found near watercourses or spring-lines (Gardner 2006). The occupation sites are often positioned on low bluffs or elevated on slopes covered by well-drained soils. The distinct soil type may have encouraged vegetation that aided hunting around the watering spots nearby.

Numerous flint scatters have also been identified around the low lying valleys along the current coastline such as the harbours of the Hampshire Basin (Allen and Gardner 2000) and a submerged site, now 11m underwater in the Solent has been excavated below Bouldnor Cliff on the north shore of the Isle of Wight (Momber 2004). The Bouldnor Cliff material has been excavated from beneath a peat deposit and was dominated by debitage and fine flint blades that lay in a sandy fluvial deposit alongside a stream. The artefacts survive *in situ* because they were protected by the alluvial sediments that built up in estuarine conditions as the western Solent was inundated (see Case Study). These areas were a little way from the sea when occupied but that is not to say that similar sites to those found around the shorelines of 6,000 to 7,000 years ago (as described above) did not exist throughout the early to middle Mesolithic. Simmons (1996:194) sums up the value of the coast to the Mesolithic, 'Coasts exert a very strong pull force in terms of available resources, to the point where no society would ignore them unless prevented by other human groups from gaining access to them.' It is highly probable that early Mesolithic peoples in the SEA8 area took advantage of the protein rich environment in a similar way to that seen at Starr Carr, North Yorkshire where the inhabitants' dog enjoyed a diet that included a substantial portion of fish (Clutton-Brook *et al.* 1990; Day & Mellors 1994).

Case Study: Bouldnor Cliff – Mesolithic occupation evidence 12m below sea level and sedimentary archive reflecting 10,000 years of sea-level change

A remnant of a submerged landscape was first recognised by Dr Tomalin and Dr Scaife when fishermen dredged up timbers and peat from the North West Solent in 1976. Inspection of the same location off Bouldnor Cliff as part of the Isle of Wight

Maritime Heritage Project in 1985, revealed large linear timbers. They appeared to originate from the foot of an underwater cliff, lying perpendicular to its face. Divers reported a cliff whose height and angle of repose varied greatly along its length. In some places it was a gentle slope while in others; it had a four metre high vertical face. These sections were subject to undercutting, below which large blocks of fallen material lay on the sea floor. Organic inclusions within the cliff and laterally consistent layers of peat were also noted. At the base of the cliff, the remains of trees and associated root systems lay in a narrow band of peat. The submerged landscape runs approximately parallel to the shore, to the north east of Yarmouth.

In 1999 the HWTMA organised a project to renew investigations of the submerged landscape and search for archaeological remains. An area of the basal peat seabed was surveyed. The results revealed a platform inlaid with boles and tree stumps with associated root systems reaching into the underlying substrate. It lies at 11m below Ordnance Datum at the foot of a 7m high submerged cliff. Within a 30 by 15m survey area 13 tree stumps, extensive pieces of timber and nine substantial boles up to 12 metres in length were plotted. On the northern edge of the platform, scour around tree stumps was undercutting the peat creating overhanging ledges up to 1.5m high causing failure and collapse. During the survey worked flints were discovered in the south west corner of the site, at the bottom of the cliff near at the mouth of a lobster burrow. It appeared that the flints had been excavated from the peat or underlying clay by the lobster. In total, 50 flints showing signs of human activity were found in two discrete locations 5m apart, at the entrance to lobster burrows. 35 humanly-struck flints were present, 8 pieces showed evidence of burning and a further 7 small flakes that might be a product of knapping were identified. The worked flints comprised one implement, 3 cores and 31 waste flakes. To confirm the source of the flint seabed excavation was necessary.

The first excavation began in 2000 at the location of the lobster burrow. It revealed over 150 worked and burnt flints, confirming the origin of the artefacts (Momber, 2001). The cultural material was recovered from a sandy deposit which was interwoven with vegetation and lay below the laminated peat and mineragenic sediments. The complex stratigraphy identified during the first excavation was further investigated in May 2003 as part of a project funded by English Heritage. Samples were excavated which are being analysed to integrate the archaeological material with the landscape within which it was deposited. The geomorphological evolution of the site prior to inundation is also being studied. The site is dated to c.8,050 BP.

The working conditions at Bouldnor Cliff can be challenging. Water speeds between 1 and 2 knots cross the site with each turn of the tide and slack water only lasts a few minutes. Visibility averages about 1.5m which can be reduced to zero due to the sediment load on the ebb tide. Visual difficulties are compounded by the dark peat seabed, which absorbs light. Consequently, many dives by many divers were necessary to complete the survey and excavations.

By the end of the Mesolithic sea levels levelled off as the Flandrian Transgression was stabilising. The lands of the SEA8 area that would have been habitable for thousands of years from the Upper Palaeolithic onwards were now drowned. It was during this last warm phase that the valleys and coastal estuaries reaching out to the Atlantic and Channel River would have been populated by the last wave of British colonizers. The submerged sites at Fermanville and Bouldnor Cliff (MA 409) owe their survival to a blanket of protective sediment which covered them as sea level rose. Their discovery demonstrates the potential wealth of material that remains.

6.2.6 Mesolithic/Neolithic transition and occupation of the coastline

Towards the end of the Mesolithic, Britain had become an island once again. Sea levels were still five to six metres lower than current Ordnance Datum but to get from mainland Europe, open-water craft were now necessary. The land that was within the SEA8 area had been greatly reduced to coastal strips immediately below our current shoreline. The reduction in size of habitable land, however, does not diminish the importance of the archaeological remains that it contains. On the contrary these strips of foreshore became the gateways to people moving to and from Britain and they became a focus of human activity.

The European coastline of the late Mesolithic was worked extensively to obtain marine resources. This is vividly demonstrated by archaeological remains from the Baltic including coastal dwellings, fishing hooks, fish traps and dug out canoes at Tybrind Vig (Andersen 1985; Andersen 1987), Møllebegt (Skaarup & Grøn 2004) and Wismar Bay (Lübke 2007; Lübke 2006) amongst others. Studies beneath the reclaimed lands of the western Netherlands have revealed widespread activity around the coastal estuaries (Peeters 2007). It was also in the Late Mesolithic that cultural dispersion is witnessed along the European Atlantic fringe.

Around the borders of the SEA8 area, the Mesolithic coastline (as described in 6.2.5), is only witnessed at lowest spring tides and invariably just beyond the reach of terrestrial archaeologists. Consequently, unless it is subject to erosion, it will remain invisible within the protective silts in the sub littoral. This is, in part, a consequence of isostatic rebound which is causing the land to sink at a faster rate than other parts of the UK and north-west Europe.

A much more evident record is that of the Neolithic, or New Stone Age. From the drowned river valleys of south east England to the limestone cliffs of west Wales, the coast and hinterland is riddled with Neolithic sites and monuments (Figure 6.11). The structures built during this period were a product of a sedentary lifestyle that was brought about by the introduction of farming practices. The influx of these skills from mainland Europe meant people had to travel across the English Channel or North Sea. The cultural change brought about by Neolithic technologies transformed the way of life in Britain over a relatively short space of time and would not have occurred unless links to the continent were well established.

The appearance of Neolithic settlement in eastern Britain was mirrored by a growth of megalithic tomb building around the west and in Ireland. The cultural characteristics of tomb builders were more in keeping with the Atlantic tradition that was first seen on the Iberian peninsula and then in Brittany from about 6,000 BC (Cunliffe 2001). By 4700 - 4400 BC the monuments in the region of Morbihan (around the Baie de Quiberon) reached their peak with grand ‘mausoleum’ like graves which were adorned with colossal decorated monoliths or Menhirs (Briard 1997). By merit of their coast hugging locations and the high proportion of seafood enjoyed by the contemporary population, the way of life was distinctly maritime. Indeed the lower stone circle on the island of Er-Lannic in the Baie de Quiberon is currently submerged at most states of the tide. This contrasted with the land based ‘agri-pastoralism’ that was working its way from the east, but society appeared to flourish when the farmers came in contact with the fishermen and the benefits of combined assets were realised. The tradition of megalithic tomb or dolmen building lasted for several thousand years along the Atlantic fringe and it was this influence that extended to Wales and Ireland. By 4,000 BC concentrations of dolmen type Portal tombs faced each other across the Irish Sea while distinctly different long

barrows dominated the English and eastern Scottish landscapes (Malone, 2001). The link between Brittany and the west of Britain was via the SEA8 area.

Figure 6.11 Megalithic tomb at Bryn-celly-ou, Wales (G. Momber)

The concept of a culture focused around the Atlantic fringe infers a strong maritime tradition and water travel would have been necessary by all those who wished to take advantage of the coastal resources. The vessels that crossed the waterways evolved from log or skin boats and would have been fit for purpose whether designed to navigate the shallows of an estuary or cross an ocean (Johnstone 1988). Being wholly organic, it is unlikely that the remains of a vessel will be found on the seabed while the chance of craft remaining within silts after abandonment on shore or for use in burial practices is very possible. Eight Mesolithic burial dug out canoes have been found in Scandinavia to date (Skaarup & Grøn 2006: 36). The discovery of a megalithic structure or tomb below low water along the down-warping SEA8 coastline is another prospect that should be considered.

The following review of Neolithic archaeological evidence within the SEA8 area provides the context for both coastal occupation and the potential use of watercraft (figure 6.12).

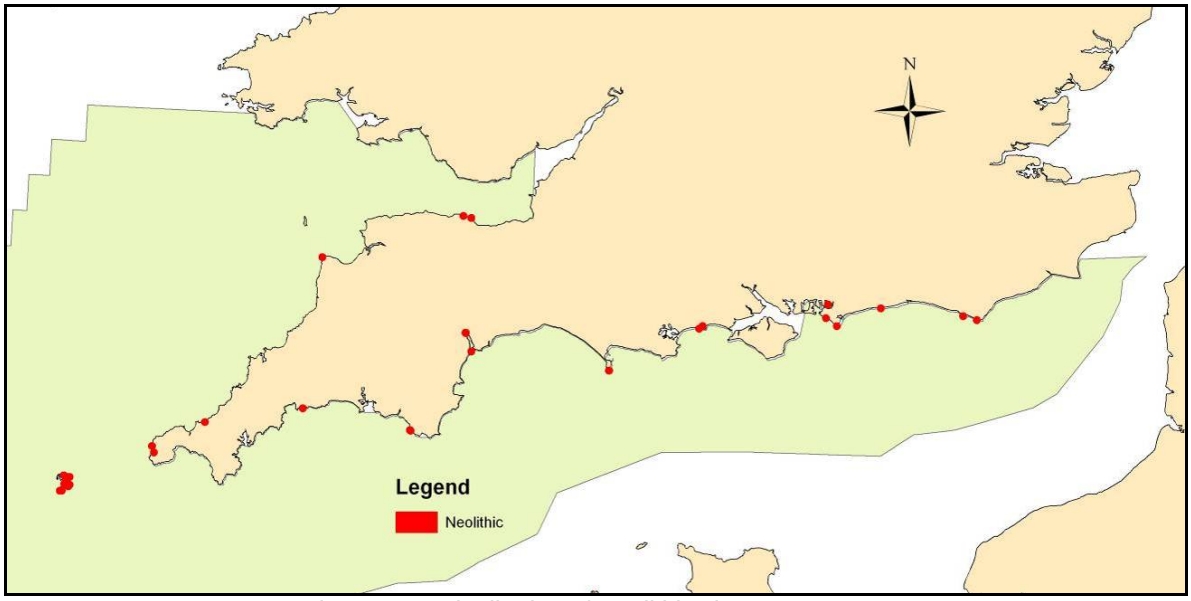

Figure 6.12 Distribution of Neolithic sites

6.2.6.1 Dover Area

The coastline between Dover and Eastbourne is poorly served with Neolithic monuments. Only a handful of Neolithic tombs remain in Kent and east Sussex while there are no stone circles in the area (Malone 2001). Two early tombs are recorded along the Medway and a couple of cairns remain north east of Dover. The lack of enduring megalithic structures such as long barrows may be due to the shortage of appropriate building stone rather a limited population base, as the archaeological record suggests occupation was generally widespread across this region. Neolithic pottery indicated that settlement existed in the valley of the Ebbsfleet east of Dartford while a small ceremonial site containing Grooved Ware pottery, flint tools and burials has been found at Eastry on the North Kent Downs (Denison 1995). Another site at the White Horse Stone boasts the best example of a Neolithic longhouse in the country (Hey 2000). More generally across the region, the archaeological archive is dominated by small finds of pottery and flint tools.

Most Neolithic sites in the south east are concentrated around inland waterways. The rivers provided a means of transport and would have been the most efficient method of infiltrating the landscape. The major drainage network in Kent and East Sussex is connected to the Thames which undoubtedly influenced settlement. The south coast had a more limited number of interconnected waterways but each one would have provided a navigable passage for small craft. The link between the waterways was via the coastline, therefore, the possibility of finding archaeological material along the coast should be considered wherever remains of Neolithic landscapes survive. These landscapes are most likely to be found where long established, depositional, geomorphological processes have been in place.

6.2.6.2 Wight

In contrast to the Dover geographical zone, the Wight region supports a hinterland rich in Neolithic monuments and structures. Long Barrows can be found in abundance across the chalk downs that traverse the Hampshire Basin from east Dorset to West Sussex (Grinsell, 1964). These are complemented by stone circles, causewayed enclosures and settlement sites which lie on watercourses such as the Rivers Test and Avon. Long Barrows can also be found at Mottistone (MA 410) on the Isle of Wight.

Sheltered watercourses that travel deep inland serve the landscape in the region. These provide passageways from open water and are fringed by estuarine mudflats that act as a great resource for raw materials and food. Exploitation of these resources would have been conducted by water and from the land. As the sea level steadily rose throughout the Neolithic, the ancient coastal landscapes became inundated and sealed below a blanket of alluvium. In many places, elements of those landscapes survive. This includes the remains of humanly crafted structures. At Wootton Quarr on the north east coast of the Isle of Wight trackways dating to over 5,000 years old have been found running down the foreshore and disappearing below the water (Loader et al 1997). On the River test in Southampton, a series of seven trackways have become exposed in the lower reaches of an inter-tidal peat deposit as the silts have eroded from above them (Figure 6.13). Typologically, they compare to the Neolithic trackways from the Somerset Levels (Coles *et al.* 1973). These sites are known because they have become uncovered and visible. Many similar prehistoric landscapes remain preserved within the foreshores of the drowned ria systems within the Wight area. Wherever such sites exist, the possibility of finding Neolithic archaeological material is high.

Figure 6.13 Trackways, typologically similar to Neolithic examples, eroding from the inter tidal muds on the River Test (HWTMA)

6.2.6.3 Portland

Dorset, the county that largely backs the Portland geographical zone is not as rich in Neolithic archaeology as its neighbours to the east and west. The monumental structures are smaller and less elaborate (Burl, 2005). The coastline is dominated by pebble covered beaches in the east, hard rocky headlands in the west towards Start Point and with a geologically soft run of cliffs in between. There are relatively few natural harbours or waterways reaching deep inland although the River Exe and Dart provide sheltered water that would have been ideal for small craft. The Fleet lagoon behind Chesil Beach is another area that could have lent itself to occupation where a sheltered shoreline would have enabled access to coastal resources. Peat has been identified within the Fleet as well as being washed ashore on Chesil Beach during storms. The preservation of peat and hence, the survival of submerged landscapes in which it lies, not only suggests a protected environment but presents opportunities for the recovery of Neolithic archaeological material.

6.2.6.4 Plymouth

Cornwall and most of Devon fall within this zone. The Neolithic settlement of Carn Brea and the megalithic tombs in the far west of Cornwall are some of the earliest examples in England. The tombs are a variant of the portal dolmen which is common in Wales and Ireland and distinctly different from the long barrows in the east (Weatherhill, 1985). The style of building was first established on the mainland before it spread to the Isles of Scilly. The Isles of Scilly would have been much larger at this time but it would still have been separated from Cornwall by many miles of open sea which necessitated sea going craft.

The development of different tomb building styles is in keeping with a western tradition or Atlantic Identity and adds merit to the concept of a cultural dispersal driven by marine contact (Malone 2001, Cunliffe 2001). This being the case, we should expect to have had extensive Neolithic activity around inlets and embayments that could have facilitated settlement and habitation. Where conditions allowed we should also expect the intertidal zone to have been utilised as it was in the Hampshire Basin (Loader *et al*. 1997).

Much of the coastline around Cornwall and Devon is rugged and exposed. These areas are subject to the ravages of the sea and any shallow deposits therein would invariably have been dispersed. However, this increases the importance of the rias and inlets that are protected from the full impact of nature. They not only offer protection to any remaining archaeology but they would have acted as gateways and nodes of activity to Neolithic coastal communities.

6.2.6.5 Lundy

The Lundy geographical zone is very diverse, including the shelter of the Severn Estuary and the rocky limestone exposures of west Wales.

Vegetation change along the Gwent and Somerset levels around 4,000 BP may have been indicative of landscape manipulation agriculture and pasture. Pollen analysis has shown a reduction in trees while grass and herbaceous taxa suitable for grazing increase (Smith & Morgan 1989). However, extensive studies on the Welsh side of the Severn Estuary have unearthed relatively few archaeological finds from the Neolithic (Neumann & Bell 1997; Godbold & Turner 1993). It not until the end of the fourth millennium BC that the inhabitants of the levels around the river Severn started to become more industrious by building structures like the Sweet Track. These track-ways provided a practical way around the marshy lands that developed at the interface with the estuary.

Moving west from the Severn Estuary and along the coastline of south Wales, Portal Dolmens appear in the landscape once again (Whittle 1992). The majority of Welsh tombs lie in a lowland setting between the coast and the highland but a number lie directly along the coast (Murphy 2002). The burial chamber at King's Quoit, Manorbier (MA 411) is one such grave that directly overlooks a sheltered bay east of Milford Haven. Similar sites exist in north Wales and Ireland.

A series of coastal surveys of Wales commissioned by CADW found numerous scatters of Neolithic artefacts along the coastline. It was noted that finds often coincide with peat shelf outcrops adjacent to the coast (Murphy 2002; 49). These are the areas that harbour the greatest potential for further finds along the SEA8 area.

6.2.7 Summary

The archaeological record for the British Isles extends back at least 700,000 years and across at least six glacial cycles. In the course of each interglacial the environment on the British mainland ameliorated making it habitable. As the climate warmed the ice sheets melted causing a rise in sea level. This process would have taken thousands of years during which time the SEA8 area would have been suitable for occupation. The research for this report has identified several sources evidence that demonstrate why the SEA8 area would have been occupied on many occasions by *Homo Heidlebergensis, Homo Neanderthalensis* and *Homo Sapiens*

- The archaeological material from Boxgrove, Clacton, Swanscombe, Purfleet and Crayford was recovered from deposits that were laid towards the onset or concluding stages of an interglacial. These were times when sea level was rising or falling and was not at its maximum height. Parts of the SEA8 area would have been dry and habitable, potentially for long periods before rising waters or a deteriorating climate forced people to move.

- Lower Palaeolithic cultural variation during interglacial phases is witnessed at Clacton, Swanscombe and Purfleet (c 500,000 BP to 300,00 BP). Well defined stratigraphic layers containing Clactonian tools beneath Acheulian

hand axes suggest two waves of hominins. Environmental analysis reveals that the first wave arrived when the climate was cooler. During this time large areas of the Atlantic continental shelf would have been dry and this would have provided the closest refugium to the peninsular that was to become Britain. If early populations did not live on the shelf during the glacial maxima, they would have migrated through it as they worked their way north.

- Middle Palaeolithic activity during cold phases of the glacial oscillation is found in La Cotte de St Brelade Jersey, Harnham near Salisbury and Fermanville, France (c.2500,000 BP to c.45,000 BP). This demonstrates that the middle Palaeolithic had developed strategies that enabled them to endure a harsher climate. An ability to survive in the cold extends the window of opportunity for exploitation of SEA8 areas by *Homo Neanderthalensis*.

- The arrival of varying Upper Palaeolithic technologies to mainland Britain may have followed a similar pattern to that which has been postulated during the Upper and Middle Palaeolithic. The concept of a steady colonisation by different peoples is endorsed by studies of Mitochondrial DNA dispersal which identified a distinct western 'Celtic' population that originated from the Basque region and another from refugio to the east. The colonisers from the south migrated along the Atlantic margin and reached Britain first. Throughout this process there may well have been populations occupying the continental shelf which in turn acted as a spring board into the UK. Migration routes would have incorporated the SEA8 area.

- The final and current interglacial, the Holocene, marks the start of the Mesolithic or middle Stone Age (c.11,000 BP to c.6,000 BP). Sea levels rose about 30m during this transgression and large areas of SEA8 were finally inundated. The Mesolithic came to a close about the same time as sea level reached comparable levels to those we see today. Coastal and riverine resources were exploited extensively during the Mesolithic. These landforms were the first to be impacted as the sea rose. Studies of submerged in-filled estuaries have revealed deposits that are suitable for the preservation of archaeological material. The stratified Mesolithic site 11m underwater within Bouldnor Cliff demonstrates the archaeological potential of similar locations that exist within the SEA8 area.

- Europe's north-west peninsula was severed for the last time when the English Channel met the North Sea as the Mesolithic Age was drawing to a close. Water transport was now necessary to reach the British Isles and it appears to have been used extensively. The Neolithic saw the import of people with new technological skills that was sufficient to cause an agricultural revolution across the whole country. However, cultural influences are seen to differ between the far west and the east of the United Kingdom. In the east settlement favoured waterways which enabled transport deep inland while in the west, strong maritime links saw the development of a well-defined culture along the Atlantic coastline. Comparable traditions can be seen around the coastal fringe from Brittany, via Cornwall, Wales and Ireland to Scotland. Recoveries of Neolithic material are particularly rich within the submerged coastlines of protected shorelines on the SEA8 periphery.

Archaeological remains are likely to have existed across the whole of the SEA8 area at some time in the last 700,000 years. However, the potential survival of material from the prehistoric period is very much dependant on taphonomy, sedimentation,

erosion and ongoing coastal / marine geomorphological processes. The potential for prehistoric remains is discussed in the next section.

6.3 Overview of Potential for Prehistoric Archaeological Remains

This section combines available data on sea level and habitable landmass with evidence from archaeological sites and other areas of research such as DNA analysis to gauge the potential for the discovery of archaeological remains.

6.3.1. Sites within a Landscape

Prehistoric archaeological potential does not mean simply the chances of finding a major concentrated site with tools, bones, canoes or burials within a small area. Because of the way in which prehistoric people interacted with and used the land for hunting, gathering, or fishing, scattered or discarded items might be found almost anywhere, and waves and currents may have eroded and scattered deposits without destroying all valuable information. If every find, no matter how randomly obtained or apparently out of context, is plotted carefully, there is a maximum chance of gradually building up the complete pattern of occupation and exploitation of the landscape and its resources. Major concentrations of artefacts provide the most valuable return for a given level of effort after they have been found, but we should not limit the objective so strictly that random scattered finds are regarded as worthless. See Peeters (2007: 21-26) for a discussion of the relationship between concentrated sites and diffuse distributions in a landscape. It should be noted that single artefacts such as the Leman-Ower harpoon trawled up in 1931 (Housely 1991) provided convincing evidence that the North Sea has been occupied by humans long before any single site of occupation had been found under the sea.

While the concepts of archaeological sites and integrated or holistic landscapes assume a different emphasis or distribution of effort, it is clearly unreasonable to conclude that, since prehistoric tribes could have lived or occasionally walked anywhere on the continental shelf, it should all be protected or preserved in the same way. Densely occupied caves or open air occupation sites, or concentrations of Mesolithic huts do tell us more about the past than a single flint out of context. It is thus reasonable to anticipate that some sites or regions should be designated as requiring complete protection, others can be designated as of high potential, and others low potential. Notwithstanding this attempt to anticipate what might be found in the future, in practice we should be alert to the possibility of some finds occurring in low potential areas. Furthermore, we should undertake a research effort to build up a comprehensive picture of the landscape and climate on the continental shelf in successive periods, where it might have been inhabited, so as to interpret the human responses.

6.3.2. Division of the SEA8 area into zones

From the point of view of the potential for prehistoric archaeological site or artefact occurrence and preservation the SEA8 sector can be divided into 4 zones, figure 6.14. These Zones have been constructed on the logical basis of seabed processes in relation to archaeology, and extend beyond the actual boundary of SEA8.

- A) Celtic Sea, shelf margin, and western approaches up the Start-Cotentin ridge.
- B) The Bristol Channel and Severn Estuary
- C) The central English Channel from the Start-Cotentin ridge to Beachy Head, the bed-load parting zone.
- D) The area around the Straits of Dover

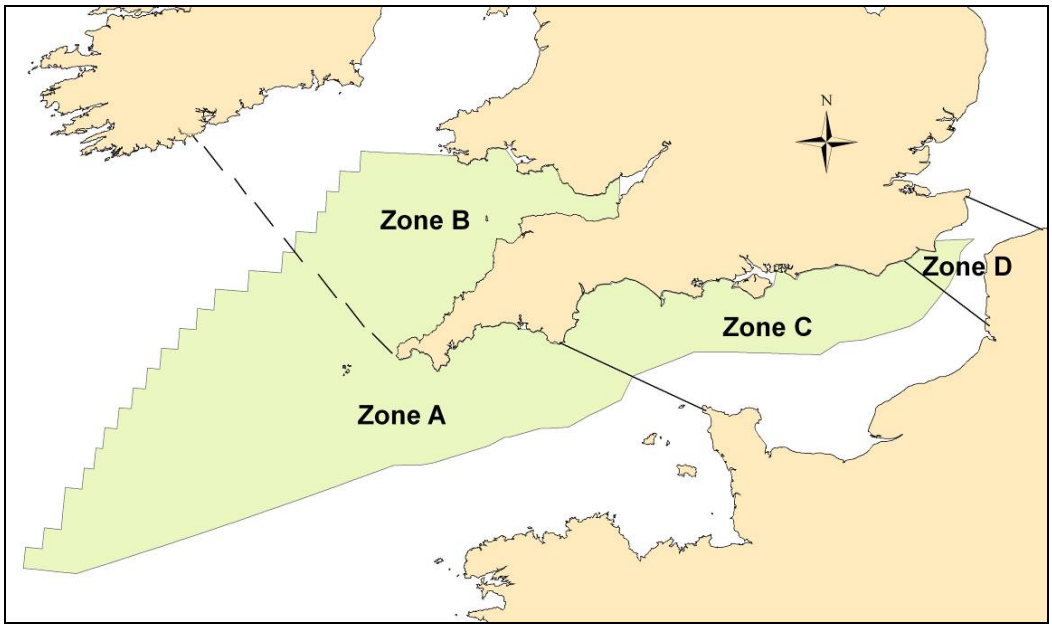

Figure 6.14 Image showing the four zones of potential for preservation of prehistoric archaeology

6.3.2.1 Zone A

Oppenheimer (2006) (and see Figures 5.5 and 5.6) shows that much of the Late Upper Palaeolithic re-occupation of Britain took place on the western margins of Europe. Sections 5 & 6 above have also shown that the Celtic Sea and western Channel formed either a refugium or an exit route whenever the climate in the British Isles deteriorated and the ice advanced during earlier glaciations. Thus, in principle, this is an area where important deposits might have occurred which would shed considerable light on the understanding of the occupation of NW Europe and the British Isles. This zone (A) is the deepest part of the SEA8 out to the shelf margin, which has always been exposed to the maximum force of the Atlantic waves, and is now partly covered in sand waves and active dunes (Bourillet *et al*. 2003). It is therefore an area where the chances of discovery of artefacts are low, and the costs of work would be extremely high. The northern part of SEA8, adjoining the Irish Sea, includes the southern edge of the continuous Quarternary periglacial deposits that infill the Celtic Deep (Evans 1990: 75 and Fig.9 in Evans).

Kidson and Stride (1970), Johnson *et al*. (1982), and Hamblin et al. (1992: 88) described the bedload parting which describes the sediment transport in the central English Channel. On a line from the Isle of Wight to Cherbourg the sediments to the west tend to be transported westwards, and the sediments to the east tend to be transported eastwards. In the central Zone C, defined above, there is a net deficit of sediments, and a tendency for net erosion. Zone A is a net area of accumulation and transport to the west.

Bourillet *et al.* (2003: 261) describe the flow of sediments westwards through the dune fields or Banks of the Celtic Sea into the valleys and canyons of the Biscay Margin. Both the Celtic Sea Margin and the Armorican Margin. The origin of the Celtic Banks is complex and unresolved (Bourillet *et al* 2003: 262). No sample or cores have been obtained from the interior of the Banks, and they could be almost entirely relict early Pleistocene deltaic material, or wholly re-worked modern tidal sand-banks, formed during the last marine transgression. The Celtic Banks occur

between the 120m isobath and the 200m isobath, and might be regarded as too deep to have been exposed during glaciations. But the probable eustatic lowering of sea level to 130-150m, combined with the slight isostatic uplift outside the glaciated area, indicates that the coastline would have been well to the west of the present 120m isobath. See also the model outputs of Lambeck (1995) and Shennan *et al.* (2000a, b).

River valleys in this area are not deeply incised (Antoine *et al*. 2003: 230) and the rivers flowing from western Normandy, Cornwall, and Brittany did not flow into the Channel River or join to each other. They made separate courses to the shelf margin (Antoine *et al*. 2003).

In summary Zone A is potentially important because it may have acted as a route for migrations and as a refugium, but in the water deeper than 100m it is a very low potential area in terms of the probability of either survival of archaeological deposits, or the possibility of finding and studying them.

Shallower than 100m, and especially in the coastal waters shallower than 50m around the Channel Islands, and the coasts of the Scilly Isles, Cornwall and Devon, there is a higher chance of finding prehistoric archaeology, probably in association with peat deposits. Evans (1990:11) describes peat at a depth of 32m, associated with earlier eroded Miocene beach terraces off Cornwall and Devon, with a date of 12,070 years; also (*ibid*. p.80) a channel extending south from the Exe river at a depth of 16.7m to 42.7m, with peat dating from 8589 years BP.

Submerged prehistoric sites in very shallow water have been found between the Isles of Scilly (Crawford 1927; Thomas 1985), and off the Channel Island of Guernsey (Sebire 2004) (See above, Section 6).

6.3.2.2 Zone B

The southern Irish Sea was analysed in the report on the prehistoric potential of SEA6 (Flemming 2005). The northern borders of SEA8 in the open sea are similar, with palaeo-glacial features (Tappin *et al*. 1994). The geology of the Bristol Channel is also reviewed by Tappin *et al* (1994). Ireland itself is devoid of Palaeolithic sites, and the Irish Sea has not so far revealed submerged prehistoric sites of any period, which is odd, given the preservation of many geomorphological features of periglacial origin on the sea floor. There are many proven Palaeolithic and Mesolithic sites in Wales, and one would expect some materials from these periods to survive in the Bristol Channel. Mesolithic footprints have been found stratified within post-glacial marine sediments at two locations on the intertidal foreshore at Uskmouth and Magor Pill, near Newport, Gwent (Bell 1991).

6.3.2.3 Zone C

This Zone is the area of bedload divergence (Johnson *et al*. 1982), and hence maximum regional and local erosion. It also includes the confluence of the major submerged river channels converging on the Hurd Deep, the Seine and Somme submerged valleys, the Northern Palaeo-valley, the Arun River extension, and the Solent River. The bottom stress in this zone is higher than anywhere else in SEA8 other than the upper reaches of the Severn Estuary and the narrowest point of the Dover Straits. Remaining sediments are dominated by lag gravels or cohesive sediments and peat.

This Zone is potentially highly prospective for prehistoric archaeology. There are well-preserved river valleys infilled with sediments. The distance from the Atlantic margin means that the seabed would have been exposed for a longer proportion of

each glacial cycle. There are peat deposits in the Solent area, and reported from Cap Levi (Scuvée and Verague 1988).

The braided river valleys in the English Channel are a unique feature of this part of the British continental shelf (Figure 5.3). Given that so many terrestrial prehistoric deposits in Britain are found in river gravels and on abandoned river terraces it is relevant to consider whether the gravels in the area of the submerged rivers might contain similar remains. There are several uncertain factors which may promote both occurrence and preservation of prehistoric deposits near the rivers. The first factor is the attraction of the river bank and wetland environment which may have been favourable for people at dates of low sea level and intermediate climate. Secondly is the protection which may have been provided for archaeological deposits by islands and river bends or meanders where the vertical relief was sufficient to protect sites from direct attack of surf during inundation. Thirdly is the question of the extent of progressive infilling or scour in the valley as the sea becomes deeper. And finally the present sedimentary conditions may have covered some deposits in local marine sands or mud. However, the general circumstance of the bed-load parting makes it likely that archaeological sites will be exposed or eroded, rather than buried.

In the coastal regions of Zone C there are the extremely sheltered environments of the Solent (Wenban-Smith 2001) and other locally sheltered or protected environments in the lee of headlands such as Portland, and in the waters of the great rias and harbours such as Poole, Portsmouth, and Chichester. In general, where tidal currents or wave action have winnowed out the fines and left a lag gravel, the larger stone tools are likely to remain, albeit after some disturbance. If they have also been eroded or rounded beyond recognition, then no archaeological signal is likely to be detected. However, many hand axes have been recovered from the river terrace deposits around the UK. In most cases, these deposits that have witnessed several glacial cycles yet very well preserved axes are being discovered. A number of which have been found in trawls from coastal waters (Wessex Archaeology 2003). Zone C represents the offshore extension of the Hampshire Basin drainage system which Wymer describes as containing more Palaeolithic sites than anywhere else in the country (Wymer 1999).

6.3.2.4 Zone D

This Zone is dominated by the strong tidal currents through the Dover Straits, and the accumulation of marine sands. The BGS Bottom Sediment charts show active features such as mega ripples and sand ribbons consisting of coarse and medium sand. In view of the active modern sediment bedforms and the strong tidal currents, this is not a prospective area for the survival and accessibility of prehistoric deposits. Reynaud *et a*l. (2003) describe the tidal current regime and the active sand banks of the Eastern Channel.

Hamblin *et al*. (1992) report peat beds detected in bore holes and cores, with peat at 36m and 37m dated at 10,530, and 9920 respectively (Hamblin *et al*. 1992: 81), and a borehole at Cap Gris Nez showing peat with ages.12,650, and 8250 years old (Hamblin *et al*. 1992: 81). The occurrence of peat is a positive indicator, but if it is buried under thick layers of modern marine sand it is unlikely that any investigation could be made searching for prehistoric indicators.

6.4 Environmental Factors Affecting the Preservation of Prehistoric Archaeology

A range of environmental factors have a bearing on the preservation of prehistoric archaeological material. These can range from underlying geological conditions which have influenced sites and deposits since their use by human populations when

the channel was dry land, through to present day oceanographic conditions which continue to affect sites and deposits that have been preserved within the modern seabed.

6.4.1 Geological and sedimentary conditions

The solid geology of SEA8 is described in the BGS Offshore Regional Reports (Evans 1990; Hamblin *et al*. 1992). The sediment conditions in the SEA8 area are provided by the BGS Series of Bottom Sediment maps at a scale of 1: 250,000. The maps vary in date from the early 1980s to early 1990s. They show sediment size, sorting, thickness, carbonate percentage, with detailed inset maps for special features such as banks, submerged river valleys, trenches, etc. They also include sketch maps of current strengths and tidal amplitudes, and a useful bibliography for the sources used in compiling the map.

There is an extensive bibliography on the geology of SEA8 compiled by Tyrell (2004).

6.4.2 Oceanographic and climatic conditions, wind, waves, currents

6.4.2.1. Timescale

The multiple marine transgressions and multiple cycles of glaciation and permafrost which effected SEA8 require that we consider the conditions over the whole timescale. In practice it is possible to conduct this analysis in some detail for the last 150,000 years, but much more difficult for previous glacial cycles. Partial reconstructions are given by the papers in Gibbard and Lautridou (2003). Tidal amplitude, and hence tidal currents, would have been different for intermediate and low sea levels. The following sections review sources of information on the present wave and current conditions.

6.4.2.2 Wave Climate in SEA8

The wave climate of SEA8 is dominated by the westerly winds from the Atlantic, and the open ocean swell waves generated by the fetch of many thousands of km to the west and south west. Within the Channel itself winds from other directions are blowing over only a few hundred km of sea, and can generate only shorter period waves of limited amplitude.

Wave data are summarised conveniently by Draper (1991) in atlas format, with successive maps showing the distribution of the significant wave height which is exceeded for different percentages of the time for spring, summer, autumn, winter, and the average for the whole year. More sophisticated data, and local data, can be obtained from databases and numerical models, including wave period and directional spectra, but the climatic data on wave height are usefully presented by Draper. This provides a general picture of the extent to which different parts of the seabed are exposed to wave action and possible erosion.

As would be expected, wave height is maximum in the open Atlantic, and decreases to the east from the shelf edge. At the shelf edge the significant wave height (H_s) exceeds 5m for 10% of the year. This decreases to 4m around the Irish southern coast, Pembroke, Lands End, and Brittany, and drops progressively to 1.5-2.0m at Dover. There are sheltered lee areas to the east of Start Point and Torbay, and east of Portland Bill and Cherbourg, where the 10% annual exceedance H_s drops to 0.5-1.0m.

Since winter is the season when storm waves are likely to be highest, and with longest period, so that they interact with the seabed in deeper water, it is important to consider the wave climate specifically in this season. In winter H_s exceeds 6m at the shelf edge for 10% of the time. The 10% winter exceedance H_s then drops to 5m on

the exposed western headlands, and decreases steadily further east in the Channel, dropping to 1.5 – 2.0m in the Dover Straits.

Maximum bed stress is caused by a combination of waves and tidal currents. While shelter from waves in areas of limited fetch is generally a favourable condition for the survival of seabed archaeological remains, the exceptionally high current velocities and tidal amplitudes in the English Channel mean that erosion may continue in locations that are fetch-limited. Thus the Solent is more eroded and scoured than one would expect from its sheltered wave climate, and gyres generated by headlands such as Portland Bill also promote bed stress and erosion.

6.4.2.3. Tidal currents

Hamblin *et al*. (1992: 87) summarise the tidal current environment in SEA8. Greater detail can be obtained from Met Office models or commercial models available to support offshore operations in the area. Some of the highest tidal amplitudes in the world occur in this area, with over 4.0m in the Severn estuary and a similar amplitude in the Golfe de St Malo. In the English Channel, Bristol Channel, and southern Irish Sea the amplitude is generally more than 2.0m. Tidal amplitude around the Isle of Wight and the Solent is in the range 0.5-1.0m.

Tidal current velocities are greatest around the Pembroke coast, in the Severn estuary, around Land's End, the Channel Islands, the central Channel between the Isle of Wight and Cherbourg, and in the narrowest part of the Dover Straits.

This pattern of currents and associated bottom stress results in the bedload parting of the central Channel, and the accumulation of sediments on the outer shelf, or in the eastern Channel and the southern North Sea. Massive tidal sand ridges accumulate on the French side of the Dover Straits.

While the strong currents make archaeological work on the seabed difficult to carry out, the winnowing effect of currents is tending to reveal deposits which may contain prehistoric remains. In the extreme cases, archaeological materials will be eroded completely, and the context destroyed.

6.5 Summary of conditions favouring high prehistoric site potential

This section brings together the factors tending to favour occurrence, preservation, and accessibility of submerged prehistoric materials in SEA8. We have not tried to apply all the discriminatory factors to all areas or features in SEA8, but it is apparent that they do correlate well with the actual archaeological sites already found, and the assessment made of the potential in the Zones A – D. The unknown factor is the extent to which archaeological deposits protected from the initial stages of inundation may have survived the subsequent strong tidal currents and scour which may have occurred in the Bristol Channel and central English Channel.

In view of the work of Pitulko *et al*. (2004) it is important to consider the effect of sea water rising over prehistoric archaeological deposits in permafrost, which would indicate the possibility of good preservation of artefacts. Although other factors also apply, for example river scour, frost shattering, and normal subaerial erosion processes, the critical period for survival of an archaeological deposit is the time when the surf zone starts to impact on the site, and the ensuing few hundred years as the sea level rises over the site, and coastal shallow water waves are breaking over the site, or washing into a cave mouth. The literature on these processes has been reviewed by Dix *et al* (2006). Favourable factors for survival of archaeological strata in the original area of deposition include:

- Very low beach gradient and offshore gradient so that wave action is attenuated and is constructional in the surf zone.
- Minimum fetch so that wave amplitude is minimum, wavelength is short, and wave action on the seabed is minimum.
- Original deposit to be embedded in peat or packed lagoonal deposits to give resistance and cohesion during marine transgression. Drowned forests and peat are good indicator environments.
- Where deposits are in a cave or rock shelter, roof falls, accumulated debris, concretions, breccia, conglomerate formation, indurated wind-blown sand, all help to secure the archaeological strata.
- Local topography contains indentations, re-entrants, bays, estuaries, beach-bars, lagoons, near-shore islands, or other localised shelter from dominant wind fetch and currents at the time of transgression of the surf zone.
- Frozen ground or permafrost enclosing archaeological deposit at time of inundation.
- Braided river pattern or deltaic islands provide numerous lee environments protected locally from wave action from the west and south-west.

This brief analysis demonstrates that survival or destruction of an archaeological deposit, whether originally inland or on the coast, depends acutely upon the local topography within a few hundred metres or a few km of the site. Generalised coarse resolution maps tend to omit the details which show the necessary local topographic clues. The BGS 1/250,000 maps, although they are primarily designed to present sediment data, provide a more accurate representation of topography, with isobaths at 10m intervals, than the Admiralty Charts. Additional high resolution swath bathymetry and sub-bottom profiling would be valuable in detecting probable sites. It is no coincidence that the most prolific area of proven submerged Mesolithic sites is between the islands of the Danish archipelago, where many hundreds of sites have been mapped and sampled by the National Museum Maritime Archaeological Institute, and the National Forest and Nature Agency, assisted by amateur divers (e.g. Skaarup and Gron, 2004). Further submerged Baltic sites have been discovered in sheltered waters off the coast of northern Germany (Lubke 2001, 2002). The Bouldnor Cliff site in the sheltered waters of the Solent is a text-book example for preservation (See case study in Section 6.2.5).

The factors in the previous paragraphs are those which promote survival of the original deposit *in situ*. However, if an archaeological deposit is buried under 5-10m of mud or sand it will not be discovered, except in very unusual circumstances. Thus the final requirements for survival and discovery are:

- Low net modern sediment accumulation rate so that the artefacts are not buried too deeply.
- No fields of sand waves or megaripples over the site.
- Ideally, a slight change in oceanographic conditions so that the site is being gently eroded to expose deposits when visited by archaeologists. (This factor is sufficiently common in known sites to be a serious factor, and should not be regarded as an unlikely fluke).
- Absence of heavy and continuous erosion which could remove the deposit completely.
- Absence of accumulation of successive layers of sediment during successive glacial cycles which would bury the archaeological material completely.

Potential discovery "hot-spots" in the SEA8 cannot be listed exhaustively at this stage. In principle the key factors are:-

- "Fossil" estuaries and river valleys, braided channels and deltas with islands.
- The flanks of banks and ridges which have been proven to have peat layers, or which are likely to have peat layers.
- Valleys, depressions, or basins with wetland or marsh deposits.
- Nearshore creeks, mudflats, and peat deposits.
- "Fossil" archipelago topographies where sites would have been sheltered by low-lying islands as the sea level rose.
- Niche environments in present coastal zones, wetlands, intertidal mudflats, lochs, and estuaries.
- Caves and rock shelters in re-entrant bays, fossil erosional shorelines, submerged rocky shores protected by other islands, or in archipelagos.
- Deposits of sediments formed within, or washed into rocky gullies and depressions.
- "Fossil" coastal sites comparable by analogy to modern Inuit migratory sites, adjacent to sea ice, giving access to marine mammals as a food resource.
- Areas of permafrost containing archaeological deposits which were then inundated, and protected by other factors listed above.

The changes in and survival of an archaeological site, and the chances of discovery, depend on the present conditions of winds, waves, and currents in the area, and the water movements on the seabed.

7. Maritime Archaeology

The establishment of Britain as an island has necessarily led to the development of a wide range and diversity of watercraft that were used by human populations for trade, transport, warfare and the movement of peoples. The remains of these vessels and associated shore side and port infrastructure are the most frequently encountered archaeological remains within the marine and coastal zones. As such these remains are an important consideration within the SEA process.

7.1 Chronology for Maritime Archaeology

Following the marine inundation of the channel during the Holocene and the establishment of Britain as an island, the South Coast of England has witnessed a high density of waterborne traffic. Sea craft have transited the study area for millennia, forming economic and cultural links with numerous and varied maritime societies. This section provides a broad overview of maritime activity related to sea craft within the study area from the Mesolithic to the modern day.

7.1.1 Mesolithic (c. 10,000 BC – c. 4,000 BC)

Evidence for maritime activities in Britain during the Mesolithic period come from a series of maritime related artefacts located during excavations at Star Carr (Mellars 1999: 8). These consist of a birch wood paddle and wooden harpoon used for fishing. Whilst in Britain there is little further physical evidence for maritime activity, across the English Channel on the Continent several sites indicative of maritime activity have been found. At Seine-et-Marne in France, a log boat and fishing equipment was found in a palaeochannel near the Seine, which at the time would have been a tidal estuary (Ancient sailing on rivers). At Tybrid Vig, a submerged coastal settlement site in Denmark, several log boats and paddles were found (Andersen 1987) during excavations. The continental sites are indicators for the potential for similar archaeological evidence in the SEA 8 area. Such evidence can be postulated for areas where there have been found Mesolithic finds inshore along the coastal belt.

7.1.2 Neolithic (c. 4,000 BC – c. 2,500 BC)

By the Neolithic period Britain had been an island for millennia (Darvill 1987:24). Although little is known about the maritime cultures during this period, there is evidence that societies were exploiting the marine environment. Such societies had the knowledge and technical know how to fish off shore as revealed by the faunal evidence from shell middens. These excavations have unearthed fish bones of a type that could only have found their way into the middens as waste products from deep sea fishing (Ellmers 1996:17-18). The discovery of the oldest log boat in Britain the St Albans log boat dating from the 4th millennium BC, provides the physical proof that Neolithic people had the tools and cognitive ability to construct simple log boats (McGrail 2004: 172). Such vessels could be used to fish the intertidal and coastal zone, certainly out to within site of land.

7.1.3 Bronze Age (c. 2,500 BC – c. 700 BC)

In Britain during the Bronze Age there is a great deal of evidence for seafaring. Individual sea craft have been found with distinctive technological and manufacturing changes when compared to the continent. There is still evidence for the use of log boats in the Bronze Age, however it is during this period that the first true trans-channel vessels emerge. These vessels are formed from several pre-carved planks stitched together. The vessels, unique to the southern and eastern seaboard of Britain represent one of the most advanced forms of early water transport and were adaptable to a range of different environments and uses.

Several examples of sewn planked vessels have been found throughout the British

Isles, from the Humber Estuary to south east Wales. The most complete examples are the North Ferriby boats and the Brigg 'raft' which were found buried within mud banks along the Humber Estuary (Wright 1994). Within the SEA8 area examples are found in the Severn Estuary at Goldcliff (MA 412) and Caldicot (MA 413), southeast Wales. Here only the fragmentary remains of stitched planking were found and not the partial remains of the whole vessel (Parry and McGrail 1994). In Dover one of the most significant Bronze Age vessels has been found. Substantial remains of a stitched plank boat were recovered whilst monitoring construction work (Clark 2004). Further environmental evidence, the remains of sand not found around Dover, from within the vessel proves it travelled along the coast and was not just necessarily operating only from Dover. These sewn plank vessels provide evidence for the means by which cross channel journeys and local coastal trips could have been made on a regular basis.

7.1.4 Iron Age and Roman (c. 700 BC – c. 42 AD and c. 42 AD – c. 410 AD)

During the Iron Age direct evidence of seacraft is notably sparse; one exception is the find of the Fiskerton logboat recently recovered from East Anglia (Figure 7.1). However, there is a great deal of indirect evidence for the type of vessel from this period. This includes a mid 1st century AD iron anchor from Bulbery, Dorset (McGrail1998: 254). In North West Europe during this period a particular type of ship construction was being developed. This ship building tradition was known as 'Romano-Celtic', that is a carvel planked vessel whose planks are nailed to large internal frames. Recently however French archaeologists discovered the remains of a small vessel that dates to the early medieval period, suggesting the construction type might have continued beyond the Roman Period. The vessel from the Charente estuary (the Porte Berteau II wreck) has planking set edge to edge in some form of the 'carvel' style with large iron nails used like those of Romano-Celtic craft.

Within Britain the first evidence for this type of construction is the Blackfriars boat (AD 150) excavated in London in 1962. It comprises the remains of what was a substantial seagoing trading vessel (Marsden, 1994). A further example of this type of construction comes from the Severn estuary, where the remains of a smaller estuary barge, the Barlands Farm Boat was found near Magor, Gwent. Although smaller than the Blackfriars boat, it is likely that the Barlands Farm Boat was capable of coastal and cross channel voyages.

Further evidence for shipping from a Roman context comes from the County Hall Ship, 3rd century AD found in London. It is carvel built, with the planks being held together by mortice and tenon joints. This is a typically Mediterranean method of construction which contrasts with the Romano-Celtic method. Dendrochronological research however shows that the ship had been built in Britain during the Roman period. Further evidence for Roman seafaring comes from the recovery of a lead anchor stock found in Porth Felen, Gwynedd (Boon 1977). These vessels and single anchor provide an indication of the seafaring capabilities of mariners during this period. It must however be remembered that log boats were still a common from of vessel during this period.

Fig 7.1 The Fiskerton Logboat (D.McElvogue)

7.1.5 Early Medieval (c. 410 AD – c. 1066 AD)

With the withdrawal of the Romans in the 5th century and the influx of Anglo-Saxon immigrants into Britain a new form of vessel construction with close connections to a Scandinavian clinker building tradition is seen within the archaeological record in Britain. Vessels of this tradition include the Snape boat grave (5th–6th century), Sutton Hoo (7th century) and Graveney boat (8-9th century).

The Snape boat was found at Snape Common, near Aldeburgh in East Anglia. It is clinker-built and about 15m long (Bruce-Mitford 1952). Further examples from this period are the famous Sutton Hoo boat burial found near Woodbridge, Suffolk and dating to the 7th century. This clinker built vessel was over 27m long and formed part of a horde of grave goods, the study of which radically re-evaluated ideas on Anglo-Saxon technology. The Graveney boat found near Graveney, Kent is an 8th-9th century clinker built vessel of about 14m in length. In contrast to the previous examples, which are considered to be high status warships, this vessel functioned as a trading vessel capable of coastal and sea voyages (Fenwick 1978). These vessels indicate that seafarers from this period undertook sea voyages out of sight of land (McGrail 2004, 222).

7.1.6 Medieval (c. 1066 AD – c. 1550 AD)

Trading networks across Europe expanded during the medieval period and several important trading confederations such as the Hanseatic League emerged. The English Channel became a highway between England and the continent, with Southampton, Bristol, London and other Cinque ports being favoured points of transit (Friel 2003: 70). There was also a greater increase in hostilities which, together with an increase in seaborne trade, had a large influence on the development of shipping. Vessels dating from this period include larger clinker built merchant vessels called keels, cogs and possibly reverse clinker built vessels termed hulks. These were able to accommodate bigger cargoes and with the addition of temporary fore and aft castles could have a military function (Friel 2003: 47).

Remains of vessels from this period comprise the 12th century Magor Pill wreck (MA 415), a clinker built vessel heavily laden with iron ore found on the banks of the Severn Estuary near Newport, in South Wales; two clinker built fishing vessels dating to the 13th century found during construction work in the Thames at Blackfriars (Marsden 1972) and five protected wrecks, the *Grace Dieu,* Cattewater Wreck*,*

Studland Bay Wreck, *St Antony* and the famous Tudor warship *Mary Rose* (Figure 7.2). These vessels all combine to provide detailed evidence for the changes in shipping and naval practices.

Representations of ships are widespread throughout the medieval period. Although it would be unwise to assume that these pictures represent real boats they do provide an overall impression of what ships must have looked like. In the case of the Graveney boat several depictions gave a good indication of what the actual vessel resembled, with its straight stem and stern post (Fenwick 1978:274).

Figure 7.2 The remains of the Tudor Warship Mary Rose *(D.McElvogue)*

7.1.7 Post Medieval (c. 1,550 AD – c. 1800 AD)

During the Elizabethan period the government made the first concerted attempt to collect data regarding the numbers of ships and sailors in England. These censuses show that in the late sixteenth century the most important seafaring regions were London, Essex, Suffolk and Norfolk (Friel 2003: 112). Trade and warfare continued to play an important role in the development of ships with innovations in ship design being stimulated by large scale trading of goods across the world to and from Europe. This resulted in ships becoming more specialised as cargo carriers and warships (Friel 2003: 169). This specialisation in cargo vessels was based on the lucrative East India trade in which the Dutch followed by the English became its most successful exponent. There are a large number of such vessels within the Sea8 area including two protected wreck sites – the *Rooswijk,* and the *Amsterdam*.

Evidence for these trading ventures and other major events such as the Spanish Armada can be found in the quantity of wrecks off the coasts of Britain. Within the SEA8 area this high density of maritime activity is represented by an array of Dutch, French and English cargo and warships which were wrecked along the coast. Nineteen of these vessels have been designated under the Protection of Wrecks Act (Appendix 10.1), these include the wreck of Warship Hazardous, a French ship which was captured by the English and later wrecked in Bracklesham Bay (Figure 7.3).

Figure 7.3 The remains of Warship Hazardous *wrecked in Bracklesham Bay in 1706 (HWTMA)*

7.1.8 Early modern (c. 1800 AD – c. 1914 AD)

With the advent of the steam engine, iron hulls and the screw propeller and their widespread use from 1820 there was a significant transformation in shipping. This technological revolution altered shipping in terms of both trading and military vessels (Friel 2003: 226). During the first part of 19th century coastal trade was dominated by wooden sailing vessels such as schooners, brigs, brigantines and snows. However with the development of steam technology there was a rapid decline in these wooden sailing vessels. The capabilities of iron hulled vessels combined with steam propulsion made long-distant trade both faster and more economic. This led to a period of increased prosperity reflected in the large volume of coastal trade, much of which involved transporting coal and other raw materials. During this period the Royal Navy was the worlds leading naval force. British warships rapidly developed from iron hulled vessels such as the HMS *Warrior*, now moored at Portsmouth Historic Dockyard, to the big gun all iron built armoured battle ship HMS *Dreadnought*. *Dreadnought* was also the first battle ship to use an oil fired steam powered turbine engine. Further developments during this period include the first submarine, *Holland I,* being acquired by the Royal Navy in 1901. Within the SEA8 area wrecks from this period are particularly prevalent, with four being protected under the Protection of Wrecks Act (Appendix 10.1).

Figure 7.4 HMS Warrior*, now moored in Portsmouth Historic Dockyard*

7.1.9 World Wars (c. 1914 AD – c. 1945 AD)

During the two World Wars the British Isles saw a great deal of maritime activity, which left its mark in the form of shipwrecks, armament remains and crashed aircraft. Enemy submarine activity was particularly high and a great deal of shipping was lost through submarine attacks. This was the first hostile use of submarines in European waters, they had been successfully used during the American Civil War. The first World War also saw the first use of air power at sea. Although they were mainly used for patrol and reconnaissance, this led the way for their use in supporting fleets at sea in World War II (Friel 2003: 238). During the Second World War with better equipped warships, U-boats and aircraft the scale of offensive shipping operations increased leading to an increase in recorded losses. These are reflected by the increased number of wrecks from this period in the waters off Britain.

7.1.10 Late modern c. 1945 AD - Present

The ten years after 1945 was a prosperous period for the British shipping industry, reflected in Britain having one of the world's largest merchant fleets. This was mainly due to the lack of foreign competition and high freight rates (Friel 2003: 277). However, since the 1960's the British shipping industry has been in decline due to competition from ships run under flags of convenience which have undercut the rates of UK owned and registered fleets. This decline has also affected fishing vessels with depleted fishing stocks and foreign competition leading to a much reduced fishing industry. Conversely however there has also been an increase in marine leisure craft with its associated mooring and berthing facilities.

7.1.11 Summary

The summary of the development of maritime craft, their capabilities and influence from the prehistoric period to modern remains has been necessarily brief. It provides the broad context for the known and potential maritime archaeological remains within the SEA8 area. It can be seen the SEA8 area has archaeological potential for all periods. From the time of the inundation of the Channel this area has been an important waterway for traffic to and from the continent and for cross channel trade between England and the continent. The marine physical environment is conducive to in situ preservation and therefore it should be expected to find the physical remains of sea craft from the Neolithic onwards through out the SEA8 area.

Concentrations of finds can be expected where there are known concentrations of inland habitation and industrial wealth, such as off the Cornish and Devon coast, the Isle of Wight and the Dover Straits. The later is a high potential area as it the best known crossing area for the channel. From here mariners could take the coast to the north where they could then penetrate the hinterland of south east England along the Thames; or if they wished along the south west towards the rich tin and copper fields of Cornwall, Devon and further north to North Wales and Anglesey. The same headlands that marked out of sight passages that had to be rounded by the prehistoric travellers also became navigational points for medieval traders as they travelled up the channel. These same points of reference were also used by the submarine commanders of the 2 world wars and are known areas for ship wrecks of all periods. The unique positions and roles of the English and Bristol Channels throughout prehistory and known history infers a high potential for archaeological remains throughout the SEA 8 area.

7.2 Maritime Archaeology of Trade and Transport

Britain's maritime trade and transport links with continental Europe are known to have developed from the Bronze Age with the English Channel being a thoroughfare for continental trade. Where applicable the sea areas used for the shipping forecast have been utilised to present the known and potential maritime archaeology related to trade and transport within the SEA8 area (figure 7.5).

Figure 7.5 Image showing the sea areas commonly used for the shipping forecast

7.2.1 Bronze Age

The archaeological evidence for the emergence of exchange networks in the second millennium demonstrates long distance, intricate powerful networks (Cunliffe 2001: 256). There is evidence for these networks being established in the Neolithic period and continuing into the Bronze Age. It is however during the Bronze Age that large volumes of raw material were transported into Britain from the continent. Around 2,700 BC (Late Neolithic), contemporary with the megalithic phases of Stonehenge, a new society the Beaker culture arrived in Britain. This culture was characterised by Beaker pottery, flat axes and the burial practice of inhumation. The distinctive Beaker pottery provides clear evidence for maritime distribution along the eastern coast of Britain with concentrations found along the Thames, the Humber and a distinct focus in Wessex (Cunliffe 2001: 246). The large reserves of tin in Cornwall and Devon gave rise to a significant trade boom, as tin is a key constituent in bronze and was exported across Europe. It is with the Beaker culture that the Bronze Age can be said to have begun in Britain. With its focus on Wessex and the South West peninsular a significant amount of maritime traffic is known to have developed. This provides an indication of archaeological potential for the discovery of Bronze Age remains where physical and environmental conditions are favourable (see section 7.6). Figure 7.6 highlights known Bronze Ages sites and finds within the SEA8 area, both within the marine zone and along the coastal hinterland.

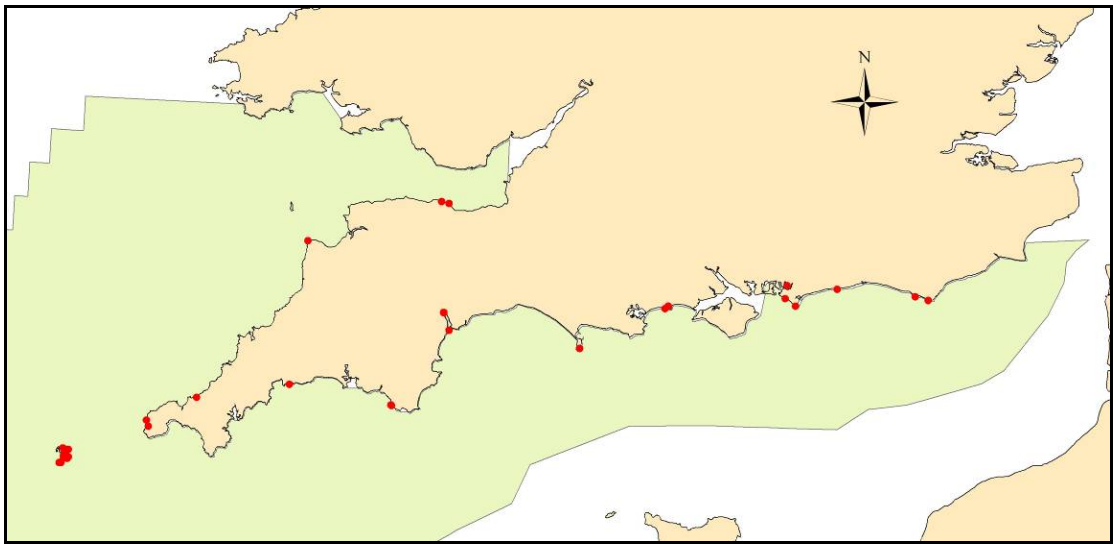

Figure 7.6 Distribution of Bronze Age sites in the maritime and coastal zones

7.2.1.1 Dover

Along the coastline of the Dover area there are six Bronze Age burial barrows and a Bronze Age hoard consisting of a sword fragment, winged and socketed axes, gold bracelets and copper ingots has been found. The socketed axes are known throughout Western Europe with similar hoards of such axes being found in Brittany and Lower Normandy (Cunliffe 2001: 288). Parallels for the Dover hoard include the Langdon Bay hoard found just off the coast of Dover, in which some 360 items of metalwork were recovered. This is one of the largest groups of metalwork located in northwest Europe (Parham et al. 2006: 42). The importance of this hoard is that it has allowed for the identification of metal production regions and trading routes along which cargoes of scrap metal were collected. These regions are mainly located along the continental sea-board of the Channel and the southern North Sea. Together with the Dover Bronze Age boat, they emphasis the trade taking place across the channel and the potential for locating further Bronze Age finds within this marine zone. Figure 7.7 shows a bronze artefact in situ on the Langdon Bay site.

Figure 7.7 A Bronze Age find in situ *on the Langdon Bay site (D. Parham)*

7.2.1.2 Wight and Portland

The coastal area of Wessex, in the Solent region, is a distinct area for Bronze Age seafaring activity. The calm and sheltered waters of the Solent were ideal for coastal navigation and fishing. The archaeological evidence tells us there were wide ranging trading links between the Wessex culture and the continent. The people of Wessex traded amber from the Baltic, and daggers and beads from Mycenaean Greece. This focus of activity is also demonstrated by the 18 Bronze Age barrows, several flanged and socketed axes, palstaves and pottery fragments that have been found just off the coast and along the shore of this area. More recently a Bronze Age sword was recovered by a fisherman off the North East coast of the Isle of Wight (ROW pers comm).

The most significant collections of finds are those of two underwater Bronze Age sites believed to represent the cargoes of two shipwrecks. The Moor sands shipwreck site consists of swords, rapiers and axes but more unusually includes tools and ornaments. The swords are amongst the earliest found in north-west Europe (Parham et al. 2006: 45). These wreck sites provide an important insight into cross channel and continental trade in Bronze Age metal ware that took place across Europe. The amount and nature of the evidence highlights the importance of this area and demonstrates the potential for locating Bronze Age marine finds off the central south coast of England.

7.2.1.3 Plymouth

Within the Plymouth sea area there is a large concentration of Bronze Age funerary remains along the coast. These include barrows, cists and cairns along the coastline. Actual Bronze Age finds include a fine example of a cauldron used in feasting and the ubiquitous axes. The large density of coastally located cairns demonstrates the practical or symbolic importance of the sea in the lives of the Bronze Age inhabitants (Fisher, P. & Farrelly, C. 1997). Further evidence for the symbolic nature of the coastline and the importance of water is demonstrated by the number of ‘offerings’ which were cast into water courses.

The unique and strategic location of the Isles of Scillies at the head of the English Channel makes it an important maritime place. During the Bronze Age the islands were settled and distinctive Barrows and standing stones built. The people who came to the Sicily’s to live or just to bury their dead could only have come to the island by boat. This movement of peoples and goods across such a long distance and relatively dangerous stretch of water with its local currents and tidal flows, during the Bronze Age further demonstrates the importance of the marine environment and seafaring during this period.

7.2.1.5 Lundy

The coastline of the Lundy sea area, other wise known as the Bristol Channel is characterised by having a series of barrows and cists but relatively few cairns. In the intertidal zone several Bronze Age axes and flints have been found. The Somerset Levels and Severn Estuary have had a great deal of archaeological work undertaken on them and this has been published in a range of journals and volumes including the series of annual reports of the Severn Estuary Levels Research Committee (REF). During the Bronze Age the Severn Estuary was an important area and has a rich array of maritime finds including two fragments of sewn boat remains from Caldicot and Goldcliff (see Section 7.1). Further research into wooden trackways and pile alignments believed to be ritualistic (Brunning 1997; Nayling 1999; Bell & Neumann 1999) has shown the importance of this area for the Bronze Age people.

7.2.2 Iron Age and Roman

By the Iron Age there was a comprehensive trading network between Britain and continental Europe. The period is marked by changes in both burial practices and access to prestige goods (Cunliffe 2001: 320). The distribution of prestige goods and art styles provides an indication of Britain's maritime links with the continent. There is also a change in settlement type, from simple temporary structures to more permanent substantial structures situated on hilltops, the ends of ridges and promontories overlooking the sea (Cunliffe 2001: 337). The countryside of Iron Age south-western Britain was densely populated, with continuity of occupancy extending from the Iron Age into the Roman period and to the modern day.

Prior to the Roman conquest of Britain there was a thriving continental trade in wine and other goods, with Hengistbury Head being an important port for this trade. With the invasion of Britain, under the Emperor Claudius in AD 43, this trade increased dramatically with larger volumes of trade being brought into Britain. During the beginning of the Roman period trade routes were mainly focused on Hengistbury and London however, during the later part of the first century trade shifted to be centred on London (Cunliffe 2001: 417). With this increase in trade would come a substantial increase in the amount of shipping needed to carry it. Evidence for Roman seaborne trade to Britain is demonstrated in the discovery of a Roman lead stock anchor near Port Felen (MA 414) Wales and the finding of the substantial remains of a Roman ship in Guernsey. This vessel built in the Romano Celtic fashion carried continental pottery and coins onboard, indicating it operated in cross channel trade between France and England (Rule et al. 1994: 130). A lack of Mediterranean finds within the north Atlantic archaeological record suggests that shipping during the Roman period was undertaken by local shipmasters, and that Mediterranean trading fleets did not regularly brave the Atlantic crossings to Britain (Cunliffe 2001: 421).

The distribution of known sites and finds from the maritime zone and the adjacent coastal hinterland are shown in Figure 7.8.

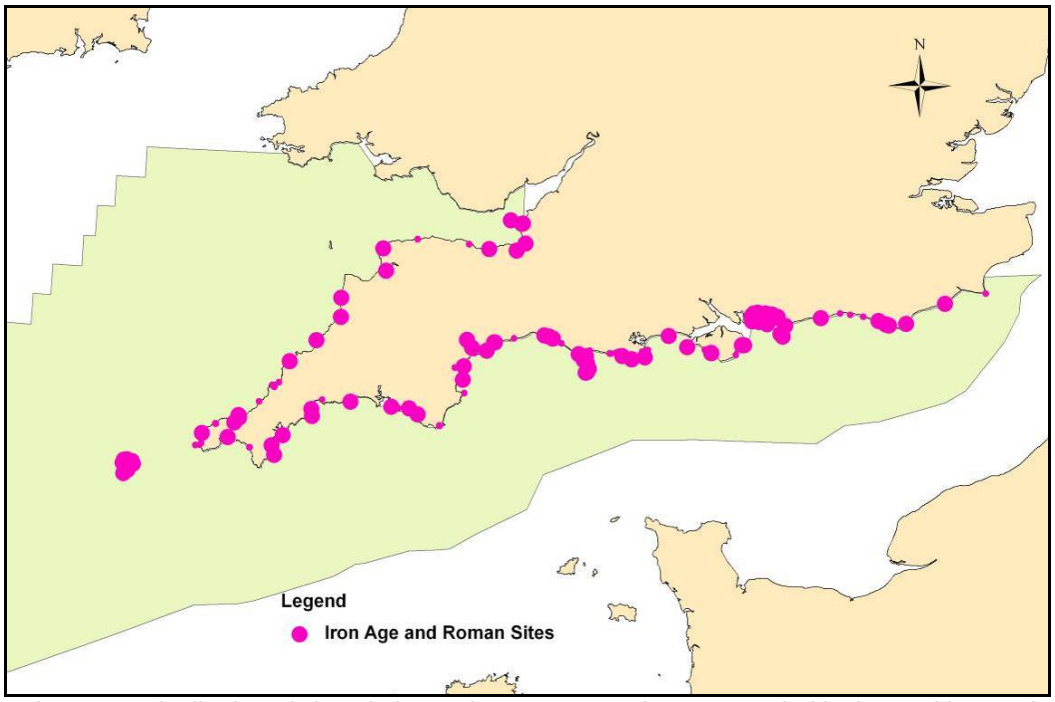

Figure 7.8 Distribution of sites dating to the Iron Age and Roman Period in the maritime and coastal zones

7.2.2.1 Dover

Iron Age coins and pottery associated with Warren Glen, a scheduled monument overlooking Hastings harbour, and an Iron Age hearth along with two further Iron Age hillforts, Seaford Camp and Castle Hill, are all located along the Dover coastline. These sites show continued occupation from the Iron Age through into the Roman. During the Roman period further remains can be found along the coast such as Roman lighthouses and several look out towers along the Dover coastline (Cuncliffe 2001: 423). A single gold Roman ring (MA 416) has been found off Dungeness. It dates from the Emperor Marcus Aurelius Probus, 282 AD and is probably indicative of a personal item lost at sea during a voyage or possibly a wreck. With the wealth of marine related Roman material on the shoreline there is potential for finding marine finds offshore.

7.2.2.2 Wight

Within the Wight area there is substantial evidence for Iron Age occupation. There are numerous forts lying adjacent to the river and harbour mouths of the Solent. An example of this is the Iron Age hillfort of Tournerbury (MA 417), which was associated with the management of salt working in the area, and the famous site of Hengistbury Head. This fortified Iron Age mercantile centre played an important role in cross-Channel trade between Britain and Gaul. The large amounts of continental pottery and coins that have been discovered at a number of coastal settlements are further indicators of continental maritime trade (Trott and Tomalin 2003). Direct evidence comes from the discovery of a Late Iron Age anchor and chain (MA 418) from Bulberry Camp near Wareham (Williamson 1998: 11). Such a large iron object would have represented allot of wealth at the time and therefore the person whom buried it must have come from the upper mercantile classes, if not the aristocracy. This find represents an important indication of increased status of maritime communities during this period.

The waters around the Solent linked the continental Roman Empire with major Romano-British provincial settlements such as *Noviomagus Regnensium* (Chichester), *Venta Belgarum* (Winchester), *Clausentum* (Southampton), and directly bordering Porstmouth Harbour *Portus Adurni* (Portchester Fort) which served the Roman Navy. Additionally, vessels would have landed in a variety of locations throughout the Solent (*Magnus Portus*) which has a number of large maritime villas on its shores (Drummond & McInnes 2001).

Although evidence for the vessels used is lacking, remains of Roman port facilities have been found along the river Itchen in Southampton (figure7.9) and Roman pottery and coins have been recovered by fishermen. Such Roman pottery recovered from Yarmouth Roads demonstrates an active trading network within the Solent area (Trott and Tomalin 2003: 177). With such a rich nature of finds within the Wight area the potential of marine finds should be considered.

Figure 7.9 Roman posts located on the Itchen River (HWTMA)

7.2.2.3 Portland

Like its neighbouring areas the Portland area is also characterised by Iron Age coastal settlements and industrial activity. These include the coastal hillfort of Flowers Barrow (MA 419) and an early Iron Age hearth site indicative of salt working taking place within the area. Despite this Iron Age finds within the Portland area are relatively scarce though pottery, shale and coins have been found. This is thought to be due to the mixed-farming and fishing regime which was operating in the hinterland. The island of Portland however did function as a trading port (Taylor 2001: 201). These included imported goods from the continent and probably exported agricultural goods which due to their perishable nature have not been picked up in the archaeological record. It is therefore not surprising that an Iron Age log boat and two Iron Age jetties have been found within Poole harbour close to Green Island (MA 420).

The Roman period sees continuity and expansions of settlement and industry, with finds for this area comprising several shale working sites, coins and pottery located on the coast. A possible Roman fort associated field systems and the discovery of what is believed to be the Roman town of Mordunum, all overlooking the harbour of Seaton indicates the inter-reliant complexity of such communities. Such evidence for trade and coastal settlement is indicative of further archaeological potential in the offshore zone of the Portland area where it can be expected to find Roman period wrecks. Evidence for this is the partial remains of an amphora dredged up by a fisherman off Portland.

7.2.2.4 Plymouth

The coastline of the Plymouth sea area is also characterised by several Iron Age promontory hill forts. Inland of these forts are densely populated settlement areas. Iron Age finds however are limited to the hill forts, cists and some pottery. Despite this, Iron Age trading networks in the area were extensive and include St Michaels Mount, which has been identified as a major British centre for the tin trade. Tintagel in Cornwall was also used as a trading port during the late Iron Age. The Isles of Scilly have some limited evidence for Iron Age settlement but this is limited to pottery and an Iron Age sword.

Roman finds within the Plymouth sea area consist of several coin hoards and pottery, with numerous amphorae remains have been trawled from the fishing grounds.

These amphorae are likely to be from a Roman merchant ship that foundered off the coast. During the Roman period the Isles of Scilly were known as "Scillonia insula" and were likely to have been occupied and engaged in trade with Britain. Evidence for this comes from Roman coins and pottery brought to the Scillies by vessels engaged in trade. Although there is a lack of shipwreck remains from this period the potential for finds within the marine zone should be considered.

7.2.2.5 Lundy

There are numerous Iron Age promontory hillforts and pottery finds within the Lundy sea area. Archaeological work undertaken in the Somerset levels and Severn Estuary has provided further evidence for Iron Age dwellings, iron manufacture and pottery (Allen & Fulford 1997). That water transport must have played an important part in the economy of the Bristol Channel area is demonstrated by a vessel discovered at Barlands Farm, Section 7.1.

An increase in trade during the Roman period is highlighted by the larger quantities of Roman pottery and coins found along the coast and dredged up from the sea and rivers. The transhipment of goods, to Gloucester and Cirencester, from the Roman stores depot at Sea Mills is the first documented use of the Bristol and Severn Estuary (Wheatley 1990: 141). Further evidence for extensive Roman settlement and farming can be found along the Severn Estuary (Allen 2002) at Caerleon and along the Welsh side of the Bristol Channel, where large and extensive Roman Villas were supported by an active maritime trade.

7.2.3 Early Medieval (c. 410 AD – c. 1066)

With the decline of the Roman Empire, Britain was effectively left to defend itself from the raiding Saxons and Franks. By 410 – 420 there is evidence showing Saxon settlements in eastern Britain (Cunliffe 2001: 453). This influx of settlers culminated in the formation of the kingdom of Sussex which stretched from Pevensey along the coast toward Chichester.

Historical sources reveal Gaulish vessels traded along the coasts, highlighting that trade took place between the Saxon kingdoms and the continent. The early medieval period is characteristically sparse in terms of direct evidence for maritime trade, although vessels like the Snape, Sutton Hoo and the Graveney boat gives an indication of the type and form of vessels that could be found. Indirect evidence for trade along the coasts of Britain is seen in the excavation of settlements such as Tintagel, where exotic pottery from the Mediterranean has been found. By the seventh century this trade in Mediterranean pottery is replaced by trade in pottery from western France.

In the seventh to ninth century a centralised settlement pattern and greater political control developed in England. It is also the time that the first of England’s seaports were established. The large number of Anglo-Saxon towns that were also ports or had associated ports, such as London and Hamwic associated with Winchester, demonstrates the importance of continental sea trade for the Saxons (Friel 2003: 26). In the ninth century Viking raiders disrupted these now established trading networks, with the ports in Southampton, London, Cornwall and Cheshire coming under frequent attack. The Vikings however were also to establish their own ports or use those of the Saxons. The establishment of the great trading port of Dublin in the tenth century saw Viking ships plying the channel on their way to and from their political bases in Scandinavia.

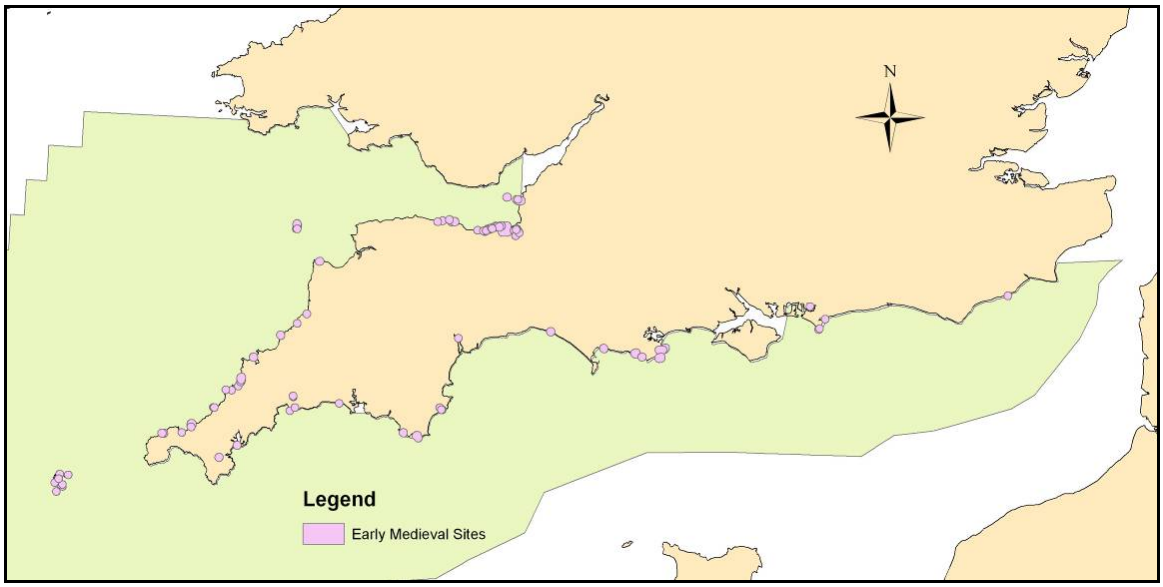

Figure 7.10 Distribution of sites dating to the Early Medieval Period in the maritime and coastal zones

7.2.3.1 Dover

The port of London played an important role a centre for trade with the continent for the Saxon settlers, and from the seventh to ninth century developed as a major trading port (Cunliffe 2001: 485). Prolonged Viking raids during the ninth century caused great disruption but London continued as a major trading port throughout this period. Due to the importance of this port and the trading links operating through out this period there is high potential for archaeological remains within the marine zone.

7.2.3.2 Wight and Portland

The port of Hamwic was founded in c. 700. Lying on the west bank of the river Itchen this was the principal port for the kingdom of Wessex, having regional and continental trading links. The original town of Hamwic flourished for approximately 150 years before population pressures in the 10th century caused it to be shifted to the present day area of Southampton (Hamerow 2002). Direct evidence for maritime transport during this period has been located in Langstone Harbour. Here the remains of a log boat (MA 423) have been excavated and recovered (HWTMA 2003). The Wight area should be considered to have a high potential for marine archaeological remains for the early medieval period due to the degree of trade occurring. Further along the coast in the Portland area documentary evidence for a trade in skins, cattle and other organic produce with the continent occurs. During this period the coastal area suffered from episodic raiding and resettlement by maritime forces (Reynolds 2005: 110).

7.2.3.4 Plymouth and Lundy

The archaeological evidence for the Plymouth sea area demonstrates a varied pattern of regional and overseas trade. In the sixth century the Isles of Scilly and Tintagel in Cornwall are importing Luxury goods from the Mediterranean. Later in the seventh and eight century these luxury goods are replaced by western French pottery wares indicating a refocusing of direct trading links with the continent. With the onset of Viking and Irish raids in the ninth century the supply of luxury goods ceases (Cunliffe 2001: 481) and there is little further evidence for overseas trade. This disruption of the trading net works however was only for a short time and maritime trade resumed once the Viking onslaught had been defeated and the trading ports of Dublin and Wexford had been established.

7.2.4 Medieval (1066 – 1550)

In 1066 the Norman conquest of England brought about the reorientation of English trade from the Scandinavian world towards that of Western Europe (Friel 2003: 49). With this reorientation of trade medieval England became significantly richer through the export of wool, tin, lead and coal. The most significant item imported was wine, particularly that from Gascony and Bordeaux with 20,000 tuns being imported annually. However, in the fourteenth century with the advent of the Hundred Years War this French continental trade declined rapidly (Friel 2003: 66). In compensation for this traders of the Hanseatic League retained and strengthened their links with England. The Hanseatic League was a trading union of towns based in the Baltic and North Sea formed during the thirteenth century. They welded a huge influence on English trade by imposing trading restrictions at its ports. This influence is demonstrated through documentary records which show a large volume of trading goods particularly wool being exported in Hanseatic ships. The documents also highlight a number of wrecks, a significant proportion of which are foreign vessels.

Coastal shipping played a significant role in trade around the British Isles. Most of the trading routes were either coastal, up and down the channel, or cross channel with few documented trips into the Mediterranean. Large quantities of material were moved from around the coast to the larger ports and from there it was transhipped to the continent (Friel 2003: 68). The largest port during the medieval period was London with several other trading ports like Southampton and Bristol playing an important role in coastal and continental trade.

The importance of this medieval trade and the potential it has for marine archaeological remains within the SEA8 area is demonstrated by the medieval wrecks in the Harbour of St Peter Port, Guernsey. Through investigations prompted by erosion at St. Peter Port the remains of several medieval wrecks have been identified. After dredging operations had taken place, draw down of sediments resulted in further medieval wreck structure being exposed, and after several surveys no fewer than five individual wrecks are believed to exist within the harbour (Adams et al 2004: 232).

The distribution of known medieval sites and finds from the maritime zone and the adjacent coastal hinterland are shown in Figure 7.11.

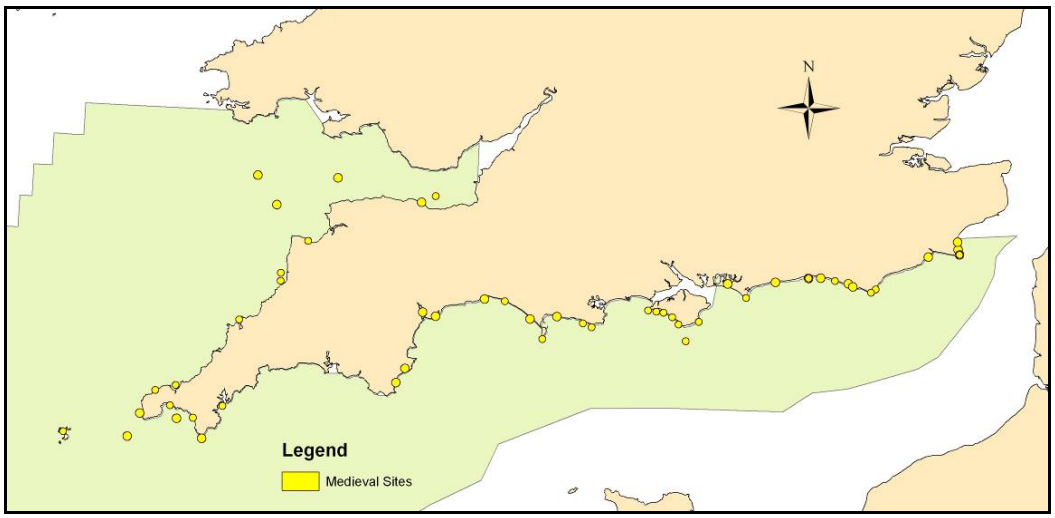

Figure 7.11 Distribution of sites dating to the Medieval period in the maritime and coastal zones

7.2.4.1 Dover

The port of London was the largest port in Medieval England, with shipping from the continent and other ports along the English coast converging here. This large volume of coastal and continental trade is seen through the numerous wrecks of cargo vessels which litter the coastline of the Dover sea area. Recorded losses for this period have identified 23 vessels of French, Portuguese, Spanish and Flemish origin. A small number of other vessels are Irish and English reflecting the coastal trade along these shores.

7.2.4.2 Wight

The Wight area incorporates the port of Southampton, which was one of the largest ports along the south coast. In the twelfth century Southampton was almost exclusively involved in the wine trade between Gascony and England. By the fifteenth century Southampton had expanded its trading links to include Italian city states, notably Genoa (Wheatley 1990: 97). These trading links are reflected in the recorded shipping losses in the Wight area with the majority being French vessels, thereafter Italian, Portuguese and Flemish with several coastal vessels of English origin also having been recorded in the National Monuments Record.

7.2.4.3 Portland

Dartmouth and Poole harbour also had large continental trade similar to that of Southampton and London. This is reflected in the documented shipping losses in the area consisting of approximately 11 cargo vessels of French, Italian and Spanish origin. One such wreck is the Studland Bay Protected Wreck site. This consists of the remains of an early 16th century armed Iberian trading vessel carrying a mixed cargo. Its partial excavations by the Poole Bay Archaeological Research Group, on behalf of the Poole Museums Service, revealed a cargo of pottery which demonstrates that this Spanish vessel was engaged in long-distance trade. The ceramic collection indicates that the voyage was undertaken by “coastal hopping” along the ports of the Channel and Atlantic seaboards (Gutierrez 2003: 34). This type of coastal trade was prevalent during this period and allowed for the exchanging of cargo throughout the voyage, even when political upheaval officially censored direct trade between certain countries. The remains of the Studland Bay Wreck demonstrates the potential for other finds from this period both within the Portland area and along much of the SEA8 coastline as recently revealed by the Swash Channel Wreck (DCMS 2007).

Figure 7.12 Finds from the Studland Bay wreck (J. Satchell)

7.2.4.4 Plymouth

The harbours of Plymouth and Fowey both played an important role in the medieval maritime networks. In 1254 Plymouth was recognised by Royal Charter, becoming the first town in England to be granted a Charter by Parliament (Friel 2003: 70). Offshore on the Isles of Scilly trade is demonstrated during this period by pottery finds.

Within this area are three protected wrecks sites related to medieval trade: namely the Cattewater wreck, St Antony and the Gull Rock wreck. The Cattewater wreck was discovered after a dredger brought up timber and the fragments of two guns in 1973. Survey and excavation work, carried out in 1977 and 1978, suggested that the ship was a merchantman of 200-300 tons lost around 1530 (Redknap 1985: 39). The St Antony lying off Mounts Bay in Cornwall was a Portuguese merchant vessel which sailed as the flagship of a fleet bound from Flanders carrying silver, copper and other metal goods to Portugal. It was partially investigated throughout the 80's and 90's with survey beginning in 1983 (Fenwick and Gale 1998: 50). The Gull Rock Wreck off Lundy in Devon is an unidentified merchantman consisting of a scatter of 15th to 16th century objects. Further evidence for continental trade within the SEA8 region are is the known recorded losses of 12 shipwrecks of Spanish, Portuguese, Italian and French origin; whilst coastal trading networks are indicated by Welsh and English vessels.

7.2.3.5 Lundy

The Lundy sea area comprises of a rich collection of medieval material with the ports of Barnstaple and Bristol being relatively important centres of trade and smuggling. A recent study by Bristol University has highlighted the high proportion of trade that was undertaken by smugglers in this area, significantly altering the perceived total amount of trade that was taking place both in Bristol and other ports for this period (Smuggling in Tudor Britain). The majority of cargo vessels lost off this coastline are English with some few French, Italian and Welsh vessels present within the recorded losses. This would indicate that the majority of shipping would be related to coastal trade of goods to harbours along the south east.

7.2.5 Post Medieval (1550 – 1800)

The collapse of the Antwerp cloth market in the sixteenth century had a serious impact on English merchants and, it is believed, created the motivation which led them to locate new markets (Friel 2003: 103). By the early 1600s English merchants had gradually expanded their trading areas to include new markets in the Baltic and the Mediterranean. This resulted in an increase in trade, most of which was centred on London and several other larger ports along the south east. Although English mariners had been undertaking transoceanic voyages from as early as the fifteenth century, it is not until the 1550s that England's oceanic trading enterprise begins (Friel 2003: 108). The Royal Charter obtained in 1601 by the English East India Company led to one of the most extensive trading networks with the east, rivalling that of the Dutch East India Company.

By the seventeenth century England's overseas growth greatly increased, with London remaining a major port. With its growing population, mercantile wealth and royal court London dominated international and coastal trade in England. This growth not only benefited London but can be seen to have developed England's coastal trade and the regional centres which directly traded with it, such as Bristol (Friel 2003: 160). This period of prosperity is reflected in England's merchant fleet, which grew five times its size between 1580 and 1680, and continued to grow into the eighteenth century. Official values of imports, exports and re-exports during these periods are also seen to have grown phenomenally. The Industrial Revolution in

1790 resulted in a further increase in coastal and overseas trade as greater amounts of raw materials and manufactured goods were required (Friel 2003: 154).

During the eighteenth century it has been estimated that approximately 3- 5 percent of ships were lost per year (Friel 2003: 188). This equates to over a quarter of the shipping during this period. The shipping losses for the Post Medieval period indicate that there should be high potential for encountering shipwrecks within the SEA8 area (Figure 7.13).

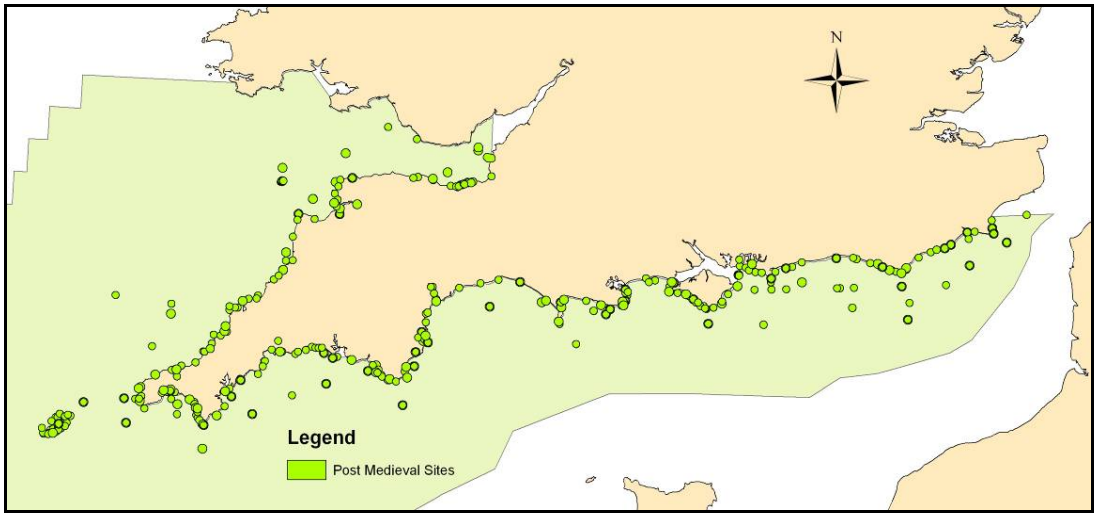

Figure 7.13 Distribution of sites dating to the Post Medieval period in the maritime and coastal zones

7.2.5.1 Dover

The importance of London's coastal and international trade resulted in substantially increased shipping in this area. This is reflected in the recorded losses of the Dover area which has approximately 266 recorded known wreck sites. The wrecks are of French, Danish, Dutch, Flemish, Swedish and Spanish origin, which attests to the overseas trade prevalent at this period. Although the great majority of shipwrecks are English vessels engaged in coastal trade, supplying London with goods and services there are also Dutch East Indiamen. An example of such is the Amsterdam, protected under the Protection of Wrecks Act. After running into difficulties on its way to the East the Amsterdam was grounded on the beach at Bulverhythe, East Sussex where it quickly sank into the beach sediments. The Amsterdam is of global importance since it is two-thirds complete, the most intact East Indiaman of any country known in the world. It represents the East India Companies of Europe that opened up global trade in the 17th and 18th centuries (Gawronski 1990: 53).

7.2.5.2 Wight and Portland

The trade in goods to supply the burgeoning port of Portsmouth, and coastal trade taking goods along the south coast towards London, is reflected in both the quantity and diversity of shipwrecks from this period. Of the approximately 313 wrecks located within the Wight area and 243 in Portland the majority are English coastal traders. Other nationalities represented include the Dutch, Portuguese, Swedish and Spanish.

The Yarmouth Roads wreck is an example of a significant trading vessel from this period. Located within the Solent in 1984 the site is the wreck of a late 16th or early 17th century merchantman, possibly the Spanish Carrack *Santa Lucia* lost in 1567

(Watson & Gale 1990:183). This wreck site is protected under the Protection of wrecks Act. Complementing this and highlighting the richness of marine sites within this area is the wreck of the *Campen.* This was a Dutch East Indiaman that wrecked off the Needles when outward bound from Texel to the West Indies in 1648 (Larn 1985: 3). The number of recorded shipping losses (313 wrecks) in the Wight area is likely to be a small proportion of the actual number of wrecks.

7.2.5.4 Plymouth

The Plymouth sea area at this time was particularly busy with a great quantity of ships passing around this stretch of coastline towards London or the West Indies. This is reflected by the approximately 611 foreign and English cargo vessels recorded as wrecked within the Plymouth sea area. One of these cargo vessels is the protected wreck site known as the *Salcombe Cannon* site. It comprises a number of guns, gold coins, jewellery and ingots. This site also contains the largest find of Islamic coins in the UK, which provides insights into North African trade during this period (Salcombe cannon Site). On the Isles of Scilly 228 cargo vessels are recorded as having been lost, the majority being British and Dutch vessel most probably involved in the East India trade. An example of such vessels is the *Catherina van Flemsburg* wreck, a Danish vessel which sank in Plymouth Sound in 1786. This vessel was found to be carrying a load of Russian reindeer hides (Garbett 1987). The scale of shipping in this area and period makes the potential for further finds relatively high.

7.2.5.5 Lundy

During the seventeenth century the port of Bristol played an important trading role both on the west coast of England and overseas, with fifty ships a year engaged in transoceanic trade. The increase in trade during this period is reflected in the significant amount of ship losses within the Lundy area. Of the approximately 1500 wrecks in the area, the majority are English cargo vessels involved coastal trade between ports in Wales, England and Ireland.

7.2.6 Early Modern (1800 to 1914)

The industrialisation and urbanisation of Britain continued apace up to the 1840s when the urban/rural population balance tipped, and for the first time in British history more people lived in towns and cities than in the countryside. At the same time there was a dramatic increase in the population (Friel 2003: 210). This change was driven by the Industrial Revolution which drove both Britain's overseas trade and influenced the development of merchant shipping. The need to supply both the growing population and industries of Britain with food and raw materials saw a huge reliance on fishing and sea trade during this period. This is demonstrated by the fact that by the early twentieth century one quarter of the world's seaborne trade passed through British ports (Friel 2003: 211).

In the late twentieth century there was a decline in Britain's export trade of manufactured goods, however, this was offset by the trade in coal which saw a great demand fuelling the growth of ports such as Cardiff. Further effects of the Industrial Revolution on the British merchant fleet were a massive increase in the average tonnage of vessels as wooden vessels were abandoned in favour of iron and steel. This, together with the steam engine, served to reduce freight cost and increase profits (Friel 2003: 227) resulting in a growth in merchant shipping. The upsurge in merchant shipping is reflected by the increase in recorded vessel losses. Due to this change and increase in merchant shipping there is high potential for encountering wooden, steel and composite wreck material from this period.

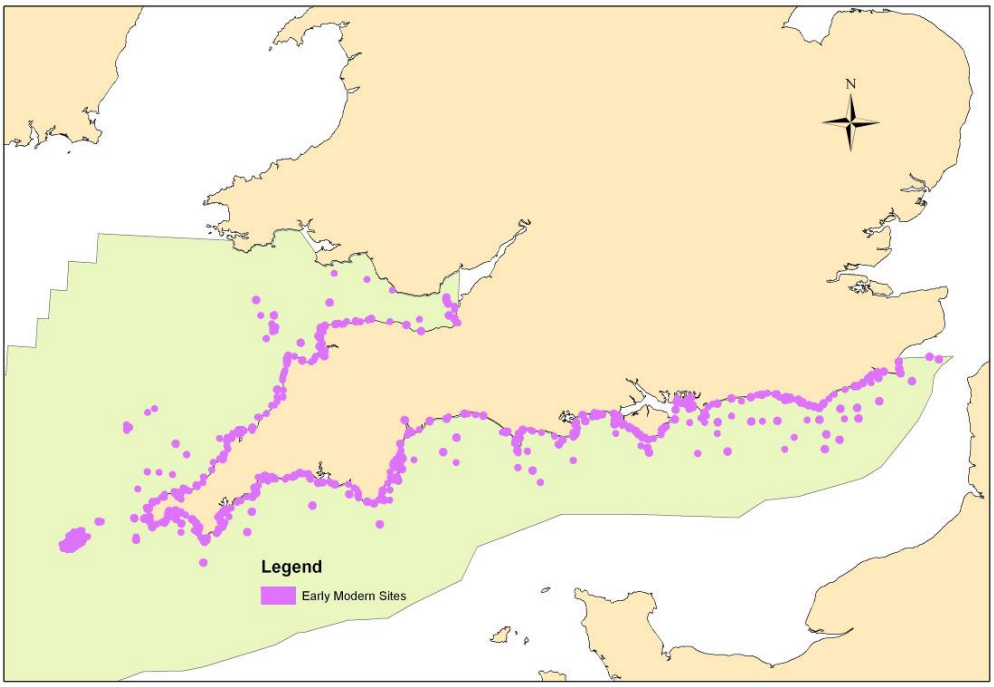

Figure 7.14 Distribution of sites dating to the Early Modern Period within the maritime and coastal zones

7.2.6.1 Dover

Approximately 700 wrecked cargo vessels are recorded in the Dover area, the majority of which are British. There is also a general increase in the amount of Spanish, Danish, Norwegian, German and French vessels. According to these losses the majority of vessels are wooden sailing ships, although due to the incompleteness of the record some of these may be iron vessels. The *Thomas Lawrence*, a Danish Schooner, has been designated under the Protection of Wrecks Act. The *Thomas Lawrence* was carvel built and copper clad with the foremast and rudder still in position. The archaeological and historical significance of this ship is due to it being from a period and geographical region where the use of ship drawings in the local ship building tradition is rare. The wreck therefore provides an important example of a vessel type for which there is little documentary evidence. The known amount of shipping and shipping losses within the Dover area makes it an area of high potential for wrecks from this period.

7.2.6.2 Wight and Portland

Within the Wight and Portland areas the Industrial Revolution played a major role in the development of ports, with Southampton and Portsmouth becoming major centres for trade. Evidence for this is clearly reflected in the large amount of shipping that was lost off these shores, numbering over 1800 vessels. The majority of these vessels are English, reflecting the vast scale of England's merchant fleet at this period. Further vessels include those registered as French, German, Norwegian, Danish, Scottish, French, Swedish, Portuguese and German. This high incidence of wrecks gives this offshore area high potential for encountering wrecks.

7.2.6.4 Plymouth

The Plymouth sea area was a region in which shipping from America, Ireland and the continent passed en route to ports along the Welsh and west English coasts. Within the Plymouth area there are over 1500 recorded vessel losses, the majority of which

are English. Foreign shipping includes Spanish, Danish, Norwegian, German and French cargo vessels.

The *Little Gannick* wreck, a ship of national significance protected under the Protection of Wrecks Act lies off the Isle of Scilly. It comprises a discrete mound of post 1850 Cornish mining equipment. The cargo is considered to be of national significance given its rarity and potential for informing use about the international trade in Cornish mining equipment and technology. Due to the high incidences of known shipping losses within this area, the potential for future discoveries within the marine zone can be considered to be high.

7.2.6.5 Lundy

The largest number of shipping losses for this period occurs in the Lundy sea area, with approximately 2000 recorded losses. This can be related to the nineteenth century demand and trade in coal from the coal mines of south Wales being exported via ports such as Cardiff and Swansea. Transhipment of coal along this section of coastline involved numerous vessels, from those of large shipping companies to smaller individually owned tramp steamers. The demand for coal also saw an increase in service industries associated with it, and a demand in goods to feed the needs of the all such industries. Cardiff's central position within this network saw it rise to be one of the greatest tramping ports of the world, with an associated increase in shipping within this area (Friel 2003: 232). Indicative of this development is the protected wreck site of the *Iona II*. This iron hulled, steam powered vessel was built in 1862, and sank one year later on her first trans-Atlantic voyage(Duckworth & Langmuir 1967: 32). This is one of the first vessels under 150 years old to be protected under the Protection of Wrecks Act (Fenwick and Gale, 1998:140). The high incidence of shipwrecks in the Lundy area makes it an area of high potential for archaeological remains.

7.2.7 World Wars (1914 to 1945)

The Royal and Merchant navies played an important part in the Allied victories during both World Wars by providing the so called "Atlantic lifeline" on which Allied positions in Britain and Europe depended (Friel 2003: 249). The convoys of merchant ships also provided Britain with the necessary supplies to remain in the war and feed its population. Merchant shipping during this period relied on the Royal navy to protect the convoys, especially from U-boat attack which was responsible for some of the greatest losses in shipping along the English coastline. During the World Wars the majority of vessels lost off the southern British coast merchant men mainly in military service. The majority of these vessels are British, although several French, Norwegian and Danish examples have also been recorded.

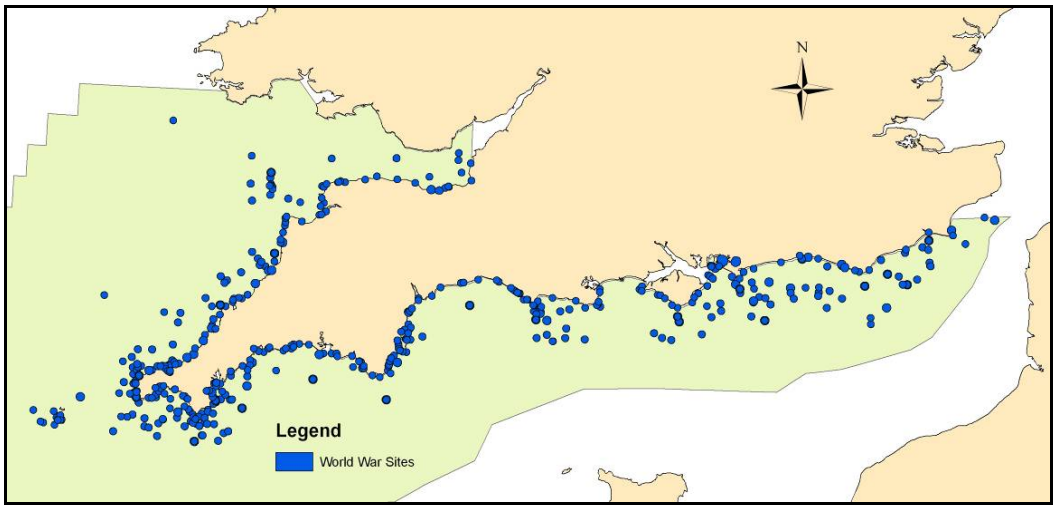

Figure 7.15 Distribution of sites dating to the World Wars in the maritime and coastal zones

7.2.7.1 Dover

In the Dover area there are over 150 recorded lost cargo vessels. Of significance within these losses are a number of ferries. In 1928 the first ferry service for accompanied cars began, with initially 6000 cars being ferried across the channel annually. This later increased to just over 31000 (Wheatley 1990: 96). Several ferry remains have been found within the Dover area, including the P&O liner *Maloja*, which was mined off Dover on 27 February, 1916. Another vessel representing a generic vessel type is the *T.R. Thompson,* a cargo steamer built in 1897 and sunk by the German Submarine UB-57 while carrying a cargo of iron ore from Beni Saf Algeria to Middlesborough in 1918. It now lies approximately 10 miles south of Newhaven and is regularly dived by sport divers.

7.2.7.2 Wight

Both the White Star and American Line chose Southampton as their transatlantic terminus, which resulted in an increase in shipping to the port. The loss of over 200 cargo vessels has been recorded within the Wight Area for this period. Examples of such losses show the varied nature and surviving extent of these vessels. The wreck of *SS Westville* (MA 424) torpedoed in 1917, and sunk approximately six miles from St Catherine's lies in approximately 40m of water and is relatively intact (Wendes 2006: 136). The wreck of the Steam Drifter *New Dawn* (MA 426), mined 3 miles off the Needles, has little remaining structure (Wendes 2006: 182).

7.2.7.3 Portland

The Portland sea area saw substantial changes during the World Wars, with Portland becoming an important shipbuilding yard between 1941 and 1945. This in turn increased the amount of cargo vessels that were calling into this area of coastline, as well as making it a target for German attacks. Of approximately 300 recorded vessel losses the majority are British while several French, Norwegian, Belgian and American vessels are also represented. Wrecks off this coastline include the *Binnendijk* (MA 427), a 6873 ton Dutch steamship that lies inside shambles bank in Portland, and which struck a mine and caught fire. The wreck is well broken after salvage operations but is still substantial (Weymouth Diving).

7.2.7.4 Plymouth and Lundy

The large quantity, over 900 recorded cargo vessels, of merchant shipping lost during this period through enemy action is indirect evidence of trade. The majority

are British with several French, Norwegian, American and Dutch vessels represented. Off the Isles of Scillies approximately 50 foreign cargo vessels were lost. Archaeological sites include the wreck of the *Louis Sheid* (MA 428), a Belgian grain steamer that ran ashore on Leas Foot Beach, Devon in December 1939 after being torpedoed. It currently lies at a depth of 10m and has undergone archaeological survey as part of the Nautical Archaeology Societies Adopt a wreck scheme (NAS). During this period Cardiff remained an important area for the trade in coal, and due to enemy action significant losses occurred. This also affected the type of vessel recorded as lost with the majority being British vessels engaged in supplying ships with coal for the war effort. Several wrecks from this period are regularly dived and many survive relatively intact. An example of this is the Spanish Steamer *Monte Gurungu* (MA 429), which due to severe weather on the 13 November 1949 foundered in the Bristol Channel. Although partly broken up, substantial sections of hull survive (Ilfracombe Wrecks).

7.2.8 Late Modern

A short post-war shipping boom between 1918 to 1921 was soon followed by an economic downturn, resulting in a rapid decline in the British shipping industry which was having to compete with subsidised German, American and Japanese fleets (Friel 2003:277). By the 1960s world shipping had undergone a technological revolution with the advent of containerised shipping. The search for economic benefits in world trade saw the development of bigger tankers and larger bulk carriers (Friel 2003: 279). There was also a significant increase in the amount of leisure craft and associated infrastructure. The Sea8 area is known to contain important sites from this period. This includes the largest tin processing bucket dredger to remain underwater, the *Kautoug* (MA 430), which lies off the Cornwall coastline. (Parham 1996).

7.3 Maritime Archaeology of Warfare and Sea Battles

British military history is long and varied with several phases of attempted invasion, occupation and civil war. Although there is plenty of evidence for warfare on land prior to the Roman invasion there is little or none for maritime warfare. The Roman invasions are the first significant documented records we have for warfare within England. Other well documented battles include the Saxon and Viking period as well as the Norman Conquest of 1066. Later the English Channel became the stage for several sea battles with Spain, France and Germany. These conflicts have left traces within the maritime archaeological record. The consideration of maritime activities related to warfare and sea battles and their associated archaeological remains have been considered in the shipping forecast areas that cover the SEA8 area where applicable.

7.3.1 Roman

By 43 AD, the time of the Roman conquest of Britain, Britain had already been the target of frequent invasions by the Roman Empire. Within four years of the invasion Roman rule extended from an area south of a line from the Humber to the Severn Estuary (Friel 2003: 10). Initially though during the Roman invasion the south east coast was used extensively by the Roman Military. This almost certainly includes Fishbourne Creek (MA 425) within Chichester Harbour, which most probably continued as an important maritime base until the 4th century AD.

The Roman army in Britain was accompanied by a naval fleet, the *classis Britannica*. It was stationed at Boulogne in Gaul but had bases in the south-east of Britain.). It essentially performed a logistics role, transporting troops and provisions, as well as seemingly managing the iron industry in the Kent and Sussex Weald (Cleere 1977: 17). The river port at Bodiam, from where iron products were exported was connected with the Roman naval fleet (Milne, G. 1996:237) although no Roman ships

have been found on or near the Sussex coast. By the late third to fourth century ten large coastal forts had been constructed. These were situated along the south coast of England from Porchester castle in Hampshire to Brancaster in Norfolk. The primary use of these forts was to defend against Saxon attackers, hence their being titled “Saxon Shore Forts” but they were also used to control the high level of piracy affecting cross channel trade (Johnson 1976: 14).

The fate of the fleet during the late empire is uncertain, but it seems likely that it was broken down into smaller units that were attached to the *limitanei* in coastal forts such as Pevensey. Indeed, the *Notita Dignitatum* mentions the *classis Anderetiana* (fleet of Anderida), which presumably was originally based at Pevensey (Roman Sussex). By the first half of the second century AD the port of Dover became the main naval base for the *Classis Britannica* fleet. It comprised a quay and two Roman lighthouses one of which can still be seen in Dover Castle. By the middle of the third century several new forts such as Burgh, Bradwell, Walton and Richborough were constructed strengthening the system of coastal defences along this section of coastline (Philp 1981: 3).

The defence of Roman Britain was not just reliant on these forts but also included a network of legionary bases and ports situated along the coast. These included, Torquay, Exeter, Woodbury Farm immediately south of Axminster in Devon, and Moridunum fort (MA 421) all of which formed an important part of the defence of the southern most section of the channel. There is a large amount of evidence for the Roman occupation of the Isles of Scilly although no apparent defensive structures exist. Roman fortifications appear to end at Exeter with few recorded remains found in Cornwall.

There are however a number of forts which supported the Roman invasion of Wales. During the conquest of Britain the Roman army came up against the formidable opposition in Wales. It was not until AD 78 that the whole of Wales was occupied (Friel 2003: 13). Consequently, Wales was subjected to tight military control by a network of forts garrisoned by several auxiliary forts including Brecon, Caernarfon (Segontium), Caersws, Gelligaer, Loughor and Pen Llystyn. Further Roman forts within the Lundy sea area are Caerleon and Nidum legionary fortresses that would have had maritime links from which these legions could be supplied with troops and material.

7.3.2 Early Medieval

Britain was almost defenceless against attacks from the Anglo-Saxons when the Romans retreated. Initially the Anglo-Saxons undertook a series of seaborne attacks followed by the establishment of raiding settlements. This was later followed by wide spread settlement culminating in the formation of the kingdom of Sussex (Friel 2003: 17). This period of settlement and centralised political control lead to the formation of several prosperous port towns, which later became targets for the Vikings. These raids began in the late eighth century when Vikings entered Western Europe plundering along the coastlines of Britain. Although attempts were made to defend against the Viking raiders at sea, these met with very limited success.

From the ninth to tenth century Milford Haven was used as a base from which the Viking could raid along the coastline of the English Channel, whilst the Severn estuary was used as a conduit by which the Danes could reach further into the hinterland (Sherratt 1996). The port of Bristol at this time was subject to frequent raids and suffered a steady decline. Due to the prosperity of the Saxon towns within the Wight area and that it was the seat of power for King Alfred, Viking raids targeted this area of coastline causing a significant amount of disruption to the ports. In the

ninth and tenth century King Alfred established fortified *burhs* along the coastline at Chichester, Porchester, Southampton, Twynham, Wareham and Bridport. These fortified areas together with a fleet assembled by King Alfred ensured a degree of peace until the return of the Danes in 1013 (Williamson 1998: 31). Although there is a great deal of documentary evidence little archaeological evidence for these maritime military actions has been found. The coast further east in the Portland and Plymouth sea areas, due to its rich hinterland and undefended shorelines, was under almost constant attack by the Viking raiders (Kennedy 2002: 132). In the ninth century Danish fleets are recorded as being a constant threat along the shoreline of the Plymouth area with major recorded battles at Wembury, near Plymouth and Exeter. In one of the earliest examples of a British crown's use of sea power King Alfred, in 897 AD confronted and cleared the Danes out of Exeter (Wheatley 1990: 116).

In 1050 Edward the Confessor introduced a new defensive strategy utilising shipping and manpower provided by Cinque Ports. These Cinque Ports were situated along the Kent and Sussex shoreline being, Hastings, Romney, Hythe, Dover and Sandwich. By providing the Crown with a set amount of ships and men for the purpose of defence they were allowed a degree of local self-government (Wheatley1990: 94). This formed the first national navy in England. This defensive strategy proved very effective in defending against attacks from Viking raiders.

7.3.3 Medieval (1066 – 1550)

With the Norman invasion of 1066 the British Isles underwent a final phase of conquest (Friel 2003: 49). The first substantial national navy since the destruction of the Anglo-Saxon fleet by the Norman conquest, was formed during this period. King Richard the 1st developed this fleet to guard against French encroachments into his lands in Normandy. It was this fleet that his brother John, was to wield for his own political ends (Warren 1966. 137-42). This was supplemented by the improvement of the Cinque Ports which provided a stronger defensive network with additional ships and soldiers. The effectiveness of this newly formed naval force was demonstrated in 1350 with the defeat of the French at the Battle of Sandwich. An increase in hostilities with the French leading up to the Hundred Years War saw one of England's largest naval build ups with Portsmouth, Southampton, Rye and Winchelsea becoming major naval ports (Rose 2002: 8).

Vessels drafted into the military during this period were mainly merchant vessels, as their primary purpose was to transport troops, but also engage in reconnaissance, coastal raiding and small-scale actions against enemy shipping. Later developments in the formation of a Navy come about in the Tudor Period during the reign of Henry VIII (Platt 1998:208). A large scale building programme was undertaken and the Royal fleet was increased from five to thirty ships. These included both the Grace Dieu, one of the largest carracks built during this period, at about 1500 tons and the Mary Rose, 600 tons.

7.3.3.1 Dover

Within SEA8 Dover area there are several ports which, during the medieval period would have supplied ten or more ships for royal expeditions. These were Dover, Hythe, Rye and Wichelsea (Rose 2002: 20). The ports played a significant role in the Battle of Winchelsea, 1350 in which the English fleet defeated a Castilian fleet of 40 ships commanded by de la Cerda. Between 14 and 26 Castilian ships were recorded as being captured while several were sunk. Approximately 22 recorded vessels from this period have been lost within the area of Dover. It is plausible that some may have been as a result of the cross channel skirmishes and battles, whilst others may have been the result of subsequent raids by the French.

7.3.3.2 Wight

The ports of Southampton, Poole, Isle of Wight, Hamble and Shoreham formed part of a network which supplied vessels and personnel for royal expeditions. Under Henry VII, Portsmouth dockyard was constructed. It included one of the most important naval developments during this period, the construction of one of the world's first dry docks (Friel 2003: 88). During this period there were frequent attacks and invasion attempts by the French, including an attack on Brighton (Fenwick and Gale 1998: 60). This site is currently protected under the protections of wrecks act. The remains of a shipwreck located at Brighton Marina is thought to be associated with these attacks. Evidence for potential ship losses during this period comprises approximately 22 vessels including the protected wreck sites of the *Mary Rose* and the *Grace Dieu* and Brighton Marina wreck.

The *Grace Dieu* at 1400 tons was one of the largest vessels of Henry V's fleet and is probably one of the largest clinker vessels ever built. It was designed to combat the formidable Genoese carracks, allied to the French, which contested control of the English Channel. Having only completed one documented voyage the ship was towed to Southampton Water where it was moored for 12 years. In 1439 the ship was moved upstream on the Hamble, where it was later struck by lightening and found its final resting place beneath the sediments of the river bank. A project by Southampton University undertook a high resolution geophysical survey of the *Grace Dieu*. This acoustic survey managed to identify the true plan form and dimensions of the remaining segments of this historic vessel (Dix et al. 2005). The survey also identified the presence of a horizon of incoherent timbers demonstrating the potential for survival of wooden wrecks within the intertidal zone.

The warship *Mary Rose* was an English Tudor carrack and one of the first to be able to fire a full broadside of cannons. Built in Portsmouth it was one of the earliest purpose-built warships to serve in the English Navy. In an engagement with a French invasion fleet the ship was accidentally sunk in Portsmouth Harbour on July 19th 1545 (Rule 1982). It is also recorded that one of the French galleys was also lost during this engagement. After re-discovery by Alexander McKee the archaeological excavation of the site was undertaken during the late 1970's and early 80's which culminated in the lifting of the hull on October 11, 1982. The substantial vessel remains and archaeological material that survived demonstrates the high degree of preservation that is possible when physical seabed conditions and environmental factors allow.

7.3.3.3 Portland and Plymouth

Within the Portland sea area there are several ports which supplied ships and men for royal expeditions. The port of Dartmouth, an important deep water port, was a base for the English navy from the reign of Edward III onwards. During the Hundred Years' War it had twice been surprised and sacked. As a consequence of this by the Tudor period Dartmouth had become one of the most fortified harbours of the south coast (Wheatley 1990: 117). The ports of Plymouth, Looe and Fowey would have supplied ships and personnel for royal expeditions during 1297 – 1347. Plymouth was an important naval port at this time and attacked several times by the French during the Hundred Years' War. Within this area there is evidence for at least 23 vessels losses, which include a possible merchant vessel lost off the Isles of Scilly.

7.3.3.5 Lundy

The ports of Bristol, Barnstaple, Newport, Cardiff and Swansea all provided ships and men for royal expeditions. Military engagements along this stretch of coastline were mainly against French backed Scottish force. Several expeditions against Ireland were also undertaken from the port of Bristol by Henry II (Wheatley 1990:

140). The *Gull Rock* wreck off Lundy Island is a protected wreck site of unknown identity which comprises a scatter of 15th to 16th century objects. This includes two wrought iron breech blocks, a wrought iron gun and a quantity of stone shot (Fenwick and Gale 1998: 56). A programme of survey work has been conducted, identifying the presence of wreckage material within the soft silt seabed sediments, however no excavation to investigate these has been undertaken (DCMS 1997).

7.3.4 Post Medieval (1550 – 1800)

During the Post Medieval period the British navy developed from a small force dependent on hired merchant ships to an increasingly professional standard of men and purpose built warships (Lambert 2000:24). In 1585 a deterioration of relations with Spain lead to the start of a mainly naval war. This lasted 19 years and was fought off the coasts of Africa, South America, the Caribbean and England. The most significant of these battles is that of the 1588 Spanish Armada which set sail from Lisbon intent on invading England. This fleet of 141 vessels was constantly harried by the English as it progressed up the channel and finally dispersed by a fire ship attack off Calais. In an effort to return to the continent and avoid the English Channel the Armada sought to circumnavigate Britain (Friel 2003: 94). Many Spanish vessels were lost along the coasts of Northern Britain and Ireland during this period. More importantly a Galleass was lost off the Lizard off the South Cornish Coast (Larn 1997). Whilst the Spanish attempted several other Armadas none actually came to fruition and by 1604 with the death of Elizabeth Queen of England and coronation of James 1st and the beginnings of the Stuart Period a treaty between England and Spain was signed.

The early Stuart period was marked by a general decline in the Navy though saw the development of the naval ship from the galleon into the forerunners of the ship of the line. Important vessels such as the Prince Royal, the Sovereign of the Seas, Mary and Constant Reformation were all built during this period. A growing discontent with the Crown and disfavour with the Kings policies lead to the start of the Civil Wars in 1642. Whilst most of the Civil war was fought on land there were several sea battles which helped decide the final outcome in favour of the Parliamentarians. The navy was also used to support land forces or bombard coastal defences, such as Portsmouth.

By 1648 Spain had lost most of its military power which soon led to its inability to protect its colonies from foreign trade and left Spain's colonial possessions without protection. This resulted in a competition for trade between the two remaining great naval powers, England and the Netherlands. English merchants however could not compete with the more powerful Dutch shipping industry. In response the Navigation Act of 1651 was enacted.

The Navigation Act was designed to cut the Dutch out of trade with England and her colonies and limit fishing off the coasts of England (Lambert 2000: 56). This soon led to the First Anglo Dutch War in which English and Dutch naval forces battled each other within the English Channel and abroad. A short-lived peace treaty was agreed in 1654 but by 1665 England was again at war with the Dutch in the Second Anglo Dutch War. After a resounding Dutch victory England's shipping interests were severely depleted. This was followed by an extensive build up of the Royal navy. Through an obligation by Charles II to Louis XIV, England was once again at war with the Dutch in the Franco-Dutch War or Third Anglo Dutch war which ended in 1674. The importance of the Anglo Dutch Wars to naval history was the noted changes in the tactics and vessels as well as the growing number of ship losses during naval engagements (Friel 2003:127). It is during this period through the influence of cavalry commanders commissioned into the navy that the famous line ahead came into

practise. This saw the greater use of stand off artillery engagements which gave a premium to the size and number of naval ordnance onboard a vessel.

By the end of the Third Anglo Dutch War France had become one of the most powerful European states with the world's largest battle fleet (Lambert 2000: 80). During this period France began to implement an expansionist policy into Europe. After the successful invasion by William of Orange in November 1688 William as Stateholder of the Dutch republic also became King of England. In this way he was able to form a coalition to oppose France and on 12 May 1689, the Grand Alliance was formed. The declaration of war by France saw the beginning of a series of Anglo-French conflicts which culminated in the Napoleonic War of 1803 – 1815. There is high potential for marine archaeological finds from this period along the SEA8 area.

7.3.4.1 Dover

The Dover area has been the scene for several naval battles with the port of Dover being the area in which the main English fleet was positioned before the attack on the Spanish Armada (Friel 2003: 127). During the First Anglo Dutch war five English vessels were lost in the Battle of Dungeness. Conflicts with the French in the War of English Succession lead to the Battle of Beachy Head in which several vessel losses are recorded. Approximately 200 British, French and Dutch vessels losses are recorded in the Dover area. Of these recorded losses two are now protected wreck sites; the *Anne* and the *Resolution*.

The Anne was a British 70-gun warship run ashore at Petts Level in 1690 after being seriously damaged by the French navy in the Battle of Beachy Head. The site lies in a bed of firm clay, beneath which substantial remains of the hull remain, demonstrating the potential for survival of vessels along this coastline (Marsden 1977: 15). The *Resolution* another 70-gun warship was lost in 1703 in the Great Storm off Pevensey Bay. It had served as the flagship in an expedition against the Barbary Corsairs in 1669 and took part in the unsuccessful attack on the Dutch Smyrna convoy, resulting in the Third Dutch War. In September 2005 archaeological work was conducted in which sufficient data was obtained to designate this wreck due to its historical significance. The site comprises a cluster of guns lying on top of ballast material, with a large anchor in the middle of the site (Wessex 2006).

7.3.4.2 Wight

One of the first battles during this period occurred off Dunnose Head, Isle of Wight where an attack on the fleet of the Spanish Armada occurred. During the English Civil War further decisive battles between the Royalists and Parliamentarians took place near the Isle of Wight and Portsmouth. Further conflicts during this period were restricted to skirmishes between the English and Dutch, and English and French. Within the Eastern Solent lies Spithead the world famous anchorage of the Navy. This area is likely to contain a large amount of archaeological material which can provide evidence for the activities of these warships during this period.

Approximately two French and eleven English warships are recorded lost in the Wight area, of which three are Protected Wreck Sites namely the *Assurance*, *Invincible* and the *Hazardous*. The *Assurance* a 44 gun, fifth rate ship of the line was lost off the Needles in 1738 and forms one of two wrecks protected in the Needles protected wreck site. The *Invincible* was originally one of the first French 74 gun ship of the line, captured by the British in 1747 during the war of Succession (Lavery 1988). It later served in the Royal navy until 1758 when it hit a sandbank in the East Solent and sank (Bingeman 1985: 191). The warship *Hazardous* was another French vessel captured by the Royal Navy. In 1706 *Hazardous* was part of a convoy en

route from Dartmouth to the Downs when she struck shoals off Bracklesham Bay and sank (Owen 1991).

The study of the *Hazardous*, *Assurance* and *Invincible* wreck sites have provided evidence for the technological development of the warships at this time, as well as providing important evidence for areas of navigational hazards for ships during this period. Research into the environmental processes affecting these wreck sites provides quantifiable evidence for the potential for archaeological remains within such dynamic environments (McNinch et al. 2006).

7.3.4.3 Portland

Along the Portland coastline there is a documented account of an engagement between the Spanish Armada and English forces. This skirmish took place off Portland Bill with some vessel losses having been reported (Friel 2003: 94). The Protected Wreck Site at Church Rocks, Teignmouth, Devon is believed to be one of the Spanish merchant vessels that were used during the Spanish Armada (Preece and Burton 1993). Finds from the Church Rocks Wreck site include incendiary devices which were used during naval conflict confirming their documented use (Martin 1994: 216). During the First Anglo Dutch war 41 vessels were reported sunk off Portland, one fifth of the recorded 200 losses in the Portland area.

7.3.4.4 Plymouth and Lundy

Plymouth harbour was one of two main stations for the English fleet during the Spanish Armada. It was form here that the English Navy left to first engage the Spanish Armada in 1588 (Friel 2003: 94). During the English civil war Bristol was a Royalist port. It was attacked by the Parliamentarian navy resulting in its capitulation and a Parliamentarian victory. During the Anglo Dutch Wars, and later skirmishes with French forces during the Second Hundred Years War, a number of vessels were lost off this coast and the Isles of Scilly. Approximately 2200 recorded vessel were lost in the area including the protected wrecks *HMS Colossus*, the *Coronation*, the *Schiedam* and the *Royal Anne Galley*.

HMS Colossus a 74-gun, 3rd rate ship-of-the-line was involved in a number of famous naval actions including Groix and Cape St Vincent. Returning to England with wounded from Nelson's Battle of the Nile she was wrecked off Samson in the Isles of Scilly on 10th December 1798 (CISMAS 2005). Survey and excavation work by a number of groups on the site, including the recovery of a large section of the ornately carved stern section in 2001, demonstrates the potential for the survival of shipwreck remains in this dynamic environment.

The *Schiedam* a Dutch fluyt of 400 tons sank in 1684 in Gunwalloe Cove Cornwall. The vessel was captured and incorporated into the Britsh navy. The site consists of 16 cannon, ship structure and other artefacts and it is likely that it would have been transporting cannon for the English army from Tangiers to Portsmouth. Two lead containers from this wreck site have also been found on the *Colossus* and *Association* and are believed to be two of five known to exist in the world (Larn 1984: 118).

The *Coronation*, a 90 gun second rate ship-of-the-line was lost in heavy weather sometime shortly after September 1691. The ship was involved at the Battle of Beachy Head in 1690 and carried the commander of the Blue squadron. Due to the nature of its foundering the site lies in two separate concentrations, both an onshore and offshore site (McBride 1981: 31). This wrecking process demonstrates the diverse nature within which wrecks can be lost and further emphasises the importance of the circumstances of the loss.

The *Royal Anne,* a 5th rate galley, was wrecked in 1721 off the Lizard in Cornwall only twelve years after it was built. The Royal Navy built only six such galleys, and the *Royal Anne* was described as the finest ever constructed. This wreck site is one of the first designated historic wrecks to have a Marine Environmental Assessment commissioned by English Heritage (Camidge et al. 2006). This assessment will be used to develop management plans for the future.

7.3.5 Early Modern (1800 – 1914)

The beginning of the Early Modern period saw further attempts by the French under Napoleon to invade England. This attempt was however stopped by the Royal Navy's blockade of the French coast which after several further engagements, notably the Battle of Trafalgar, reinforced Britain's hegemony over the seas (Lambert 2000:173). Between 1815 and 1914 the Royal Navy was the worlds leading naval force. Later during this period naval conflicts occurred mainly overseas. In 1901 the Royal Navy commissioned their first submarine the Holland I, this can now be found in the Gosport Submarine Museum. The submarine was to play an important part in naval warfare, especially in the coming two World Wars.

7.3.5.1 Dover and Wight

With the increase of the naval fleet during the eighteenth century and Napoleonic era the south cast of the England saw a period of virtually unrestricted expansion. Although no battles were fought within this area there are several recorded warship losses, lost mainly due to strain of weather. The wreck of the *Pomone*, a 38 gun fifth rate, lost off the Needles in 1811, is such a vessel (Adams et al. 1995).

Within the Dover area lies the protected wreck site of the submarine, Holland V. The Holland V was the first submarine to actually be commissioned into the Royal Navy, on the 19th January 1903. In 1912 the Holland V was being towed to Sheerness when it foundered and sunk 6 miles SE of the Royal Sovereign Lighthouse off Littlehampton, Sussex, England. The hull is upright and in a fair condition, demonstrating the potential for the survival of iron remains. Further along the coast off Bracklesham Bay lies the wreck of the HM submarine A1. Built by Vickers this was the first British designed submarines to be commissioned by the Royal Navy. The A1 submarine was initially struck by a ship during a training exercise and sank but was later recovered. Afterwards it was used as a submerged target and was lost off Selsey Bill. Surveys conducted on the wreck site have demonstrated the well preserved remains of this vessel. These wreck sites are protected under the Protection of Wreck Act.

7.3.5.2 Portland and Plymouth

Plymouth was a base for the English fleet when preparations were made to oppose Napoleon. In 1812 several expeditions set sail from Plymouth and Dartmouth. Portland harbour because of its strategic position was established as a naval base comprising a refuelling depot, dockyard, hospital and shore training establishments. In 1891 with the development of the torpedo, special ranges were developed to test them. The area off Portland is known to contain a number of important vessels from this period, including Battleships of the pre-Dreadnought period. Within the Plymouth area there are approximately 1600 recorded vessel losses. Although there are several warship losses none of these were lost during naval action.

7.3.5.3 Lundy

The character of the marine archaeology of the Lundy area is different to that of the other areas, being predominately merchant in nature. Of the approximately 1800 recorded vessel losses only approximately 10 are warships. This demonstrate that

this area of coast had fewer naval battles and subsequently losses, as is known form the historical record.

7.3.6 World Wars (1914 to 1945)

In the First World War, Germany attempted to isolate Britain in an effort to force it to surrender, while the British fleet attempted to confine the German surface fleet to port. The largest sea battle of the war "The Battle of Jutland" was fought on 31 May and 1 June 1916 off the Danish coast in which the German fleet attempted to defeat the Royal Navy enabling it to isolate and defeat Britain (Friel 2003: 234). Although there was a great loss of life during the Battle of Jutland Germany did not succeed in defeating the Royal Navy and blockading Britain. A further attempt to blockade Britain was carried out by German U-boats in an offensive against British merchant shipping. This proved highly effective with 2.3 million tons of Allied shipping being sunk in 4 months during 1917 (Friel 2003: 237).

In the Second World War With the defeat of France, Britain was put under direct threat of invasion from German forces. This invasion threat culminated in the Battle of Britain in which British airpower was seen to play a decisive role in preventing Hitler's invasion plan, 'Operation Sealion'. Although an invasion had been prevented Germany still attempted a blockade of Britain utilising aircraft, U-boats and the surface ships. Throughout this period numerous merchant and military vessels as well as aircraft were lost along the coast of Britain and within the English Channel. In 1944 the single biggest naval operation of the war took place, Operation Overlord, the Allied invasion of Normandy (Robin 2002: 34). Ships for the invasion force were based across the UK, although the most significant invasion ports were on the south coast including Falmouth, Newhaven, Plymouth, Portsmouth, Shoreham and Poole. At the end of World War II the Royal Navy had lost over 350 major warships, 1000 smaller vessels (corvettes, destroyers and frigates) and 74 submarines (Friel 2003: 249).

7.3.6.1 Recorded Losses

World War related losses make up significant proportion of the wrecks within the SEA8 area and provides a significant legacy for maritime archaeology. The Dover straits were a natural choking area for shipping and therefore it is not surprising that there is a large number of recorded losses, over 300 with approximately 11 are German submarines from both World Wars. Within the Wight area Portsmouth, Southampton and the Isle of Wight were heavily bombed due to the importance of its ports. The general area was used to base and deploy "D – Day" forces. Whilst a great deal of merchant shipping was lost, both to air, surface and sub surface forces, few naval vessels were lost, though approximately 10 submarines lye within the Wight area. The wreck of HMS *Warwick Deeping* lost in an engagement with four German torpedo boats, after having sustained a continued barrage of shelling lies in 36m of water south of St Catherine's point. This well preserved vessel provides an excellent example of the potential survival of wrecks even after sustaining substantial enemy fire.

Portland was an important harbour during the World Wars with many ships anchored in its harbour. However with the fall of France, Portland like Portsmouth and Southampton came under server German air attacks. As a result of this the anti-aircraft ship HMS Foylebank sank at her moorings within the harbour. Approximately 10 other British warships are recorded as being lost within the Portland area through German submarine attack or having struck mines. The Plymouth area also suffered heavily during both World Wars, with submarines and aircraft undertaking raids along the coastline and making shipping particularly hazardous. Of the approximately 500 recorded losses that occurred along this coastline 9 are submarines.

Within the Lundy area are approximately 400 recorded vessel losses. The majority of these are merchant vessels. Recorded military losses from this period include four submarines and several Royal Navy destroyers, one of which HMS *Montagu* although not lost in a naval engagement further demonstrates the nature of the archaeological material for this period. Built in 1901, HMS *Montague* sank on the 29th May 1906 after running aground in fog on Shutter Reef, Lundy Island. After efforts to re-float the ship failed it was salvaged. Although it had been salvaged there is still 2m high piles of armour plate amongst the scattered material.

7.3.7 Late Modern

Between 1945 and 1982 none of the Royal Navy's deployments had been against a serious naval opponent and no British warship have been sunk in action. Along the coastline of the SEA8 area there are no recent military losses. However there are significant vessels lost due to marine causes or sunk as training targets. Such vessels include the M1 and most recently HMS Sylla sunk as an artificial reef.

7.4 Ports and Harbours and Anchorages

Ports, harbours and anchorages, and their associated archaeological remains and traces, relate to the volume of shipping in an area. This section reviews the known and potential archaeological resource related to maritime infrastructure.

7.4.1 Bronze Age, Iron Age and Roman Period

Seafaring during the Bronze Age was undertaken using vessels that would have been beached (Section 7.1). These vessels therefore did not require any built structure on the shoreline and landing places would have been based on the suitability of the coastline and viability of inland trade. By the Iron Age and Roman period maritime installations included jetties, hards, docks, harbours and ports. The appearance of such formal landing places with waterfront structures occurred earlier in some regions than others (McGrail 1985: 12). During the Roman period there was a significant development in harbours, with ports such as London becoming a thriving commercial centre with quays and warehouses by the 2nd century where goods were imported and exported. However as mentioned by Tomalin (2006) the majority of vessels during the Roman period would have utilised natural harbours and favourable offshore anchorages. Due to this ephemeral nature of potential Bronze and Iron Age as well as Roman period landing places and vessels, it is only possible to infer their locations from similarly dated material found in coastal areas.

7.4.1.1 Dover

The Dover area is particularly rich in Bronze Age material, including finds of a vessel and hoard (Section 7.1 and 7.2). While during the Iron Age and Roman period the coastal belt was populated by strategically placed forts. Iron Age promontory forts within the Dover area include Hastings Castle and East Hill, while three more, Castle Hill, Seaford Head and Belle Tout were built on the downs where the chalk meets the sea. According to Tomalin (2006) a series of potential safe havens and anchorages that may have been used during the Roman period can be found at Folkestone, Hastings and Eastbourne. During the Roman period the main interest in Hastings was the presence of iron ore. The largest of these was at Beauport Park, also considered one of the largest in the Roman Empire employing up to one thousand men. This industry was supported by the port at Bulverhythe which is believed to be the original Hastings Port (Roman port).

7.4.1.2 Wight

The Wight area is significant for the amount of Bronze Age activity. Notable Iron Age ports within the Wight area occur at Green Island in Poole and at Hengistbury Head,

both important trading centres. During the Iron Age, Green Island acted as a hub for local and continental trade and probably controlled the imports and exports of the region. Timber pilings excavated from a deep layer of silt on the sea bed have been radio-carbon dated at 250BC and represent the oldest substantial port structures by several centuries anywhere on the British coast (Markey et al. 2002). This Jetty would have reached out into deeper water allowing access for larger vessels. Hengistbury Head with its rich iron ore deposits became a significant trading port, trading worked iron, silver, and bronze with the Continent in return for wine, tools, and pottery.

Iron Age port facilities which possibly comprise shallow dips where boats obtained flint/shingle for ballast are found within Christchurch harbour (Cunliffe 2001: 404). Further potential landing places could be found along the shores of Portsmouth, Chichester, Southampton and Langstone. The Isle of Wight with its rich Iron Age settlements would also have been populated with landing places along its shores (Trott and Tomalin 2003: 158). During the Roman period the Solent was known as Magnus Portus or Great Port, being an important area of trade for the Romans both before and after the Roman invasion of Britain (Tomalin 2000: 85). Roman ports have been identified at many places including Portsmouth, Southampton, Chichester and Langstone. Whilst several Roman villas with probable associated landing places have been identified along the shores of the Isle of Wight (Tomalin 1987). These ports would have served both a commercial and defensive role within the Roman Empire.

7.4.1.3 Portland

The Portland area is particularly rich in evidence for Bronze Age maritime activity with the two shipwreck sites of Salcombe B and Moor Sands. While analysis of an unworked piece of shale on the bottom of the Dover Bronze Age boat proved to originate from Kimmeridge Bay in Dorset (Clark 1997) situated some 300 kilometres to the south. Although no direct evidence for Bronze Age landing places exists it is certain that these areas were frequently visited in the Bronze Age. Shale mining at Kimmeridge continued from the Iron Age through to the Roman period, whilst further along the coastline at Portland Roman mining of Purbeck Marble was taking place. Evidence for this is found at several sites in Dorset, Weymouth, Poole and Silchester (Drury 1948). All such stone would have been transported by sea.

7.4.1.4 Plymouth

The presence of Bronze Age cairns along this coastline demonstrates the importance of the sea in the lives of the Bronze Age inhabitants (Fisher & Farrelly 1997). This is also true for the island community on the Isles of Scilly. During the Iron Age several trading ports were located at Mount Batten in Plymstock, Seaton and Axemouth. These ports continued into the Roman period as part of the Roman Empire trading in tin, cattle and hides. Further potential Roman port sites have been identified by Tomalin (2006) at Otterton point, Exmouth and Totnes.

7.4.1.5 Lundy

A large amount of evidence exists for Bronze Age settlement and maritime activity in the Bristol Channel. This includes two fragments of Bronze Age sewn boat planks (section 7.1). No physical evidence for landing places has been positively identified. There are also several coastal Iron Age promontory forts such as Chun, Cliff and Tintagel; Tintagel (MA 422) being an important port with trading links continuing into the Roman and post Roman period. Further along the South Wales coastline lie the promontory forts of Burry Holms and Sully Island. Several Iron Age and Roman settlement sites with associated with maritime links have recently been identified within the Severn Estuary (Rippon 1994). With the establishment of the twentieth

Roman legion in AD 49 at Gloucester, Roman vessels are recorded within the Bristol Channel. The first recorded major use of the estuary for trade was underway, with ports springing up on the Avon, Parrot and at Sea Mills, a Roman stores depot. Evidence for the possible type of vessels utilising the Bristol Channel was found close to the inland margin of the levels at Magor, Gwent (Section 7.1).

7.4.2 The Medieval Period

During the early and later medieval period informal beach landing places were still being used. Iconographic evidence for this can be seen in the Bayeux tapestry whilst archaeological evidence comes from the Graveney boat, which was excavated from such a landing place (McGrail 1998: 268). According to Hodges (1982) the earliest medieval town waterfronts were built in the ninth century and by the twelfth century most economic regions had at least one such port. In 1050 Edward the Confessor utilised the ports along the south coast to supply ships and manpower for the defence of England. The development of shipping in the late medieval period saw larger vessels with greater carrying capacity which subsequently required a greater depth of water for berthing. This was seen to have a major impact on smaller ports which were not able to supply deep water berthing facilities (Friel 2003: 70) resulting in fewer ports along the coastline.

7.4.2.1 Dover

The most important ports within the Dover area were the Cinque Ports, these included the ports of Hastings, Rye and Winchelsea. The Cinque Port of Hastings, already an important port when William the Conqueror landed there in 1066, soon became a premier port during the medieval period. At this time the port of Rye supplied approximately five percent of the ships for the Royal Fleet and was an important fishing village. Like many of the Cinque Ports during this period Rye was under constant attack by the French, and as a result Henry III ordered the building of Camber castle. At the height of Rye's prosperity approximately 300 – 400 ships were calling into the Harbour. In the 13th century numerous storms and a rise in sea level destroyed the port of Old Winchelsea which was replaced by the present day port of Winchelsea. This continued to prosper during the 13th century through its lucrative continental wine trade. Littlehampton was an important fishing village in the Middle Ages and was the main port of entry for Caen stone (Wheatley 2000: 106).

7.4.2.2 Wight

Ports within the Wight area include Portsmouth, Southampton and Poole, all of which had a significant role to play in medieval trade and warfare. Other ports within the area include Shoreham, Chichester, Portsmouth, Hamble, Lymington and others. Shoreham became one of the most important channel ports in the 12th and 13th centuries, exporting both wine and wool. However, its trade as a harbour and its usefulness for shipbuilding were subject to the drifting sandbanks in the area, which eventually lead to its decline in the 14th century. Chichester was a thriving centre for inland trade and became the tenth most important port in the country (Williamson 1998: 44). However as medieval trading ships grew larger the port of Chichester declined as their greater draft precluded them from entering the harbour.

Up until 1345 Portsmouth remained a relatively small trading port, unlike Southampton which was a burgeoning trading centre. Much like many of the Cinque Ports Portsmouth was frequently invaded by the French even though several attempts were made to fortify the harbour. With Henry VII's creation of a permanent Navy the first recorded dry dock in the country was created at Portsmouth. This and Henry VIII's development and fortification of Portsmouth harbour greatly increased its importance and prosperity during this period (Kitson 1947: 256). Throughout the medieval period Southampton had been a major naval, commercial and shipbuilding

port with strong trading links with the continent. In 1346 the port of Hamble supplied King Edward III with ships and men, and in return was granted a charter to trade with all merchandise. Throughout the medieval period it continued to function as an important commercial and shipbuilding port.

During the fifteenth and sixteenth century the Hamble was also used to lay up the Kings vessels that were not in service such as the *Jesus* of 1000 tons and the *Holigost* or 760 tons. During the fourteenth century Lymington was an important trading port second only to Southampton. Lymington's trade was mainly coastal and dealt with salt, wine, wool and fish. (Local history) On the Isle of Wight during this period there are several important ports namely Yarmouth, Newtown, Cowes, Ryde and Brading Haven. These ports were mainly engaged in coastal trade although some trade with the continent did take place. Several fortifications were built at Cowes and Yarmouth due to frequent raiding by the French in the fourteenth century. Wareham was the most important trading port within Poole Harbour and engaged in coastal trade transporting wool, wine and Purbeck stone (Drury 1948).

7.4.2.3 Portland

The importance of the port of Weymouth is seen in a local charter of 1252 which mentions how it supplied 15 ships and 263 mariners for the siege of Calais. The 15th century saw the port prosper as an embarkation point for pilgrims sailing to Spain. Situated at the mouth of the Axe estuary, Seaton was an important port for several centuries, supplying ships and mariners in the time of Edward I for his wars against Scotland and France. Exmouth's importance grew in the 1100's being part of the coastal trading network supplying various goods to Exeter and Weymouth. The port of Exeter saw a rapid growth in the 10th and 11th centuries functioning as a regional centre for much of Devon and Somerset, with its markets and fairs, town crafts and foreign trade. By the 1520s it was among the top half-dozen important English towns, after London, Norwich, York, Bristol and Newcastle. The foundation of this new prosperity was the Devon cloth industry which saw the exportation of cloth to France, the Mediterranean and the Low Countries (Munro 2005).

7.4.2.4 Plymouth

The Plymouth sea area during included several important ports notably Plymouth and Dartmouth. The earliest account of cargo leaving Plymouth dates from 1211, and for the next two centuries it flourished, particularly during the 100 Years War with France (Friel 2003: 65). As Plymouth's importance grew, so to did its trade with other English regions, the Baltic and Northern Europe. The port of Dartmouth also flourished during this period and was noted as an assembly point for the fleets of two crusades in 1147 and 1190. Founded in 1216, Penryn is one of Cornwall's most ancient towns, and was a port of some significance in the 15th century. By the 1600s, the port thrived on its trade in Cornish tin and copper. It is only later when Falmouth's importance grew and that Penryn's coastal trade slowly declined.

7.4.2.5 Lundy

Several ports rise in importance as trade within the Bristol Channel developed. Newport received its first Charter in 1385, although there is little documentary evidence for its importance. The discovery of a near complete sea-going vessel at Newport in 2002 however, provides the first hard evidence for Newport being a centre of industry and trade. The Newport ship is one of the most complete examples of a late medieval ship (Owain 2004) and gives us evidence of a busy estuary, with trading links to Spain and Portugal. The medieval port of Bristol saw a great increase in trade as commercial trade with Ireland and the ports of South Wales developed (Rawley and Behrendt 2005).

7.4.3 The Post Medieval and Early Modern period (1559 - 1914)

One of the most important developments during this period was the advent of the Industrial Revolution. This resulted in a substantial increase in coastal and overseas trade and the development of merchant shipping (Friel 2003: 154). This increase in trade and merchant shipping brought about many changes to the development of ports and harbours with the bulk of trade becoming concentrated in a small number of ports which underwent substantial re-development with dock gates, sluices and other port facilities being built. Further developments included dredging operations and other capital works to improve access for the new larger vessels with deeper draughts. In the late eighteenth century just over a hundred ports were legally engaged in foreign trade, with most of the trade concentrated in approximately one fifth of the ports (Friel 2003: 161). Further changes to shipbuilding occurred during the development of steam powered, steel hulled vessels. Those ports with access to a readily available supply of steel, coal and other raw materials were able to take advantage of this and soon grew into major shipbuilding yards.

7.4.3.1 Dover

During the Napoleonic wars several ports along the Dover area such as Eastbourne had large garrisons stationed there before they were transported abroad. Later with the development of ships several ports lost importance due to not being able to supply the necessary harbour and port facilities required. Environmental factors such as silting up and erosion played an important role in the fortunes of these ports. In 1807 an Act of Parliament was passed to build a pier and harbour at Folkestone and by 1820 this had been completed. Although plagued by constant silting, dredging operations and the construction of a railway freight line allowed Folkestone to become a principal port for continental traffic to Boulogne. Further developments along the coastline included an increase in the amount of visitors to these seafront resorts increasing their size and facilities.

7.4.3.2 Wight

Substantial developments occurred during the build up to the wars due to the increase threat of invasion. These include the development of shipbuilding centres and increased capacity of port and harbour facilities. Major military developments within the Solent occurred during 1859 with a Royal commission for the defence of Portsmouth Dockyard. This resulted in the construction of a series of Forts to defend against possible French invasion(Palmerston Forts). Portsmouth Harbour also saw substantial development as a major builder of warships (Friel 2003: 228). These increases in production lead to a substantial increase in the shipping visiting Portsmouth bringing supplies of iron and coal.

During the mid-sixteenth century trade to the port of Southampton had virtually collapsed (Wheatley1990: 97) due in part to the wars in Italy and the outbreak of war with France. After the Napoleonic wars Southampton developed into a major trade port with coastal and overseas links. In the early 19th century many new shipyards were built along the Itchen. With the advent of the paddle steamer Southampton became a major destination for people travelling to France and the Channel Islands. By 1830 approximately 100,000 people were travelling from Southampton by steamship every year. Further developments occur with the establishment of the White Star line and the development of trans Atlantic voyages from Southampton.

Poole harbour in the seventeenth century was a busy and thriving port with coastal and overseas links. By the nineteenth century however this dropped dramatically as vessels were not able to enter the shallow waters of Poole harbour.

7.4.3.3 Portland

Within the Portland area several ports attained importance during this period. The port of Weymouth was initially involved in substantial coastal and overseas trade to the Mediterranean and America. Later this trade declined. The importance of Lyme Regis, a sub-port of Exeter, was recognised when a Martello Tower was built there in the Napoleonic period. In 1660 Exeter itself entered a period of high prosperity and by 1700 the city was the fourth largest in Britain. The basis of this prosperity was the flourishing Devon cloth industry, and the development of a major new market in the Netherlands, especially Rotterdam (Munro 2005). In 1750 Exeter still ranked among the leading English cities and was still the centre of one of the country's most important industrial areas. Although it later declined in the nineteenth century, it still functioned as an important harbour for coastal and overseas trade (Munro 2005).

During the mid to late 19th century Portland Harbour saw substantial development. Construction of the modern harbour began in 1848 when the Royal Navy created a breakwater to the south of the anchorage. This was completed in 1872 creating a much larger harbour. In 1901 with the threat of torpedo attack from the eastern side of the anchorage, two more breakwaters were added.

7.4.3.4 Plymouth

The two most important ports during this period were Plymouth and Falmouth. Falmouth grew into an important town when given a charter by King Charles II in 1661. During the seventeenth and eighteenth century fishing played a major role in Falmouth, the third largest natural harbour in the world. Falmouth grew further as a major mail packet port in the eighteenth and nineteenth century and was also a major ship building area during this period.

The rise of Plymouth's importance is due to its geographical and strategic position. It subsequently became a crucial point for the assembly of the Royal fleets. On the basis of the Devon cloth industry, in the 1700's Plymouth became the fifth largest city in Britain. During the next three centuries it established its reputation both as a centre for voyage and discovery, transatlantic trade and military importance. Plymouth's military expansion began in earnest in 1670 with the building of a citadel. While in 1690 the first Naval Dockyard opened on the banks of the Tamar to the west of Plymouth. Further docks were built in 1727, 1762 and 1793, and a huge naval complex was later established. Plymouth's role during the war against Napoleon's France was pivotal, and in 1812 a mile-long breakwater was laid to protect the fleet. Throughout the nineteenth century the population and physical size of the towns increased dramatically. In 1824 Plymouth Dock was renamed Devonport, and in 1914 the three towns of Plymouth, Devonport and Stonehouse were united under the Borough of Plymouth

7.4.3.5 Lundy

The Lundy sea area saw a substantial increase in trade and consequently a growth in ports. With the Industrial Revolution the demand for coal dramatically increased the use of ports like Cardiff, Newport and Swansea. These ports undertook large developments in their berthing facilities and saw rapid expansion. Shipping during this period also underwent a hundredfold increase to take advantage of this lucrative trade, even with the dangers of the Bristol Channel. One in seven of all British shipwrecks up until the nineteenth century are calculated to have occurred in the Bristol Channel (Wheatley 1990: 145).

Cardiff's transformation with regards the coal industry is demonstrated by shipping records during this period with no record of shipping in 1806, this increased to 211,000 tons by 1829. By the mid 18th century Bristol became England's second

biggest city through imports brought in from the Americas. During this time Britain was flooded with goods imported via Bristol including sugar cane, tobacco, rum and cocoa, all of which were products of the slave trade (Rawley 2005). By the 19th century with larger ships unable to reach Bristol it began to decline, however this was short lived as shipping was diverted further down to Avonmouth.

7.4.4 The World Wars (1914 – 1945)

Ports during the two World Wars experienced considerable fluctuations based on the capabilities of ports to accommodate the ever increasing amount of shipping and the effects of enemy action. The First World War saw a substantial rebuilding programme for some dockyards whilst during the Second World War an even greater rise in dockyard activity occurred (Friel 2003: 266).

Trading patterns and port developments that were established in the nineteenth century continued into the twentieth century. However as oil gradually replaced coal boom towns such as Cardiff were hard hit as coal exports fell until coal exports ended in 1964. During the interwar period several ports saw increases in their trade with the growing sizes of cargo ships and liners influencing the growth of a smaller amount of ports.

7.4.4.1 Dover

During the World Wars Dover became one of the most important military centres in Britain. Ports along this stretch of coastline were used to ferry vast amounts of men across to France and provided a base for the support of shipping for various deployments including Dunkirk and the landings of D-Day. Various ports like Folkestone were seriously damaged during both World Wars due to enemy bombardment.

7.4.4.2 Wight

During the interwar period Southampton saw an increase in trade due to its ability to handle larger cargo ships (Friel 2003: 268). Further developments at Southampton included the development of a dry dock big enough for ocean liners which formed a large part of Southampton's economy (Local history). During the Second World War Portsmouth and Southampton suffered from heavy bombing, they both played an important role in supplying troops abroad and in the preparations for the D-Day landings.

7.4.4.3 Portland

Weymouth and Portland also played important roles in the World Wars. During the First World War, Portland Castle was a seaplane station and during the Second World War it was at the forefront of the massive preparations to recapture Europe. Weymouth was home to Nothe Fort, an important part of the D-Day preparations and bouncing bomb development. The Bouncing bomb was tested in the Fleet lagoon to the west of the town. Nothe Fort played an important role in World War II, when the harbour was used as a base by the British and American navies.

7.4.4.4 Plymouth

World War One had very little effect on Exeter, however during World War Two Exeter was quite heavily damaged by bombing. Plymouth and Devonport were both principal dockyards during this period and provided a staging post for the Normandy landings. Plymouth was heavily bombed during the Second World War which destroyed Plymouth's and Devonport's centres.

7.4.4.5 Lundy

Bristol and Cardiff both suffered heavy damage by bombing during air raids. During World War II, merchant navy vessels from countries such as America and Canada brought essential food, equipment, troops and fuel to England via Bristol. Bristol's position on the west coast of Britain made it an ideal place to receive and distribute this cargo but it also made Bristol a target for the German Luftwaffe. Shipbuilding and ship repairs also took place at Bristol docks during the war with several warships for the Royal Navy being built and many more repaired.

7.4.5 Late Modern

A short post-war shipping boom between 1918 and 1921 was soon followed by an economic downturn which saw a rapid decline in the British shipping industry (Friel 2003:277). This rapid decline in the shipping industry also severely affected many ports. With the advent of containerised shipping many ports were radically changed or replaced by facilities which could deal with bigger tankers and larger bulk carriers (Friel 2003: 279).

7.5 Aviation Archaeology Underwater

From the earliest experiments with flight in 1911-12, there have been large scale aerial operations over the United Kingdom. Many aircraft have been lost over water but little if any remains have recovered. Those that have been found in the marine environment highlight its potential as being better than that on land (EH 2002: 4). The preservation of aircraft crash site remains in the marine environment is due to a number of factors which have been outlined in a statement given by English Heritage,

"In general terms preservation is often best in waterlogged contexts, where anaerobic conditions slow the oxidisation of metals and allow the survival of organic materials such as wooden airframe structures, wooden and fabric coverings, parachutes, documents and clothing. Heavy clay soils also aid survival by sealing the debris in pockets of oil or aviation fuel, thus retarding deterioration" (EH 2002: 4).

Archaeological and documentary evidence for aircraft crash sites includes sites from the early 1900's to present day, the majority of which, however, are from the Second World War (Holyoak 2002). During the Second World War the English Channel and North Sea area saw a considerable amount of air activity in which several hundred aircraft were lost, the majority occurring during the Battle of Britain, 1940. Within the SEA8 area there are hundreds of recorded aircraft crash sites, the majority of which occurred close to the coastline. While the majority of the recorded aircraft crash sites from the Second World War are British there are also large amounts of German and American aircraft.

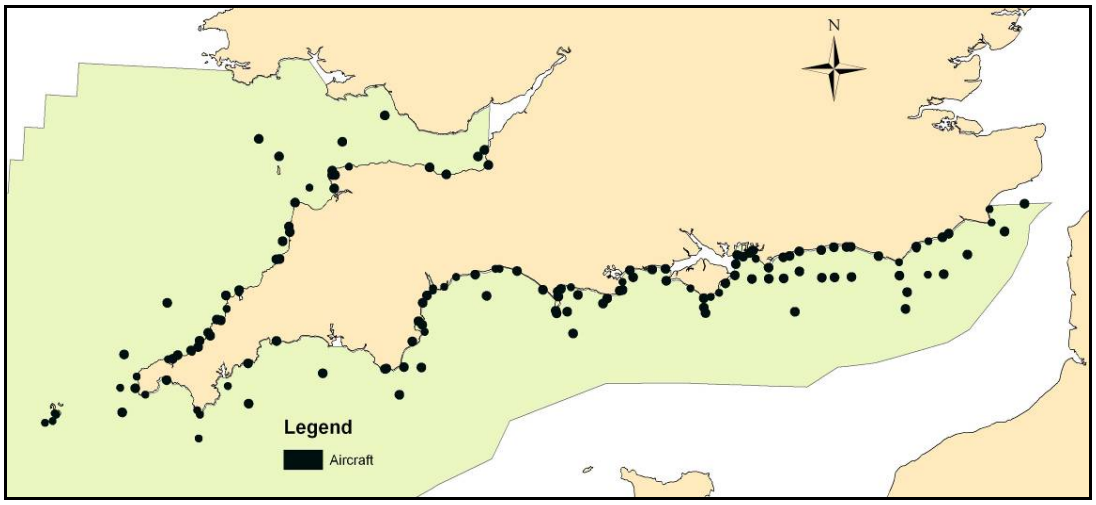

Figure 7.16 Distribution of documentary records of aircraft losses

Notwithstanding the nationality of these aircraft they are all protected under the Protection of Military Remains Act, 1986 and it is an offence to interfere with the wreckage without a valid licence.

Aircraft crash sites are listed within the National Monuments Record (NMR) however this record can be further augmented by local Historic Environmental Records (HER), websites and developer lead archaeological investigations in which previously unknown aircraft remains have been located (Wessex Archaeology 2005). The potential of locating hitherto unrecorded aircraft crash sites within the SEA8 area can be considered to be relatively high. This is demonstrated by the *BMAPA/EH Protocol for Reporting Finds of Archaeological Interest, 2005* in which a series of aircraft remains were reported during dredging operations.

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Although these finds were not made within the SEA8 Area they are representative of the types of finds that can be found (Wessex Aircraft).

The finds comprise a selection of aluminium parts an aircraft pedal and lamp. The pedal was found to be engraved with the logo for the North American Aviation Company which produced the P-51 Mustang fighter and the B-25 Mitchell bomber. Additional finds were of two parts of a rear wing spar. These were identified as the remains of a Supermarine Attacker, the first jet fighter to be deployed by the Royal Navy. Due to the known high potential for underwater aircraft crash sites, they provide an important resource in understanding Britain's aviation history. This has

been recognised by English Heritage whom have created a series of criteria to identify their historical significance,

"English Heritage recognises the importance of sites in terms of survival, rarity or historic importance, and would wish to minimise unnecessary disturbance to examples that meet a combination of the following criteria:

- The crash site includes components of an aircraft of which very few or no known complete examples survive. Examples of the commonplace may also be considered of importance where they survive well and meet one or more of the other criteria.
- The remains are well preserved, and may include key components such as engines, fuselage sections, main planes, undercarriage units and gun turrets. Those crash sites for which individual airframe identities (serial numbers) have been established will be of particular interest.
- The aircraft was associated with significant raids, campaigns or notable individuals.
- There is potential for display or interpretation as historic features within the landscape (for example as upland crash site memorials), or for restoration and display of the crashed aircraft as a rare example of its type.

In general terms, sites meeting any three of these criteria are sufficiently rare in England to be considered of national importance."

The criteria and further notes on guidance relating to military aircraft crash sites is given in *Military Aircraft Crash Sites Archaeological guidance on their significance and future management* (EH 2002).

7.6 Environmental Factors Affecting the Preservation of Maritime Archaeological remains

The environment in which maritime archaeological remains are lost has a significant impact on the state of their preservation. The deposition of material on or within the seabed is subject to a complex array of environmental factors that have a long-term influence on the archaeological resource. Study of the wrecking process is commonplace however, the study of post-depositional processes and long term monitoring of sites is still a developing discipline. This section reviews the principle factors influencing maritime archaeological remains within the SEA8 area, drawing on a number of sites as examples and case studies. It is also worthy to note that the environmental factors affecting the preservation of more recent maritime archaeological remains differs from those affecting prehistoric remains (Section 6.4). This is due in part to the nature of the material and the circumstances in which these remains entered the archaeological record.

7.6.1 Circumstances of loss

The circumstances in which marine archaeological material enters the archaeological record is extremely varied and based on several natural and anthropogenic factors. Those that influence the circumstances of loss can include incidents such as fire, foundering, collision, violent engagement and abandonment of vessels. Natural hazards include the physical nature of the seabed, meteorological and oceanographic conditions. The circumstance of loss affects the material that is deposited within the archaeological record and what will survive.

The circumstances in which maritime archaeological material is lost has been the focus of a Project undertaken in the Solent by Bournemouth University titled "Navigational Hazards" (Merritt *et al* 2007). This project identified and characterised

areas exhibiting trends in shipping losses due to meteorological, navigational, and natural hazards.

7.6.1.1 Meteorological Conditions

The climate within the SEA8 area is predominately maritime temperate. This climate comprises moist, warm and predominately south westerly winds, which influence both the sea state and visibility along the coastline (MET Office). Channelling and shifting of winds within areas of narrowing landmasses and peninsulas can generate localised adverse conditions and create ship traps (Merritt *et al* 2007). Along the coastline these areas are identified by an increase in the amount of shipping losses. An example of this can be seen at the Needles where the two protected wrecks of *HMS Pomone* and the *Assurance* are found (Tomalin *et al* 2000) along with the scattered remains of vessels from a range of periods both historic and modern.

These warm moist winds also generate areas of fog, reducing visibility near landmasses such as the Scillies and Lundy which can also result in substantial shipping losses. Such losses can be due to strong south westerly winds, which have driven ships onto lee shores. These factors have a significant impact on the clustering of shipwrecks in areas which are adversely affected by these prevailing winds such as the Scillies, Isle of Wight and in particular the South West coastline. These winds also have a great effect on the wave and tidal regimes within the SEA8 area (considered in section 7.6.4), which in turn influence the clustering of shipping losses.

7.6.1.2 Navigational Hazards

A navigational hazard can be defined as any obstacle encountered by a vessel *en route* posing risk or danger to the vessel, its contents or the environment. A substantial proportion of these hazards can be related to the presence of natural features such as sandbanks, reefs, islets, headlands (Figure 7.17), areas of turbulent water and strong tidal currents.

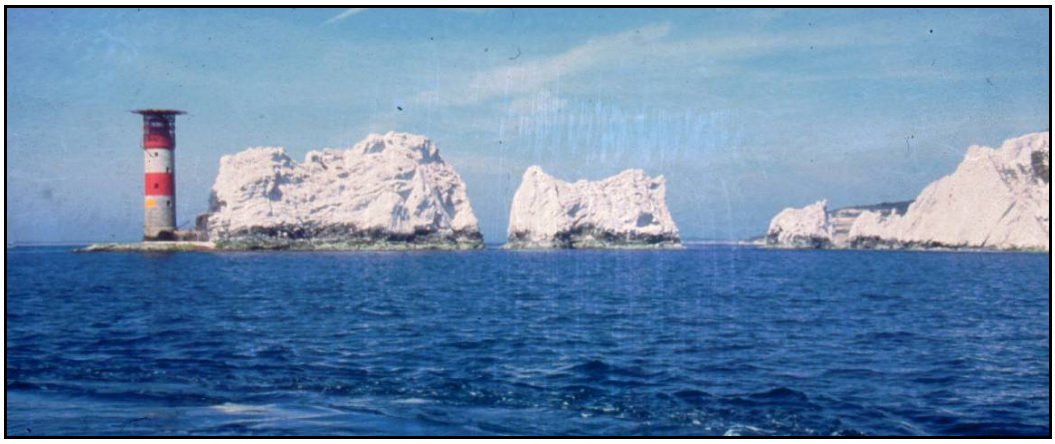

Figure 7.17 The treacherous chalk stacks of the Needles at the entrance to the Western Solent

There are several areas within the SEA8 zone which are known navigational hazards and which have resulted in hundreds of vessel losses through time. Particularly important natural hazard areas include the Cornwall Peninsula, Isles of Scillies, Lundy, Bristol Channel, Eastern Solent, Beachy Head and Dungeness (Figure 7.18). The identification of these areas was undertaken by identifying clusters of recorded vessel losses as supplied by the NMR and RCAHM. For the Solent theses results

were further augmented by findings from the Navigational Hazards Project undertaken by Bournemouth University (Merritt *et al* 2007) which has helped in determining areas in which environmental factors have created a higher incidence for shipping losses. These areas identified are those where there is likely to be a high occurrence of archaeological remains on the seabed.

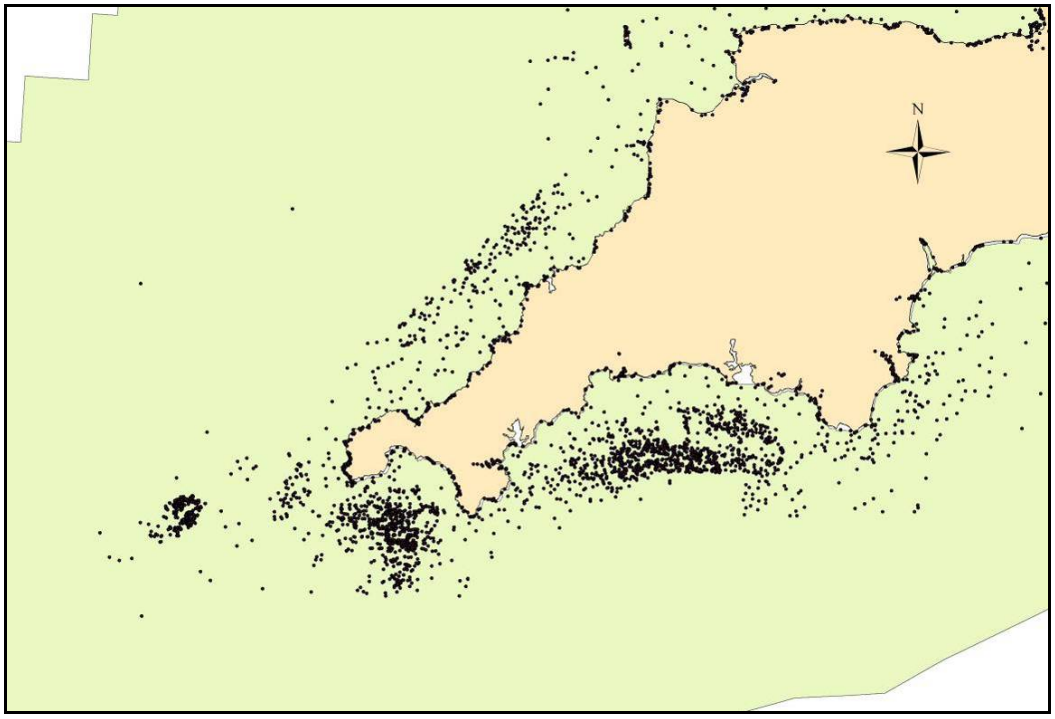

Figure 7.18 Image showing the distribution of shipping losses, which cluster around navigational hazards, particularly near the coast.

7.6.1.3 Anthropogenic Hazards

A vast amount of the recorded shipping losses within SEA8 are the result of anthropogenic causes, whereby the sinking of a vessel has been brought about by the actions of another vessel or craft. The SEA8 area was the theatre for numerous large scale sea battles that took place along the coastlines from Plymouth to Dungeness. These include Britain's first use of sea power in which King Alfred, in 897 AD confronted and cleared the Danes out of Exeter (Wheatley 1990: 116). Further major battles as outlined in Section 7, occurred off Plymouth, Portland, Isle of Wight and the Solent, Beachy Head, Dungeness and indeed much of the English Channel.

The effects of shipping lost during warfare would differ according to the period and type of vessel. Wooden vessels lost during the age of sail were generally holed and capsized, sinking with a great deal of the ship remaining intact. In some cases the vessels would have been set alight, either through enemy action or by the crew themselves, burning to the waterline before sinking. The *Anne* off Petts Level, Hastings is a good example in which, after the battle of Beachy Head, being significantly damaged was burnt to avoid enemy capture, only few timbers survived above the waterline when it sank (Marsden 1977: 11).

With the advent of explosive ordinance the remains of shipping losses from enemy engagements resulted in large areas of structural damage. The nature and extent of

the damage was dependant on the nature of the attack, whether by a U-boat or aircraft. Torpedoes would have struck below the waterline causing damage low in the hull whilst a bomb dropped into a vessel results in significant upper structural damage. There are numerous examples of these vessels throughout the SEA8 area which demonstrate the nature of the damage these methods of attack would have inflicted.

7.6.2 Wrecking Process and Taphonomy

Although the areas in which shipping losses are likely to occur can be mapped, the amount of surviving archaeological material is dependant on the wrecking process of individual ships. According to Muckelroy (1978) the wrecking of a vessel constitutes a singular deposition 'event'. The assemblage forming the original ship's structure and contents is transformed through interaction with the environment from an organised but dynamic state, to a disorganised but stable form. The wreck event also equates to the move from a systemic to archaeological context (Schiffer 1987).

Cultural and natural forces then act upon the archaeological material rearranging patterns, including later deposition of unrelated material on the site. The changes acting upon the archaeological material involves physical, biological and chemical processes. These changes in the shipwreck material and seabed movement have been extensively investigated in several site formation studies seeking to understand the taphonomy of wreck sites (Murphy 1997; Stewart 1999; Wheeler 2002; Trembanis 2006).

Taphonomy is the study of those changes which occur to material once it has been buried (either deliberately or accidentally). Archaeological deposits may subsequently be covered by deep sediments which are protected or eroded by rivers, beach waves, storm waves, or tidal currents. These may also be chemically altered or disturbed by trawling, dredging, entrenching, or drilling. The survival of archaeological material or sites is a complex process, and there are a number of inter-related factors which require consideration.

7.6.3 Physical seabed conditions affecting preservation

The physical conditions on the seabed are a dominant factor in the long term preservation potential for maritime archaeological remains. This section considers these conditions and draws on geological data for the SEA8 area, which has been described in Section 5.2. It also utilises data from two broad scale shoreline management studies. The *Coastal Sediment Transport Study* undertaken by Standing Conference on Problems Associated with the Coastline (SCOPAC) provides a spatial map of sediment types and movement. The study relates to the coastline of central-southern England, between Lyme Regis, Dorset and Shoreham-By-Sea, West Sussex. Defra's *Future Coast Study* includes mapped data covering the onshore and offshore geology, bathymetry, seabed sediments and sediment transport regimes. The study also provides an overview of the hydrodynamic processes for both offshore and near shore areas. These reports provide clear and concise references for determining coastal processes which affect the physical seabed conditions throughout the SEA8 area.

7.6.3.1 Geology

Understanding the offshore geological processes is vital, as they represent a major control underpinning topographic, geomorphological and sedimentological processes. The underlying geology on which a wreck site is located is an important factor in determining potential for the survival of archaeological material.

Offshore Bedrock Geology of the seabed between Folkestone and North Foreland comprises Upper Cretaceous Chalk, with a small outlier of softer Tertiary rocks (Woolwich and Thanet Beds) extending a short distance eastwards into Pegwell Bay. Approximately 16km south of Beachy Head, Upper Cretaceous Chalk passes southwards into a Lower Tertiary sequence of clay, silt and limestone that occupies the extensive Hampshire-Dieppe Basin (Hamblin et al. 1992). The softer geological nature of the seabed in these areas is easily eroded; this can provide volumes of sediments. It also allows shipwrecks to work their way into the geological deposits, which affords them some protection and preservation potential.

Further along toward the south west of England and Wales the geology is formed of resistant carboniferous limestone and Palaeozoic or older rocks. Highly folded slates, commonly with hard sandstone intercalations, are the most common lithologies, and these contain numerous igneous intrusions ranging in size from thin dikes to major granite bodies such as the Isles of Scilly (BGS, 1985). These areas of resistant bodies of igneous rock contain a limited amount of sediments and consequently provide lower preservation potential for archaeological remains.

7.6.4.2 Sedimetology

As mentioned in Section 6.4 the British Geological Survey (BGS) produced a series of seabed sediment maps for the UK Continental Shelf at a scale of 1:250,000. These maps, and the associated cores, are an essential tool for assessing the archaeological potential and sensitivity of areas of the sea floor. They provide classification of surface sediments by grain size, thickness of active marine sediments, thickness of Holocene deposits, standard cross-sections, information on tidal currents, sand waves and sand ripples, carbonate percentage, and other items of varying information.

A recent study on the effects of sediment type on the preservation of archaeological material was undertaken as part of Bournemouth University's *Mapping Navigational Hazards as Areas of Maritime Archaeological Potential*. Utilising sediment maps from the BGS offshore data and other seabed classification systems, 26 sediment types were identified (Gregory 2006: 2). These were then given a ranking based on the possible preservation potential of these on submerged archaeological material. As a result of this a table of sediment type and preservation potential was drawn up identifying the sediment types more likely to preserve archaeological material. This demonstrates that archaeological material within sediments of mud or sand had a higher preservation potential than those within gravel or rock deposits (Gregory 2006: 14). Through using this model, areas of high potential for the preservation of archaeological material were identified by the sediment types within which they lie.

Within the North Foreland to Beachy Head area the convergence of regional sand transport has led to the accumulation of sand into linear tidal ridges which lie in the offshore zone between Folkestone and Hastings (BGS, 1989 and 1990; Hamblin et al., 1992). These ridges of sand are likely to represent areas in which wreckage material is likely to survive. Examples of this can be seen in the Goodwin Sands where several wrecks including the *Stirling Castle* have survived relatively protected.

From Beachy Head to Portland Bill the seafloor sediments are dominated by gravels deposits of generally less than one metre (Hamblin et al., 1992). There are few sandy sediments within this area and those which do exist are generally found in the more sheltered areas such as Poole and Christchurch Bays and the Solent. In this instance sediment in offshore areas provide a potentially lower degree of protection than those near shore. Examples of well preserved sites in the near shore zone include the

Studland Bay and Swash Channel wrecks just outside Poole Harbour and the *Mary Rose* within the Solent.

Offshore sediments between Portland Bill and Start Point are mostly less than one metre thick over the whole of the offshore area (Hamblin et al., 1992) and in many places bedrock is exposed on the sea bed (BGS, 1983). While sediments within the near shore zone become progressively mud-rich from the east to the west (Kelland, 1975). Within the inshore zone are sites such as the Salcombe cannon site which was discovered when sediment movements uncovered the wreck site.

Sedimentological data for the south western area of the SEA8 coastline has been taken from the maps published by the British Geological Survey (BGS 1983 and BGS 1987). Seabed sediments across the area are generally very thin because the bedrock is resistant and therefore slow to erode and has limited glacially-derived sediment in the region, either onshore or offshore. This provides less protection for archaeological material along this stretch of coastline, although pockets of sediment are likely to exist in hollows in which wreckage has a higher potential for survival. This is demonstrated by a number of sites including the wrecks of Tearing Ledge, Little Gannick and the *Colossus* off the Isle of Scillies which show the potential for survival in areas with little sediment covering (Larn *et al* 1985).

The Bristol Channel seabed area is covered by a variety of unconsolidated sediments but extensive areas are devoid of such sediment and bedrock is occasionally exposed at the seabed. Extensive areas of rock are exposed across the channel off the South Glamorgan coast due to the removal of sediment accumulations by tidal currents. Lundy Island presents an obstacle to tidal flows and has led to the formation of two sand banks off the north-western and north-eastern shores of the island (BGS, 1983). While little protective sediments are available within the channel and offshore areas, the near shore and sand banks are likely to have potential for survival. Examples are seen along the banks of the Severn Estuary where fragments of Bronze Age boat remains from Caldicot and Goldcliff have been excavated and off Lundy where the Gull Rock wreck and *Iona II* survive (Section 7).

Care should be taken when utilising broad scale BGS mapping as there are some limitations based on the extent and nature of these mapped sediments. While broad scale sediments reflect a general overview, areas within gravel deposits or bedrock could contain sand or mud deposits such as areas in which geological hollows occur. This change in the general sediment regime is particularly relevant within the near shore zone where waves and tidal currents can further influence the nature and extent of sediment deposition.

Several studies undertaken have shown that, although the nature of the sediment is important there are numerous additional factors that need to be taken into account when determining the preservation of wreck sites (Quinn *et al* 2000; Palma 2005 and McNinch *et al* 2006). These factors include the pre- and post depositional processes, oceanographic conditions and the mobility of sediments.

Case Study: Warship Hazardous

Le Hazardeux was built in 1698 in France. The vessel was a 3rd rate ship of the line in the Navy of Louis XIV. In 1703 the ship was captured by the English and refitted as a 4th rate ship of the line with 54 guns. In poor weather *Hazardous*, following the lead of *Warship Advice*, was forced to head for shelter in the Eastern Solent off Bracklesham Bay where *Hazardous* was wrecked. The wreck was designated in 1986 under the Protection of Wrecks Act 1973 and is now managed by English Heritage.

The site of *Warship Hazardous* has undergone approximately 20 years of diver survey; several site plans have been drawn and artefacts recovered. Over recent years sediment levels around the site have been monitored by the Hazardous Project Group. This data was incorporated into a study of the environmental factors affecting the site which sought to quantify the loss of cultural material (HWTMA 2006). This quantified the extent and rates of erosion to enable future management approaches to be formulated. Site data included archival archaeological photography, monitoring points, artefact distribution and diver observation. Environmental data included the coastal environment of the on, near and off shore zones including data on sediment transport, hydrodynamic processes, beach monitoring and historical charts.

Through analysis of the various archaeological and environmental data sets several long term hydrodynamic and sedimentological processes were recognised. Analysis of these processes has assisted in identifying those factors which have the greatest effect on the survival of the site. This has also provided further information for the formulation of a management plan to provide long term protection for the site.

7.6.4.3 Sediment Transport

Sediment transport arises from the application of hydrodynamic force to mobile sediment particles and is primarily influenced by sediment type, currents and waves. Around the coast of the UK, the relative importance of these factors varies with currents tending to be more important offshore, whilst waves are more dominant in shallower nearshore areas (Pingree and Griffiths, 1979: McCave, 1987; Grochewski *et al*, 1993, 1994; ABP Research, 1996; Velegrakis *et al*, 1997; UKDMAP, 1998; ABP Research & Posford Duvivier, 2000).

The key features of the offshore sediment transport around the SEA8 section of England and Wales are that sediment pathways follow the large scale orientation of the coast. Within the English Channel there is both a westerly and easterly transport and along the West Coast, southerly and south-westerly transport of material is predominant. Near shore sediment transport around England and Wales is governed by the predominant wave directions.

The effect of sediment movements on the preservation of wreck sites has been demonstrated through several recent studies on Protected Wreck Sites, namely the *Stirling Castle* (RASSE 2006), *Royal Anne Galley* (Camidge 2006) and the *Warship Hazardous* (HWTMA 2006). A Rapid Archaeological Site Survey and Evaluation (RASSE 2006) project was undertaken on behalf of English Heritage by the University of St Andrews. This project utilised high-resolution sonar for the archaeological investigation of the wreck site of the *Stirling Castle* and mapped sediment movements between 2002 – 2006 (Figure 7.19). Analysis of the changes in sediment profile around the site indicated that there had been a general accretion of sediment although to the east scouring had begun to threaten the site. These changes are believed to be related to changes in the sediment movements influenced by nearby shingle banks (RASSE 2006).

Figure 7.19 Swath bathymetric survey is being used to monitor sediment movements around the Protected Wreck Site of the Stirling Castle. (Copyright RASSE. Reproduced with permission)

7.6.4 Oceanographic conditions affecting preservation

Oceanic conditions play an important role in the dynamics of a site in influencing the movement of sediments and archaeological material.

7.6.4.1 Waves

In any one area the wave climate is the summation of locally generated wind waves and swell waves. The motion of water beneath a wave causes wave generated currents, which decreases with depth. Whilst the influence of waves is generally more important in shallow water, large storm waves can influence bottom velocities at depths of 160-200m in some areas (Kenyon and Stride, 1970).

Within the SEA8 area the highest wave heights occur on the West Coast with the dominant wave directions coming from the west and southwest on the West and South Coasts. On the East coast the dominant wave directions are from north - northeast. Nearshore wave conditions are variable, in part due to the indented nature of the coastline, shelter provided by islands, and the nature of the sea floor topography (Ramsey and Brampton, 2000).

These wave climates play an extremely important role in the survival of wreck deposits in the nearshore zone. Waves influence seabed sediments through generating currents which can cause scouring of the seabed. Studies undertaken by the HWTMA (2006) on the environmental effects on the Warship *Hazardous* have demonstrated the severe erosive effects that the wave climate during winter storms can have on the survival potential for a wreck site.

7.6.4.2 Tides

The coastlines of England and Wales are subjected to an Atlantic tidal wave, which enters the seas around the UK from the north and southwest. It then propagates southwards down the East Coast and Irish Sea; northwards into the Irish Sea and eastwards into the English Channel (UKDMAP, 1998). As the tidal wave passes across the continental shelf, interactions with the sea bed and landforms produce regional variations in both elevation (tidal range) and displacements (tidal currents). The frictional loss of tidal energy on the seabed results in large-scale sediment movement with areas being scoured to expose bedrock. These tidal streams interact with sediment movement and can cause scouring of areas which could reduce the potential for the survival of archaeological remains.

7.6.4.3 Bathymetry

The UK is located on the northwest corner of the European Continental Shelf where water depths are generally less than 300m. Around the coastlines of England and Wales, the main features of the bathymetry are nearshore water depths generally less than 50m. The deepest areas of nearshore water (>100m) are found offshore on the South Coast to the west of Start Point, and also on the West Coast off the western most tip of Wales. Off the West Coast, the Celtic Sea is characterised by a deep (100-200m) channel running north-south and off the South Coast, the western half of the English Channel is characterised by a fairly deep (100m) central channel which runs (and shallows) in a west-east direction (Futurecoast).

The bathymetry of the SEA8 provides further information on the potential for survival of archaeological remains. By identifying deeper areas it is possible to identify those sites which are less likely to be affected by hydrodynamic processes which can scour and disturb archaeological remains. The depth of wreck sites also has an influence on their disturbance by sports divers although with the extended range of technical divers this situation is changing. The depth of the archaeological resource also affects the biological and chemical conditions influencing the preservation of sites.

7.6.5 Biological and chemical conditions affecting preservation

The influence of biological processes on the archaeological resource has been the subject of a limited number of studies. These have mainly concentrated on the burrowing micro and macro fauna have on archaeological sites (Ferrari et al. 1990). Further research into the effects of micro fauna on wooden archaeological remains has been studied in the Monitoring of Shipwreck Sites (MoSS) project. Phase I of this project involved the monitoring of the various physical, chemical and biological factors that helped identify potential threats to buried and exposed archaeological material (Palma 2005). The biological aspects researched were the presence and activities of bacteria and marine fungi as well as that of wood boring animals which affected the survival of archaeological material. The results of this project further demonstrated the degree of biological attack on sites with aerobic and anaerobic conditions (Palma 2005: 331).

Further influences on preservation potential are the chemical processes which affect archaeological material. This has been studied for both metal (Fox 1994; Robinson 1982) and wooden archaeological remains (Gregory 1998).

7.7 Summary of factors favouring high maritime archaeological site potential

This section brings together the factors favouring both the occurrence and preservation of maritime archaeological materials in the SEA8 area. Due to the nature of the available evidence relating to shipwreck remains and losses some bias within this record must be recognised as the distribution of known sites is largely related to areas which have been intensively surveyed.

The areas in which there is a higher occurrence of shipping losses are:

- Areas where environmental factors have created navigational hazards. Such hazards would include submerged reefs, shallow sand banks or windward shores.

- Areas where anthropogenic factors have contributed to a higher incidence of loss. These would include the location of sea battles or water-ways where the loss of shipping during the two World Wars has been caused by mines,

submarines or other discrete enemy action. These losses show less patterning in their number and distribution.

Those factors which favour the preservation of maritime archaeological material are dependant on several interrelated conditions. One or more conditions may be present to provide protection for remains. Those factors favouring the preservation would include many of those outlined in Section 6.5 for prehistoric material in addition to:

- Areas where geology erodes readily, this would favour the burial of material
- Areas in which muddy, sandy sediments exist provide the highest preservation potential for archaeological material
- Minimal sediment movement, areas in which sediments remain relatively static would favour burial and preservation
- Minimal wave and tidal movement, these factors would influence the dynamics of sediment movement causing scouring
- Depth, the depth of a site influences its preservation potential in terms of the lack of sediment movement on the seabed and lack of aerobic conditions favouring biological interference

8. Oil and Gas Activity

This section reviews the potential impacts on the marine historic environment in terms of possible physical effects and considers opportunities provided through the various phases of survey and exploration for oil and gas activity. These activities have the potential to impact on the archaeological resource from the initial exploration phase through to the production and de-commissioning phases.

8.1 Opportunities

Oil and gas activities on the seabed can provide opportunities for archaeologists to understand the nature and extent of marine archaeological material. This section outlines the various methods which are utilised by oil and gas companies which can also be used by archaeologists to understand the cultural resource. Information on oil and gas methods and procedures has been drawn from the UK Offshore Operators website (www.oilandgas.org.uk).

8.1.1 Seismic Survey

In an effort to detect the presence of hydrocarbons within different rock strata seismic survey methods are employed. These methods utilise an airgun device to create a shockwave and hydrophones to measure the signal. This method penetrates the seabed revealing geological stratigraphy. Seismic surveys undertaken generate interpreted sections showing geological structure which can include sedimentary details, these are mapped to show the thickness of the layers and deposits. These seismic surveys provide an opportunity whereby past landscapes could be identified and mapped as well as providing further information on buried archaeological material. This potential has been recently demonstrated through the North Sea Palaeolandscapes project (see case study).

Case Study: The North Sea Palaeolandscapes Project

The North Sea Paleolandscapes project utilised a variety of geophysical data sources gathered by the oil and gas industries, in conjunction with geological BGS map data. This data was used to generate a regional model for the Late Quaternary and Holocene period. It also allowed for a better understanding of this period when the Channel was extensively populated by humans before being inundated during the Mesolithic as a consequence of rising sea levels. This data provided a framework for the further integration of shallow borehole, environmental and shallow (high resolution) geophysical data for the purposes of geological and archaeological interpretation.

This project has also assisted in the characterisation of the environmental, archaeological and geomorphological resource of the study area. It has also demonstrated the methodological and technical development in remote sensing, in particular the potential use of extensive 3D seismics for the purposes of maritime heritage management. The baseline data generated will also be able to be utilised to assist effective aggregate extraction and future management of the archaeological and environmental resource contained within the Southern North Sea (North Sea Paleolandscapes 2006).

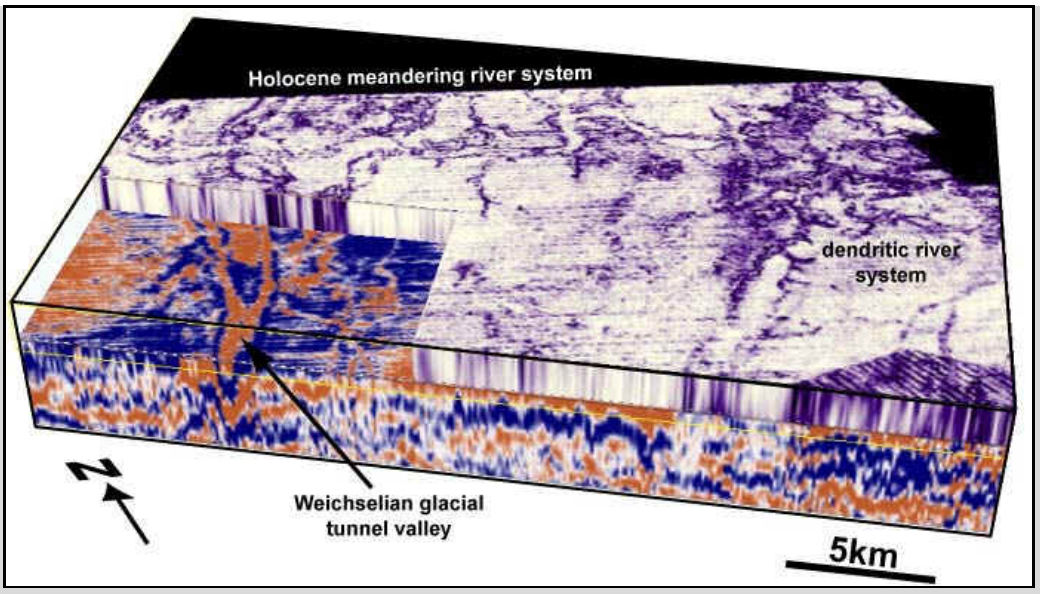

Figure 8.1 – Seismic data cube illustrating chronostratigraphic relationship between Holocene and earlier features (North Sea Palaeolandscapes Project, Reproduced with permission)

8.1.2 Borehole and Grab Sample Survey

Borehole and grab sample surveys are generally conducted to ground-truth seismic survey results and obtain data which can provide details of the structure and nature of the sediments or rock. Boreholes can potentially provide important evidence for the remains of former submerged archaeological landscapes and sites. While grab samples can provide important evidence for archaeological sites and material by chance finds of shipwreck debris, prehistoric artefacts and outcrops of peat deposits.

8.1.3 Bathymetric and Sidescan Surveys

Bathymetric and sidescan surveys are utilised by the oil and gas industry to locate hydrocarbon reserves by mapping of the seabed. These surveys are also used in the planning of subsea structures by highlighting artificial and geological obstructions on the seafloor. Where these surveys are carried out with sufficient resolution it is possible to utilise the generated data to identify shipwreck remains or anomalies with archaeological potential on the seabed.

8.1.4 Magnetometer Survey

Magnetometer surveys enable the location of metallic/ ferrous material which lies on or near the surface of the seabed. A magnetometer survey is normally undertaken prior to oil and gas developments in an effort to locate obstructions such as previous pipelines, cables, anchors, unexploded ordnance and shipwrecks. Magnetometer surveys can provide an additional source of information for the identification of metallic/ ferrous material associated with shipwreck sites and anomalies with archaeological potential.

8.1.5 Diving Operations and Remotely Operated Vehicles (ROV)

Diving operations are undertaken at various stages throughout oil and gas activities and are likely to be related to a specific area of the seabed which will be impacted by subsea activities. Where diving operations are not possible due to depth or other constraints an ROV is utilised instead. Observations by divers or from ROVs can provide information on the nature and extent of the archaeological resource and assist in decisions regarding the potential impact of subsea activities.

Case Study: The Ormen Lange Marine Archaeology Project
The Ormen Lange Marine Archaeology Project demonstrated the opportunities which for undertaking archaeological research in combination with the oil and gas industry. In 2003 Norwegian University of Science and Technology (NTNU) discovered an historic shipwreck close to one of the planned Ormen Lange gas pipeline routes. Since the shipwreck was protected under the Law of Protection of Cultural Heritage, additional investigations of the wreck site are necessary before the pipeline could be installed (Jasinski 2004). Utilising bathymetric and sidescan sonar data a clearer picture of the nature and extent of the wreck site was developed. Due to the substantial water depth of 160 to 200 meters an ROV was used for further investigations. The ROV conducted all mapping, surveying, sampling and excavation of the shipwreck. In 2005 the team used this advanced technology to completely document and excavate the site. The Ormen Lange project is the most technologically advanced underwater archaeology project ever undertaken, and the first archaeological shipwreck excavation in deep water (NTNU 2005).

8.2 Impacts

Potential impacts related to the oil and gas industry will be dependant on the nature of the activity undertaken during exploration, production and de-commissioning phases.

The definition of impact within the EIA Directive is:
"an action which causes damage to the surrounding environment" (EIONET)

The assessment of such impacts and their potential effects is undertaken as part of the EIA process. This section includes some commonly encountered impact situations within the marine zone which could be associated with oil and gas activity.

Impact can be 'direct' or 'indirect', and the resulting effects on the historic environment can be negative, neutral or positive. Examples of impacts include:

Direct Impact – disturbance of sites, finds and deposits related to cultural heritage through the physical disturbance of seabed material. This may result in any of the following effects:
• Physical damage to a site and its related deposits
• Physical damage or disturbance to the archaeological context of a site and its constituents
• Destabilisation of deposits surrounding sites
• Erosion around sites which could prompt long term damage

The effects of direct impacts are often adverse in relation to cultural heritage, although there are instances where beneficial effects can be gained (e.g. burial and stabilisation of sites of archaeological significance).

Secondary Impact – direct impact work can result in 'knock on' effects on sites of archaeological potential. These can include:
• Promotion of the movement of sediments resulting in the exposure of sites, finds or deposits
• Changes in the hydrodynamic regime which induces erosion or scour
• Introduction of chemical and biological changes to sites and deposits

Again, the effects of secondary impacts are often adverse. An example of potential beneficial secondary effect might be the changes in a hydrodynamic regime causing siltation over a sensitive archaeological site.

8.2.1 Exploration

During exploration non-intrusive geophysical survey techniques are used to locate and quantify the hydrocarbon resources. The data gathered can provide useful information on the archaeological resource by providing information on the presence/ absence of archaeological material or deposits. Exploration activities which may have an impact include:

Boreholes and Grab samples: potential impacts on the archaeological resource are likely to be localised due to the penetration of cultural material and sediments. Grab sampling does not penetrate deeply into the seabed, however, where archaeological material lies on or just beneath the seabed some impact may occur. Additional localised impacts may occur during the borehole operations when vessels such as a jack-up barge are used.

Diving Operations: Diving operations have a significant role to play throughout the various stages of oil and gas activity. Potential impacts are likely to be limited although the mooring of support craft could impact the archaeological resource.

8.2.2 Drilling

There are two basic types of drilling rigs, fixed platform rigs and mobile rigs. Fixed platform rigs are installed on large offshore platforms and remain in place for many years. These are mainly used on the large fields in the North Sea. Mobile rigs comprise of the jack-up rigs used in shallow water less than 100 metres deep and semi-submersible rigs used in deeper waters down to 1000 metres or more. Where depths exceed this drilling ships are used.

Jack-up rigs have lattice legs which are lowered to the seabed before the floating section carrying the derrick is raised above the sea surface. Semi-submersible rigs float at all times, but when in position for drilling are anchored and ballasted to float lower in the water with their pontoons below wave-level. Most oil and gas production platforms in offshore Britain rest on steel supports although a small number of platforms are fabricated from concrete.

More recently, however, there has been less emphasis on new production platforms and more emphasis on sophisticated remotely controlled pumps, with links to existing platforms or pipelines.

Potential effects on the construction of these drilling platforms on the archaeological resource are likely to be localised disturbance of deposits. Direct impacts are only likely to occur to seabed and sub-surface archaeological deposits situated within the footprint of these wells and their supporting structures. Potential secondary impacts would be changes in sedimentary regimes which could cover or uncover archaeological material.

8.2.3 Pipelines

Pipelines are used to bring most offshore oil and all offshore gas to the shore. Pipeline placement is based on numerous factors including seabed sediments and topography. The pipeline is welded together offshore on a laybarge and then fed through a stinger onto the seabed. As the barge winches forward on its anchor lines, the pipeline drops to the seabed while either a pipe trenching barge or gravel dumping vessel covers the pipeline. Additionally tractor ROVs can be used in trenching operations.

During these operations there is potential to impact cultural material both on and beneath the seabed surface. Tractor ROV's used in trenching operations can directly affect the archaeological resource through movement along the seabed and during trenching. Further impacts along the pipeline are those posed by the anchoring of vessels and gravel dumping. Secondary impacts could include changes in sedimentary regimes which can cover and uncover archaeological material.

8.2.4 Decommissioning

After the depletion of a particular hydrocarbon reservoir the government grants a Cessation of Production Permit. Decommissioning will normally be carried out by the developer in an approved manner. Decommissioning involves carrying out a number of defined tasks including removal of all subsea structures and installations, or ensuring that anything left behind does not adversely affect the marine environment or other users of the sea (UKOOA 2002).

The potential impacts to the seabed during decommissioning will be dependant on the procedures undertaken. The removal of wellheads, casings, pilings and other obstructions may impact archaeological material on and beneath the seabed.

8.3 Mitigation - Reporting and Recording Protocols and Practices

A summary of the existing legislation regarding the reporting, investigation and protection of prehistoric and archaeological remains has been provided in Section 4. Further reporting and recording protocols for archaeological practice relevant to oil and gas activity are outlined below.

8.3.1 Research and evaluation ahead of development

Once areas of oil and gas resources have been targeted an assessment of the archaeological resource would be required according to current best practice and guidance. The initial stage of assessment would be the evaluation of the archaeological potential of the area to be impacted. Undertaking assessment early provides a greater chance for significant archaeological resources to be identified. This enables the most cost effective approach to archaeological material to be taken through appropriate mitigation measures.

8.3.1.1 Desk Based Assessment (DBA)

The assessment of the archaeological resource is governed by the standards and guidance of the Institute of Field Archaeologists (IFA). The initial stage in research will be a desk based assessment which is an integral part of research into the known archaeological potential required as part of an EIA.

DBA's are defined by the Institute of Field Archaeologists (IFA) as:
"*a programme of assessment of the known or potential archaeological resource within a specified area or site on land, inter-tidal zone or underwater. It consists of a collation of existing written, graphic, photographic and electronic information in order to identify the likely character, extent, quality and worth of the known archaeological potential archaeological resource in a local, regional, national of international context as appropriate*" (IFA 2001).

Sources of data that would be utilised in researching the potential for archaeological material within the SEA8 area would include, but not be limited to, the following sources:

- National Monuments Record (NMR's), national archaeological databases maintained by England, Wales and Scotland. For the maritime zone this

would include shipwrecks, aircraft, reported obstructions, submerged sites, documented losses and other archaeological material.

- Historic Environment Record (HER), a database of local archaeological resources maintained by local authorities. For the maritime zone local archaeological resources maybe the same sites as recorded in the NMR.
- United Kingdom Hydrographic Office (UKHO) wreck index, an index of charted and uncharted shipwreck sites where the general but not precise location is known.
- United Kingdom Hydrographical Office (UKHO) cartographic collection, historic charts which can be utilised to identify the presence of wreck sites and changing seabed topography.
- The Receiver of Wreck (ROW), holds details of all reported wreck material which according to the Merchant Shipping Act, Section 4, should be declared. These records are reported annually to the NMR, but should be checked for most recent discoveries.
- Existing geophysical and geotechnical data, this could include a range of seismic, bathymetric, sidescan and magnetometer survey data as well as boreholes, vibrocores and grab samples. While any further data from diving and ROV inspection would also be utilised to determine the presence or absence of archaeological data.
- National Maritime Museum (NMM), holds a large maritime research collection which includes an extensive historic chart archive, in addition to information on some archaeological material and historic vessels.
- Archaeological Data Service (ADS), a digital archaeological resource which contains information on archaeological sites, events and material.

8.3.1.2 Archaeological Fieldwork for Assessment & Mitigation

On completion of the desk based assessment and further consultations with national bodies it maybe necessary to undertake archaeological fieldwork for assessment or mitigation. This can include obtaining geophysical and geotechnical data, diving and/or ROV inspection. Archaeological field evaluation is defined by the Institute of Field Archaeologists as:

"*An archaeological field evaluation will determine, as far as is reasonably possible, the nature of the archaeological resource within a specified area using appropriate methods and practices. These will satisfy the stated aims of the project, and comply with the Code of conduct, Code of approved practice for the regulation of contractual arrangements in field archaeology, and other relevant by-laws of the IFA* "(IFA 2001)

Methods of archaeological field evaluation includes a range of techniques to provide detailed information on the subsea archaeological resource:

- Seismic survey - provides a detailed sub-bottom profile of sediments, this data can be used to locate buried archaeological sites and quantify their extents. This is particularly relevant for buried landsurfaces and palaeochannels.
- Bathymetric Survey - can identify localised topographical anomalies which after processing and interpretation can be used to identify wrecks sites and other archaeological remains.
- Sidescan Survey - provides a topographical map of the seabed which after processing can be used in the interpretation of archaeological remains. In conjunction with bathymetric survey a detailed picture of the seabed is provided, this can be utilised in the identification of archaeological material which lies exposed on the seabed.

- Magnetometer Survey - can locate metal/ferrous objects on or near the surface of the seabed and depending on the Magnetometer being used can also provide relative size and orientation of metal/ferrous objects. Used in conjunction with bathymetric and sidescan surveys this can help identify the nature and extent of partially buried archaeological material.
- Borehole, Vibrocore and Grab Sample Survey - allows the character and stratigraphy of the seabed sediments to be determined. Analysis can result in the mapping of significant archaeological horizons, often related to prehistoric submerged landscapes. Recovered samples may also contain archaeological material including wreck remains and prehistoric material.
- Diving Operations - diving operations are covered by several Approved Codes of Practice (ACoP) dependant on the nature of the diving been undertaken (HSE). In line with the IFA approved standards and guidance diver inspection could involve several evaluation methods such as measured drawings, video and photographic surveys. Where part of a mitigation strategy involved the full excavation and recovery of the archaeological remains this will normally involve the production of a pre-disturbance plan, excavation and recovery. The recovered finds would then be recorded and conserved, specialist analysis of aspects of the site undertaken and a full excavation report compiled. This collection as a whole forms the 'archaeological archive', best practice outlines that this should be kept together and deposited in a public museum.
- Remotely Operated Vehicle (ROV) - due to the constraints of depth and time imposed on divers in certain circumstances it may be necessary to deploy a ROV to investigate and excavate subsea archaeological resources.

8.3.2 Scheme Design for Avoidance

Where archaeological material is located during the assessment or evaluation phase it is often desirable to alter the position or course of the development to avoid impacting cultural heritage. An example of this was demonstrated in the Ormen Lange Marine Archaeology Project (see case study box in section 8.1) where the course of a pipeline was altered to avoid areas in which a wreck would have been directly impacted. This action avoided the necessity to undertake a full scale archaeological recording and excavation programme.

8.3.3 Assessment and removal

Where the avoidance of archaeological material is not possible a series of mitigation procedures and options would be necessary. These measures would be undertaken under the guidance of national (for offshore) or local (for onshore) archaeological curators. Mitigation is tailored to specific conditions and needs, this aims to ensure that where impacts do occur these are minimised either through recording and *in-situ* preservation measures or through excavation and preservation by record.

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10. Appendices

10.1 Information on Designated Historic Wreck Sites within the SEA8 area

MA 500 - Cattewater Wreck, Plymouth
Position (NGR): 50 21 41.4N / 04 07 37.5W
Date of Sinking: 1530 *Designated:* 05.09.73
Description: The site of the *Cattewater wreck* was located close to the entrance of Sutton during dredging operations in 1973. Its name is still unknown as it has not been fully investigated although it is believed to date to the 16th century. After it was discovered it became the first ship to be designated under the Protection of Wrecks Act 1973.

MA 501 - *Mary Rose*, Solent
Position (NGR): 50 45 48N / 01 06 10W
Date of Sinking: 1545 *Designated:* 05.02.1974
Description: The site of the *Mary Rose* lies in the Eastern Solent off Portsmouth Harbour. The ship recognised as the pride of King Henry VIII, capsized and sank during an engagement with a French invasion fleet. Excavations from 1979 – 1982 recovered over 20,000 artefacts, after which a large section of the hull was raised.

MA 502 - *Grace Dieu*, Solent
Position (NGR): 50 53 31N / 01 06 10W
Date of Sinking: 1439 *Designated:* 05.02.1974
Description: The site of the *Grace Dieu* lies within the River Hamble, this vessel was one of Henry V's 'great ships' and is probably one of the largest clinker vessels ever built. Having only undertaken one voyage it was moored on Southampton Water after which in 1439 it was moved upstream of the River Hamble where in 1439 it was struck by lightning and burnt. Surviving remnants of the hull exist above the keel and is representative of the only known example of a composite clinker construction.

MA 503 - *Amsterdam*, East Sussex
Position (NGR): 503764.043E / 106086.685N
Date of Sinking: 1749 *Designated:* 05.02.74
Description: The site of the *Amsterdam* lies on Hastings beach. The ship was a Dutch East Indiaman vessel en-route to Indonesia from Texel, Holland which ran aground in a severe gale. The ship sank swiftly into the sands of the beach where its hull and remains have been well preserved. Due to this extraordinary preservation and archaeological analysis undertaken the site is of particular importance.

MA 504 - Needles Wreck Site (*Assurance* and *Pomone*), Solent
Position (NGR): 50 39 42N / 01 35 27W
Date of Sinking: 1738 / 1811 D*esignated:* 11.04.74
Description: The Needles wreck site contains two named wreck sites – the *Assurance*, a 44 gun frigate lost in 1753 and the *Pomone* a 38 gun frigate lost in 1811. Although the wooden hulls do not survive, various artefacts have been found washed into the gullies of the site. A diver trail and several archaeological surveys have been undertaken and a display of this work has been undertaken is exhibited at Hurst Castle, Keyhaven.

MA 505 - *The Anne*, East Sussex
Position (NGR): 50 53 22N / 00 41 46E
Date of Sinking: 1690 *Designated:* 20.06.74

Description: The site of the *Anne* is located off Petts Level and lies slightly buried in sediments in the nearshore zone. The *Anne* was a third rate 70 gun ship of the line that was badly damaged during actions off Beachy Head after which it was driven ashore and burnt to prevent it becoming a prize. Although extensively salvaged, substantial remains of the hull remain buried in the sediments. Archaeological work has shown the archaeological significance of this wreck.

MA 506 - Tearing Ledge wreck, Isle of Scillies
Position (NGR): 49 52 12N / 06 26 29W
Date of Sinking: 1707 *Designated:* 13.03.75
Description: The Tearing Ledge site may be the remains of one of a number of ships belonging to Sir Cloudisley Shovell's fleet which struck the Western Rocks on October 22-3, 1707. Although contentious it is believed that the wreck is most likely to be that of the *Eagle*, a 70 gun third rate, although it could be the *Romney*, a 50 gun fifth rate, or indeed parts of both cannot be ruled out. A series of artefacts including cannon founds at Tearing Ledge, protected after the salvage and sale of a number of items.

MA 507 - HMS *Colossus*, Isle of Scillies
Position (NGR): 49 55 15N / 06 21 02W
Date of Sinking: 1798 *Designated:* 12.05.75
Description: The site of HMS *Colossus* lies off the Southward Well Rocks where the ship grounded after dragging it anchors. HMS *Colossus* was a 74 gun third rate which was carrying prize items and part of a Greek collection of antiques belonging to Sir William Hamilton. Recent archaeological work undertaken uncovered a large ornately carved stern section and substantial amounts of debris from the wreck site.

MA 508 - Rill Cove Wreck, Lizard Cornwall
Position (NGR): 49 58 31N / 05 14 26W
Date of Sinking: 1616 *Designated:* 15.03.76
Description: This unidentified shipwreck lies near Kynance Cove in 9m of water. Little about this wreck is known, finds recovered include a breech loading gun and 300 Spanish coins. Some other small artefacts have been recovered including pewter buttons, sounding leads, lead bottle seals and unidentified copper alloy objects.

MA 509 - Church Rocks Wrecks, Teignmouth, Devon
Position (NGR): 50 32 55N / 03 29 10W
Date of Sinking: 16th century *Designated:* 12.08.77
Description: This site was discovered off the sea wall to the east of Teignmouth. It is believed that due to a number of cannons of 16th century origin that it could be the remains of an Armada wreck. A small excavation in the 1990's unearthed the only section of ship structure so far found. A 7.3m by 1.2m section of timber believed to be part of the stern and lower starboard hull. The site is protected to stop unauthorised interference.

MA 510 - Moor Sands, Salcombe, Devon
Position (NGR): 50 12 42N / 03 44 20W
Date of Sinking: Middle Bronze Age *Designated:* 08.03.78
Description: The Moor Sands site consists of a scatter of eight Bronze Age implements including a sword and palstave axes, discovered between 1977 and 1982. Additional searching in 1979, which included an extensive metal detection survey failed to find and further artefact or evidence of a shipwreck. The potential for these artefacts coming from a shipwreck is supported by the fact that these bronze artefacts are not British in origin.

MA 511 - *Coronation* Offshore and Inshore, Penlee Point Cornwall
Position (NGR): 50 18 57N / 04 11 34W
Date of Sinking: 1691 *Designated:* 31.03.78 & 03.01.89
Description: The site of the *Coronation*, a 90 gun second rate ship of the line lies in two parts off Penlee point where it foundered after a severe gale. The offshore area consists of 17 cannon and various pieces of wreckage while the inshore section comprises of 60 cannon, cannon balls and debris all marked with the Royal Navy broad arrow.

MA 512 - Langdon Bay Wreck, Dover Kent
Position (NGR): 51 07 36N / 01 20 48W
Date of Sinking: Middle Bronze Age *Designated:* 25.05.78
Description: The site of the Langdon Bay wreck consists of 90 Bronze Age weapons and tools found in 1979. Work has continued and currently the number of artefacts total 363. The sheer number of artefacts and their distance from the shoreline (500m) is an indication that these finds come from a shipwreck. 50 winged axes were found in this hoard making it the largest European Bronze Age hoard.

MA 513 - *Invincible*, Horse Tail Sand Eastern Solent
Position (NGR): 50 44 20N / 01 02 13W
Date of Sinking: 1758 *Designated:* 30.09.80
Description: The site of the *Invincible* lies within the sands of Horse Tail sands. The first of a new style of ship known as a 'True 74' the *Invincible* was a new design suited to a worldwide fleet. Sands that cover the site have offered excellent protection and it is believed that much of the wreck remains.

MA 514 - *Schiedam*, Gunwalloe Cove Cornwall
Position (NGR): 50 02 13.8N / 05 16 24W
Date of Sinking: 1684 D*esignated:* 15.02.82
Description: The site of the *Schiedam* consists of 16 cannon and some ship structure found in good preservation and other artefacts. The *Schiedam* was a Dutch fluyt of 400 tons that was captured by the English and incorporated into the English Fleet.

MA 515 - Brighton Marina Wreck, East Sussex
Position (NGR): 50 48 36.5N / 00 06 29W
Date of Sinking: 16th Century *Designated:* 18.10.83
Description: The site of the Brighton Marina wreck is an unidentified armed vessel from which a bronze gun was recovered and two wrought iron stave guns and a rare 15th century bronze hackbut. Some timber remains are also sporadically visible when the sands uncover them.

MA 516 - Yarmouth Roads Wreck, Isle of Wight
Position (NGR): 50 42 31.2N / 01 29 35.8W
Date of Sinking: 1567 *Designated:* 11.04.84
Description: The site of the Yarmouth Roads wreck lies off the Isle of Wight in a relatively undisturbed clay bed. The ship is a 16th century Spanish merchant vessel, possibly the *Santa Lucia* and comprises of large fragments of hull including the collapsed sides and stern. Artefacts include ceramic, lead, pewter and copper alloy have been recovered. A bronze gun was found 150m to the east of the main site. As this wreck was not considered to be under threat only limited excavation was conducted.

MA 517 - Studland Bay Wreck, Poole Dorset

Position (NGR): 50 39 39N / 01 54 47.4W
Date of Sinking: 1520 *Designated:* 27.11.84
Description: The site of the Studland Bay wreck consists of three areas of wreckage and includes hull remains of the keel and parts of the hull and stern section. Further artefacts include wrought iron guns and artefacts including Spanish pottery. This vessel is considered to be best example of a late medieval merchant ship, and may have a Spanish origin.

MA 518 - *Hazardous*, Brackelsham Bay, West Sussex
Position (NGR): 50 45 6N / 00 51 28.2W
Date of Sinking: 1706 *Designated:* 22.09.86
Description: The site of the *Hazardous* lies in shallow waters off Bracklesham Bay. The *Hazardous* was originally a French 3rd rate, captured by the English and converted to a 4th rate. This vessel has many unique features, for example the frames are set in pairs bolted together longitudinally, in the bow the frames are set at increasing angles; a feature not introduced into English Warships until 1715. Lead has been found between planks to act as caulking, a feature found on only two other ship examples. A lead alloy has also been placed between the components of the laminated bow structure, another unique feature. Initially a large amount of the vessel structure remained, however, in recent years active erosion has led to the disappearance of a large section of ship structure to the south.

MA 519 - Gull Rock Wreck, Lundy, Devon
Position (NGR): 51 11 6.6N / 04 39 24.6W
Date of Sinking: 15th to 16th century *Designated:* 14.03.90
Description: This site is an unidentified wreck which consists of a scatter of 15th to 16th century objects including two wrought iron breech blocks, a wrought iron gun and a quantity of stone shot. The site was originally found in 1968 but was not relocated again until 1983. No excavation has been undertaken. The site lies within a nature reserve.

MA 520 - Erme Estuary Wreck, Bigbury Bay Devon
Position (NGR): Bigbury Bay
Date of Sinking: Unknown *Designated:* 03.05.91
Description: The site of the Erme Estuary wreck comprises of a range of material dating from the 16th to 18th century and is likely to come from a number of different wrecks. An important feature is that of a cluster of cannon including a swivel cannon dating from 1450-1550. A Swedish cannon dated from 1690-1720 was also found. Trial excavation has not found any vessel structure, although additional maritime artefacts have been scattered on the seabed.

MA 521 - Erme Estuary ingot site, Bigbury Bay Devon
Position (NGR): 50 18 24.6N / 03 57 11.4W
Date of Sinking: Unknown *Designated:* 26.11.93
Description: The site consists of tin ingots of an unknown date. This site has provided unique early evidence for the West Country trade in tin, which was needed for the production of bronze. In 1992 a scatter of 44 tin ingots was found nearby a designated wreck site. Even on land tin ingots are rare, so dating the finds was not possible. However, the variation in sizes indicates small scale production during a pre-standardisation period.

MA 522 - Hanover, Hanover Cove, Cornwall
Position (NGR): 50 20 4.5N / 05 10 49.38W
Date of Sinking: 1763 *Designated:* 19.07.97

Description: The site of a 100ft two masted brigantine which was driven into Hanover cove during a gale where it wrecked. After a salvage attempt recovered some guns from the site it was designated.

MA 523 - Salcombe Cannon Wreck, West Prawle Devon
Position (NGR): 50 12 41.76N / 03 44 40.74E
Date of Sinking: 1640 *Designated:* 24.10.97
Description: A number of guns were known to have existed at this site, however after 1995 the site became very well known as gold coins, jewellery and ingots were found. The site is the largest find of Islamic coins found in the UK. Jewellery similar to that found on the site is still being made today; the site has provided precise dates for earlier use of style and manufacture.

MA 524 - HM submarine *A1*, Bracklesham Bay West Sussex
Position (NGR): Off Selsey Bill
Date of Sinking: 1911 *Designated:* 26.11.98
Description: This site represents the remains of the first British designed submarine which was built in 1903 by Vickers. Converted to unmanned target and lost in 1911. After some disturbance it was protected to prevent further unauthorised access and theft.

MA 525 - Loe Bar Wreck, Mounts Bay Cornwall
Position (NGR): 50 44 31.2N / 00 55 11.4E
Date of Sinking: 17th century *Designated:* 14.6.99
Description: The identity of this wreck is uncertain, but there is evidence to suggest that it is a 17th century wreck. 18 guns and an anchor have been found. The site could provide vital information on shipbuilding techniques of the period.

MA 526 - *Colossus* stern section, St Mary's Roads Isles of Scilly
Position (NGR): 49 55.471N / 06 20.505W
Date of Sinking: 1798 *Designated:* 04.07.01
Description: The *Colossus* was a 74 gun 3rd rate. The bow section was designated in 1975 where over 30,000 sherds of Greek pottery were found. A large part of the stern section remains, including structure, cannon, muskets, mizzen chains, and rudder gudgeon. A carved figure from the port side stern was recently raised. Included in the site is a large debris field comprising of timbers, shot, cannon and small artefacts. This debris field has been surveyed and ground-truthing of geophysical anomalies has taken place.

MA 527 - Swash Channel, Poole Harbour Approaches
Position (NGR): 50 49.8971N / 01 55.5905W
Date of Sinking: Early 17th century *Designated:* 10.12.04
Description: Structural remains on the seabed suggest that a sizeable proportion of a large vessel survives coherently in substantial sections and that the quality of survival of some of the structural timber is very high. A fragment of Rhenish stoneware with decoration typical of 1630 has been recovered, a date consistent with the visible form and structure of the vessel.

MA 528 - West Bay Wreck, West Bay Dorset
Position (NGR): 50 42.244N / 02 46.708W
Date of Sinking: Unknown *Designated:* 19.07.05
Description: The site comprises of a low mound of heavily concreted iron bars, and a heavily concreted iron gun, and a possible seventeenth century muzzle loading bronze gun of European or Eastern origin. The large number of iron bars suggests this may be a merchant vessel.

MA 529 - Bartholomew Ledges Wreck, St Mary's Sound, Isles of Scilly
Position (NGR): 49.54.364N / 06 19.889W
Date of Sinking: 1597 *Designated:* 03.10.80
Description: The site consists of lead ingots, guns and bell fragments from a possible 16th century Spanish wreck. It is believed that this is possibly the Armada ship *San Bartolome*, although this is unconfirmed. Discovered in 1976, recent archaeological reports have refined the site position.

MA 530 - St Anthony, Mounts Bay, Cornwall
Position (NGR): 50 03.335826N / 05 16.911581W
Date of Sinking: 1527 *Designated:* 03.10.80
Description: The site is believed to be a Portuguese merchant carrack which foundered in 1527 during passage from Lisbon to Antwerp. Finds include copper and silver ingots.

MA 531 - *Iona II*, Lundy Devon
Position (NGR): 51 11.0861N / 04 38.8594W
Date of Sinking: 1864 *Designated:* 03.01.90
Description: This site is one of the first ships under 150 years old to be protected. However, recent archaeological investigation has shown a substantial area of the site lies unprotected. Built in 1863 and originally designed as a passenger ferry for the Clyde, this merchant vessel was acquired to allegedly run guns and supplies for the Confederate Forces in the American Civil War. The *Iona II* was lost on its first trans-Atlantic voyage, only a year after it was built in 1863.

MA 532 - *Royal Anne Galley*, Lizard Cornwall
Position (NGR): 49 57.48N / 05 12.99W
Date of Sinking: 1721 *Designated:* 11.11.93
Description: Launched in 1709 the *Royal Anne Galley* was a 5th rate galley which sank in 1721, while transporting Lord Belhaven, the new governor of Barbados, to the West Indies. The Royal Navy built only six such galleys, and the *Royal Anne* was described as the finest ever constructed at its launch. Archaeological exploration taking place in 2005 revealed a new cluster of wreck material outside the designated zone leading to re-designation. Artefacts include cutlery bearing Lord Belhaven's family crest.

MA 533 - *Holland V*, Sussex Coast
Position (NGR): 50 41.655N / 00 30.867E
Date of Sinking: 1912 *Designated:* 04.01.05
Description: The *Holland V* was launched in May 1902 as the last of five prototype submarines to evaluate the submarines potential in war. It had one of the first periscopes. It foundered on 8th August 1912 while being towed to the breakers yard and represents one of only two that are still surviving.

MA 534 - Norman's Bay Wreck (HMS *Resolution*)
Position (NGR): 50 48.1767N / 00 24.6380E
Date of Sinking: 1703 *Designated:* 14.06.06
Description: Site believed to be the remains of the 70-gun warship *Resolution*. A protection area of 100m was placed around the wreck site to prevent accidental damage.

MA 535 - *Thomas Lawrence*, south of Hastings east Sussex
Position (NGR): 50° 43.401' N / 00° 35.816' E
Date of Sinking: 1862 *Designated:* 2007

Description: The site of a Danish schooner from which a cargo of gin, brandy, rice, jewellery, machetes, window glass and a tombstone has been recovered. This carvel built, copper clad vessel has its foremast and rudder still in position although no decking was observed. National museum of Denmark has requested that it be designated as they believe the vessel is of archaeological and historical significance as the ship is from a period and a geographical region where the use of drawings in local tradition is rare. Evidence suggests that the site has been interfered with in the past by divers.

MA 536 - Little Ganinick, Isles of Scilly
Position (NGR): 49° 56.445' N / 06° 16.381' W
Date of Sinking: post 1850 *Designated:* 2007
Description: The site consists of a discrete mound of post 1850 Cornish mining equipment cargo considered to be of national significance given its rarity. Potentially could give information on the international trade in Cornish mining equipment and technology. The recent designation of the Cornish mining landscapes as a World Heritage Site lends even greater weight to any surviving unaltered evidence of mining machinery from this period. The wreck is therefore a very rare find of mining equipment, lost during transhipment in this historic period of major migration.

10.2 Gazetteer of sites referenced in the text

MA Ltd Reference	Original Source Reference	Period	Name	Description
MA 400	NMR 918155	Neolithic	Wooton Quarr	Prehistoric settlement remains and trackway as well as evidence of a Roman/Early Medieval/Medieval harbour site (incorporating an anchorage, watering place & stone shipment depot), found at Wootton Creek
MA 401	NMR 1214353	Lower Palaeolithic	Kent's Cavern	A Hoxnian period site with flint tools from the Lower Palaeolithic period
MA 402	RCAHM 300251	Early Upper Palaeolithic	Goat's Hole Cave, Paviland	Upper Palaeolithic human burial of a six foot man covered in red ochre
MA 403	British Archaeology issue 86	Lower Palaeolithic	Pakefield	This site has the earliest evidence for human activity in Northern Europe
MA 404	NMR 658426	Lower Palaeolithic	Boxgrove	Boxgrove is a Middle Pleistocene site in West Sussex, England. Since the early 1980's a number of localities within the gravel quarrys at Boxgrove have provided detailed insights into the life and palaeoecology of the earliest colonisers of Northern Europe
MA 405	NMR 458641	Multi period	Hengistbury Head	An important multi-period site containing finds from the Upper Palaeolithic to Iron Age Period
MA 406	NMR 636702	Mesolithic	Westward Ho!	An important Mesolithic site containing a shell midden
MA 407	NMR 1302048	Mesolithic	Culver Well	An important Mesolithic site containing a shell midden
MA 408	RCAHM 400748	Mesolithic	Goldcliffe	A series of relic Mesolithic footprints in the inter-tidal zone
MA 409	IWSMR 1804	Mesolithic	Bouldnor Cliff	A submerged Mesolithic settlement site with flint finds
MA 410	NMR 1232504	Neolithic	Mottistone	A rectangular enclosure believed to be a Neolithic Longbarrow
MA 411	RCAHM 305436	Neolithic	King's Quoit, Manorbier	A Neolithic burial chamber overlooking a sheltered bay east of Milford Haven

MA 412	Parry and McGrail 1994	Bronze Age	Goldcliff	Sewn plank fragments of a Bronze Age vessel
MA 413	Parry and McGrail 1994	Bronze Age	Caldicot	Sewn plank fragments of a Bronze Age vessel
MA 414	Boon 1977	Roman	Port Felen	A Roman lead anchor stock
MA 415	RCAHM 440	Medieval	Magor Pill wreck	Scant remains of a clinker-built vessel's hull, on the eastern edge of Magor Pill palaeochannel system. The vessel is clinker-built in the North European tradition, with the remains comprising 7 metres of the incomplete forward section of a 15-20m boat. Split oak planks were attached to a solid oak keel, and to one another, with iron nails. The cargo remains comprised a mound of iron ore piled onto a hazel hurdle.
MA 416	NMR 462678	Roman	Roman gold ring	A Roman gold ring found off Dungeness from the Emperor Marcus Aurelius Probus, 282 AD
MA 417	NMR 462185	Iron age	Tournerbury	Earthwork remains of an Iron Age univallate plateau hillfort. Excavations in 1959 located Medieval pottery from the outer edge of the rampart and possible Iron Age pottery from the old ground surface which was sealed by the rampart. Excavations in 1968
MA 418	Williamson 1998	Iron age	Late Iron Age anchor and chain	A anchor and chain found at Bulberry Camp near Wareham
MA 419	NMR 650483	Iron age	Flowers Barrow	Earthwork remains of an Iron Age hillfort and cross ridge dyke which probably formed an outwork to the fort. The site was probably originally univallate before being strengthened with extra defences.
MA 420	NMR 457515	Iron age	Poole Logboat	Iron Age monoxylous log boat dredged from Poole Harbour, east of Brownsea Island in 1964.
MA 421	NMR SY 28 NW 14	Roman	Moridunum	Seaton is one of the suggested locations of the Roman town of Moridunum, listed in the Ravenna Itinerary. However, it is more than 15 miles from Exeter, an alternative suggestion of Honey Ditches as the site of the town is more likely.

MA 422	NMR 649846	Multi period	Tintagel	An harbour and settlement site with finds from the Iron Age to Medieval period
MA 423	NMR 1122558	Early Medieval	Langstone Logboat	A logboat recovered in the intertidal zone of Langstone harbour
MA 424	NMR 895347	World Wars	SS Westville	1917 wreck of English cargo vessel which capsized and foundered 4 miles SW of Brighstone Bay after being torpedoed, en route from Blyth to Blaye with coal. Constructed of steel, she was a steam-driven vessel.
MA 425	NMR 1356173	Roman	Fishbourne	An important Roman maritime base that survived into the 4th century AD
MA 426	Wendes 2006	Early Modern	*New Dawn*	The wreck of the Steam Drifter *New Dawn,* mined 3 miles off the Needles, has little remaining structure.
MA 427	Weymouth Diving	Early Modern	*Binnendijk*	*Binnendijk,* a 6873 ton Dutch steamship which struck a mine and caught fire. The wreck is well broken after salvage operations but is still substantial.
MA 428	Nautical Archaeological Society,2005	Early Modern	*Louis Sheid*	The wreck of the *Louis Sheid*, a Belgian grain steamer that ran ashore on Leas Foot Beach, Devon in December 1939 after being torpedoed.
MA 429	Ilfracombe Wrecks	Early Modern	*Monte Gurungu*	Steamer *Monte Gurungu,* which due to severe weather on the 13 November 1949 foundered in the Bristol Channel.
MA 430	Parham, D. 1996	Late Modern	*Kautoug*	The Kautoug is the largest tin processing bucket dredger which is found underwater and lies off the Cornwall coastline.