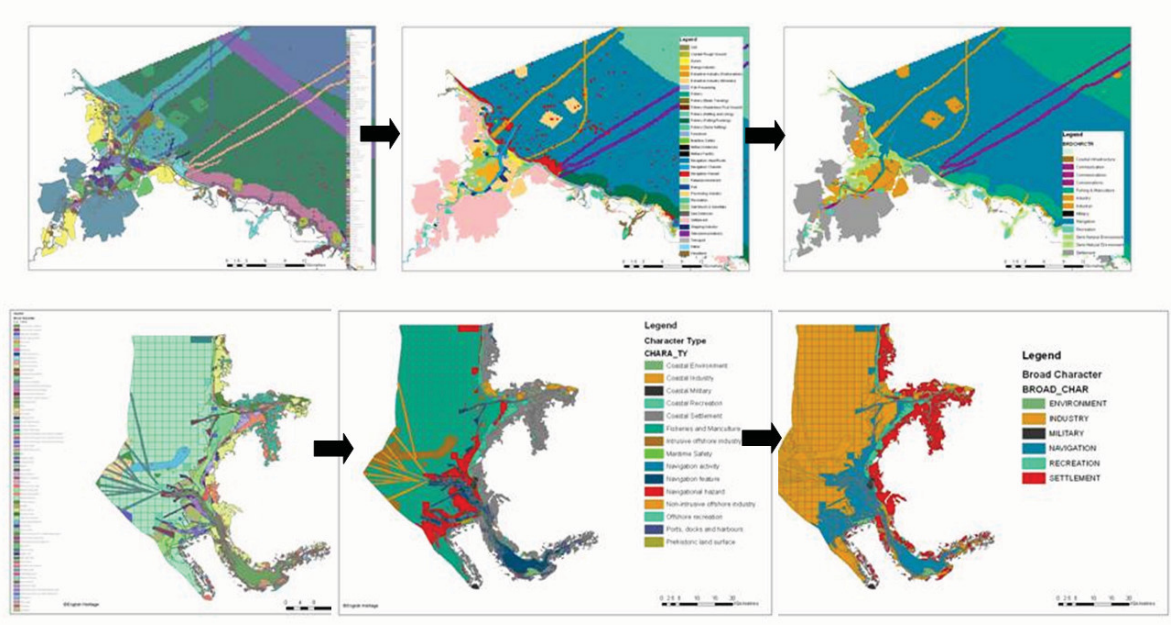
Report No: 2008R023

England's Historic Seascapes
Consolidating the National Method

Final Report



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England's Historic Seascapes
Consolidating the National Method

Final Report

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Report author(s)	**Bryn Tapper, Charles Johns**
Checked by	**Charles Johns**
Approved by	**Peter Rose**

Historic Environment Service, Environment and Heritage,
Cornwall County Council
Kennall Building, Old County Hall, Station Road, Truro, Cornwall, TR1 3AY
tel (01872) 323603 fax (01872) 323811 E-mail hes@cornwall.gov.uk
www.cornwall.gov.uk

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Within the Historic Environment Service, the Project Manager was Charlie Johns and the Project Officer was Bryn Tapper.

The views and recommendations expressed in this report are those of the Historic Environment Service projects team and are presented in good faith on the basis of professional judgement and on information currently available.

Freedom of Information Act

As Cornwall County Council is a public authority it is subject to the terms of the Freedom of Information Act 2000, which came into effect from 1st January 2005.

Cover illustration

Extracts from the Liverpool Bay and Scarborough-Hartlepool pilot projects' GIS

Contents

1 EXECUTIVE SUMMARY 13

2 INTRODUCTION 14

2.1 PROJECT BACKGROUND 14

2.2 RATIONALE 15

2.3 AIMS AND OBJECTIVES 17
2.3.1 PROJECT AIMS (Hooley 2007a, 4-5) 17
2.3.2 KEY OBJECTIVES 17

3 PRINCIPLES OF HSC 19

4 REVIEW OF THE PILOT PROJECTS 20

4.1 INTRODUCTION 20

4.2 SOURCE DATASETS 21
4.2.1 ANALYSIS OF CORE DATA 21
4.2.2 ANALYSIS OF SUPPLEMENTARY DATA 24

4.3 SPATIAL DATA MODELS 28
4.3.1 MULTI-MODE APPROACHES TO HSC 28
4.3.2 MAPPING HISTORIC CHARACTER WITHIN GIS 33
4.3.3 REVIEW OF THE PILOT PROJECTS' HSC DATABASE ATTRIBUTES 35

4.4 MAPPING THE RESULTS OF CHARACTER ASSESSMENT 40
4.4.1 APPROACHES TO THE DEFINTION OF HISTORIC CHARACTER 40
4.4.2 IDENTIFYING DOMINANT HISTORIC SEASCAPE CHARACTER 44
4.4.3 CONFIDENCE RATINGS 45
4.4.4 ASSESSMENTS OF VULNERABLITY AND SIGNIFICANCE 46
4.4.5 COMPILING HSC TEXTS 47

4.5 MANAGING THE LAND/SEA OVERLAP 48

4.6 HSC CHARACTER TYPES 49
4.6.1 CHARACTER AREAS 49

4.7 FIELDWORK 51

4.8 CURATING THE HSC 51

4.9 DATABASE STANDARDS AND GUIDELINES 51
4.9.1 MIDAS HERITAGE 2007 51
4.9.2 HSC INFORMATION GROUP 52
4.9.3 GIS SOFTWARE 53
4.9.4 PROJECTIONS 53
4.9.5 METADATA 54
4.9.6 HSC TERMINOLOGIES 54

5 THE NATIONAL HSC METHOD STATEMENT 55

5.1 INTRODUCTION 55

5.2 APPLICABILITY 55

5.3 SOURCE DATASETS 57
5.3.1 ROLES OF SOURCE DATA IN THE CHARACTERISATION PROCESS 57
5.3.2 COVERAGE AND CONSISTENCY 58
5.3.3 CORE AND SUPPLEMENTARY DATA 59
5.3.4 CORE DATA 60
5.3.5 SUPPLEMENTARY DATA 73
5.3.6 ADS ALSF MARITIME ARCHIVE 83

5.3.7 MARINE ALSF GIS DATABASE 83
5.3.8 MARINE DATA AND INFORMATION PARTNERSHIP (MDIP) DATA ARCHIVE CENTRES 83
5.4 HSC SPATIAL DATA MODEL(S) 83
5.4.1 MULTI-MODE METHOD APPROACH TO CHARACTERISATION 84
5.4.2 HSC AND MAPPING THE LAND/SEA OVERLAP 85
5.4.3 HSC DATABASE STRUCTURE 87
5.4.4 HSC DATABASE ATTRIBUTES 92
5.4.5 HSC UNITS OF INFORMATION 97
5.4.6 PROJECTIONS 103
5.4.7 SOFTWARE 103
5.4.8 METADATA 104
5.4.9 DATA CAPTURE AND PROCESSING 104
5.5 MAPPING THE RESULTS OF CHARACTER ASSESSMENT 109
5.5.1 Character assessment 109
5.5.2 TIME-DEPTH 110
5.5.3 IDENTIFYING DOMINANT HISTORIC SEASCAPES CHARACTER 111
5.5.4 CONFIDENCE RATINGS 111
5.5.5 ASSESSMENTS OF VULNERABILITY AND SIGNIFICANCE 112
5.5.6 CHARACTER ASSESSMENT WORKFLOW 112
5.5.7 GIS WORKFLOW 113
5.6 HSC CHARACTER TYPE HIERARCHY 117
5.6.1 SUB-CHARACTER TYPE LEVEL HSC 118
5.6.2 CHARACTER TYPE LEVEL HSC 118
5.6.3 BROAD CHARACTER TYPE LEVEL HSC 118
5.6.4 COMPILING HSC 'TYPES' TEXTS 119
5.6.5 MULTIMEDIA 121
5.7 HSC CHARACTER AREAS 121
5.8 FIELDWORK 122
5.9 PROJECT PRODUCTS 122
5.10 PUBLICITY AND DISSEMINATION 123
6 CONTEXTS OF HSC 124
6.1 EU MARITIME POLICY 124
6.1.1 EIAs AND SEAs 124
6.1.2 Integrated Coastal Management 124
6.1.3 EU Integrated Maritime Policy 125
6.2 EUROPEAN LANDSCAPE CONVENTION 126
6.3 UK MARINE PLANNING 127
6.3.1 CHARTING PROGRESS 127
6.3.2 MARINE BILL WHITE PAPER: A SEA CHANGE 127
6.3.3 THE NATIONAL HERITAGE ACT (2002) 128
6.3.4 TAKING TO THE WATER 128
6.3.5 CLIMATE CHANGE AND THE HISTORIC ENVIRONMENT 128
6.3.6 WELSH- IRISH SEASCAPES APPROACH 129
7 APPLICATIONS OF HSC 130
7.1 INFORMING FORTHCOMING SPATIAL PLANNING (MSP) 130
7.2 DEVELOPMENT CONTROL / PLANNING ADVICE /AGGREGATE EXTRACTION LICENCES 131
7.2.1 THE PROPOSED MARINE MANAGEMENT ORGANISATION 131
7.2.2 DEVELOPMENT CONTROL / PLANNING ADVICE 131
7.2.3 EXAMPLE - EIA FOR THE FALMOUTH CRUISE PROJECT 132

7.2.4 MARINE AGGREGATE EXTRACTION LICENSING 133
7.2.5 EXAMPLE – EIA FOR MARINE AGGREGATES EXTRACTION AREA IN THE SOUTHERN NORTH SEA 134
7.3 COASTAL MANAGEMENT 134
7.3.1 RAPID COASTAL ZONE ASSESSMENT SURVEYS 135
7.3.2 SHORELINE MANAGEMENT PLANS 135
7.3.3 EXAMPLE – INPUT INTO SHORELINE MANAGEMENT PLAN 136
7.4 MARINE CONSERVATION ZONES (MCZs) 137
7.5 REGIONAL RESEARCH FRAMEWORKS 138
7.6 OUTREACH AND EDUCATION 139
7.6.1 CHARACTER AREAS 140
7.6.2 EXAMPLE – INPUT INTO OUTREACH AND EDUCATION 140
7.7 USERS OF HSC 140
8 REFERENCES 143
9 PROJECT ARCHIVE 146
APPENDIX 1: HSC CHARACTER TYPE DESCRIPTIONS 147
9.1 NAVIGATION 147
9.1.1 NAVIGATION FEATURE 147
9.1.2 NAVIGATION ACTIVITY 148
9.1.3 NAVIGATION HAZARD 150
9.1.4 MARITIME SAFETY 151
9.2 INDUSTRY 153
9.2.1 EXTRACTIVE INDUSTRY (MINERALS) 153
9.2.2 ENERGY INDUSTRY 154
9.2.3 PROCESSING INDUSTRY 155
9.2.4 SHIPPING INDUSTRY 156
9.3 FISHERIES AND MARICULTURE 156
9.3.1 FISHERY 156
9.3.2 MARICULTURE 158
9.4 PORTS, DOCKS AND HARBOURS 159
9.4.1 PORTS,DOCKS AND HARBOURS 160
9.4.2 SEA DEFENCES 161
9.5 COMMUNICATIONS 161
9.5.1 TRANSPORT 161
9.5.2 TELECOMMUNICATIONS 162
9.6 MILITARY 162
9.6.1 MILITARY DEFENCES 162
9.6.2 MILITARY FACILITY 162
9.7 SETTLEMENT 164
9.7.1 SETTLEMENT 164
9.8 RECREATION 164
9.8.1 RECREATION 164
9.9 PALAEOLANDSCAPE 166
9.10 SEMI-NATURAL ENVIRONMENT 167
9.10.1 CLIFF 167
9.10.2 DUNES 167
9.10.3 FORESHORE 167
9.10.4 WOODLAND 168
9.10.5 COASTAL ROUGH GROUND 168

9.10.6 WATER 169
9.10.7 MARINE FEATURES 170
APPENDIX 2: PILOT PROJECT HSC TERMINOLOGY COMPARISON 171
NAVIGATION 171
COASTAL INFRASTRUCTURE 173
FISHERIES AND MARICULTURE 173
INDUSTRY 175
RECREATION 177
PALAEOLANDSCAPES 178
SEMI-NATURAL ENVIRONMENT 179
SETTLEMENT 180
MILITARY 181
COMMUNICATIONS 181
APPENDIX 3: TECHNICAL GLOSSARY 182

List of Figures

Fig 1 HLC and HSC coverage in England to 2007-8

Fig 2 Core data sources used by each of the five Seascapes pilot projects

Fig 3 Supplementary datasets used by the five pilot projects

Fig 4 Example (right) of attribute structure from the Liverpool Bay project

Fig 5 Example of character type hierarchy from the Solent-Isle of Wight pilot project

Fig 6 Example of character type hierarchy from the Southwold-Clacton pilot project

Fig 7 Example of attribute structure and character type classifications from the Withernsea-Skegness project

Fig 8 Example of attribute structure and character type classifications and hierarchy from the Scarborough-Hartlepool project

Fig 9 Spatial data models used by the pilot projects

Fig 10 Examples of use of grids and polygons to map character assessment

Fig 11 The basic attributes of each of the pilot HSC geodatabases

Fig 12 Character assessment workflow for HSC projects

Fig 13 Simplified Character assessment workflow for HSC projects

Fig 14 Character assessment workflow used by the five pilot projects

Fig 15 HSC linked texts in the five pilot projects

Fig 16 Diagram showing how character areas may overlie character types and are created through subjective 'top down' assessment

Fig 17 Revised mandatory units of information which are required for the 'Area' Information Group including specific HSC values

Fig 18 The test-bed areas for the national HSC method consolidation

Fig 19 The Falmouth Bay testbed area for the national HSC method consolidation

Fig 20 The Solent testbed area for the national HSC method consolidation

Fig 21 The Off Humber testbed area for the national HSC method consolidation

Fig 22 Core datasets required by HSC projects

Fig 23 Use of historic OS maps (left) and historic UKHO charts (right) to map historic character (extracts from Scarborough-Hartlepool HSC project

Fig 24 'The view from the sea', coast profile for guiding sailors into Hartlepool

Fig 25 Steam drifters leaving harbour, Hartlepool

Fig 26 Cornish herring boats at Whitby

Fig 27 Supplementary datasets for HSC projects

Fig 28 Example of NMR point data for Liverpool Bay (after Wessex Archaeology 2006a)

Fig 29 British Petroleum (BP) oil rig in the North Sea

Fig 30 Graphic reconstruction of North Sea landscape

Fig 31 RMS Mulheim aground at Castle Zawn, Sennen, Cornwall

Fig 32 Differences in visual perceptions of landscapes and seascapes

Fig 33 Examples of use of grid cells to map character assessment

Fig 34 Range of map scales and their associated levels of spatial resolution

Fig 35 Variation in the accuracy of grid cells

Fig 36 Spatial resolution of grid cells

Fig 37 Showing the spatial resolution of the grid cell to indicate a notional map scale

Fig 38 Abbreviated attribute names explained

Fig 39 Diagram outlining the relationships between the HSC database attributes identifying where one-to-one (1-1) or one-to-many (1-∞) relationships occur.

Fig 40 The mandatory Units of Information which area required for the Area Information Group

Fig 41 Laying a cable in the River Esk

Fig 42 Process flow for the preparation and conversion of source data to common format for inclusion in the character assessment

Fig 43 Extract from historic chart for the River Tees

Fig 44 Overview of HSC character assessment workflow

Fig 45 GIS workflow stages taken during character assessment

Fig 46 Diagram showing the character type hierarchy, from complex to generalised, being derived from a 'bottom-up' process of attribute analysis

Fig 47 Examples of character texts and interactive mapping produced by pilot projects

Fig 48 Diagram showing how character areas may overlie character types and are created through subjective 'top down' assessment

Abbreviations and acronyms

ADS	Archaeological Data Service, York
ALSF	Aggregates Levy Sustainability Fund
AMAP	Areas of Maritime Archaeological Potential
BGS	British Geological Survey
BMAPA	British Marine Aggregates Producers Association
BODC	British Oceanographic Data Centre
CCC	Cornwall County Council
CCW	Countryside Council for Wales
Cefas	Centre for Environment, Fisheries & Aquaculture Science
CLG	Communities and Local Government, formerly the Office of the Deputy Prime Minister
CMIP	Coastal Mapping Improvement Programme
DASSH	Data Archive for Seabed Species and Habitats
DAC	Data Archive Centre
DCMS	Department for Media, Culture and Sport
Defra	Department of the Environment, Food and Rural Affairs
DTI	Department of Trade and Industry
EH	English Heritage
EIA	Environmental Impact Assessment
ELC	European Landscape Convention
ESRI	Environmental Systems Research Institute
ETRS89	European Terrestrial Reference System 1989
EU	European Union
FISH	Forum for Information Standards in Heritage
GIS	Geographic Information System
HEAP	Historic Environment Action Plan
HER	Historic Environment Record
HES	Historic Environment Service, Cornwall County Council
HLC	Historic Landscape Characterisation
HSC	Historic Seascape Characterisation
HTML	Hypertext Markup Language
ICZM	Integrated Coastal Zone Management
INSPIRE	Infrastructure for Spatial Information in the European Community
IPR	Intellectual Property Rights
ISO	International Standards Organisation
JNAPC	Joint Nautical Archaeology Policy Committee
JNCC	Joint Nature Conservation Committee

MAGIC	Multi-Agency Geographic Information for the Countryside
MALSF	Marine Aggregates Levy Sustainability Fund
MarLIN	Marine Life Information Network
MCEU	Marine Consents and Environment Unit
MCZ	Marine Conservation Zone
MDIP	Marine Data and Information Partnership
MEDAG	Marine Environmental Data Action Group
MEDIN	Marine Environmental Data and Information Network
MESH	Mapping European Seabed Habitats Project
MFA	Marine and Fisheries Agency
MIDAS	Manual and data standard for Monument Inventories
MHW	Mean High Water
MLW	Mean Low Water
MLWM	Mean Low Water Mark
MMO	Marine Management Organisation
MoLAS	Museum of London Archaeological Service
MPA	Marine Protected Area
MSP	Marine Spatial Planning
NBN	UK National Biodiversity Network
NCI	National Coastwatch Institution
NGR	National Grid Reference
nm	Nautical Mile
NMR	National Monuments Record, Swindon
OS	Ordnance Survey
OSGB36	Ordnance Survey Great Britain 1936
PAG	Project Advisory Group
P-GA	Pan-Government Agreement
RCZAS	Rapid Coastal Zone Assessment Survey
SEA	Strategic Environmental Assessment
SFCs	Sea Fisheries Committees
SMP	Shoreline Management Planning
SQL	Structured Query Language
UKDEAL	UK Digital Energy Atlas and Library
UKHO	United Kingdom Hydrographic Office
VMS	Vessel Monitoring System
WGS84	World Geodetic System 1984)
XML	Extensible Markup Language

1 EXECUTIVE SUMMARY

In September 2007 English Heritage (EH) with Aggregates Levy Sustainability Fund (ALSF) support, appointed the Historic Environment Service (Projects), Cornwall County Council (HES) to develop a national methodology for Historic Seascape Characterisation (HSC) using the experience gained from the five pilot projects undertaken between 2004 and 2007 during the initial two rounds of the England's Historic Seascapes Programme.

The aim of this, the third round, was to consolidate the national methodology for England in close consultation with English Heritage. The resulting national HSC methodology will substantially realise the Programme's over-arching aim of seeking a robust method for applying the principles of Historic Landscape Characterisation (HLC) to England's coastal and marine zones, extending seaward to the limits of England's share of UK Controlled Waters.

This report presents the results of the project, including an overview of the national HSC methodology developed by HES; a full Method Statement is presented in a separate report (Tapper 2008).

At the outset of the project the methods of the five pilot projects were reviewed and the most useful elements of each identified. Next the principles of HLC were reviewed and their application to the sea considered. The range and coverage of source data was identified and analysed and lists of essential core and supplementary datasets for HSC complied.

The methods and workstages for data processing and producing the attribute-led spatial data models in GIS were carefully documented. Issues of copyright were considered and where possible resolved. In the course of consolidation the applicability of the method was trialled in three test-bed areas; in the Solent, the North Sea and the Fal Estuary. The resulting robust national method for HSC is source-led and guided by current terrestrial multi-mode-HLC methodology, defining areas that share similar and repeating historic character as Historic Seascape Character 'Types', allowing historic trends and processes to inform and frame the broader sustainable management of change through marine spatial planning, outreach and research projects.

To reflect the multi-dimensional or multi-layered nature of the marine environment (ie the sub-seafloor, seafloor, water column and sea surface) a fine grid of cells with tiered attributes is used to record the present and dominant historic character for each marine layer. From this database a single, conflated, HSC layer can also be derived. To assist the wide variety of users of HSC, texts will be prepared for each HSC Type, describing different aspects of the historic character under headings which include; 'Historical processes, components features and variability', Values and perceptions', 'Condition and forces for change', Research and amenity potential' and 'Rarity and vulnerability'. Significance and sensitivity can be assessed independently when required by applications as a secondary process informed by these texts.

Historic Seascape Characterisation aims to provide an historic environment context for traditional archaeological and historical sources such as HERs. It offers a baseline survey that will better inform the forthcoming marine spatial planning system and encourage the sustainable future use and management of the marine historic environment. It will improve understanding of the marine environment more generally, enabling it to be more fully involved in strategic debates about our future use of the sea. HSC can also strengthen the sense of identity of those individuals and communities who live by or make their living from, or otherwise use the sea, giving them the confidence to engage in those debates.

2 INTRODUCTION

2.1 PROJECT BACKGROUND

In September 2007 English Heritage (EH), with Aggregates Levy Sustainability Fund (ALSF) support, appointed the Historic Environment Service (Projects), Cornwall County Council (HES) to develop an England-wide methodology for Historic Seascape Characterisation (HSC) using the experience gained from the five pilot projects undertaken between 2004 and 2007 during the initial two rounds of the England's Historic Seascapes Programme (Wessex Archaeology, 2006 a and b; HWTMA *et al*, 2007 a and b; MoLAS 2007 a and b; Oxford Archaeology 2007; Tapper *et al* 2007 and Val Baker *et al* 2007: see Fig 1). The aim of this, the third round, was to consolidate the England-wide methodology in close liaison with EH, ensuring that the selected elements from the pilot methodologies function together in a practicable manner to meet the needs of the method's anticipated end-users both within and beyond EH. The resulting HSC methodology will substantially realise the Programme's over-arching aim of seeking a robust method for applying the principles of Historic Landscape Characterisation (HLC) to England's coastal and marine zones, extending seaward to the limits of England's share of UK Controlled Waters (Hooley 2007a, 2).

The project envisaged in the EH Project Brief (Hooley 2007a) would examine and review the methodological products and experience from the five pilot projects undertaken in the England's Historic Seascapes Programme which were designed, with this third round in mind, to be experimental. The project would consider the varied approaches and solutions adopted by the pilot projects in order to establish the parts of their experimental methodologies which:

- provide the most effective solution to each of those challenges;
- conform with the principles of HLC/HSC; and
- are demonstrably valid and applicable across all areas covered by the pilot projects.

These assessments adhered to a 'method guidance document' agreed between interested parties at EH (Hooley 2007b) and outlining those aspects identified as preferred among the pilot project methodologies. Determining the detailed outcome of each of those assessments required a close working relationship throughout the project with EH's Characterisation and Maritime Archaeology Teams. Engagement was also necessary with other parties sharing interests in the methodological outcome, including the local authorities and those involved in the establishment of the data coverage, standards and accessibility necessary to inform the coming marine spatial planning. Some further methodological development was anticipated as necessary in some aspects, beyond that undertaken by the pilots, to bring together the chosen elements from the pilots' methods to produce a coherent and efficiently operating unified 'national methodology'. The project also needed to review the potential and positive contributions which the national method can offer to the various contexts in which it is expected to have application. Practical demonstration of the national HSC method's operation and capabilities will be provided by its application, subsequent to the current project, across an area of England's coastal and marine zones (Hooley 2007a, 3).

This project, as with the preceding pilot projects in this Programme, was funded from the Aggregates Levy Sustainability Fund in view of its relevance and immediate application to managing aggregates extraction (*ibid*, 3).

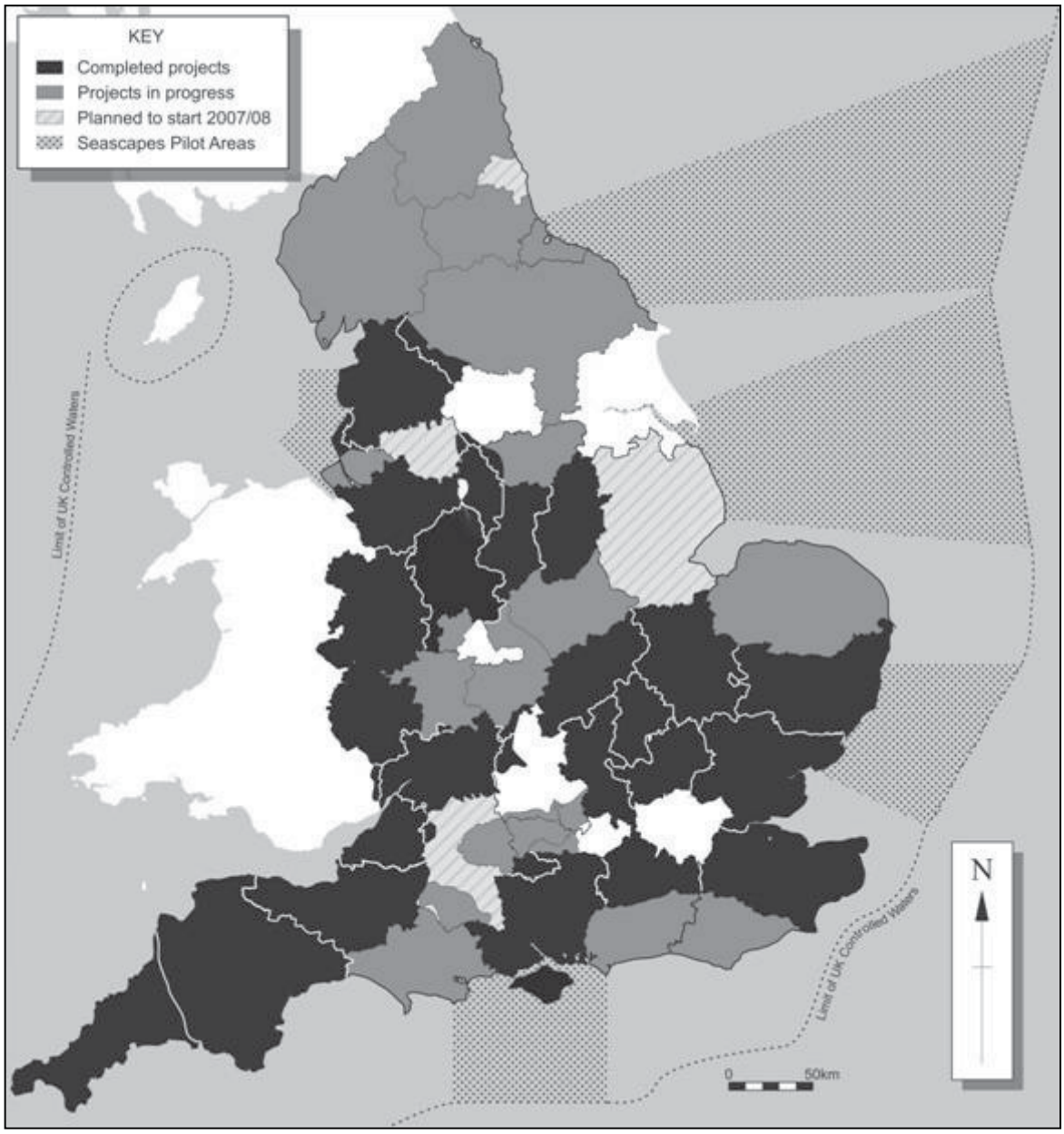


Fig 1 HLC and HSC coverage in England to 2007-8 (English Heritage)

2.2 RATIONALE

The whole of the sea area covered by UK Controlled Waters comprises historic seascapes altered, transformed and affected by human activities. Seeking an archaeological understanding of the historical and cultural development of the present marine, inter-tidal and coastal areas of England's share of UK Controlled Waters, Historic Seascape Characterisation (HSC) maps the historic character of those seascapes within a GIS, basing its character assessment on the analysis of historic charts, maps and associated documentary sources alongside modern marine data.

HSC aims to provide an historic environment spatial context for the traditionally-understood archaeological and historical resource. It offers a base survey that may better inform marine spatial planning and encourage the sustainable future use and management of the marine environment. It will improve understanding of the marine historic environment more generally, enabling it to be more fully involved in strategic debates about the future of the sea. HSC will also strengthen the sense of identity of those individuals and communities, who use,

live by or make their living from the sea, giving them the confidence to engage in those debates.

HSC aims to improve our understanding of the present historic character of the area, shaped as it is by human activities and natural processes, and place that understanding on an even footing.

The methodology developed in the Seascapes programme is primarily aimed at a range of applications which will inform the management of change affecting the coastal and marine historic environment at a strategic level. English Heritage is the sole body with statutory curatorial responsibility for the historic environment across 95% of England's share of UK Controlled Waters. The Marine Bill White Paper *A Sea Change* envisages the setting up of a single Marine Management Organisation (MMO) to administer and deliver most objectives of the forthcoming marine spatial planning (MSP) system across the area seaward of at least the English coastline (Defra 2007). A single HSC methodology is needed to integrate with such an overwhelmingly unified planning system under a single administration: in principle, the HSC methodology will be analogous to that of HLC used by a local authority in its land-based area of administration and responsibilities (Hooley 2007b, 4).

A key role for the HSC methodology will be to enable an effective, multi-faceted and area-based historic environment input by EH and others to the system of MSP signalled by the Marine Bill White Paper. The project explored the range of opportunities which the White Paper presents for the HSC database to provide that input, with scenarios given to exemplify various specific applications. Those applications included the framing of responses to aggregates extraction. The effectiveness of the database's input rests in part on its capacity for interoperability with other environmental datasets informing the forthcoming marine planning system. The project team therefore worked closely and in cooperation with those bodies charged with building the standards and mechanisms necessary to facilitate appropriate levels of interoperability and accessibility among coastal and marine environmental datasets, some of whom formed the Project Advisory Group (PAG) (*ibid, 2*).

This project will enable the application of HSC to complement and interlock with EH's national programme of terrestrial HLC projects. It will enhance the capability of English Heritage and other users to inform the sustainable management of change affecting the historic dimension of that environment, contextualising it and doing so in a manner compatible with analogous natural environment datasets. As with purely terrestrial HLCs, the project's scale of analysis was at a strategic-level. Its main object of study was the present landscape, transcending and giving context to the predominantly point-data records of the coastal and marine historic environment. In its landscape-oriented objectives, its comprehensive relevance and coverage, its ready assimilation with marine natural environment datasets, and its potential to contribute towards future inter-disciplinary marine landscape assessment, the project will make a major contribution to meeting the commitments arising from the European Landscape Convention now in force in the UK (*ibid,* 2).

2.3 AIMS AND OBJECTIVES

2.3.1 PROJECT AIMS (Hooley 2007a, 4-5)

The projects overall aim was to produce a robust, nationally applicable methodology for coastal and marine historic seascapes characterisation (HSC), capitalising on experience gained from Rounds 1 and 2 of England's Historic Seascapes Programme's projects, and to prepare material for dissemination as part of future promotion and implementation of the method.

The project's more specific aims were to:

- consolidate and build on the methodological experience from the England's Historic Seascapes Programme pilot projects, clearly documenting in a Method Statement the new HSC methodology produced by this project;
- ensure that the new methodology produced historic seascapes GIS-databases fully compliant with the principles of HLC, so that HSC is a natural extension of HLC (and vice versa);
- ensure the new methodology produced historic seascapes GIS-databases that enhance and provide landscape-scale contextualisation of the Maritime Record of the National Monuments Record, the County HERs and the Rapid Coastal Zone Assessment programme;
- collaborate sufficiently closely with EH (Characterisation and Maritime Teams) to ensure that the detailed user-needs of EH were met within the timetable of the project, with regard to the method's scope, content and practicality, and to meet available standards for data content, management, inter-operability and accessibility developed and agreed for the needs of forthcoming marine spatial planning (MSP);
- enable area-based understandings of the historic environment that are designed to promote well-informed decision-making relating to the sustainable management of change and conservation planning affecting the historic environment in the coastal and marine zones;
- provide an initial framework to structure, inform and stimulate future research programmes and agendas relating to the coastal and marine historic environment
- provide material to improve the awareness, understanding and appreciation of the historic dimension of the coastal and marine environment to professional and non-professional users of the database; and
- be a demonstration project for extending the application of the national HSC methodology to the full extent of England's coastal and marine zones and adjacent UK Controlled Waters.

2.3.2 KEY OBJECTIVES

The project's key objectives were to:

- create a new HSC methodology, in close conjunction with EH and with other parties such as the Marine Data and Information Partnership (MDIP) and Marine Environmental Data Action Group (MEDAG) as appropriate
- ensure that the resultant Method is aligned with the principles of HLC (as presented in Clark *et al* 2004, Part 1), with the needs of EH and the standards for data content, management, inter-operability and accessibility being developed for marine spatial planning
- produce a Method Statement clearly detailing the new HSC methodology in such a way that will provide future practitioners with simple and effective guidance for replicating the methodology in other areas

- assess the generic contexts and applications for the HSC in informing the sustainable management of change and conservation planning affecting the historic environment in the coastal and marine zones, including specific reference to contextualising marine aggregates extraction licensing
- produce an Archive and Project Report detailing:
    - the development of the national HSC method;
    - the considerations taken to ensure its national applicability and conformity with the principles of HLC;
    - an assessment of contexts and applications where the national HSC methodology has potential in informing sustainable management of change,
    - the potential of the HSC for raising public awareness and understanding of the coastal and marine historic environment; and
- disseminate information on the project through professional and popular publications and other media, and to organise a stakeholder meeting at the end of the project.

3 PRINCIPLES OF HSC

The principles of HSC follow the principles of land-based Historic Landscape Characterisation as set out in *Using Historic Landscape Characterisation* (Clark *et al* 2004). The constancy of HLC principles mean they are capable of receiving expression in all contexts of the historic environment, whether on land, coast or sea. It is essential to ensure that the coastal and marine historic environment is afforded the same opportunities as that on land to inform the shaping of our future landscapes, our understanding of ourselves and our environment, while accepting inevitable differences in the expressions of those principles. The principles can be summarised as follows:

- **It is comprehensive not selective:** characterisation covers the whole seascape and recognises that the whole marine historic environment has value and can be managed more or less appropriately. It encompasses all aspects, the commonplace, typical and modern as well as the locally distinctive, rare, special and historic
- **Areas not sites:** HSC-based understandings are concerned with areas, not point data and individual site-based approaches
- **Present, not past:** it maps the historic dimension of our *present-day* seascape, not the hypothetical reconstruction of 'past seascapes/landscapes'. Earlier landscapes exist only as hypothetical constructs based on fragmentary evidence within the present landscape, nevertheless HSC can allude to those previous sea/landscapes
- **Seascape as history not geography:** seascapes as 'documents' of time-depth expressing change and stability within areas. The emphasis is on the dynamic aspect of the seascapes, the most important characteristic being its time-depth; with change and earlier landscapes existing in the present.
- **Seascape as a cultural phenomenon:** recognising semi-natural and living features, indeed biodiversity overall, as a consequence of historic human activity in an area and therefore equally part of historic seascape character alongside more traditionally understood 'archaeological' features. Seascapes are lived in and through, mediated, worked on and altered and are filled with cultural meaning and symbolism
- **Interpretation not record:** characterisation of the seascape is a matter of perception rather than objective fact. Understanding 'seascape' as an idea, nor purely an objective thing. It reflects the world 'as perceived by people', an understanding combining our direct sensory inputs and vast range of more indirect cognitive sources bearing on place. Recognising the perceptual basis of HSC enables the approach to inform and capture collective and public perceptions of seascape alongside more specialist views
- **Informed management of change, not preservation:** the seascape is dynamic not static; it is the product of change and change will continue. With comprehensive coverage, HSC seeks to guide that change, asserting that better informed change can be better guided. It does not oppose the need for preservation where appropriate but provides a means of contextualising decision-making designed to address that need
- **Transparency and accessibility:** the characterisation process should be transparent, with clearly articulated records of data sources and methods used, and interpretation accompanied by confidence statements making explicit the decision-making process. HSC maps and text should be easy to understand, jargon-free and easily accessible to users
- **Inter-operability:** HSC databases should be readily inter-operable with other environmental databases, especially those providing area-based analyses. Not only does this facilitate better-integrated environmental inputs to management decision-making but critically, contributions to new understanding arise as much from observations of similarities and disparities in patterning *between* databases as from examination of the content *within* a database

4 REVIEW OF THE PILOT PROJECTS

4.1 INTRODUCTION

This section describes how the national method for HSC was developed from review of the five pilot projects' reports and method statements, with comparative analyses undertaken of the various work stages, principles, methods and results deployed by each project. The review and assessment of the each of the pilot methodologies was undertaken and guided by the broad themes and structure set out in the EH Method Guidance Document for this project (Hooley 2007b) under the following headings:

- **Source datasets** – source datasets used by the projects and geo-processing methods. A cross-comparison of the range of data sources used by the projects was undertaken. They were grouped into two types of data, categorised on the basis of their geographical coverage and information consistency and thus application to a national HSC methodology: 'Core' and 'Supplementary' data. this section also identifies the **roles of source data** and how the projects converged and differed in their use and treatment of source data and its application to character assessment.
- **Spatial data model, GIS workflow and attributes** – the GIS model, geo-processing techniques and database record attributes used.
- **Mapping the results of character assessment** – how the projects mapped historic seascape character in GIS.
- **Managing the land sea/overlap** – how the projects managed and recorded, mapped the overlap between land and sea and links with HLC.
- **Character Types and Character Areas** – how the projects defined the HSC 'character type hierarchy' (sub, character, broad) and its relationship to character areas.
- **Database standards and guidelines** – the standards used and best practise methods employed.

The Method Guidance Document also emphasised the importance of three criteria were particularly important for the national methodology:

- effectiveness, in conveying the character of the historic environment to the standards and levels of manipulability required in the national database's main anticipated applications,
- robustness, in providing that effective characterisation across the range of environmental and management contexts presented by England's coastal and marine environment,
- conformity with the established principles of HLC (cf Clark *et al* 2004).

The pilot projects are available for download from the ADS' ALSF maritime project archive: http://ads.ahds.ac.uk/catalogue/projArch/alsf/search_maritime.cfm.

4.2 SOURCE DATASETS

HSC is informed by the range of information available bearing on archaeological and historic activity. The divide between 'Core data' and 'Supplementary data' corresponds with normal practice in HLC projects and is maintained in HSC projects (see Figs 2 and 3).

Most of the Seascapes pilot projects placed emphasis on those datasets with consistent national coverage. More specific datasets, those in hard-copy only, or sources with more localised coverage were used to fine-tune and qualify the characterisation where appropriate. All the projects produced a divide between 'Core datasets' and 'Supplementary datasets' although the Solent-Isle of Wight project took a slightly different approach, subdividing their source data into those 'used for Seascapes' and those 'sources consulted' with considerable overlap between the two.

Source datasets are categorised into:

- **Core data** - comprising datasets with consistent national coverage and quality, preferably in digital format.
- **Supplementary data** – comprising datasets with inconsistent coverage, often at regional or local level but which can inform and qualify the historic characterisation about local variation which may be significant for the outcome of the character assessment. Given the current lack of very detailed national base-mapping coverage for the marine environment, unlike the terrestrial OS mapping, supplementary sources may play a greater role in HSC than they have traditionally in HLC. Again digital sources are to be preferred although much locally relevant data may be only available in hard copy.

4.2.1 ANALYSIS OF CORE DATA

Core data is dominated by OS modern and historic map and UKHO chart and survey data in coastal and inshore regions, and of most topics contained within the SeaZone Solutions Hydrospatial package; SeaZone Solutions Ltd is a subsidiary of the UKHO. Those data for offshore regions are dominated by the SeaZone data which was obtained by the pilot projects under licence and embodies a range of datasets supplied to SeaZone by their parent source providers, including the UKHO, BGS, JNCC etc.

The table on page 22 (Fig 2) identifies the convergence and divergence of the core data sources used by each of the five Seascapes pilot projects.

4.2.1.1 SEAZONE SOLUTIONS LTD HYDROSPATIAL DATA

All five pilot projects used the SeaZone Hydrospatial dataset although there were some differences between the Topics and Features used and the degree of 'derivation' of the source data.

The derivation of historic character from this dataset resulted in a number of challenges for the pilot projects, principally concerned with issues of copyright and data derivation. See section 5.3.4.1 for more detailed discussion.

4.2.1.2 ORDNANCE SURVEY MODERN AND HISTORIC MAPS

All five pilot projects used OS modern and historic maps to undertake character assessment in the coastal and inter-tidal zones. Modern OS maps provide information on present historic character whilst historic OS maps can provide further information on time-depth and

Source	Format	Location	Wessex Arch.	HWTMA, B/mth & Soton Univs	Oxford Arch.	MoLAS	Cornwall HES
Modern Charts	Digital/Hard copy	UKHO (SeaZone)	✓	✓	✓ (as supp. data)	✓	✓
Historic charts	Hard copy/digital	UKHO/NMM/other	✓	✓	✓ (as supp. data)	✓	✓
Modern OS maps	Digital	EH	✓	✓	✓	✓	✓
Historic OS maps (1st and 2nd OS Editions)	Digital	EH	✓	✓	✓	✓	✓
SeaZone Hydrospatial* (including the following Topics: Bathymetry & elevation (BE), Natural & physical features (NP), Structures & obstructions (SO), Socio-economic & marine use (SM), Conservation & environment (CE), Climate & oceanography (CO) and Wrecks (W))	Digital	UKHO: SeaZone Solutions Ltd	✓ (BE, SO, SM, W)	✓ (BE, NP, SO, SM, W)	✓ (all)	✓ (all)	✓ (all)
Adjacent County HLC data	Digital	Local Authority	✓	✓	✓	?	✓ (considered though not available at time)
Modern Aerial Photos	Digital	Local Authority					✓

*Fig 2 Core data sources used by each of the five Seascapes pilot projects, *the individual themed datasets comprising SeaZone Hydrospatial were used variably.*

Source	Format	Location	Wessex Arch.	HWTMA, B/mth & Soton Univs	Oxford Arch.	MoLAS	Cornwall HES
Fisheries data	Digital	CEFAS, Sea Fisheries Committees (regional), JNCC	✓	✓(Kingfisher charts)		✓	✓
HER/SMR/NMR data (including RCZAS)	Digital	Adjacent, EH NMR	✓	✓	✓	✓	✓
Geology (bedrock and sediment, borehole)	Hard copy	BGS	✓	✓	✓	✓	
Industry (offshore)	Digital	UKDeal, JNCC	✓ (JNCC)			✓	✓
Palaeoenvironmental data (sea-level index points)	Hard copy	Various		✓ (Soton Uni)	✓		✓ (Durham Uni)
Tidal Range (sea-level models)	Hard copy	DTi	✓	✓	✓	✓	
Environmental data and designations	Digital	Natural England/JNCC/MAGIC	✓	✓	✓ (for shipping info)		✓
Misc. documentary sources (texts, maps, images, art)	Hard copy	Various	✓	✓	✓	✓	✓
Other ALSF projects*	Hard copy/digital	ALSF (ADS www)	✓	✓			
FutureCoast (coastal morphology)	Digital	Defra		✓			
Shipping data	Digital	Anatec Ltd, JNCC, SeaZone, other	✓ (JNCC, England's Historic Shipping project)	✓ (SeaZone)	✓		✓ (Anatec)
Geophysical data	Digital	Various		✓ (Soton Uni)			
Marine Physical processes (currents etc)	Digital	Various		✓ (Soton Uni)			
Leisure Sailing Areas	?	RYA			✓		

Fig 3 Supplementary data sources used by each of the five Seascapes pilot projects. a comprehensive list of ALSF sponsored projects, for both the natural and historic environment is available for consultation from the Archaeology Data service website: http://ads.ahds.ac.uk/project/alsf/projects_new.cfm.*

are an important source for previous historic character, also allowing time-slices to be taken at their edition dates. See section 5.3.4.2 for more detailed discussion.

4.2.1.3 UKHO MODERN AND HISTORIC CHARTS, SAILING DIRECTIONS AND FOLIOS

All five pilots used modern and historic maritime charts although in varying capacity and according different precedence to them. Historic charts were obtained in both hard copy and digital formats, that in hard copy being scanned and geo-referenced in house (Liverpool Bay,

Withernsea-Skegness or from digital versions provided by UKHO (Scarborough-Hartlepool, Solent-Isle of Wight). The Southwold-Clacton project did not incorporate historic charts stating that notable information recorded on them is available from other datasets. Information derived from the charts was captured as intermediate layers before incorporation into the final character assessment. See section 5.3.4.3 for more detailed discussion.

4.2.1.4 HISTORIC LANDSCAPE CHARACTER ASSESSMENTS

Adjacent HLC datasets were used directly or considered by four pilot projects where it was available. See section 5.3.4.4 for more detailed discussion.

4.2.1.5 AERIAL PHOTOGRAPHS

Modern aerial photographs were consulted by the Scarborough-Hartlepool pilot only. See section 5.3.4.5 for more detailed discussion.

4.2.1.6 FISHERIES DATA

All five pilot projects considered commercial fisheries data in their methods. Only the Southwold-Clacton pilot did not incorporate the results in the character assessment mapping although some information was used to inform character area descriptions (Oxford Archaeology 2007, 22). All the projects identified problems with discovering readily mapped fishing information and incorporating fisheries information into the character assessment, despite the fact that historically fisheries have been well organised and extensively farmed. The greatest issue was precisely defining fishing grounds beyond broad and generic areas, a problem that may, in part at least, reflect the loose definition and use of fishing grounds themselves. See section 5.3.4.6 for more detailed discussion.

4.2.1.7 ENVIRONMENTAL DATA

Natural environment datasets were consulted by all the pilot projects. Such data provide important information informing HSC on various aspects of semi-natural environments that to many people may appear to be wholly 'natural' but which also reflect, whether directly or indirectly, the cumulative impact of man's activity in the environment. Habitat and land cover mapping also inform HSC indirectly on farming regimes and land use patterns. Natural environment designations demonstrate current policies and attitudes towards these areas. In the marine environment such mapping and designation descriptions are often the only datasets available for large areas. See section 5.3.4.7 for more detailed discussion.

4.2.2 ANALYSIS OF SUPPLEMENTARY DATA

The table on page 23 (Fig 3) identifies the convergence and divergence of the supplementary data sources used by each of the five Seascapes pilot projects. Even where supplementary, preference should always be given to using sources with national coverage for a specific subject over those with local coverage and data should be obtained consistently in digital format wherever it is available.

4.2.2.1 HER AND NMR DATA

NMR and HER data were used variably in the pilot projects. Most data was used to complement and inform character mapping, providing exemplars of the components and features in associated character text descriptions. The data was also used to assess the archaeological potential of the project areas and provide further information on time-depth.

Specific monument types and sites such as wreck data and maritime landmarks were used directly to define and map particular areas and types of historic character. Wreck clusters and dangerous wrecks were mapped in all the projects either through the use of buffers (Liverpool Bay, Isle of Wight-Solent) or correlation against a grid mesh (Scarborough-Hartlepool pilot).

All the pilot projects identified that HER and NMR data requires cross referencing in order to remove duplicates before combining into a single layer in preparation for inclusion into character assessment.

Following the HER and NMR data cross referencing, the resulting datasets also require further reviewing with SeaZone's Hydrospatial wreck data to identify and remove any further duplicates before combining into a single layer. Some wreck data was divided on the basis of positional accuracy and whether the wreck was DEAD, LIVE or LIFT (as in Liverpool Bay project). Once merged three methods were used by the pilot projects to inform character assessment mapping.

- Buffering wreck points by a spatial tolerance to produce polygons (Liverpool Bay, Solent- Isle of Wight and Scarborough-Hartlepool)
- Frequency count where point wreck point is joined to a vector grid and cell-based frequency count used to identify cells where two or more wrecks occur (Withernsea-Skegness and Scarborough-Hartlepool).
- Wreck density map using a weighted raster grid which is then converted to vector polygons (Southwold-Clacton).

See sections 5.3.5.1 and 5.3.5.2 for more detailed discussion.

4.2.2.2 BGS DATA

The Liverpool Bay and Scarborough-Hartlepool projects included the BGS seabed sediment data through their gridding although the original attribute names were removed and wholly new, generic terminologies applied. The Solent-Isle of Wight and Withernsea-Skegness projects did not directly transpose the BGS polygons into the HSC, rather they were consulted for the development of character areas. The Southwold-Clacton project did not include BGS information in the final HSC layer due to copyright issues. See section 5.3.5.3 for more detailed discussion

4.2.2.3 INDUSTRY DATA

Three pilot projects (Liverpool Bay, Solent-Isle of Wight and Southwold-Clacton) categorised industry into 'Intrusive and non-intrusive industry' aiming to record and present an assessment of sea-floor and sub-sea floor directly in the character assessment. Industry was also differentiated on the basis of geographic location (eg. offshore, coastal etc).

Intrusive offshore industry was used to refer to any industrial activity at sea that continuously disrupts and impacts on the marine environment (particularly the sea-floor) through time. For example aggregate dredging, oil and gas installations etc.

Non-intrusive industry was used to refer to any industrial activity at sea that does not have a continuous and incremental intrusive impact on the sea-floor such as commercial shipping.

The Withernsea-Skegness project did not distinguish between intrusive or non-intrusive industries but made a distinction between coastal and offshore industries.

The Scarborough-Hartlepool project did not differentiate between intrusive or non-intrusive industries or the distinction of industries on the basis of geographic location preferring instead to discuss the different aspects of industries in associated character type texts and viewing different types of industry as an extension of those found and recorded in land HLC.

In the Liverpool Bay project, in the creation of the offshore industry layer, data was copied directly from SeaZone although the project noted that 'there are licensing and copyright constraints associated with this data layer' (Wessex Archaeology 2007b, 24). When the final character assessment mapping was delivered to the NMR it was removed (*ibid*, 92).

The Solent-Isle of Wight project also used industry data directly from SeaZone.

The Southwold-Clacton project also used industry data directly from SeaZone although 'Once the primary datasets have been prepared, they are 'unioned' in order to create a single 'Near-level' layer -an amalgam of all of them that shows the approximate spatial distribution of marine use and activities (Oxford Archaeology 2007, 17). 'In order to merge the data into a single Near-level layer it was first necessary to assess every polygon in the primary datasets to assign it to an abstract 'Subcharacter Type' (Oxford Archaeology 2007, 28).

See section 5.3.5.4 for more detailed discussion

4.2.2.4 PALAEOENVIRONMENTAL DATA: MODELS OF SEA-LEVEL CHANGE AND PALAOEOGEOGRAPHIES

Palaeolandscape information was considered by all the pilot projects and models of sea-level were generated only by the Liverpool Bay and Scarborough-Hartlepool projects. References were made by Solent and Isle of Wight, Withernsea-Skegness and Southwold-Clacton projects as to the potential of buried land surfaces below the sea-floor.

To include this aspect of the past character, the Liverpool Bay pilot project saw it as necessary to 'devise a model of sea level change in the Pilot Area to provide an approximation of the course of marine transgression in the region in the post glacial period. This past dry land use of the seabed was difficult to draw through the characterisation process as its survival and influence on the present inter-tidal and marine landscape is difficult to establish. However, the possibility of past dry land landscapes surviving in some form at least is noted in the narrative texts for the final character areas so that it was not lost merely because its survival and influence is poorly understood' (after Wessex Archaeology 2006, 19-20).

Although research in this field is developing, at present for most areas the distribution and resolution of available data is not high or consistent enough to produce a meaningful characterisation (HWTMA *et al* 2007a, 52). Nevertheless 'though current models are indicative with the exception of coastal areas where OS mapping or historic charts begin to provide more reliable data from the late 18th century onwards, the interpretation of time-depth for [HSC] is reliant on the sea level change map as its sole data source. As such future pilot projects may be able to use developing models with a greater level of accuracy and confidence' (Wessex Archaeology 2006, 38-39, ref. 58370.06). Models of sea-level change, where they exist, would normally be used to inform previous historic character. 'The changing sea levels and available land mass have had a dramatic effect on the land and seascapes of the British Isles and add even further dimensions to the marine zone in terms of characterisation' (HWTMA *et al* 2007a, 19-20).

Similarly accurately estimating and removing isostatic movement from the sea level calculations is beyond the scope of HSC projects, unless data specific to the project area is already available.

Within the Liverpool Bay and Scarborough-Hartlepool study areas the decision was made 'to engage with this potential through use of models of past sea-level intersected with modern bathymetry. This classified the current bathymetry into a series of 'last exposed' date regions'. As both projects noted, 'this method creates some significant interpretive problems that need to be critically considered prior to their use within HSC' (HWTMA *et al* 2007a, 14-15; Tapper *et al* 2007), notably the direct evidence emerging from various recent surveys (eg. Gaffney *et al* 2007) that modern bathymetry is often not an accurate guide to the topography of pre-submergence landscapes and therefore to their patterns and dates of submergence.

See section 5.3.5.5 for more detailed discussion.

4.2.2.5 FUTURECOAST DATA

FutureCoast data was used only by the Solent-Isle of Wight pilot project to identify coastal morphology. See section 5.3.5.6 for more detailed discussion.

4.2.2.6 SHIPPING DATA

The Liverpool Bay project used data from JNCC, England's Historic Shipping project and sailing directions to identify shipping routes.

SeaZone depth and transportation data used to infer and identify shipping channels (latter for commercial channels) by Solent-Isle of Wight and Scarborough-Hartlepool projects.

Commercial shipping data (provided by Anatec Ltd) was used by the Southwold-Clacton and Scarborough-Hartlepool pilot projects. See section 5.3.5.7 for more detailed discussion.

4.2.2.7 GEOPHYSICAL DATA

Geophysical data was used only by the Solent-Isle of Wight pilot project to identify buried landsurfaces in the Solent region. Generally the use of geophysical data was only sparsely represented in the pilot projects. This is likely to reflect difficulties associated with its discovery and sourcing from originating organisations (usually industry), variability in its coverage and detail across English waters and issues arising from its availability on licensing grounds and interpretation. Much of the data, where available, is in raw data formats, often unfamiliar to archaeologists undertaking characterisation and requiring further manipulation and interpretation which is outside the scope of HSC projects. Nevertheless where it is readily available to use directly it should be considered. See section 5.3.5.8 for more detailed discussion.

4.2.2.8 BILBIOGRAPHIC AND DOCUMENTARY SOURCES

Bibliographic and documentary sources play an especially important role in HSC projects. All the pilot projects undertook extensive searches of local libraries, museums, record offices and archives to gather sources on general historic, archaeological, contemporary and environmental information.

In future further relevant bibliographic sources will become available to HSC projects, many being made available through the Marine Environmental Data and Information Network (MEDIN is a merger of the Marine Environmental Data Action Group (MEDAG) and the Marine Data Information Partnership (MDIP)) – with the focus to improve access to and management of UK marine environmental data and information; and the Marine ASLF ADS archive and website (http://ads.ahds.ac.uk/catalogue/projArch/alsf/). See sections 5.3.5.9-12 for further discussions of these sources.

4.3 SPATIAL DATA MODELS

All the pilot projects built database structures that stored data in a flat file format, that is, where no relationship classes were used. However varying techniques were used to 'build' the finalised character assessment layers including the use of database joins and automated re-classification to populate attribute values.

A flat file database is designed around a single table where all the information is stored one table, with attribute fields representing all the parameters and their values – one polygon equals one record. Designing flat file databases is simple and requires little design knowledge and can be developed using most database engines. They are simple to create, populate and maintain. They can be created in relational database engines by not taking advantage of relational design concepts but may be split up at a later date if a relational design is required. Flat files offer the functionality to store information, manipulate fields, print or display formatted information. Spatial data models used by the pilot projects are described below (Fig 9).

4.3.1 MULTI-MODE APPROACHES TO HSC

All the pilot projects used attribute-led classifications of historic character, exhibiting to a greater or lesser degree multi-mode methodology (see Aldred and Fairclough 2003); with attribute-led character description producing their lowest (most detailed) tier of characterisation, classified at higher tiers (generalised) by a 'top-down' prescriptive classification of Character Types and Broad Types (see 4.3.2). By contrast, the ascription of Character Areas, also undertaken by the pilots is a secondary 'top-down' process.

The pilot projects reflected the attribute-led method through the design of their GIS databases and the GIS workflows resulting from the ascription and interpretation of the database attribute values to produce character mapping.

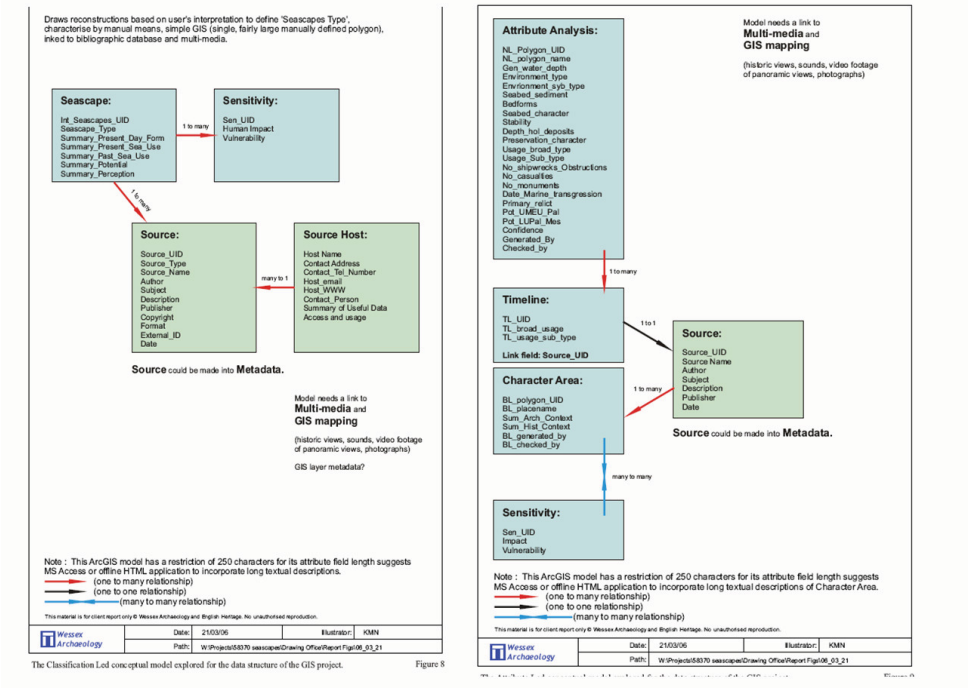


Fig 4 Example (right) of attribute structure from the Liverpool Bay project (Wessex Archaeology 2006, , figures 8 and 9)

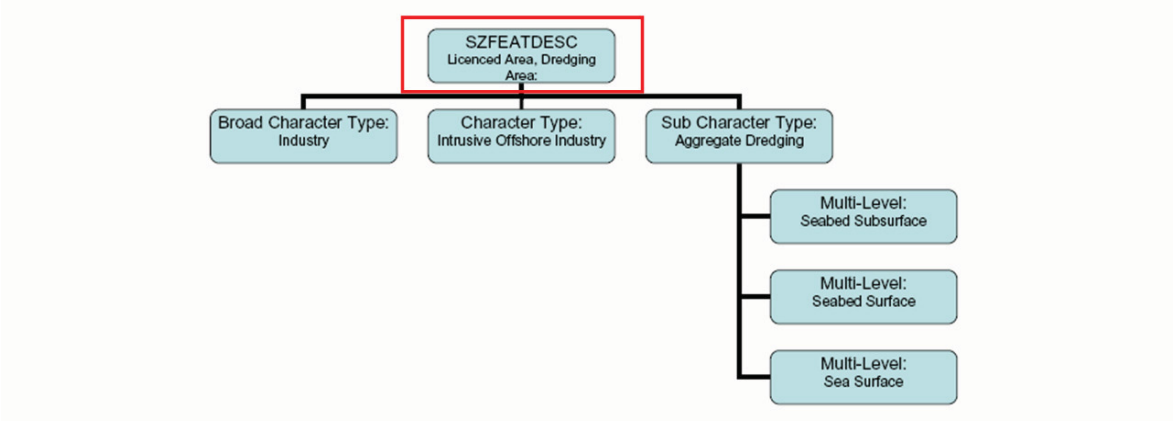


Fig 5 *Example character type hierarchy from the Solent-isle of Wight project (HWTMA et al 2007, 21)*

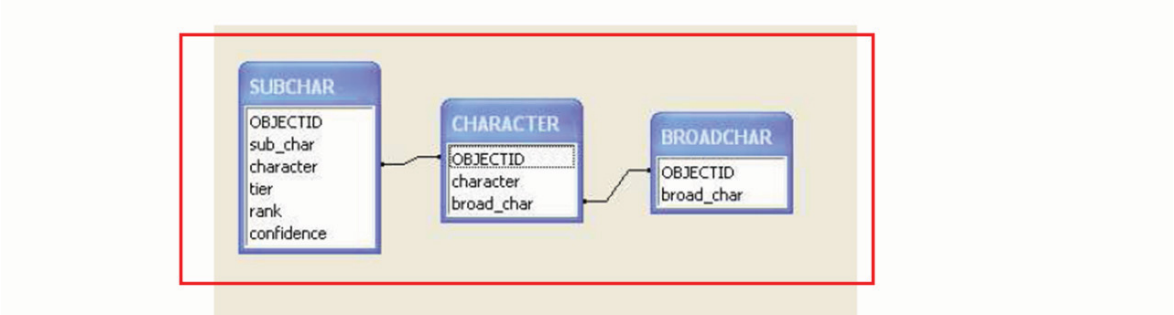


Fig 6 Example of attribute structure and character type hierarchy from the Southwold-Clacton project (Oxford Archaeology 2007, 29)

The Withernsea-Skegness project stated 'The multi-mode approach taken by Wessex was not followed as a more organic developmental model was deemed to be more efficient. An intermediary GIS project was created which included all the core datasets, grouped and arranged for maximum efficacy and inter-visibility. This intermediary investigative GIS project was visually investigated and interrogated to inform on the shape and attributes of the Characterisation_polygons which in turn informed on the shape and attributes of the Character_Area(s).' (MoLAS 2007, 14-15). This reflects, as does closer analysis of the database structure, an attribute-led methodology.

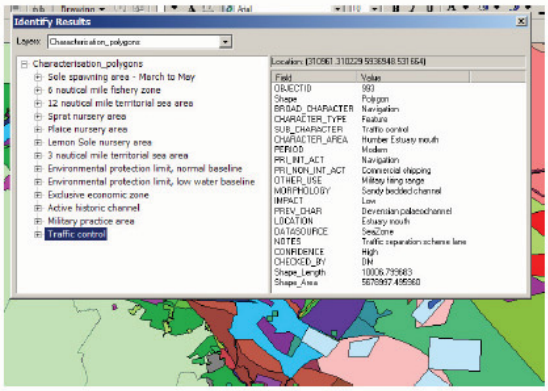


Fig 1 Display of Characterisation_polygons attributes

Fig 7 Example of attribute structure and character type classifications from the Withernsea-Skegness project (MoLAS 2007, 15)

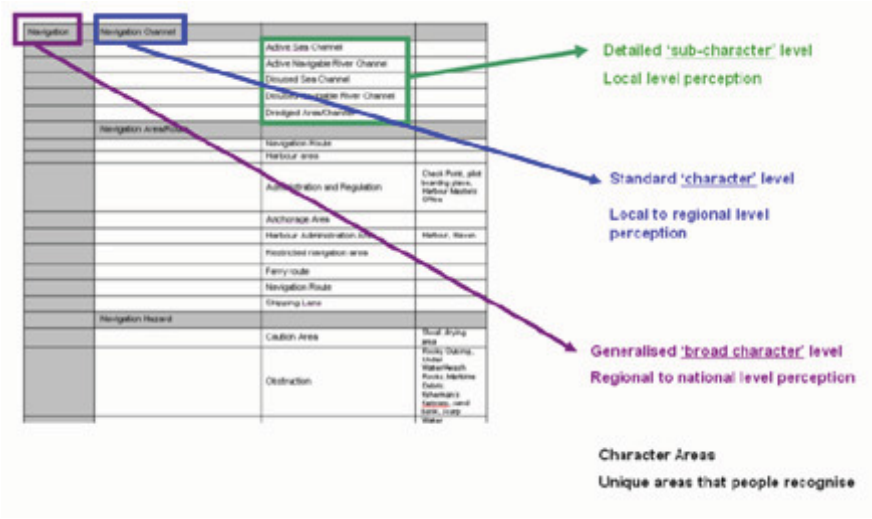


Fig 8 Example of attribute structure and character type classifications and hierarchy from the Scarborough-Hartlepool project (Tapper et al 2007, 25)

Multi-mode approaches to historic land/seascape characterisation conform to current HLC best practice and ensure that the character assessment is transparent and readily understood by users.

	GIS software/ database format	Metadata standard	Data structure	Flat file or Relational	Projection	Copyright
Liverpool Bay	ESRI ArcGIS 9.0 geodatabase: shp and mdb;	(UKGEMINI)	Personal Geodatabase comprising three Feature Class shapefiles: • Characterisation_areas • Seascapes_final_polygon_layer • Study_area	Flat	OSGB36	GIS database subject to Crown and SeaZone copyrights; attribute data relating to sediment, morphology, and tidal range was deleted from version of attribute analysis mapping delivered to EH, as was all data relating to industry, geology and geomorphology from the intermediate themed mapping.
Solent/IoW	ESRI ArcGIS 9.1 geodatabase : shp and mdb;	UKGEMINI	Personal Geodatabase comprising five Feature Class shapefiles: • characterareas • coastal • seabedsubsurface • seabedsurface • seasurface	Flat	OSGB36	All sub-layer mapping remains in the copyright of all source datasets it contains: this is the mapping which bears the character-type hierarchy attributes. Only the Character Area (Top Level Polygons) mapping is assigned to EH copyright and it does not give access to the sub-layer character assessment.
Southwold-Clacton	ESRI ArcGIS geodatabase : shp and mdb;	UKGEMINI	Personal Geodatabase comprising four Feature Class shapefiles (shp) and five link coded reference tables (tbl): • BROADCHAR tbl • CHAR_AREAS shp • CHARACTER tbl • CONFIDENCE tbl • NEAR_LEVEL shp • SA_COASTAL shp • SA_MARINE shp	Flat	WGS84	Despite omission of BGS data from the project's sources on grounds of its copyright implications, this GIS database remains subject to the copyright restrictions of its source data providers, notably SeaZone, which the project's 'Near Level' data amalgamates

	GIS software/ database format	Metadata standard	Data structure	Flat file or Relational	Projection	Copyright
			• SUBCHAR tbl • TIERS tbl			
Withernsea-Skegness	ESRI ArcGIS 9.1 geodatabase : shp and mdb;	FGDC Content Standards for Digital geospatial Metadata, version: FGDC-STD-001-1998	Personal Geodatabase comprising four Feature Class shapefiles: • Character_area • Characterisation_polygons • Project_area • Statutory_boundaries	Flat	WGS1984 UTM Zone 31N	Some deliberate altering of polygon boundaries from original source-data polygons, apart from being a dubious practice, the GIS database's polygons almost certainly remain subject to the copyright restrictions of its source data providers, notably SeaZone, of which the project's 'Characterisation Polygons' are roughly drawn amalgamations
Scarborough-Hartlepool	ESRI ArcGIS 9.1 geodatabase : shp and mdb;	UKGEMINI (MetaDragon application)	Personal Geodatabase comprising five Feature Class shapefiles: • Scarborough_hartlepool_hsc_character_areas • Scarborough_hartlepool_hsc_derived • Scarborough_hartlepool_hsc_final • Scarborough_hartlepool_hsc_historic_maps_charts • Scarborough_hartlepool_hsc_modern_maps_charts	Flat	OSGB36	All are assigned to English Heritage copyright achieved by placing character assessments in 250m grid for marine zone using polygons for OS maps in coastal and intertidal zones.

Fig 9 Spatial data models used by the pilot projects

4.3.2 MAPPING HISTORIC CHARACTER WITHIN GIS

The pilot projects took varying approaches to mapping character assessment – principally using polygons and grid cells to define the lateral extent of areas of historic character (see fig 14 for more detail). The use of polygons conforms with terrestrial HLC practice and was adopted by all the projects. The adoption of grids, initially tested by the Liverpool Bay project, was only taken forward by the Scarborough-Hartlepool project in Round 2 and then only to capture character assessment below MLW.

The Scarborough-Hartlepool pilot project's use of a gridding method produced much the most convincing resolution of the need to maintain the integrity of the method and expression of HSC; accordingly it was viewed as the favourable approach (Hooley 2007b, 9) to map historic character below MLW. Polygons are the most appropriate method for capturing historic character above MLW. The use of grids is further discussed in section 5.4.3.2.

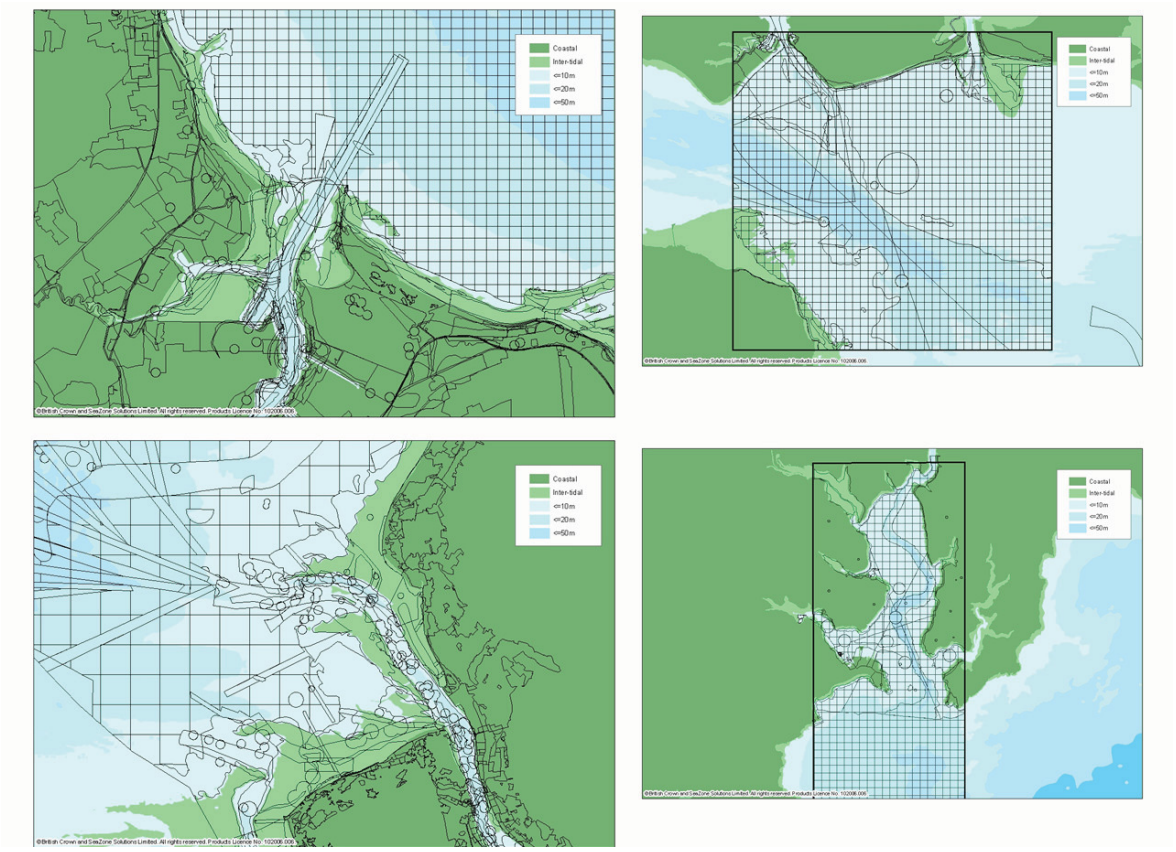


Fig 10 Examples of use of grids and polygons to map character assessment, tl: Scarborough-Hartlepool project; bl: Liverpool Bay project; tr: Solent test-bed area; br: Falmouth Bay test-bed area

The relative merits and drawbacks of using grid cells are outlined below (after Wessex Archaeology 2006a, 32-36):

Benefits:

- Through its visual appearance, gridding immediately flags to the user the diffuse nature of offshore character areas (i.e. user will know that the edge of marine habitat is extremely unlikely to be perfectly straight line, and hence the user recognises a level of summarisation);
- Uses the power of GIS queries to populate attributes;
- Visually highlights the boundary between HSC and terrestrial HLC (e.g. grid square abuts polygon);

- Eases 'density' analysis and frequency count, for example wreck concentrations;
- Approach being utilised by marine spatial planning initiatives such as the JNCC Irish Sea Pilot, which may bring as yet unknown benefits for creating integrated marine spatial planning.
- It maintains the integrity and expression of the resulting HSC, providing clear separation of the results of historic character assessment from the content of source datasets by which the assessment is informed.
- It provides a common framework for mapping character at different tiers of the marine environment, facilitating their comparison and manipulations (see 4.3.2.1)

Drawbacks:

- Considerable data preparation required to convert data and attributes into a format ready for auto-population;
- Treatment and preparation of 'point' data (eg monument data) for inclusion utilises GIS generated buffering that may or may not accurately reflect the true extent of the site; a vector grid system may be deemed to represent a degradation of the accuracy of the original data source being presented at fine scales (MoLAS 2007b, 15)
- Basic premise of querying mapping layers and auto-population may place too great an emphasis on the availability of mappable data;
- Inclusion of external data requires good quality metadata to ensure that the limitations associated with the external data's use are understood by HSC compiler;
- The visible difference between the terrestrial and intertidal/marine character maps may perpetuate the perceived barrier to treating archaeology seamlessly from the terrestrial across the intertidal and into the marine zone.

4.3.2.1 MULTI-LEVEL SEASCAPES

A significant development in the Round 2 pilot projects was the development of a spatial data model that allowed the historic characterisation of the various levels of the sea ie. sea-surface, water-column, sea-floor, sub-sea-floor. Three projects (Solent-Isle of Wight, Southwold-Clacton and Scarborough-Hartlepool) mapped the multiple layers recognising that markedly different activities can occur in the different levels (see section 5.4.2.1 for further discussion).

Whilst the first two projects mapped the different levels independently the Scarborough-Hartlepool project, through its use of grids, was able to map each level within a single layer – greatly facilitating cross-comparison between them. The use of grid model also makes population of the character assessment of the each level of the marine tier easy to achieve without extensive re-digitisation and it is easily updatable as new data become available. The four levels identified in this project, along with the associated attribute structure (see section 4.3.3) was the method favoured by EH to take forward to the national method (Hooley 2007b, 17).

4.3.2.2 TIME DEPTH

All the pilot projects included time-depth in their character assessment although it was restricted in four (see fig 14) to the recording of an interpreted value representing the estimated or known period of origin of the present-day character type. Only the Scarborough-Hartlepool project recorded a 'previous HSC' period value in its mapping.

The use of benchmark periods through the assessment of previous historic character allows time-slices to be produced and the emphases and variations in forces for change to be

recognised over time for any area where information is available. See section 5.5.2 for further discussion.

4.3.3 REVIEW OF THE PILOT PROJECTS' HSC DATABASE ATTRIBUTES

The table below (Fig 11) identifies the basic attributes of each of the pilot HSC geodatabases Irrespective of how the data is structured, such basic attributes as given in Fig 11 form the 'Units of Information' recorded by the methodology. Those units of information that carried forward to the national HSC method following this project's review can be used to inform a MIDAS Information Scheme entry for HSC (see 4.9.1).

The attribute structure of the Scarborough-Hartlepool project, with suggested amendments, was the method favoured by EH to take forward to the national method (Hooley 2007b, 15-17).

The finalised national method attribute structure is presented in section 5.4.4.

Attribute Name	**Description**	**Wessex Arch.**	**HWTMA, B/mth & Soton Univs**	**Oxford Arch.**	**MoLAS**	**Cornwall HES**
ObjectID	Unique polygon identifier(s)	*Object ID, WA_ID*			*ObjectID*	
Name (Sea Area)	Name of sea area or topographic identifier					*NAME*
NLO_area	Named Location	*NLO_area*				
Broad Character Type *(conflated)*	Broad Character Type (present, dominant; national strategic level)	*BROAD_CHAR*	*BROAD_CHAR(1-∞)*	*BROAD_CHAR*	*BROAD_CHARACTER*	*BRD_CHRCTR*
Character Type *(conflated)*	Character type (present, dominant; regional level)	*CHAR_TY*	*CHARA_TY (1-∞)*	*CHARACTER*	*CHARACTER_TYPE*	*CHRCTR*
Sub Character Type *(conflated)*	Sub character type (present, dominant; local level)	*SUB_CHAR*	*SUB_CHAR(1-∞)*	*SUBCHA_DOM*	*SUB_CHARACTER*	
Sea-bed HSC	Sea-bed historic character (present, dominant; sub-character level)		*Seabedsubsurface (separate GIS layer)*	*SUBCHA_SUB (Tire 1: Sub-geosurface)*		*SBBNTHC (Sub-Benthic Character)*
Sea-floor HSC	Sea-floor historic character (present, dominant; sub-character level)		*Seabedsurface (separate GIS layer)*	*SUBCHA_GEO (Tier 2: Geophysical surface)*		*BENTHC (Benthic character)*
Water Column HSC	Water column historic character (present, dominant; sub-character level)			*SUBCHA_WAT (Tier 3: Water body)*		*PELAGIC (Pelagic character)*
Sea-surface HSC	Sea surface historic character (present, dominant; sub-character level)		*Seasurface (separate GIS layer)*	*SUBCHA_WAT (Tier 3: Water body)*		*SURFACE (Surface character)*

Attribute Name	Description	Wessex Arch.	HWTMA, B/mth & Soton Univs	Oxford Arch.	MoLAS	Cornwall HES
Previous Character Type (1-∞)	Previous historic character for which evidence is available				*PREV_CHAR*	*PRVSCHRCTR*
Period (1-∞)	Benchmark period of origin of the area represented in the polygon. Historic character date (eg. prehistoric, medieval, post-med, modern etc)	*PERIOD*	*PERIOD_TY(1-∞)*		*PERIOD*	*PERIOD1 (Present Character date), PERIOD2 (Previous character date)* *1-∞*
HLC Character Type	Adjacent HLC Type	*HLC_CHA_TY*				
Character Area	Unique character area.		*AREA_NAME (separate GIS layer)*	*CHAR_AREAS tbl*	*CHARACTER_AREA*	*CHRCTRAR*
Primary Landscape		*PRI_LNDSC*				
Other Landscape/Use	Other secondary seascapes uses that are apparent but are not dominant	*OTHER_LAND*			*OTHER_USE*	
Primary_Intrusive_Industry/Activity	Description of the principal intrusive activity in the area	*PRI_INT_IND*			*PRI_INT_ACT*	
Primary_Non-Intrusive_Industry/Activity	Description of the principal non-intrusive activity in the area	*NO_INT_IND*			*PR_NON_INT_ACT*	
Location	General location (eg. Offshore marine, inshore marine, estuary, coast etc)	*LOCATION*			*LOCATION*	*LCTN*
Morphology	Form and structure of sea-floor/coastal area				*MORPHOLOGY*	

Attribute Name	**Description**	**Wessex Arch.**	**HWTMA, B/mth & Soton Univs**	**Oxford Arch.**	**MoLAS**	**Cornwall HES**
HLC_REF	Terrestrial HLC Type/identifier	*HLC_ref*				
Habitat	Natural or semi-natural habitat	*HABITAT*				*HABITAT*
Sea_Level	Sea level date for submerged landscapes, ie. The date at which land was submerged.	*SEA_LEVEL*				*SEALVL*
Impact	Assessment of primary activities' impact on character. Broadly assessed as High Moderate and Low.	*P_IMPACT*			*IMPACT*	
Confidence (1-∞)	Degree of certainty/confidence of HSC interpretation	*CONFIDENCE*	***Inherent in the use of original source data in character mapping.***	***confidence***	*CONFIDENCE*	*CNFDNC*
Source (1-∞)	Sources used to identify present and previous historic character			***Fid_datasource?***	*DATA SOURCE*	*SOURCE1 (Sources used to identify present character),* *SOURCE2 (Sources used to identify previous character)* *1-∞*
Notes	Further background information on history of the polygon. Expansion on information recorded at broad character and sub-character levels.				*NOTES*	

Attribute Name	**Description**	**Wessex Arch.**	**HWTMA, B/mth & Soton Univs**	**Oxford Arch.**	**MoLAS**	**Cornwall HES**
Scale (1-∞)	Scale of original data					*SCALE*
Links (1-∞)	URL hyperlink to character texts and media					*LINK1, LINK2* *1-∞*
Creation Date	Date of dataset creation/completion					*CRTDATE*
Checked_By		*CHECK_BY*			*Checked_By*	
Shape_Length		*Shape_Length*			*Shape_Length*	
Shape_Area		*Shape_Area*			*Shape_Area*	

Fig 11 The basic attributes of each of the pilot HSC geodatabases

4.4 MAPPING THE RESULTS OF CHARACTER ASSESSMENT

4.4.1 APPROACHES TO THE DEFINTION OF HISTORIC CHARACTER

In terms of process all the pilot projects adopted broadly similar approaches to the definition of historic character. Each project passed through at least two stages of character assessment. The initial stage involved the description and mapping of historic character at a detailed level (attributed at sub-character level) and the production of a series of intermediate source-based data layers. The second stage involved the prescription of the character type hierarchy and development of the final characterisation layer.

Two projects (Liverpool Bay and Scarborough-Hartlepool) identified a series of themed layers whose sources were grouped to develop three expressions of historic character: historic sea-use, present sea-use and (semi-)natural environment processes. This involved the projects establishing which sources best informed on each of the three themes followed by a programme of digitisation by source before GIS union and dissolve routines brought the data into a single HSC layer. Attribute analysis was then applied to produce mapping on the classification of the repeating character types. The projects differed in the linkages of the associated character texts however; with linkage to specific character areas used for the former project and generic character types the latter.

The Solent-Isle of Wight project undertook a reclassification of original source data, choosing to maintain direct relationships between that source data and character assessment mapping. It stored extracted source data as a number of separate layers organised by data type; the actual method of extraction of useful data involved making explicit which elements informed on the physical form of the sea, the current uses of the sea and previous use of the sea (HWTMA *et al* 2007a, 19-20). The source data was then assigned (reclassified) to a character 'Type' within one of five separate layers: 'coastal', 'seabedsubsurface', 'seabedsurface' and 'seasurface'. A 'Top Level Polygon' character areas layer was then mapped and presented as the final characterisation. The project states however that this layer was not based on any assessment of dominant character between the separate levels mapped, 'in recognition of this a system was devised that presented the known character of the sub-layers through a top-level character area polygon without the need to prioritise one activity (ie. level) over another' (HWTMA *et al* 2007b, 35).

The Southwold-Clacton project adopted a three stage process. The first stage involved identifying and preparing the 'primary datasets' which were then 'unioned' to create the single 'Near-Level' layer - essentially an amalgam of all of source-data polygons which was used as a foundation for the third stage: identifying, investigating and describing 'Character Areas'. These represented the final characterisation and 'identify generic maritime use at the small scale, intended to delineate regions which are cohesive yet unique local contexts. As separately derived spatial entities, they also avoid the licensing and copyright issues associated with distributing 'Near-level' data.' (Oxford Archaeology 2007, 16-17).

The Withernsea-Skegness project, in its own terms 'followed a more organic developmental model' (than Liverpool Bay) which it deemed to be more efficient. This involved the creation of an 'intermediary GIS project' holding all the core datasets. From these core datasets two levels of characterisation were mapped: 'Characterisation_polygons' and 'Character_Area' mapping. The 'Characterisation_polygons' represent the analysis of the morphology and recorded human usage of areas of the seascape and were designed to be overlapping 'in order to enhance the depth of available characterisation and interpretation by the user' (*ibid*, 14). The 'Character_Area' polygons represent the 'informed fusion of the Characterisation_polygons to generate an overarching discrete polygon that encapsulated and defines the primary dominant character of that area' and unlike the characterisation polygons are discrete and contiguous (MoLAS 2007b, 14-15).

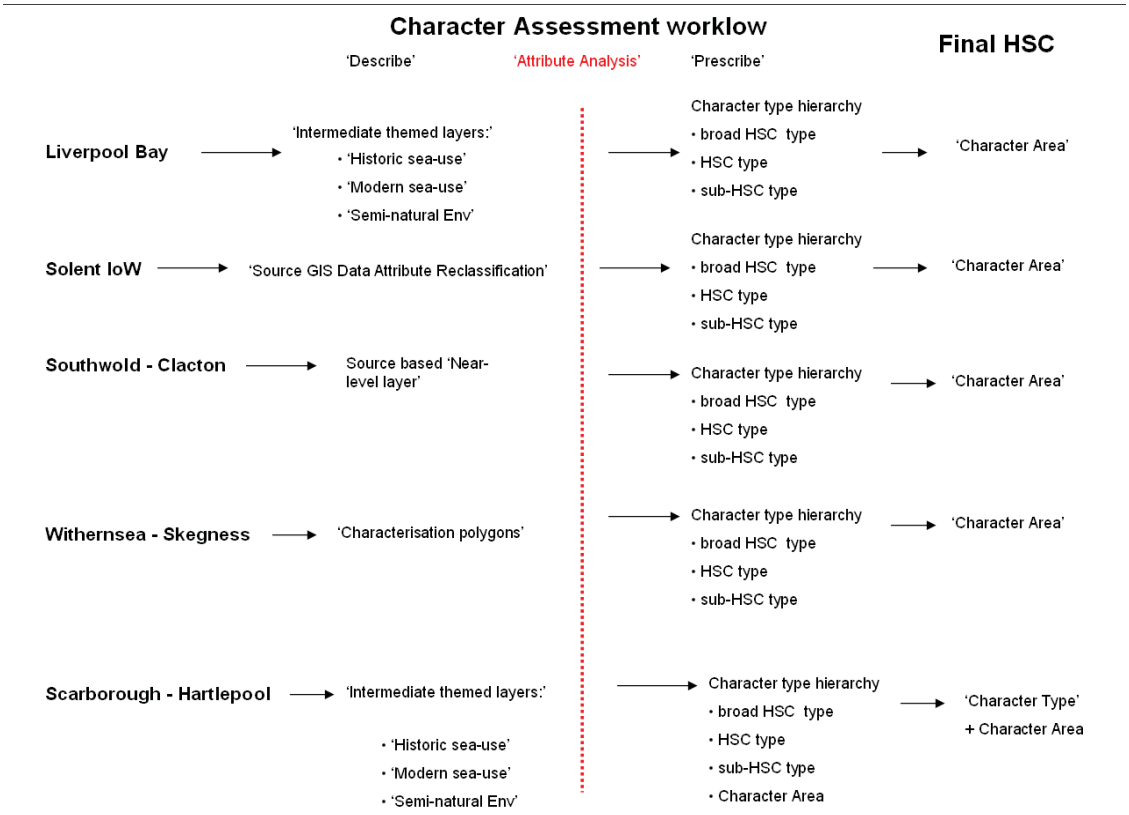


Fig 12 Character assessment workflow for HSC projects

In light of the various methods taken by the pilot projects a simplified character assessment workflow (Fig 13) is recommended for the national method, described below in section 5.3.3.1.

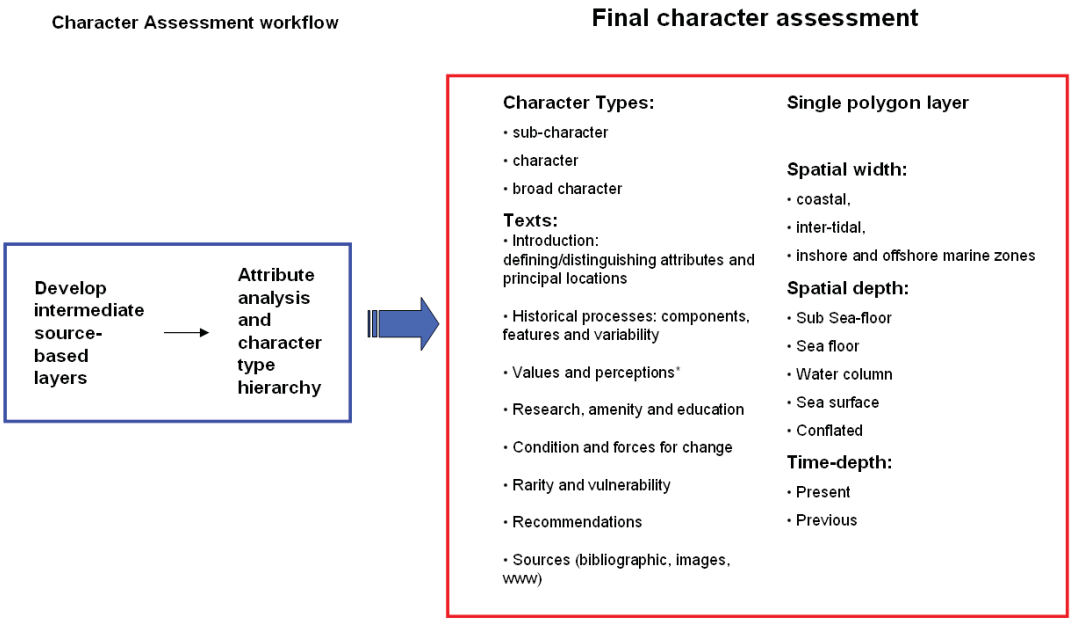


Fig 13 Simplified Character assessment workflow for HSC projects

Project	**Mode**	**Character Assessment workflow**		**Final character assessment**	**Single or multiple polygon layers and geo-processing methods**	**Layering of the HSC database**		
						How many dimensions of the marine historic environment can be portrayed by HSC mapping using queries on the attribute structure?		
						Two dimensions=area portrayal only. Whether zones are defined in the project database (eg. coastal; inshore, marine etc)	Spatial depth=portrayal of HSC at differing depths	Time-depth= portrayals of HSC areas at differing depths and differing times (periods/present vs previous)
Liverpool Bay (Wessex Arch.)	Multi-mode	Develop 'intermediate 'themed layers' *Modern sea-use* *Historic sea-use* *Environmental processes*	Generate 'Attribute Analysis' > character type hierarchy *Broad type* *Character type* *Sub type*	Produce 'Character Area Analysis' *Character Areas (CA)* *CA texts*	Single, query-able against attributes; unioned	Subdivided into coastal, estuarine, intertidal and marine zones.	*Conflated. HSC expressed as single layer*	*Present*
Solent/IoW (HWTMA, B/mth & Soton Univs)	Attribute-led (re-classification)	Data Reclassification> *(attribute re-naming, amalgamation of source dataset polygons with <u>no</u> alteration. ie. data mapping not character assessment)*	Generate 'Attribute Analysis' > Character type hierarchy *Broad type* *Character type* *Sub type*	Produce 'Top-Level Character Area polygons analysis' *Character Areas* *CA texts*	4 vertical sub-layers, query-able against source data and reclassification attributes; unioned	Coastal, marine. Only Character Area mapping is comprehensive (but this uses *Navigational Hazards* project polygons for marine area and not query-able against attributes)	*Sea-surface,* *Seabed surface (incorporating water column),* *Seabed sub-surface;* *Conflated.* *No comprehensive coverage in 4 sub-layers*	*Present*

Southwold to Clacton (Oxford Arch.)	Attribute-led (re-classification)	Develop 'Near-level layer' > *(amalgamation of all source dataset polygons which <u>some</u> alteration ie. data mapping not character assessment with source data organised by data type).*	Generate attribute analysis> Character type hierarchy *Broad type* *Character type* *Sub type*	Create Character Area layer *Character Areas* *CA texts*	Single layer, query-able against attributes; unioned	Subdivided into coastal, estuarine, intertidal and marine zones.	*Sub-surface,* *Water body* *Geo-surface*	*Present*
Withernsea to Skegness (MoLAS)	Attribute-led	Intermediary GIS analysis project > *Characterisation_polygons*	Generate attribute analysis > character type hierarchy *Broad type* *Character type* *Sub type*	Character Area analysis *Character Areas* *CA texts*	Single layer, query-able against attributes; polygon overlaps merged	Subdivided into coastal, estuarine and sea zones.	*Conflated. HSC expressed as single layer*	*Present*
Scarborough to Hartlepool (Cornwall HES)	Multi-mode	Develop intermediate layers/grid > *Historic sea-use* *Present sea-use* *Semi-natural environment*	Generate 'Attribute Analysis' > character type hierarchy *Broad type* *Character type* *Sub type* *Char. area*	Produce 'Character Types analysis' *Character Types (CT) CT texts*	Single, query-able against attributes; unioned and spatial joins, derived	Subdivided into coastal, intertidal, inshore marine, offshore marine zones.	*Seabed,* *Sea-floor,* *Water column,* *Sea-surface;* *Conflated*	*Present,* *Previous*

Fig 14 Character assessment workflow used by the five pilot projects

4.4.2 IDENTIFYING DOMINANT HISTORIC SEASCAPE CHARACTER

Determining predominant character in the multi-dimensional seascape is a key aim of the character assessment. The identification of predominant historic character was approached in various ways by the pilot projects. Generally however it was based on an assessment of the perceived threat of impact on the archaeological and historic resource by current anthropogenic activities.

The Solent-Isle of Wight project noted 'precedence depended upon one main factor: the presence of anthropogenic activity, which always dominated an environmental feature. Where two environmental or similarly anthropogenic features conflicted, the modern aspect took precedence.' (HWTMA *et al* 2007a, 30).

During the character assessment various datasets generally informed the interpretation of two types of historic character which may be termed seascapes and sea-use. In discussing these, the Scarborough-Hartlepool pilot argued that 'seascapes are identified from those sources that directly inform seascape assessment, that is, physical artefacts, landscapes, features, sites etc on the seabed. These can be relatively easily and precisely mapped and give an indication of the known archaeological potential of any given area. On the other hand sea-use is identified by those sources that indirectly inform character assessment by identifying human uses of the sea. These map activities and processes that principally occur in or exploit the sea itself, that is, the water column, as with fishing, and on the surface, as with shipping routes. Historic uses of the sea can be used as a proxy indicator of historic character, particularly in those levels of the marine environment that rely more heavily on cognitive perceptions ie. sea-surface and water-column environs (see also section 5.4.2.1). Given the indirect nature of this information confidence values are essential to qualify the interpretation of historic character. The project based its decision making of predominance on the following rationale and in order:

- Seascapes take predominance over sea-use. Largely in archaeological terms this is represented by artefacts, mapped landscapes and such like on the seabed. Impositions are included here;
- Those sea-uses that most likely to disturb, threaten or impact on the seabed predominate over less intrusive ones (eg with regard to fisheries, trawling has predominance over seining or lining);
- Confidence rating has predominance when considering different sea-use types.
- These criteria were taken into account when deriving the conflated HSC dataset from the final HSC dataset. Predominance was based on likely impact to likely archaeological resource and historic character' (Tapper *et al* 2007, 33-34).

In the final analysis, whatever formulaic approach is taken, the assessment of dominance among several expressions of historic character in a given area is essentially a matter of perception. The outcome of such an assessment should satisfy the perspective of the assessor and the weightings apportioned to the various character strands that flow from that assessor's viewpoint. Despite that, it should still be clear from the database that those other strands are present in that given area and that alternative perceptions are possible.

The Liverpool Bay project identified during the 'Attribute Analysis' stage of the GIS workflow the 'human potential impact', an assessment of impact of primary intrusive and non-intrusive industries (Wessex Archaeology 2007a, 15).

The Southwold-Clacton project identified predominance principally on the basis of each level of the marine tier with 'Sub-surface Subcharacter Type (principally dredging and palaeolandscapes) being judged as least dominant (from a heritage perspective); the Water-

body Subcharacter Types ranked as secondary in importance due to their generally transient nature and Geosurface Subcharacter Types, including almost all coastal Subcharacter Types, being given most dominance' (Oxford Archaeology 2007, 32).

The Withernsea-Skegness project identified predominance on the basis of impact and consistency of use, using the assessment of those sub-character types with highest impact to rank the polygons into hierarchical and vertical order in the characterisation layer, 'those SUB_CHARACTER classifications that had the highest impact were given the highest positions and so forth downwards' (MoLAS 2007b, 32).

The Solent-Isle of Wight project discussed 'the weighting of significance in terms of which level or activity should take precedence over another. For instance should an activity that affects all the seascape levels, such as aggregate dredging, dominate the expression of broad character over elements such as submerged prehistoric landscapes which are more archaeologically significant and also stretch over a considerable area?' (HWTMA *et al* 2007a, 53-56). The equation of dominance with significance in that approach is at odds with the HLC principle of being comprehensive not selective: that characterisation covers the whole land/seascape and recognises that the whole marine historic environment has value and can be managed more or less appropriately. It encompasses all aspects, the commonplace, typical and modern as well as the locally distinctive, rare, special and historic.

This project also touched on the issue of ascribing dominant character in the mapping of character areas stating '… the creation of a 'top-layer' with only a single character attribute led to difficult questions over the prioritisation of a certain level of the Seascape or a certain activity … a decision was made that the creation of 'hierarchy' between the Seascapes levels was not possible, or desirable' (HWTMA *et al* 2007b, 35). The project identified the scarcity of meaningful data as one of the primary factors for this suggesting that the ascription of historic character on the basis of fragmentary data is potentially dangerous at this stage given the intended use of HSC for marine planning.

4.4.3 CONFIDENCE RATINGS

The inclusion of the 'Confidence' field is an essential part of the HSC attribute structure, as in all HLC-related databases and forms a key element in the method's transparency and bench-marking. Through time, changes in confidence ratings may also contribute to monitoring developments in the physical and subject areas reflected in the HSC, and in the state of research and knowledge about marine historic environment.

Southwold-Clacton identified the following confidence values: High, Medium and Low.

Unusually in this project confidence values were assigned to subcharacter types based on the researcher's degree of certainty that boundaries of a polygon correctly identified the spatial extent of an entity (Oxford Archaeology 2007, 32).

Liverpool Bay identified the following confidence values: Certain, Probable and High likelihood of certainty

Solent-Isle of Wight did not give confidence values to interpretation because the project's character assessment used known evidence and existing map sources and data and did not extrapolate beyond that. It is assumed therefore that high confidence values are inherent in the data.

Withernsea-Skegness identified the following confidence values: High, Moderate and Low

Scarborough-Hartlepool identified three levels of confidence:

- Certain: established as true or sure; unquestionable; indisputable;
- Probable: having more evidence for than against, but some room for doubt;

- Possible: some evidence for, but considerable room for doubt;

In the consolidated national HSC methodology, confidence ratings are given to the polygons comprising the HSC dataset. Confidence is itself an assessment based on the level of detail observed from sources, whether cartographic or textual and its bearing on the HSC assessment. Essentially it provides a basis for qualifying the certainty or otherwise that can be ascribed to the character interpretation (rather than the location and extent of polygon), and therefore by extension, the archaeological and historical potential of any given area. The following confidence values are used:

- Certain: established as true or sure; unquestionable; indisputable
- Probable: having more evidence for than against, but some room for doubt
- Possible: some evidence for, but considerable room for doubt

4.4.4 ASSESSMENTS OF VULNERABLITY AND SIGNIFICANCE

The Liverpool Bay project identified vulnerability and sensitivity values for the archaeological/historical resource in response to threats such as modern industry aggregate dredging. The approach measures the impacts of human activities by whether an area is currently or likely to be effected by them in the near future and the potential scale of those impacts to estimate 'vulnerability'. Sensitivity is achieved by assessing the combination of the importance of the archaeological potential of the area and vulnerability to achieve an estimate of the significance of the effect (Wessex Archaeology 2007b, 42).

Similarly the adoption by the Solent-Isle of Wight project of a Broad Character Type 'Historical Maritime Significance' is revealing. It was subdivided into historic wrecks, submerged landscapes, and prehistoric land surfaces, in order to distinguish known archaeological features and historically significant submerged vessels and other underwater cultural heritage (HWTMA *et al* 2007a, 26). However the terminology implies greater significance and therefore importance of some features and sites over the surrounding marine historic environment and by extension viewed as a form of designation.

As the Solent-Isle of Wight project notes, 'although HSC requires an assessment of archaeological potential to be undertaken as part of the characterisation, this can currently only be founded on a qualitative assessment of fragmentary archaeological evidence, this becomes increasingly vague the further away we get from the coast. The pilot projects used a combination of the currently available data, results of research projects and accumulated knowledge of the local area to develop broad statements in terms of archaeological potential. To refine our ability to determine archaeological potential for material to exist and survive within seabed sediments will require extensive future investment in the gathering of baseline data' (HWTMA *et al* 2007a, 58-59).

Although the assessment of vulnerability, sensitivity and significance are very useful and valid analyses they are value-judgments which need to relate to the time, aims and contexts of the applications which the characterisation is designed to inform, not the baseline information of the characterisation itself. As the Scarborough-Hartlepool project noted 'each historic character type has an associated text covering criteria such as historical processes, values and perceptions, condition and forces for change, rarity and vulnerability and present recommendations. Rather than assigning an absolute 'value' to the Types this is designed to allow users to independently assess significance and sensitivity as a secondary process as and when they need to' (Val Baker *et al*, 2007, 53).

4.4.5 COMPILING HSC TEXTS

The five pilots produced descriptive and explanatory texts to accompany the historic character assessment's GIS mapping. The table below (Fig 15) identifies the varying themes and aspects discussed and covered by the texts and the level at which they were associated with the mapping.

Liverpool Bay	**Solent**	**Clacton to Southwold**	**Withernsea to Skegness**	**Scarborough to Hartlepool**
Texts attributed to Character Areas	Texts attributed to Character Areas	Texts attributed to Character Areas	Texts attributed to Character Areas	Texts attributed to Character Types
Present day form Sea Use: present Sea Use: past Archaeological potential Perceptions References Online Sources	Summary description Sea surface Seabed surface Seabed subsurface Coastal Archaeological potential References Links (www) Images	Main character: current form/use Historic character and archaeological potential Character perceptions	Present day form Sea Use: present Sea Use: past Archaeological potential Character Perceptions References	Introduction: defining/distinguishing attributes and principal locations* Historical processes: components, features and variability Values and perceptions* Research, amenity and education Condition and forces for change Rarity and vulnerability Recommendations Sources (bibliographic, images, www) * these texts only were used for this pilot's Character Area mapping

Fig 15 HSC linked texts in the five pilot projects

In discussions with EH it was decided to take forward most of the text headings identified in the Scarborough-Hartlepool pilot as they cover all aspects of the topics used by the other projects whilst offering a slightly more refined distinctions.

Similarly it was decided to retain in the national Method Statement that pilot's association of the texts with Character Types rather than Character Areas. The advantages of linking the texts to Types rather than Areas is that it allows the texts to compliment and enhance the HSC analysis of the characteristics a given area shares with others of its type, rather than emphasising something entirely different – the uniqueness of a particular area. Linking with Types enables the texts to function in harmony with the HSC rather than cross-cutting it: it gives the texts relevance to strategic level forward planning which is likewise concerned with the shared characteristics of areas rather than focussing on the unique and particular.

All the pilot projects produced character assessment texts to accompany the GIS character mapping. The current configuration of most GIS limits the database attribute fields to a maximum of 250 characters which obviously restricts the use of textual descriptions to qualify and exemplify the character mapping. The most common way to present long texts was within a textual report and linked offline HTML application.

4.5 MANAGING THE LAND/SEA OVERLAP

The pilot projects varied slightly in the extent to which their character assessment mapped the land/sea overlap.

Seaward the Liverpool Bay project extended to 12nm limit as its brief directed whilst the Round 2 projects extended, according to their briefs, to encompass the whole extent of England's part of UK Controlled waters.

Landward all the projects were required by their briefs to characterise to at least the OS-mapped line of MHW, extending beyond it to avoid truncating HSC character polygons and to include further areas of maritime character. For many areas this meant identifying the line of MHW from historic sources as the present line will often have moved – in some instances considerable distances.

The Liverpool Bay project extended inland by 2km from MHW 'to gain greater understanding of coastal activities that may have had a direct bearing on inter-tidal and marine activities' (Wessex Archaeology 2006a, 3). However this distance was arbitrary and resulted in the character assessment of many landscape polygons whose character was fully captured from land-based HLC perspective rather than one rooted in HSC.

In light of this the Round 2 projects amended their rationale to refine the criteria by which 'seascapes' were mapped landward. The landward limit of the Scarborough to Hartlepool project extended beyond the OS mapped level of Mean High Water (MHW) to encompass the full physical extent of any coastal areas with an essentially marine or maritime character.

The Solent-Isle of Wight project extended its character assessment 2km landward but, unlike Liverpool Bay, mapped only areas of relevant marine/coastal features located within the 2km landward buffer zone.

The Withernsea-Skegness pilot project did not use a 2km terrestrial buffer but rather let the 'analysis of the seascape dictate the shape of the landward boundary by its association with the sea. This was to give a clear definition, for terrestrial HLCs to work to in the future' (MoLAS 2007b, 38).

The Southwold-Clacton project, 'with a view to contextualising activities that are directly related to the character of the intertidal and marine zone extended the character polygons to include landward territory. This only applies to polygons whose character is demonstrably related to the marine environment in order to include only those areas of the terrestrial environment that directly influence use of the marine zone, the extent of the landward polygons was limited to 2 km' (Oxford Archaeology 2007, 10).

Future HSC projects should extend landward to at least the OS-mapped line of Mean High Water (MHW) but should continue landward beyond that line to avoid any arbitrary truncation of HSC polygons and to accommodate inland areas perceived, from a maritime perspective, as possessing distinctively maritime character. This may result in the inclusion of some areas on land which are discontinuous with MHW, for example to accommodate prominent inland areas serving as navigational daymarks, resulting in HSC polygons separate from the main body of the HSC characterisation (though the intervening areas will of course be subject to HLC coverage). All estuaries and rivers within project areas should be included to the Normal Tidal Limit along their channels and tributaries, though there may be exceptions for some longer rivers where that would extend the brief considerably inland (see section 5.4.2).

The land/sea overlap is necessarily one of degree and gradation and future HSC projects should ensure that their character assessment provides a seamless transition from terrestrial

HLC to marine HSC and by extension the understanding and management that comes from such a holistic approach.

4.6 HSC CHARACTER TYPES

The results of character assessment produced the most marked differences between the pilot projects. Figure 14 identifies the character assessment workflow adopted by each project and revealingly demonstrates each project's conceptual understanding of what constitutes historic seascape characterisation.

Whilst all the projects undertook broadly similar stages in the attribute-led (ie. bottom-up) mapping, producing intermediate layers of 'historic character types' ranging from detailed sub-character type, to character type and generalised broad character type (a legacy of the structure initially produced by the Liverpool Bay project), the attribute analysis that produced the final results showed two distinct approaches – the use of historic character AREAS and the use of historic character TYPES to present HSC. All the projects apart from the Scarborough-Hartlepool project adopted unique character areas as the final character assessment.

As the attribute analysis shows the Character Areas are based to some extent, but not entirely, on the Character Types as a final tier or layer in the GIS. Although only the Scarborough project adopted Character Types it is favoured as the approach to take forward to the national method (Hooley 2007b, 10). See also section 5.6 for further discussion of Character Types.

4.6.1 CHARACTER AREAS

There are other ways than identifying 'types possessing shared characteristics' in which 'seascape' can be approached, notably by identifying discrete areas that are perceived as possessing a uniquely distinctive historic character reflecting their physical location and unique combinations of historic and natural environmental influences - areas characterised as being distinctive because of their particular combinations (or absences) of different types. The concept of 'Character Areas' is designed to accommodate this distinctive 'sense of place' and express it as a GIS layer. It is based on subjective personal perceptions about what makes an area distinctive and where the break-points lie between such areas. Character Areas are not derived from 'bottom-up' processes of attribute analysis and they may use various frameworks to define their boundaries. As personal perception plays a dominant role in defining these areas, they will be defined differently across any given sector of our marine environment by differing interests, groups and communities within society. In providing a means of capturing and accommodating that diversity of perception in a form readily inter-operable with the HSC character type mapping, Character Areas offer a ready route for other groups, not only archaeologists but, for example, local fishermen, diving groups, coastal communities or tourists, to offer their understandings of areas of 'distinctive character' and for those perceptions to be correlated with variation in historic character. This form of mapping of the marine historic environment offers valuable potential for engagement with outreach programmes, wider community involvement with HSC, and for enabling better understanding of the roles played by the historic environment in shaping people's sense of place.

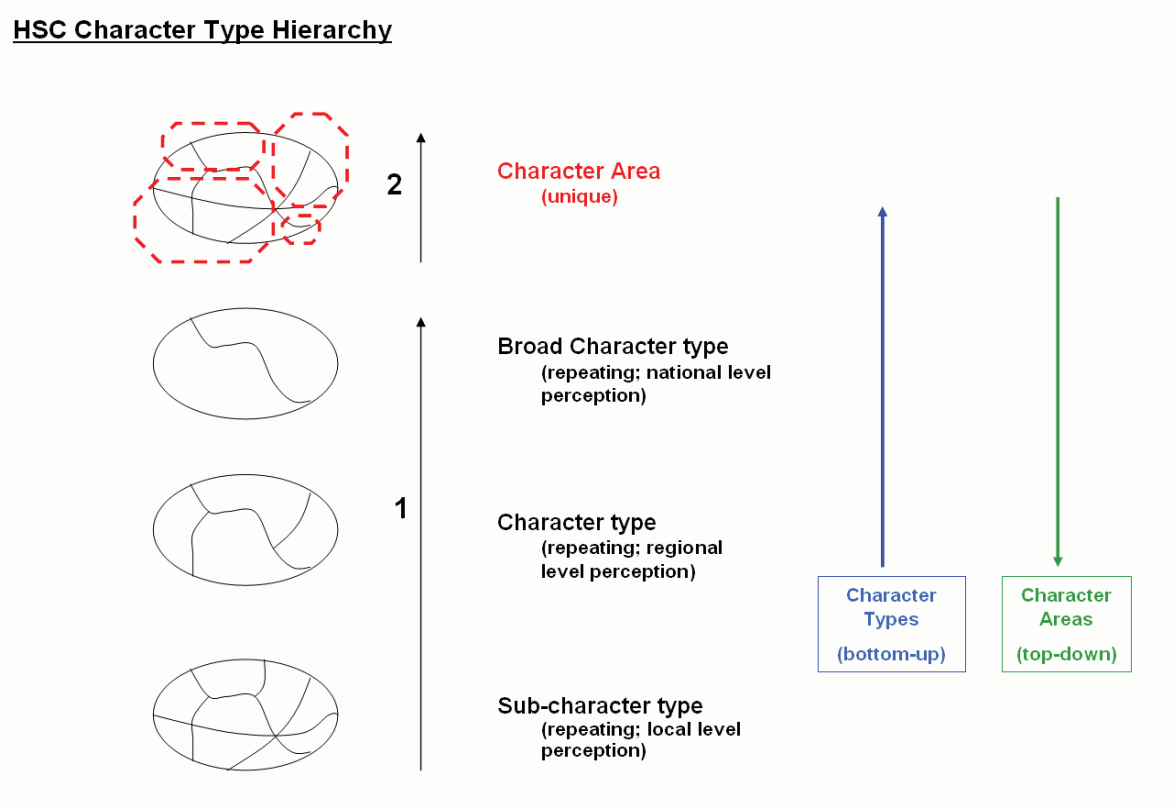


Fig 16 Diagram showing how character areas (red) may overlie character types (grey) and are created through subjective 'top down' assessment

Character Area definition involves the creation of a new GIS polygon layer based on the understanding and initial perceptions of the observer. The initial definition will be by the HSC mapper, usually an archaeologist. It may be stored separately but alongside the HSC Character Types layer. Practically, Character Areas may be based on the visual identification of human activity patterns observed by displaying the HSC Types layer at the conflated level or may reflect large homogenous areas where differentiation is difficult to achieve and mapped place names in documentary sources (as on charts and fishing grounds) may be used.

Character Areas may follow to some extent, but not entirely, the boundaries of Character Type polygons, as a layer in the GIS. They reflect areas that local people might recognise or more readily identify with. There are however several risks attached to using Character Areas however. as explained more fully elsewhere (Herring 1998, 47). The initial characterisation, being bottom-up, focused on identifying sub-character, character and broad character types in a hierarchy of scaleable perspective. As such, maps, documentary sources and images were used to identify repeating and similar seascapes rather than unique definable areas which are inherently less objectively defined than these Types. Unique areas, though simpler and perhaps more easily used by seascape managers, planners etc may in practice disguise the benefits of characterisation and the holistic understanding that it brings. By extension the definition of unique areas could risk the introduction of notions and rankings of relative importance, with a form de facto designation and influences on planning controls and targeting of resources. That would run counter to the philosophy of sustainability underlying characterisation but the risk should be greatly reduced by clear guidance and explanation to professional users of the respective roles of Character Types and Character Areas. The benefits of capturing public perceptions of their historic environment in a form interoperable with Character Type mapping far outweigh the potential disadvantages of their incorrect use.

4.7 FIELDWORK

Although primarily a desk-based exercise, some limited fieldwork is advantageous for seascapes projects. Primarily to familiarise project staff with the project area's coast and, as resources allow, its marine environment, it is also an invaluable opportunity to visit the HERs for each county bordering the study area; to visit archives and museums and collect further information relevant to the study. It is also an opportunity to meet people with vested interests including local heritage professionals who may provide important guidance and understanding; and to acquire field notes and photographs to compliment the final characterisation texts. Stakeholder meetings also provide an opportunity to gauge local people's responses to the characterisation project and collect ideas and thoughts they wish to contribute.

As the sea can be a source of livelihood as well as myth and legend, local perceptions may usefully be obtained by interview or surveys within local populations and workers. Oral history has considerable potential for wider appreciation and enjoyment adding important qualifications to the HSC study

Future HSC projects might also consider producing Character Area information in a form that can be made available and accessible over mobile devices such as mobile phones, PDAs etc, using GPS to select the relevant text for the phone users' location as they pass through and within character types. If practicable, that would open up interesting possibilities for Seascapes character type texts allowing users to access information as they travel at sea (eg. passenger ferry crossings, dive sites, recreational fishing and leisure boat trips etc).

4.8 CURATING THE HSC

It is inevitable that the HSC method will evolve through time as developments in technology, marine management contexts and our breadth of understanding change the opportunities for undertaking characterisation and the frameworks in which HSC needs to operate.

Similarly, the long-term applicability of the Seascapes database is reliant on the system being easily updated to incorporate change and as new datasets become available. To maintain relevance to informing live management and planning decision-making, the HSC database needs to be curated, to be kept up to date as a process, rather than simply subject to periodic review and update. It is inevitable that the pace of seascape change will always vary from place to place, with some areas such as the Solent and the Thames Estuary consistently presenting more intensive demands for future curation that others. For the national HSC database, the responsibility for that curation will lie within the NMR.

4.9 DATABASE STANDARDS AND GUIDELINES

All the projects largely followed the guidance set out in *Guidelines for English Heritage Projects involving GIS* (Froggatt 2004).

4.9.1 MIDAS HERITAGE 2007

One outcome from the HSC consolidation project will be to enable the incorporation of HSC standards into English Heritage's MIDAS Heritage project, developing data standards for the historic environment'.

The *MIDAS Heritage – The UK Historic Environment Data Standard* (English Heritage 2007a) outlines the data standard for information about the historic environment. It states what information should be recorded to support effect sharing and long-term preservation of the knowledge of the historic environment. It lists what information should be recorded and how it should be recorded.

The content of MIDAS Heritage 2007 has been extended and reworked in comparison with the 1998 standard in order to better reflect the wider range of heritage sector information. A series of new (or renamed) Information Groups have been developed including the group 'Area' (English Heritage 2007a, 11) of principal relevance to historic landscape and seascape characterisation. The standard recommends that future plans for the updating of Information Groups includes the proposed development of 'more detailed standards for capturing the understanding of landscapes, urban and sea areas from Historic Landscape Characterisation … based on the Area, Research and Analysis and Management Report information groups' (*ibid*, 12).

MIDAS Heritage sets out the change process for updating Information Groups (either schemes or unit of information) via FISH (Forum for Information Standards in Heritage) (*ibid*, 14-15).

An initial HSC information group and units of information have been identified by the national method but future practitioners of HSC projects should refer to MIDAS Heritage for the latest situation regarding HSC Information Group.

4.9.2 HSC INFORMATION GROUP

MIDAS Heritage identifies Information Groups, thematic groupings of related Units of Information which together answer key questions about aspects of the historic environment and its management.

Historic landscape characterisation is included in the Information Group 'Area' defined as 'a defined area of land, urban or seascape, of significance for an understanding of the historic environment and its management', qualifying that 'historic environment research and management activity increasingly looks beyond the boundaries of traditionally defined sites, monuments and built structures, taking a more holistic view of the landscape, townscape and seascape' (*ibid*, 29).

Each Information Group identifies the key relationships between it and other Information Groups (and their units of information) that are required to be recorded to create a full record. The full details of the 'Area' Information Group and its key relationships, issues and recommendations and 'compliance table' (with mandatory and optional, single and repeating Units of Information) are set out elsewhere (*ibid*, 29-31). It is recommended that the 'Area' Information group adheres to the mandatory Units of Information for the Information Groups 'Area', 'Map Depiction' and 'Research and Analysis' (*ibid*, 31).

Whilst HLC and HSC projects fall under the umbrella of the Information group 'Area' it does not include a number of specific Units of Information required by the historic seascape characterisation itself. Thus a revised structure might follow:

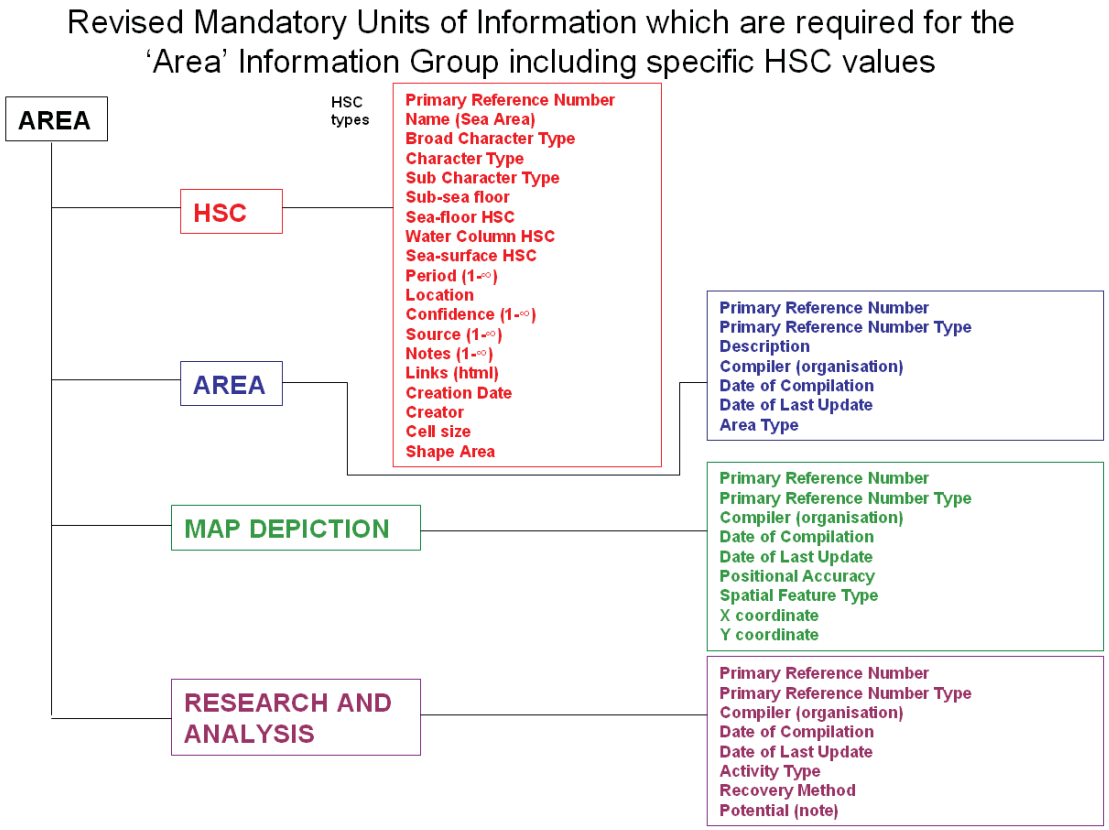


Fig 17 Revised mandatory units of information which are required for the 'Area' Information Group including specific HSC values

The analysis of the HSC attributes produced by the five seascapes pilot projects can develop and guide the content of MIDAS information standards for future HSC projects. Through the implementation of MIDAS Information Groups and Units of Information underpinned, where appropriate, by INSCRIPTION wordlists can ensure the interoperability of future HSC projects. However it is recognised that future developments and additions are inevitable so any standards employed must be flexible and open to addition or change to reflect more regional or local historic character where appropriate.

4.9.3 GIS SOFTWARE

All the pilots employed ESRI ArcView suite, principally ArcGIS Desktop with the character assessments presented as Personal Geodatabases comprising a number of Feature Class shapefiles.

'A philosophy of software-agnosticism is advocated for what is likely to be a long-term programme of characterisation undertaken by a number of different organisations. Hence, only processes, rather than the use of individual software packages, should be considered a part of the methodology (although software used should be recorded as metadata)' (Oxford Archaeology 2007, 48).

4.9.4 PROJECTIONS

Figure 9 identifies the projections used by the pilot projects to present their character assessment mapping. Section 5.4.6 identifies the use of OSGB36 for future HSC projects.

4.9.5 METADATA

Figure 9 identifies the metadata standards and applications used by the pilot projects to contextualise their character assessment mapping. Section 5.4.8 identifies the suggested use of UK GEMINI Discovery Metadata Standard for future HSC projects.

4.9.6 HSC TERMINOLOGIES

A detailed analysis was undertaken to compare the historic seascape character types (broad, character and sub-character) generated by the pilot projects (see Appendix 3). From this comparison a simplified list was created and presented as the initial wordlist to be used by future HSC projects.

5 THE NATIONAL HSC METHOD STATEMENT

5.1 INTRODUCTION

The HSC Method Statement is designed as a user-guide for future HSC practitioners. It sets out the tried, tested and preferred methodology to be deployed in future historic seascape characterisation designed to inform English Heritage's roles with respect to the marine and maritime historic environment. The HSC methodology also has far wider advantages and applications for those whose work, interests, lives or enjoyment have connections with our marine environment. This section identifies the detailed methodological stages and processes necessary to undertake HSC.

5.2 APPLICABILITY

In order to ensure the applicability of the national HSC method across England's full range of environmental and management circumstances in the coastal and marine zones to the limit of UK Controlled Waters it was trialled in three test-bed areas, each with contrasting environmental and management complexities: in the Solent, the southern North Sea and Falmouth Bay

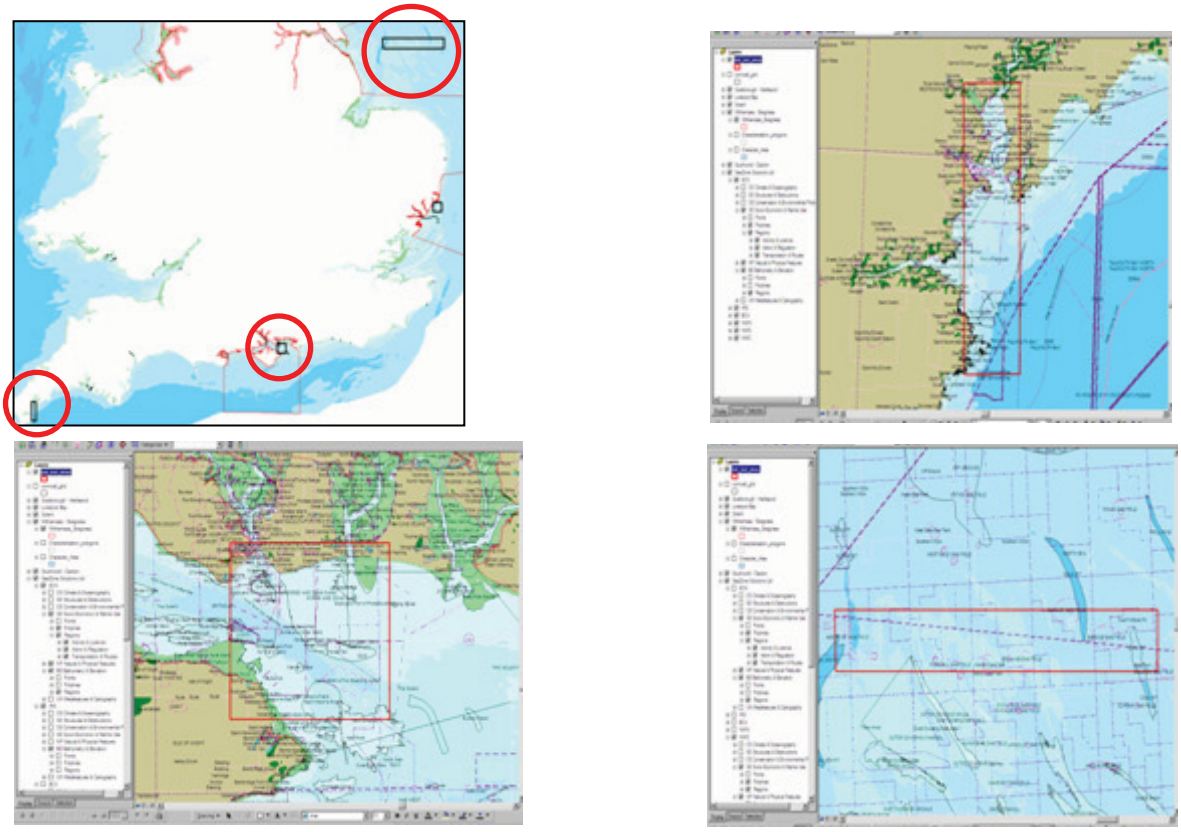


Fig 18 The testbed areas for the national HSC method consolidation

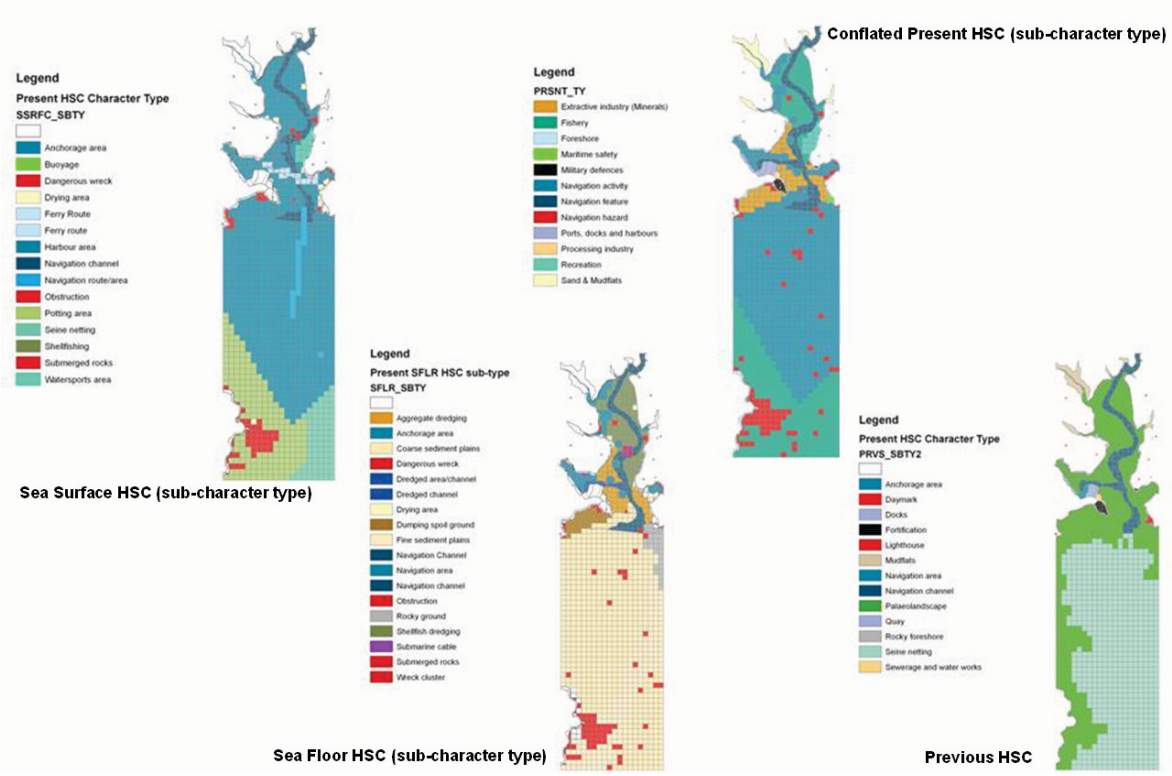


Fig 19 The Falmouth Bay testbed area for the national HSC method consolidation

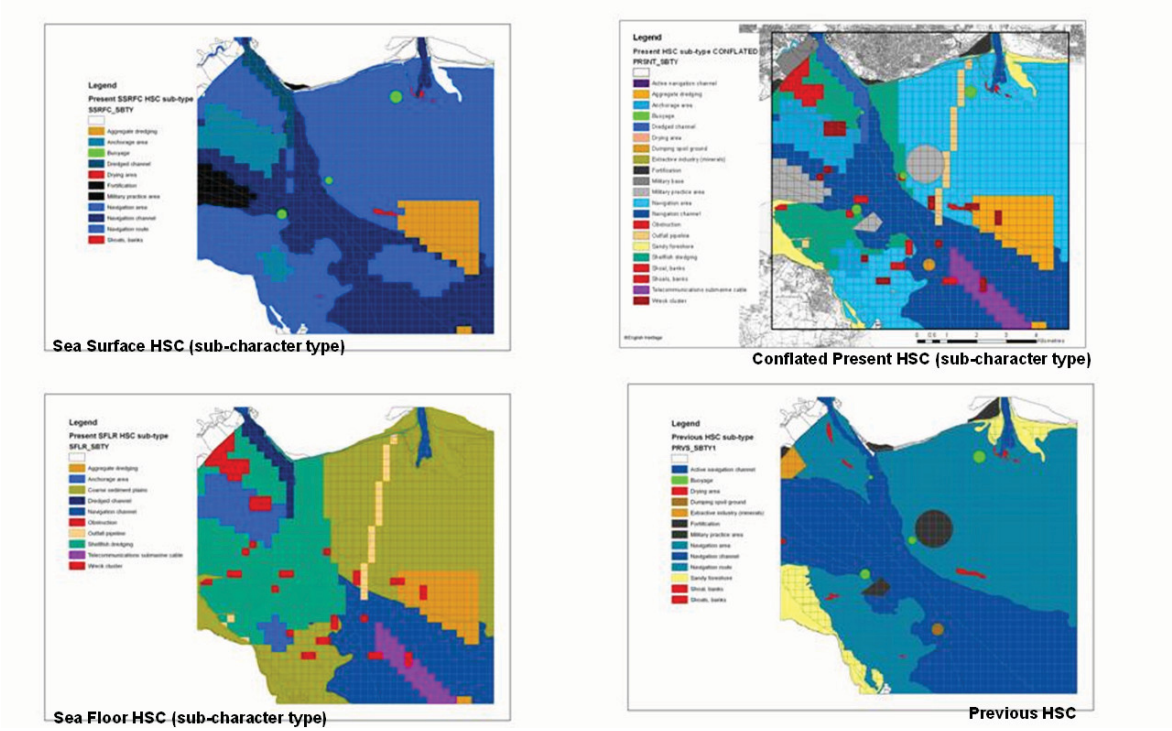


Fig 20 The Solent testbed area for the national HSC method consolidation

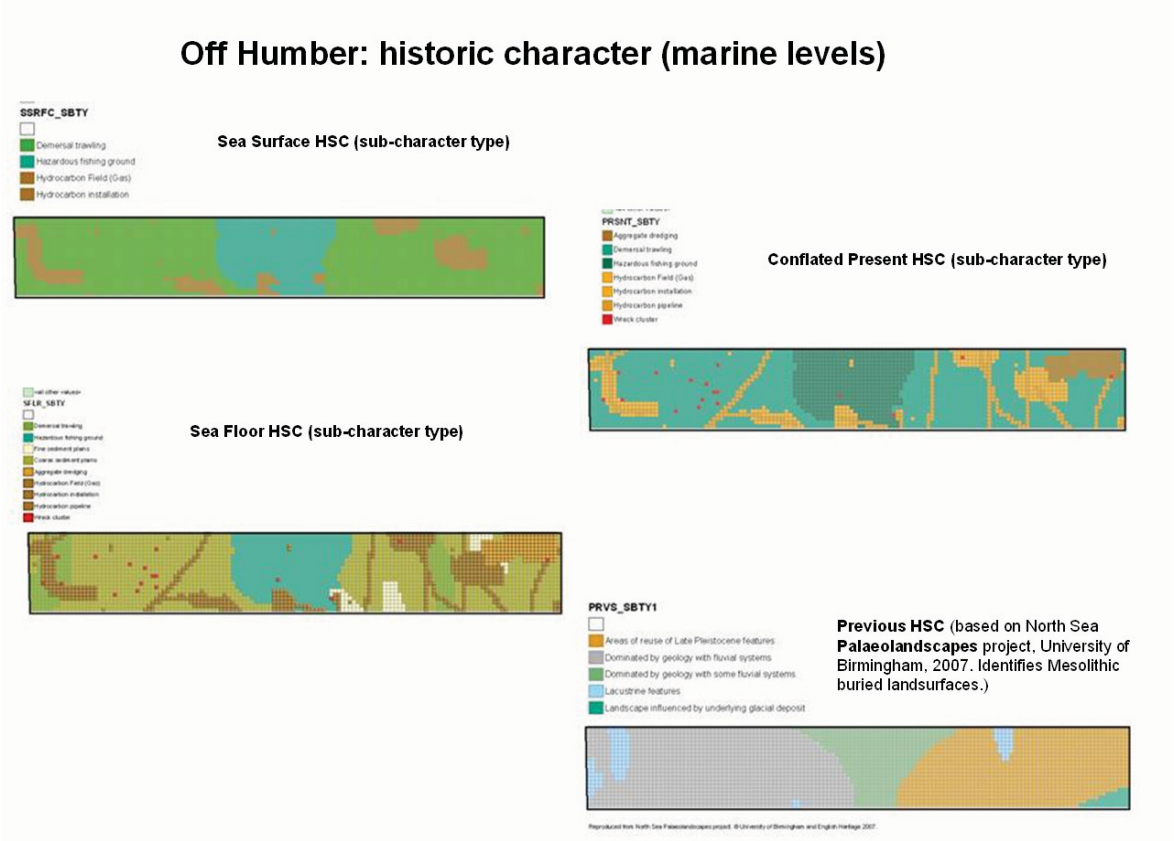


Fig 21 The Off Humber (North Sea) testbed area for the national HSC method consolidation

5.3 SOURCE DATASETS

HSC is informed by a range of data sources which may relate to archaeological, historic or present human activity or to aspects of the semi-natural environment.

5.3.1 ROLES OF SOURCE DATA IN THE CHARACTERISATION PROCESS

The range of data sources, taken together, serve as 'character attributes', providing strands of evidence for the impact of human activities when perceived from an archaeological perspective. From analysis of patterning in those attributes across a given area and recognition of the regularly occurring historic seascape groupings a historic character hierarchy of 'Broad Types', 'Types' and 'Sub-Types' can be identified of the historic character of human activity.

The analysis of character attributes and identification of historic seascape character 'Types' is a perceptual process. It relies on the knowledge and understanding of the character assessor to perceive and articulate the historic character from the combined intrinsic features of the attributes themselves. Generalisation and extrapolation from data are the key tools: characterisation is an interpretation not merely a collection of data. There should be a clear separation between, on the one hand, the data sources which may in whole or part feed into lists of character attributes, and, on the other hand, the identification and mapping of historic character types at various levels that have been constructed from the data.

Given the lack of a comprehensive mapped framework for the marine environment it is important that sources are not used to 'short-cut' the process of HSC character assessment by combining and transferring those datasets' mapping directly, even in conflated form, into the mapping of the character assessment. While source data plays a vital role in informing the

compilation of the HSC database, it does not form an integral part of the HSC layers on GIS: these layers are capable of being made available and manipulated without reference to source datasets or their licences.

It is also recognised that in addition to the historical and archaeological material elements that inform the characterisation of the inter-tidal and marine seascapes, there are more 'intangible' aspects relating to social and cultural perceptions, often only discernible through bibliographic sources, but which nevertheless provide important perceptions and context to the HSC.

5.3.2 COVERAGE AND CONSISTENCY

In assembling the datasets to use in HSC projects, emphasis is placed on those datasets that currently or will, when completed, have consistent national coverage. Emphasis is also placed on those available in digital formats, treating other or more localised or hard-copy source data available as supplementary (see 5.3.3).

The consultation and treatment of sources is one of the principal determining factors in establishing historic seascape character. Understanding data sources also underpins the construction of the HSC data structure. What is used and how it is used ultimately influence the decisions taken during character assessment. It is important therefore that:

- Sources are relevant and consistent
- Core dataset coverage is national (or at least regional)
- Sources are treated in a consistent manner and even-handed way, following a clearly stated workflow; and are used to reflect time-depth and past change
- Standard terminologies are used to maintain clarity
- Consistent assessment and capture of historic seascape character is deployed
- Common 'perception scale(s)' are established – that is, the scale at which characterisation is expected to be read and applied

There are however a number of issues relating to the coverage and consistency of marine data that need to be borne in mind when undertaking HSC projects:

- Coverage: there are often substantial gaps in marine datasets. Coverage may be nominally national but is not necessarily area-based and is commonly itself a characterisation based on point-data, interpolated to achieve extensive coverage and therefore represent indicative maps, demonstrating trends and patterns. Archaeological and historical datasets, when they do exist, are often fragmentary. And to compound all that, the marine environment lacks a comprehensive coverage by the network of boundaries we find on land
- Detail and accuracy: the level of detail in marine data is often of poor resolution, particularly when compared with terrestrial datasets. Many marine datasets are tailored specifically for navigation purposes or to inform development and therefore lack archaeological and historical detail implicit within them. Generally marine data tend to be mapped at smaller scales than terrestrial equivalents and perception scales in character assessment are likely to be significantly smaller as a consequence
- Bias: where archaeological and historical data exist they are often focused on the inter-tidal zone and in shipwreck databases. Existing data on shipwrecks is biased to areas where survey and modern activity takes place and is not necessarily representative of the actual distribution of losses. The available datasets also tend to reflect the more recent recording of early-modern and modern losses

- Format: many marine datasets are in hard-copy only or require further manipulation and geoprocessing to bring to a common format. Certain datasets can be acquired in both hard copy and digital format. Data should be obtained digitally wherever it is available as such

While data for the marine environment remain fragmentary, often not explicitly related to the marine historic environment, and dispersed between different organisations, it is still essential that the HSC assessor becomes familiar with marine datasets, their relevance and the area they cover. Key aspects to consider are:

- The need to understand marine data, its relevance and significance in any given area; its limitations and expression in the present environment
- The need to understand current biases within marine datasets
- The ability to transpose and apply available digital data using appropriate GIS techniques
- The need to seek and recognise the historic cultural dimension embedded, often implicitly, within the range of marine datasets, assisted by an understanding of the more traditional archaeological and historic knowledge of the area are concerned

While it is recognised that apart from a core number of datasets, data coverage for English waters will inevitably be inconsistent, HSC nevertheless consciously reflects the current state of knowledge, reflecting the impact of its variability in the confidence ratings attached to the HSC character assessments. Successive benchmark copies of HSC layers should show change in the HSC database and its confidence ratings as the state of knowledge is enhanced and refined, and as data improves and access becomes easier and, of course, as the present expression of the historic and cultural environment changes.

5.3.3 CORE AND SUPPLEMENTARY DATA

HSC is informed by the range of information available bearing on archaeological and historic activity. The divide between 'Core data' and 'Supplementary data' corresponds with normal practice in HLC projects and is maintained in HSC projects.

Source datasets are categorised into:

- Core data - comprising datasets with consistent national coverage and quality, preferably in digital format

- Supplementary data – comprising datasets with inconsistent coverage, often at regional or local level but which can inform and qualify the historic characterisation about local variation which may be significant for the outcome of the character assessment. Given the current lack of very detailed national base-mapping coverage for the marine environment, unlike the terrestrial OS mapping, supplementary sources may play a greater role in HSC than they have traditionally in HLC. Again digital sources are to be preferred although much locally relevant data may be only available in hard copy

The following sections identify and outline the various 'Core' and 'Supplementary' source data required to be consulted during HSC assessment. For each source dataset are described, their role in character assessment outlined, the geoprocessing and manipulation required and necessary during preparation to inform HSC assessment and the copyright and data derivation issues associated with them.

5.3.4 CORE DATA

Core data is dominated by OS modern and historic mapping and UKHO chart and survey data in coastal and inshore regions, and by most topics contained within the SeaZone Solutions Ltd Hydrospatial package. Seazone Solutions Ltd is a subsidiary of the UKHO. Those data for offshore regions are dominated by the SeaZone data which includes a range of datasets supplied to SeaZone by their parent source providers, including the UKHO, BGS, and JNCC amongst others. Although obtained under licence from SeaZone, the content of those source datasets remains within their parent providers' copyright.

The following table (Fig 22) identifies the core datasets required by HSC projects, their format and location.

Source	Format	Location
Modern Admiralty Charts	Digital/Hard copy	UKHO (SeaZone Solutions Ltd)
Historic Admiralty Charts and Surveys	Digital and hard copy	UKHO/NMM/Local Museums, Libraries and Record Offices
Modern Ordnance Survey maps	Digital	English Heritage
Historic Ordnance Survey maps (1st and 2nd OS Editions)	Digital	English Heritage
SeaZone Hydrospatial • Bathymetry & elevation (BE), • Natural & physical features (NP) • Structures & obstructions (SO) • Socio-economic & marine use (SE) • Conservation & environment (CE) • Climate & oceanography (CO) • Wrecks (W))	Digital	UKHO (SeaZone Solutions Ltd)
Adjacent County Terrestrial HLC data	Digital	Local Authority
Modern Aerial Photos	Digital	Local Authority
Fisheries data (offshore, inshore and coastal fishing effort and	Digital	CEFAS (outside 6nm), Sea Fisheries Committees (within 6nm), JNCC, Kingfisher charts,

pressures) *		NMR, Misc. fishing charts
Environmental data and land classification, (semi-natural, marine habitat and seabed facies/biotope mapping) **	Digital	Natural England/JNCC/MAGIC database, CEFAS, BGS (www.searchmesh.net/webGIS.)

Fig 22 Core datasets required by HSC projects

*These data are considered to be sufficiently consistent and important to be 'Core' for future projects. Projects such as 'Building GIS and environmental data management capabilities of the sea fisheries committees' (Eastwood 2007, 50-53) and 'The seabed and inshore fishing activity: Assessment and relationships' (Clark et al 2007, 54-57) will improve and standardise the fishing data available for consultation by future HSC projects.

** These data are considered to be consistent and important to be 'Core' for future projects informing the human impact on natural environments and the creation of semi-natural environments. Projects such as the Defra R & D research project 'The role of seabed mapping techniques in environmental monitoring and management' (Coggan and Boyd 2007, 18-23), the 'Eastern English Channel marine habitat map' (James et al 2007a, 24-39), the 'Outer Bristol Channel marine habitat study' (James et al 2007b, 40-48) will improve and standardise the marine habitat data available for consultation by future HSC projects.

There is an increasing body of research exploring and identifying the natural and semi-natural habitats and seabed resources potential of the marine environment. For the most part specific, local and regional, these analyses nevertheless provide the framework and method for wider national implementation and as such are an important source for consultation as a resource examining significance along with mitigation and management considerations. See Sections 1, 3 and 4 in 'Marine Aggregate Extraction: Helping to determine good practice' (Newell and Garner, 2007), for more details of projects undertaken and current initiatives (http://www.alsf-mepf.org.uk/downloads/MarineAggregateExtraction-web.pdf). Further information can be found via the Marine Environment Protection ALSF website (http://www.alsf-mepf.org.uk/default.asp).

5.3.4.1 SEAZONE SOLUTIONS LTD HYDROSPATIAL DATA

Description: Constituting the most up-to-date, extensive and consistent marine mapping, this data is provided in the following six individual Topic Layers with each Topic Layer is broken down into Themes. The data is sourced from a number of organisations including the UKHO (including S57 standard data), Countryside Council for Wales, Environment and Heritage Services (Northern Ireland), English Nature, Scottish Natural Heritage, Crown Estate, UK Offshore Oil and Gas Information (UKDEAL) and the British Geological Survey.

- Bathymetry and Elevation (BE): Depth and height contours, spot heights and digital elevation models. Also included are Depth Areas and Inter-tidal Areas, showing cartographic representations of areas of water depth.

- Natural and Physical Features (NP): Natural and physical components of the coastal and marine environment, including the biological, physical and chemical features within it. It describes the type and landscape setting of the marine environment to include the geology, seabed, water column and coastal landforms. Natural and physical

components include biota, habitats, fish spawning and nursery areas and current streams, rocks and some human impacts such as dams, canals and dykes.

- Structures and Obstructions: Those features which are man-made and physically exist on land or under the sea. These features range from wind turbines and pipelines to those of a more general socio-economic purpose eg. buoyage. Wrecks, obstructions and offshore installations included in this layer are obtained from the full database held by the UK Hydrographic Office. This contains much more than is usually displayed on a traditional nautical chart, including those wrecks that are not navigationally significant.

- Socio-economic and Marine Use: Socio-economic and Marine Use specifies areas where one or more activities have been designated, are known to occur or are restricted. These are largely intangible boundaries defining areas or zones of economic or social importance such as military areas, oil and gas or wind farm licence areas, navigation zones, dredging areas, fishing areas and national boundary limits.

- Conservation and Environment: The Conservation and Environment topic contains information on boundaries designated for the purposes of conservation and environmental protection of natural and cultural heritage. These boundaries include SSSI, SAC, some archaeological sites, shellfish beds and monitoring and assessment points.

- Climate and Oceanography: The Climate and Oceanography topic contains data relating to climate, weather and tides. This varies from locations where measurement and monitoring is or has been known to occur to predicted tidal currents. All these datasets are of a mainly temporal nature.

Role in character assessment: SeaZone Hydrospatial comprises the single most relevant modern 'base mapping' for the marine environment currently available, informing on a number of broad activities including navigation, industry, fisheries and natural processes. It is used principally to inform the assessment of present sea use as a component of overall character, particularly impositions of more recent character types (eg. offshore industry) onto earlier ones (but see 3.1.1 regarding the roles of source data in character assessment).

The Topic 'Conservation and Environment' includes some information that is relevant to HSC, however the designation data within the 'Protected Areas' theme whilst useful should not be used as the basis for character assessment.

Geoprocessing: SeaZone data cannot be used directly, as complex derived data, without incurring copyright and licensing restrictions, neither should it be so used in the final HSC layers. Simple derived data can be produced by simplifying and aggregating those features that are used to inform the character assessment, principally industrial impositions such as aggregate dredging areas, maintenance dredging areas, hydrocarbon extractions areas and pipelines, harbour areas, navigation routes, telecommunications cables etc. Even simple derived data however falls under SeaZone's current copyright (see Copyright section below).

Hydrospatial is supplied as standard in geographic coordinates, WGS84 horizontal datum, and Chart Datum vertical datum. Other datums and projections are available on request and may be subject to additional costs. SeaZone Hydrospatial is supplied with a GIS Project so that the data can be displayed fully symbolised and attributed on opening, saving project time and costs. A number of standard GIS formats are available.

SeaZone and UKHO are working with partners, including the Ordnance Survey to create marine geographic information that is joined at the coast with land mapping. The Coastline Mapping Improvement Programme (CMIP) will make SeaZone's Hydrospatial marine data product interoperable with the Ordnance Survey MasterMap terrestrial mapping product.

Copyright: Under the Pan-Government Agreement (PGA) SeaZone Hydrospatial data is made available to English Heritage. The ability to create simple derived data from the base mapping is mentioned in the following statement on the standard Digital Data Licence in Section 5:

'Product Derivative Works, which are defined as any image, representation or alteration of the Products from which the Products or portions thereof are capable of being reversed engineered, recreated, discerned or otherwise made available (eg. bounding areas, resampled or derived surface elevations), are subject to the same conditions as the Products. Product Derived Works are protected by English Copyright Law, International treaty provisions, and all other applicable national laws and the terms and conditions of this Licence.'

HSC project data when resampled against a grid mesh and the original database attributes are removed is considered to be simple derived data (M Osborne pers.comm.). SeaZone note however that as with reproductions in hardcopy or PDF there are copyright notices and restrictions that need to be applied; the most important of these is that any map must include a statement that the data is not be used for navigation. This must be the case also when the data itself or a derivation of it is being provided (M Osborne pers.comm.).

At the time of writing (March 2008), SeaZone are working towards a statement that defines the intended purpose of the data rather than what it cannot be used for (M Osborne pers.comm.). This is a positive move and will capture activities that use SeaZone mapping (such as HSC, that they have not so far considered).

Where SeaZone data is used to inform HSC character assessment, and also the geographic expression of that character, it is necessary to include a statement that covers English Heritage's own liability issues, especially concerning intended use and application of the data. That is the case even though, as simple derived data, the HSC GIS layers may be supplied without the requirement of a SeaZone licence. Such a statement may read:

This data is provided for the purpose of undertaking [archaeological assessment] only and the data, or any derivation of it, must not be used for any other purpose whatsoever. No liability whatsoever is accepted by English Heritage or its suppliers for its use, intended or otherwise. The data is protected by Crown and other copyright and unauthorised use or reproduction of the data, including its transfer to third parties, will be penalised to the maximum extent permitted under English Law. © English Heritage 2***, NOT TO BE USED FOR NAVIGATION.

Where SeaZone data itself is reproduced, as complex data or for illustrative purposes the following statement should be readily apparent:

© British Crown and SeaZone Solutions Limited. All rights reserved. Products Licence No. ******.***. NOT TO BE USED FOR NAVIGATION. (see http://www.seazone.com/licensing.php).

5.3.4.2 ORDNANCE SURVEY MODERN AND HISTORIC MAPS

Description: Modern OS MasterMap, 1:10,000, 1:25,000 and 1:50,000 scale maps are all used to determine the present character of the coastline adjacent to the study area's marine zone. Areas of historic character are identified if they are spatially adjacent to the inter-tidal and

marine zones and their primary function was associated with maritime/marine use (eg. coastguard stations, harbours, ports etc) or they had a secondary function associated with maritime use (eg. daymarks etc). Historic OS maps principally used are the 1st and 2nd Edition OS Revisions.

Role in character assessment: OS modern and historic maps are used to undertake character assessment in the coastal and inter-tidal zones. Modern OS maps provide information on the present historic character, identifying sites and landscapes related directly or indirectly to the marine environment or maritime activity. Historic OS maps can provide further information on time-depth and enable benchmarking of the characterisation, informing previous historic character time-slices and may be used to generate useful information on the analysis of the forces for change through map comparison and regression.

OS MasterMap has two distinct roles; firstly as a source of data which can inform character assessment and secondly in providing a spatial network of polygons in which to express HSC. On land, HLC Character Types are often mapped using OS MasterMap polygon boundaries, the polygons amalgamated where necessary to map the relevant 'character type'. This uses the OS MasterMap polygon network as a convenient vehicle (mode of expression), with comprehensive coverage and a very fine grain. That is separate in principle from using OS MasterMap's representation of features, such as differing forms of field systems or of industrial areas, as evidence of various character attributes to inform the character assessment: there it is the understanding of the mapped feature which is the critical aspect, not the presence of the polygon boundary.

Geoprocessing: OS maps do not require geoprocessing but polygons of character assessment are digitised over the base map producing simple derived data. Benchmarking and the creation of separate historic character time-slice polygon layers, on the basis of different OS map editions, are required to be combined into a single layer in order to identify the trends and changes in historic character between periods. These unions may be dictated by period classifications

The digitisation scale is the scale at which historic character is drawn or digitised on computer screen, and at which data and attributes are captured. The digitisation scales range between 1:2,500, 1:10,000 and 1:25,000 and reflect the OS base maps commonly used; HSC use of OS MasterMap will reflect the OS capture scales (ie. 1:1,250 in built environment contexts, 1:2,500 in rural contexts and 1:10,000 in moorland contexts). This is creating a trend towards finer resolution mapping and will be reflected in HSC projects in coastal and inter-tidal areas.

Copyright: Under the Pan-Government Agreement (PGA) Ordnance Survey mapping, modern and historic, is made available via English Heritage. The agreement between the OS and EH includes specific reference to allowing simple derived data to be derived from OS mapping. With regard to ownership in Intellectual Property Rights, Schedule 5 Contractor Licence for the Use of Ordnance Survey Digital Mapping Products includes a clause (5.1) which states that 'The Contractor will not retain any Intellectual Property Rights in material created using Ordnance Survey Digital Mapping Products and agrees to assign any rights created to the Sublicensor or Ordnance Survey as requested by the Sublicensor or Ordnance Survey'. Hence the 'intellectual property rights' of derived data generated using OS base mapping can be assigned to the Sublicensor (ie. English Heritage). The agreement requests that all extracts of OS mapping must acknowledge the source of mapping through the reproduction of the following copyright statement:

'© Crown Copyright and Landmark Information Group Ltd (all rights reserved 2***). Licence numbers ***** and ******.'

5.3.4.3 UKHO MODERN AND HISTORIC CHARTS, SAILING DIRECTIONS AND FOLIOS

Description: During the 18th century, methods of navigating, surveying and charting the sea bed developed rapidly. The Admiralty played a key role in many of these developments. From the 1750s onwards it sponsored the first comprehensive survey of the waters around the British Isles leading to the establishment of the Hydrographic Office in 1795 to sort and catalogue the collection of surveys and charts. There are an estimated 100,000 archived hydrographic surveys currently held by the UKHO National Archive of Maritime Cartography.

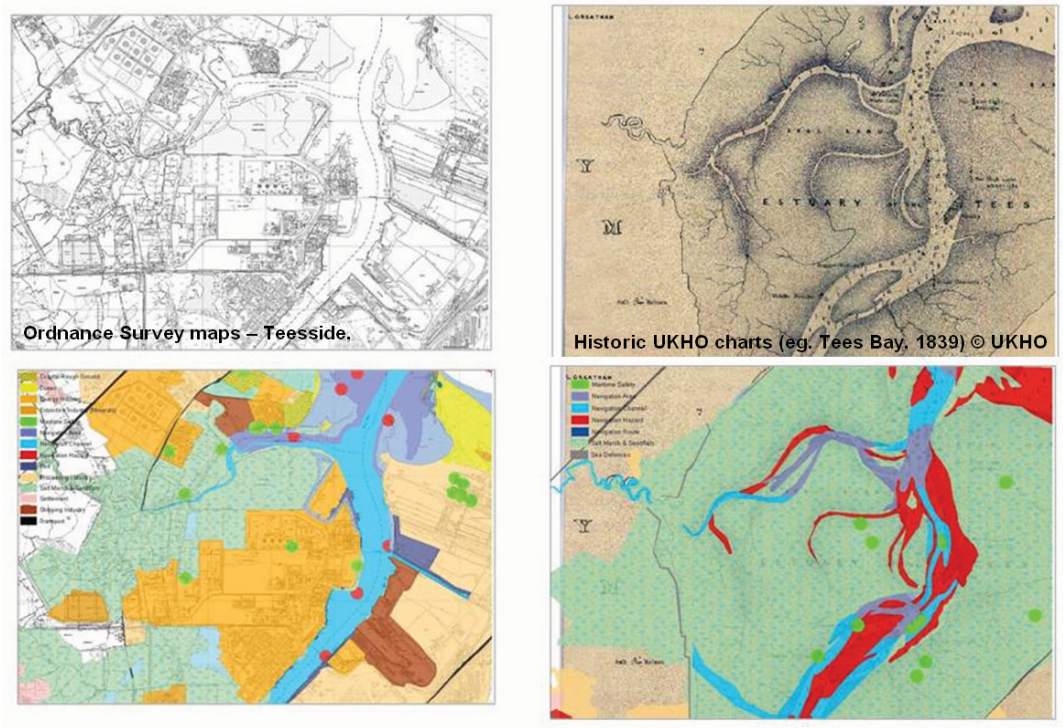


Fig 23 Use of historic OS maps (left) and historic UKHO charts (right) to map historic character (extracts from Scarborough-Hartlepool HSC project (Val Baker et al 2007)).

Role in character assessment: Maritime charts, both modern and historic, provide a wealth of cultural information and provide clues to sea use although it is focussed primarily on navigation. UKHO charts identify features, sites and monuments related directly or indirectly to the maritime environment or maritime activity. These include historic shipping channels, historic anchorages, drying areas, hazards, landmarks etc. The scale of the most continuous mapping of England's coastal waters is the coastal series of modern Admiralty charts at a scale of 1:50,000. Charting at larger scales is available for areas that experience concentrations of navigation activity, such as the approaches to harbours and ports. The scale of historic charts and surveys is equally variable.

The information recorded on historic charts is often repeated and duplicated in later editions (for obvious reasons) and often come through in the current and modern versions. 'Once the Beaufort survey (c1850) had been completed they provided the basis for modern Admiralty charts which though regularly updated do repeat much information, though there is an increase in detail around the turn of the 20th century with the addition of military practice areas, dumping grounds, wrecks and obstructions' (Merritt et al 2007, 9). Chart regression allows the HSC to benchmark and provide time-depth, as with historic OS maps, and where it is possible to accurately georeference a chart to base mapping, important details on the

changing state and nature of navigation channels, routes, marks and such like in estuaries, rivers and inshore and coastal waters can be recorded.

The UKHO also hold a large collection of mainly 19th century and early 20th century coastal 'views'. Before photography artists were employed to paint or draw the coastline as seen from ship. In many cases the surveyors themselves produced these and many 'views' subsequently appeared in engraved form on the face of Admiralty Charts and later sailing directions. These coastal profiles identify landmarks used by mariners to help guide them into port and harbour. They convey the 'view from sea' depicting obvious and recognisable buildings and structures (towers, spires, windmills etc) from a maritime perspective – as navigation aids.

Before the widespread introduction of maps and charts, sailing directions describe in text the safest route between and along stretches of coastline. As with charts the notorious local hazards are the principle concern although references are also made to navigation aids and guides on surest passage.

Geoprocessing: Georeferenced modern digital raster Admiralty Charts are available from the UKHO. The information mapped is also presented in vector format via SeaZone's Hydrospatial package. Historic charts and views are available from the UKHO Research offices and can be obtained in hard copy and digital format.

In-house georeferencing is usually required to fit the chart, where appropriate, to the base mapping used for the HSC. It should be borne in mind however that accurate georeferencing of historic charts and surveys is not achievable for most charts produced before 19th century standardised Admiralty charts. The accuracy to which rectification can be achieved is dependent on the age and scale of the chart. Early charts and surveys, pre-c1850, may be difficult or simply not feasible to reference due to the lack of observable control points or the schematic nature of the survey. The accuracy of each chart used during the project should be recorded within the HSC database as part of the source metadata. Nevertheless given that information is often repeated on later charts (as they get updated) the precise geographic location of landscapes and seascapes can be determined from these whilst the time-depth extended from earlier charts and surveys. In this sense it is recommended that later charts be prioritised for geoprocessing over earlier ones. Once georeferenced information can be digitised from the charts, as vector polygon, line and point data and incorporated into the character assessment via buffering to polygon and unioning or spatial join to the marine grid. The processing of such features should also be recorded in the HSC database's metadata.

A useful method of mapping point based information from early charts especially was identified by the Navigational Hazards Project, 'point data was gathered irrespective of the accuracy of the chart and contained attributes containing a list of keywords based on the names of the features reflected in modern charts. These keywords allow the historically charted features to be linked to their modern equivalent to enable them to be accurately displayed. This removes the need for spatial accuracy from the methodology as the focus is on enabling the charting of features to be traced through GIS by their name rather than location. This approach allows the data to be analysed and summarised into character areas, even if the feature's name has varied between charts or their location does not fit within the correct polygon due to inaccurate charting.' (Merritt et al 2007, 11).

Copyright: Historic Admiralty Charts, historic surveys, historic views and historic sailing directions over 50 years old are out of copyright and the following statement applies, 'The material supplied was protected by Crown Copyright. The copyright protection period has now expired and no new copyright has been created in the supply of the material so you may

reproduce it without the need for a copyright licence agreement or UK Hydrographic Office permission'.

Users of modern Admiralty charts, and those within 50 year limit, must apply for copyright permissions to the UKHO Copyright Licensing office. If reproductions from a modern Admiralty Chart are being used the following standard acknowledgement for either paper or digital copies is required:

© Crown Copyright and/or database rights. Reproduced by permission of the Controller of Her Majesty's Stationery Office and the UK Hydrographic Office (www.ukho.gov.uk).

The ability to create simple derived data from the modern Admiralty Charts and historic chart and survey base mapping is not specifically mentioned. If the modern chart data is accessed via SeaZone's Hydrospatial package as vector data SeaZone's copyright statements apply.

5.3.4.4 HISTORIC LANDSCAPE CHARACTER ASSESSMENTS

Description: English Heritage's HLC programme is now completed over most of England's land area. The programme provides a framework for broadening the understanding of the whole landscape and contributing to decisions affecting the landscape in the future.

Using Historic Landscape Characterisation (Clarke *et al* 2004) reviewed the applications of HLC, establishing how it was already then being used. It documents a number of good practice examples demonstrating HLC's versatility as a tool for informing an extensive range of applications as well as an increasing number of new and emerging projects.

Role in character assessment: HLC databases for counties adjacent to seascapes areas provide a valuable source of information necessary to inform HSC projects, especially for the coastal and inter-tidal zones. The landscape-seascape, HLC-HSC, relationship is inevitably one of overlap and gradation, sometimes occupying a considerable area and not necessarily encompassing areas contiguous with the coastline. HLCs are geared to take the land-based perspective, the 'view from land', but the 'view from sea', the marine perspective of coastal land can produce markedly differing and equally valid characterisations. The 'view from sea' can, literally, transform church towers and other prominent sites into daymarks, headlands into navigational hazards, rivers into navigation channels and some areas of parliamentary enclosure into post-medieval land-reclamation.

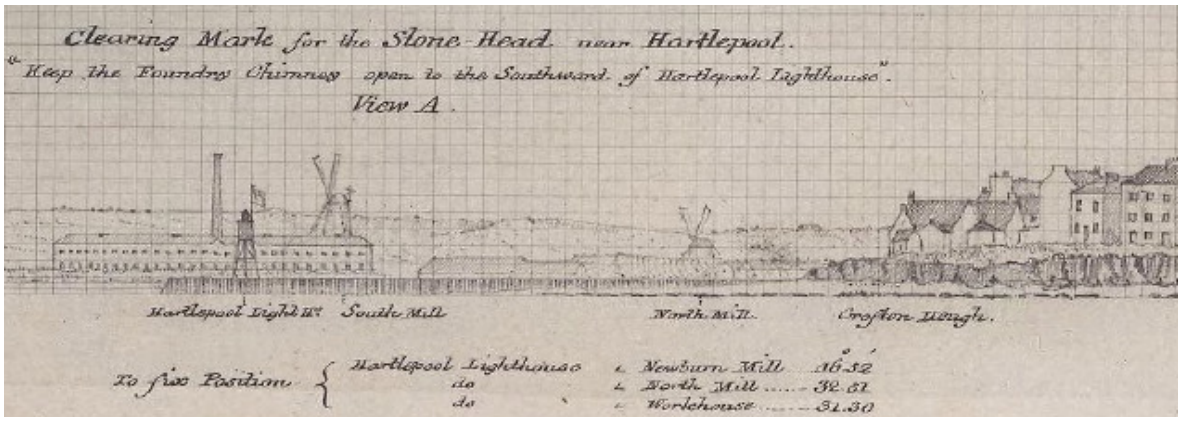


Fig 24 The 'view from sea'. Coast profile for guiding sailors safely into Hartlepool (© UKHO)

HSC approaches need a pragmatic view of the landward extent of characterisation, extending inland to encompass any polygons which can be shown to possess maritime character. Vital in considering this is the need to maintain a maritime perspective. However that perspective may still produce several characterisation options and choices will need to be made, supported by explicitly stated criteria, on which is to be adopted. The result may include isolated polygons

to landward of the coast (daymarks may be particularly prone to that effect): that does not breach HLC principles on comprehensive coverage, it is simply that sporadic HSC relevance inland is completed there by HLC coverage (or will be so if the relevant HLC has yet to be completed). Conversely, HLCs coverage of scattered islands will lie within a sea of comprehensive HSC mapping.

Geoprocessing: It is important to ensure a seamless overlap between HLC and HSC projects both in terms of the character mapping and the terminologies and data structures employed. Where possible, pre-existing HLC polygons should be re-used for such landward HSC polygonisation to aid more appropriate to any arbitrary line (such as MHW), should avoid incorporating into the HSC any land HLC polygons which are of non-marine or non-maritime character: that only duplicates previous HLC work.

Copyright: HLC projects are the copyright of English Heritage and the organisation which undertook the HLC, usually the local authority that houses the HLC project assessor. As such there are no anticipated licence issues when using and deploying HLC data in HSC projects.

5.3.4.5 AERIAL PHOTOS

Description: Digital vertical and oblique aerial photographs can be accessed through local government authorities including HERs and also from the NMR. They are a valuable resource to consult during HSC. Often at 1:10,000 scale they can be used within a GIS alongside OS mapping.

Role in character assessment: Aerial photographs provide useful information on land cover and land use and can provide more contextual information for the inter-tidal zone.

Geoprocessing: Depending on the copyright licence aerial photos used alongside OS base mapping can be used to provide definition to terrestrial and inter tidal character polygons.

Copyright: Subject to licence often held by local authority or English Heritage for those sourced from the NMR.

5.3.4.6 FISHERIES DATA

Access rights to the waters around the UK control the level of fishing activity. Access to fisheries in the six nautical mile inshore zone of UK Territorial Seas is limited to UK vessels. Access by non-UK fishing vessels to the 6-12 nautical mile inshore zone of the UK Territorial Sea is limited to nations with 'historic rights'.

Description: Sea fisheries data is available from a number of different organisations and sources. Information on current fishing practices is usually in the form of sampled data where the extent of activity, fishing effort, is based on fishing vessel sightings. A number of fishing practices are undertaken in English waters, usually dependent on species sought, with some having a more discernible impact on the seafloor and sub-sea floor than others. There are four principal sources for fisheries data.

Offshore fisheries data: Principally CEFAS, JNCC and the Marine Fisheries Agency, fishing data, including information and statistics on fish habitat and fishing effort can be used to characterise present fishing activity. CEFAS have developed a method for assessing six types of direct physical pressures on the seabed resulting from human activities including fishing pressure (identified as a biological disturbance of selective extraction) exerted by vessels deploying mobile seabed gear, namely beam trawlers and shellfish dredgers, as used in demersal fisheries. Mapping the routes taken by these vessels can be used as proxy indicators to estimate the spatial extent of fishing on the seabed where gear tracks disturb, damage and 'scar' the seafloor and seabed (Eastwood *et al*, 2007). This may also inform the likely impact

on the marine historic environment; especially that which may disturb archaeological material, artefacts, wrecks or buried landscapes on the seafloor. The most reliable source of positional data for fishing vessels is the EC vessel monitoring system (VMS). All vessels over 18m operating in EC waters automatically transmit their location at a minimum of 2 hour intervals. Smaller inshore vessels however are not represented. CEFAS also acknowledge that 'other types of fishing in addition to those considered here, such as potting and the use of certain fixed nets, will also cause direct, physical pressure on the seabed. Unfortunately, information on the sites of these activities is difficult to derive from quantitative sources' (*ibid*, 462). Based on the 2004 data, Cefas estimate the area of England and Wales' seabed affected by demersal trawling being between 9 and 21.4% and to have affected a larger area of seabed than all other pressure types combined *(ibid*, 457).

Important new research, undertaken by Cefas, has also identified the scale and impact of fishing activities based on existing geophysical survey data (with a study undertaken in the Eastern English Channel). It develops a methodology to quantify the seabed impact resulting from bottom trawling activities. Three types of trawl scars can be identified from sidescan sonar data, and correspond with scallop dredging, beam trawling and otter trawling. Maps of density and spatial coverage of the physical impact with VMS derived data show clear overlaps and demonstrate that fishing vessels using different gear types generally operate in distinct areas (Vanstaen, 2008). There may be important historical implications from this research that may indicate that distinct historic fishing practices may, firstly correspond with modern areas of activity, and secondly that seabed sedimentology may also dictate areas favoured by particular fishing practices.

Inshore fisheries data: Regional Sea Fisheries Committees also record fishing effort as sampled data and are the most reliable information for inshore waters. As with offshore data the information is based on vessel sightings for the UK 6 mile inshore fishery limit. Inshore fisheries data will also identify coastal fish farming and shellfish areas. Regional Sea Fisheries Committees (SFCs) also hold historical records some dating to the early 20th century.

The Marine Bill White Paper recommends a reform of SFCs. Management of fish and shellfish stocks would remain a key focus but there would be greater consideration of wider environmental impacts with suggestions put forward for a new name possible to be Coastal Waters Committees (Defra 2007, 110).

Charts and mapped sources such as Albert Close's Fisherman's Chart of the North Sea of 1953, held by the UKHO, are available as annotated maritime charts; Close's for the eastern coast of Britain, from East Anglia to Scotland, and identifies fishing grounds, hazards, topographic features as recorded by local fishermen and mariners. Such charts may be used to identify areas of fishing activity and the principle techniques employed.

Fig 25 Steam drifters leaving harbour, Hartlepool (© Hartlepool Arts & Museums Service)

Kingfisher charts may also be used (see http://www.kisca.org.uk/) having been produced to improve the safety of fishermen and the protection of submarine cables. Cables are often snagged by trawling fishing vessels sometimes with fatal consequences. The charts

are aimed at reducing the risks and damage to the fishing industry and other offshore operators (oil and gas industry and telecommunications cable industry).

Bibliographic references: Other references are often important sources of further information and include bibliographic sources such as England's Sea Fisheries: The Commercial Sea Fisheries of England and Wales since 1300 (Starkey *et al* 2000) and more regional and localised studies. Many such publications provide important information on the state of England's sea fisheries throughout history, especially from the medieval period onwards.

Role in character assessment: Sea fishing is an ancient and unique activity which has developed out of our hunter-gatherer origins. In modern terminology it defies classification either as industry, agriculture or transport, though it exhibits characteristics of all three. There are issues with discovering readily mapped fishing information and incorporating fisheries information into character assessment, despite the fact that historically fisheries have been well organised and extensively farmed. The greatest difficulty is precisely defining fishing grounds beyond broad and generic areas.

Without doubt fishing has been an integral part of human activity since prehistory although little direct evidence is known about prehistoric fishing activity or techniques in England's waters. Historically more is known about fishing seasons than about precise grounds and the information is often specific to local areas. Like other hunter-gatherer activities, fishing takes place across a very extensive territory (defined in part by tradition too) but within that territory, only sporadically at any one place. To convey the 'roaming' action through fixed maps requires the HSC assessor to map the overall territory relevant to any particular type of fishing. Bibliographic and other documentary sources record such information, often describing in detail the situation of the most favourable grounds and techniques employed from which it is possible to extrapolate.

Fishing effort data is used to inform the mapping of inshore and offshore fisheries.

- Inshore fishery: historically defined as areas that fishermen could fish safely and return to port before their cargo spoiled. In the present-day this is determined by 6-mile fishing limit in UK waters and usually means netting, long-lining, shellfish dredging, fish and shellfish farming and potting
- Offshore fishery: waters beyond inshore zone, often deepwater trawling (demersal and pelagic), netting and long lining and is identified as those areas of named fishing grounds

Some fishing areas may also correlate with seabed sediment types preferred by some species, for example by demersal species, especially flat fish, found largely in the finer sandier sediments which are more likely to have been trawled historically; rather than over coarser, rocky and more catchy ground more suitable for long-lining pelagic species. To bring evidence of fishing activity into consideration for HSC assessment, however, that evidence needs to be positively related to fishing, not a proxy based solely on sediment types/and/or fish species distributions.

One of the measures, although not exclusive, indicating the predominance of any one particular fishing method over another is the varying impact different fishing techniques may have on the material remains of the marine historic environment.

Geoprocessing: Such data is often of the sampled type being available as grid cell-based frequency mapping showing behaviour and trends. This data can be transferred by spatial analysis into a density or frequency plot and incorporated into the character assessment, as a grid or derived polygons but must done to ensure the data is considered 'simple derived data'. The HSC assessor must use the data to inform their assessment of the historic character and draw analogies between present day fishing practices and impacts with those of the past. Predominance may be assessed on the basis of Mean values and high, medium and low counts. As such it needs to be resampled and used with care and sensitivity by the HSC assessor before being deployed against the HSC marine grid

Fig 26 Cornish herring boats at Whitby (© Whitby Museum)

Copyright: CEFAS request that data derived from their assessments of seabed pressures be checked by them before further distribution if it is directly derived as complex data and also request that clear reference is made to the published documentary source where appropriate.

Offshore VMS data do not belong to CEFAS, and a Defra disclaimer is required whenever they are used, and the same applies to third parties and derived data. The disclaimer required is as follows:

VMS data were provided by the UK's Department for Environment, Food and Rural Affairs (Defra) in raw, uninterpreted form. The Secretary of State for the Environment, Food and Rural Affairs does not accept any liability whatsoever as to the interpretation of the data or any reliance placed thereon.

5.3.4.7 ENVIRONMENTAL DATA

Description: Natural environment datasets provide important information informing HSC on various aspects of semi-natural environments that to many people may appear to be wholly 'natural'. Habitat and land cover mapping also inform HSC indirectly on farming regimes and land use patterns. Natural environment designations demonstrate current policies and attitudes towards these areas. In the marine environment such mapping and designation descriptions are often the only datasets available for large areas.

Semi-natural environments are nevertheless those modified by human influence, either directly or incidentally, but whose character remains dominated in the present day by the results of natural processes acting in concert currently with non-intensive, sporadic, or no active human management (though there may still be impacts from 'passive management'). The impact of human action is often underestimated in these areas and they are often regarded as largely "natural". Examples might 'include coppiced oaks in an ancient but carefully managed woodland, acid heathland on moors subject to thousands of years of summer grazing, a lowland bog created by damming a stream with a causewayed track, the beetle communities living in logs trapped in the muds of estuaries silted by the waste from medieval tinning many miles upstream' (Herring 1998, 1). Equivalents in the coastal and marine environment include dune systems or sand banks accumulated over time due to the construction of coastal infrastructure such as sea defences, breakwaters and harbours; cliffs and foreshores cut, tunnelled and rent by industry now overgrown, neglected and eroded; coastal rough ground used for summer grazing, salt marshes drained and now subject to coastal squeeze against sea defences as sea levels rise, and sand flats used for bait collecting; even the trawled and scoured

seabed far out to sea or the potentially extensive areas of Palaeolithic and Mesolithic palaeolandscapes now submerged but receiving confirmation from recent analyses of geophysical survey.

Similarly in the marine environment tidal movement, seabed morphology, seabed sediments, and storminess/prevailing wind direction etc are also important to consider as they will have influenced, and been influenced by, human activity (especially regarding concerns over the causes of climate change). The assessment of this data is useful for 'determining distinctions in the seabed based on its physical geography. Bedform data, for example, distinguishes bumpy elevated areas of seabed such as sand waves and sand ripples from flat mud plains and is relevant to the historic character of an area as these physical conditions will have had a direct influence on the human use of the sea and the survival of material culture' (Wessex Archaeology 2006, 17, ref. 58370.06).

A number of organisations hold environmental data relevant to HSC. These include Natural England (http://www.english-nature.org.uk/pubs/gis/gis_register.asp), JNCC, CEFAS and BGS. Further resources include the Mapping European Seabed Habitats (MESH) project (www.searchMESH.net); the Data Archive for Seabed Species and Habitats (DASSH) that houses marine benthic data and builds on the resources established by the UK National Biodiversity Network (NBN) and the Marine Life Information Network (MarLIN).The British Oceanographic Data Centre (BODC) data holdings cover many types of marine data including physical, chemical, biological, air/sea interface and sediment data.

Further information can be found in Natural England's Marine Natural Area reports. Each Natural Area has a unique identity resulting from the interaction of wildlife, landforms, geology, land use and human impact (http://www.english-nature.org.uk/Science/natural/na_search.asp).

Role in character assessment: It is important to maintain the HSC objective of mapping the 'human dimension' of the historic marine environment. Environmental datasets can be used to inform HSC on the character of human activity's impact on the 'natural environment' to create what in reality are semi-natural environments. This would not be achieved, however, by directly incorporating natural environment data and classifications into HSC: the natural environment datasets are recording the outcomes for geology, topography and the biomass of the interplay of human activity and natural processes over the millennia, not that activity and its role themselves. These datasets provide indirect evidence, from which HSC needs to tease out their likely origins in human activity where those are known or suspected. Those human influences need particular emphasis in the structured texts compiled to accompany the Character Type mapping.

Environmental datasets help characterise areas of semi-natural environment which although employ natural environment terminologies, for ease of popular recognition and simplicity, have clearly definable human dimensions, where cultural influences have often been directly responsible for the evolution of the various types of semi-natural environments over centuries or even millennia.

Geoprocessing: Principally used to inform HSC assessment on landscapes and seascapes of semi-natural nature but not directly incorporated in the HSC GIS. The majority of environmental datasets are digital and georeferenced.

Copyright: Need to refer to the various originator organisations.

5.3.5 SUPPLEMENTARY DATA

Comprising datasets with inconsistent coverage, often at regional or local level but which inform local variation. It is worth noting that given the current lack of very detailed national base mapping coverage for the marine environment, unlike the terrestrial OS mapping, supplementary sources may play a greater role in HSC than they have traditionally in HLC.

Source	Format	Location
HER/SMR/NMR data (including RCZAs)	Digital/hard copy	Adjacent, EH NMR
Geology (bedrock and sediment, borehole)	Hard copy/digital	BGS
Offshore Industry	Digital	UKDeal, JNCC
Palaeoenvironmental data (sea-level index points, submergence models)*	Hard copy/digital	Various (eg. North Sea Palaeolandscapes Project, EH & Uni. of Birmingham)
FutureCoast (coastal morphology)	Digital	Defra
Shipping data*	Digital	Anatec UK Ltd, see also Wessex Archaeology, England's Shipping: Year 1 and 2, refs: 51552.03 and ref: 51552.05
Seismic data (geophysical surveys etc)*	Digital	Various (ALSF Projects and Corporate Industry
Misc. documentary sources (texts, maps, images, art)*	Hard copy, digital	Various (Other ALSF projects - ADS www)

Fig 27 Supplementaey data required by HSC projects

* There is an increasing body of research exploring and identifying the archaeological potential of the marine historic environment. For the most part specific, local and regional these analyses nevertheless provide the framework and method for wider national implementation and as such are an important source for consultation as a resource examining archaeological and historic significance and as mitigation and management considerations. See Sections 2, 3 and 4 in 'Marine Aggregate Extraction: Helping to determine good practice' (Newell and Garner, 2007), for more details of projects undertaken and current initiatives. See also ADS 'ALSF projects' website for further work and report downloads (http://ads.ahds.ac.uk/project/alsf/projects_new.cfm).

5.3.5.1 HER AND NMR DATA

Description: Local Authority Historic Environment Services maintain local Historic Environment Records (HER) data which is generally land based data. Nationally the National Monuments Record (NMR) is maintained by English Heritage and houses the NMR Maritime Record. These datasets hold information about scheduled monuments, listed buildings, a huge range of monument types, and extensive bodies of archived project data. Data generally tend to be in point format but GIS, HLC and HSC are playing an increasing role in providing a spatial dimension against which the point data may be contextualised.

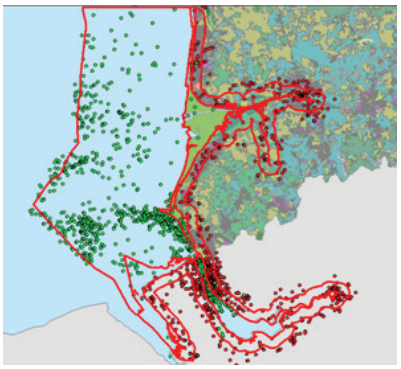


Fig 28 Example of NMR point data for Liverpool Bay (after Wessex Archaeology 2006a)

Role in character assessment: NMR and HER data may be used to complement or inform character mapping, providing exemplars of the components and features in associated character text descriptions. The data may also be used to assess the archaeological potential of the project areas and provide further information on time-depth. Some caution needs to be observed though. It should be recognised that NMR and HER data tend to capture the rare, special and atypical in an area, rather than the typical and characteristic, especially on land. Furthermore, there is a serious risk of circular argument if NMR and HER point data forms a strong influence in the HSC character assessment and that assessment is then used to contextualise the same NMR and HER data.

Bearing in mind such cautions, some specific monument types and sites, such as wreck data and maritime landmarks, may be used to define and map particular areas and types of historic character.

Geoprocessing: HER and NMR data requires cleaning and cross referencing in order to remove duplicates before combining into a single layer. Most HER and NMR data will not be used directly in HSC assessment however specific monument types are required to be analysed and processed further to facilitate incorporation into the HSC polygon dataset.

Copyright: HER data is copyright to the curating Local Authority. Some HER data and all NMR data is copyright to English Heritage.

5.3.5.2 SHIPWRECK AND OBSTRUCTION DATA

Description: Wreck and obstruction data is available from a number of sources. The NMR provides a list of known and recorded wrecks from documentary sources. UKHO charts and SeaZone's Hydrospatial dataset record wrecks discovered during survey and those deemed to be hazardous to navigation or of particular interest to mariners and other users of the marine environment. Some local wreck lists (from HERs) are also available as is further information from bibliographic sources. Currently there is no single, comprehensive and verified source. The combination of NMR and UKHO data however gives the best current representation of knowledge, though it should be noted that there are some discrepancies between the two. Additionally shipwreck data tends to be biased towards losses in the last 250 years and certain types of vessel such as military or large ships. The location of wreck data may not be 100% accurate and subject to spatial error.

Role in character assessment: Used principally to inform the character of the human material impact present at seabed level. Although NMR and HER data are generally not directly represented in character assessment, wreck data is used to identify wreck clusters, areas where two or more wrecks are located and those areas where dangerous wrecks lie exposed, in shallow water or in 10m or less of water and which pose a very real risk to, and therefore influence, navigation. Use of wreck point data is partly in response to the relative paucity of known and recorded archaeological sites in the marine environment compared to land.

Geoprocessing: HER and NMR wreck and obstruction data require cross-referencing with SeaZone's Hydrospatial wreck data to identify and remove any duplicates before combining them as a single layer. HER and NMR wreck data needs to be assessed for spatial accuracy and the certainty with which is can be included in the character assessment. Some wrecks are too poorly located to be satisfactorily included. From the SeaZone data only those wrecks considered LIVE (as opposed to DEAD or LIFT wrecks) should included as they provide the relevant data to assess archaeological potential.

Wrecks and wreck clusters can be incorporated into the character assessment via the use of a frequency count where wreck points are joined to the vector grid and used to identify cells where two or more wrecks occur or those areas where grid cells are intersected or are contiguous.

Copyright: Copyright belongs to the organisation providing the data. SeaZone's Hydrospatial wreck data is copyright to SeaZone and UKHO (see above 5.3.4.1 and 5.3.4.3). HER data is the copyright of the Local Authority curating the records. NMR wreck data is copyright to English Heritage. Buffering and undertaking a gridded frequency count on only select wreck data derives simple project data.

5.3.5.3 BGS DATA

Description: Solid geology and seabed sediment data is available via SeaZone's Hydrospatial dataset or directly from the BGS. The sediment and bedrock geology is plotted at a low resolution of 1:250,000 scale.

Role in character assessment: BGS data can be used as baseline environmental data to obtain information on the material components of the seabed. Sediment data is relevant to assessments of potential preservation state. For example, clay sediments will offer an anaerobic environment which facilitates the preservation of organic archaeological remains. Looking at other aspects, some fishing practices may also correlate with seabed sediment types eg. demersal species, especially flat fish, in finer sandier sediments are more likely to have been trawled historically rather than coarser, rocky and more catchy ground. In this sense the use of BGS data can be directed towards identifying areas of 'passive intervention'; that is large areas of the seabed that are largely devoid of directly observable material culture but which can be expected to be typified by 'background noise' of the historic character and activities identified in other marine levels (eg. fishing practices, navigation activity taking place in the water column and sea surface). These 'passive interventions' may be divisible on the basis of an understanding of the preservation potential offered by different sediment sediments on the sea floor and sub-sea floor.

Sediment composition may inform the potential for preservation of archaeological remains. Basically lithology and grain size are key indicators. From muddy, sandy and clay deposits (of very high preservation potential) to fine grained sediments with very low gravel content, less that 5%, (of high preservation potential), to those with of increasing gravel content, between 5-3%, (of medium potential); to those with high gravel content, between 30-80%, (of low potential) to shelly, diatomic and rocky deposits (of very low potential) …'the results suggest that the highest potential for risk would be predominantly inshore, and therefore the query results focused on inshore areas with a high percentage of fine grained sediments. The results of these queries showed a higher potential for loss and preservation on approaches to estuaries inshore and shallow fine-grained sandbanks offshore' ((Merritt *et al* 2007, 26-33).

Where off-shore peat deposits do exist, they have potential for historic environment data or past human habitats which should be explored. The British Geological Survey and commercial cores, which have been archived, are an important though untapped resource, but one which HSC projects themselves are unlikely to be in a position to exploit.

Geoprocessing: BGS sediment data is used to inform the character assessment of the seafloor and sub-sea floor but is not directly used or reflected in the HSC GIS. The data provided by BGS on the sediments that comprise the seabed is useful in assessing the character of this level. BGS data is one of the few consistent and complete coverage area based datasets relevant to the seabed rather than the sea surface available.

Copyright: BGS data can be acquired or purchased directly or as part of SeaZone's Hydrospatial package. Strict copyright issues mean that BGS data cannot be used in the final HSC GIS if it is deemed to be possible to re-engineer the data to produce approximate renditions of the original.

Where BGS data is reproduced for illustrative purposes the following acknowledgement applies:

Derived from 1:250,000 scale BGS Digital data under Licence No. *******. British Geological Survey © NERC.

5.3.5.4 INDUSTRY DATA

Description: Data for the hydrocarbon industry can be accessed via SeaZone's Hydrospatial data and the UK Digital Energy Atlas and Library (UKDEAL). The range of industry in UK waters covers the following principal industries:

- Hydrocarbon exploration (drilling, cuttings, storage and production including associated pipelines and infrastructure)
- Aggregate dredging and other mineral extraction
- Renewable energy (and associated infrastructure)
- Dumping (disposal of dredged materials), sewerage and waste disposal (and associated infrastructure)
- Telecommunications (submarine cables)
- Shipping activities and shipping channels
- Other processing industries (Carbon capture and storage, desalination etc)

The output from the largest hydrocarbon producers - the UK and Norway - has peaked and entered a period of long term decline. Nevertheless there are still almost 500 platforms and 10,000 kilometres of rigid and flexible oil and gas pipelines running between offshore production wells and terminals on land (DTI 2001).

Cefas data identifying the direct physical pressures on the seabed arising from human activities can also be used in character assessment. Employing a method of assessment, using data for 2004, Cefas identified six principal pressures on the seabed in UK offshore waters (Eastwood *et al* 2007). These pressures are identified in the following categories of physical loss, physical damage and biological disturbance and include the following types:

- Obstruction: Oil and gas fixed infrastructure (platforms, wells and pipelines); windfarm monopiles and scour protection and wrecks
- Smothering: Oil and gas cuttings piles; waste disposal
- Abrasion: Windfarm scour pits
- Extraction: Marine mineral dredging (direct removal)
- Siltation: Marine dredging (plumes)
- Selective extraction: Fishing with demersal gear (beam trawling, otter trawls, and shellfish dredges)

Fig 29 British Petroleum (BP) oil rig in the North Sea (© Hartlepool Arts & Museum Service)

Role in character assessment: Industry, especially 20th century hydrocarbon and minerals extraction in offshore areas tends to be an imposition onto earlier historic character types such as fishing grounds and such activity has dominant material impact on evidence for the earlier activity. Their potential impact in the marine historic environment is obvious and they constitute highly visual and perceptible forces in the seascape not only in their location but the associated infrastructure, pipelines, service and maintenance vessels, routes and exclusion areas etc that can be found in attendance. The different impacts occur at different levels of the marine tier.

Coastal industry tends to have greater time-depth than offshore industry with mineral extraction and processing industries located close to water for transportation reasons, especially before the advent of railway and the motor vehicle.

Industry can be broadly categorised into 'intrusive and non-intrusive industry' indicating an assessment of the direct or indirect impact considered. Intrusive offshore industry refers to any industrial activity at sea that continuously disrupts and impacts on the marine environment (particularly the seabed) through time, eg. aggregate dredging, oil and gas installations etc. Non-intrusive industry usually refers to any industrial activity at sea that does not have a continuous and incremental intrusive impact on the seabed such as commercial shipping. The different aspects of industries may be discussed in associated character type texts, with inshore and offshore industry being viewed as an extension of those found and recorded in land HLC.

Geoprocessing: Individual platforms, wells and pipelines should be excluded from the strategic level HSC as being too small for portrayal although this does not exclude bringing such structures etc into the character assessment in terms of identifying clusters and high densities in any given area (see the treatment of wreck data in section 5.3.5.2). Cefas' pressure data can be used to inform the character assessment but not directly incorporated.

Copyright: Originator's copyright and licensing restrictions. For SeaZone data see section 5.3.4.1.

5.3.5.5 PALAEOENVIRONMENTAL DATA: MODELS OF SEA-LEVEL CHANGE AND PALAEOLANDSCAPES

Description: Material evidence for past human activity exists as physical remains on or beneath the sea floor, especially in the central and southern North Sea, English Channel and Irish Sea. However for many areas of English waters the earliest archaeological remains comprise submerged landscapes, surviving as relict land surfaces and palaeochannels in or beneath the sea floor. After the most recent marine transgressions, archaeological evidence take the form of wrecks, lost cargoes and other marine debris.

It is clear from the archaeological record on land and from a range of sites and artefacts known from the sea floor and around the coasts of northern Europe that the submerged former landscapes late in the late glacial and in the early post-glacial period comprised rich human habitats, the lands by which the present area of the British Isles was re-populated after the last Ice Age. The archaeological potential and character of those palaeolandscapes in English waters is currently best exemplified and presented by The North Sea Palaeolandscapes Project which states '… following the end of the last Ice Age rising sea levels across the area that became the North Sea resulted in the rapid inundation of an inhabited prehistoric landscape. This marine region contains one of the most comprehensive records of the Late Quaternary and Holocene landscapes in Europe along with maybe one of the most extensive and best preserved prehistoric landscapes. The results are likely to fundamentally change

current interpretations of north-western Europe and to impact the heritage strategies of every country that possesses a North Sea coastline' (Gaffney *et al* 2007).

Role in character assessment: Understanding the prehistoric archaeology of the north-west European Continental Shelf is an essential part of understanding the prehistory of Europe and the British Isles. Changing sea-levels and available land mass has had a dramatic effect on the landscapes and seascapes of the British Isles. Palaeolandscapes were once human habitats. Although current models are indicative with the exception of coastal areas where OS mapping or historic charts begin to provide more reliable data from the late 18th century onwards, the interpretation of time-depth for HSC is often reliant on the sea-level change maps. HSC projects work from state of present knowledge: it is not within their brief to produce accurate and reliable models of sea-level rise, submergence and archaeological potential.

Fig 30 Graphic reconstruction of North Sea landscape (© North Sea Palaeolandscapes Project, University of Birmingham)

However projects such as the North Sea Palaeolandscapes Project recognise that 'the scale at which the North Sea project has operated, and the extensive topographic data generated, has a clear HLC application'. The project goes on to note 'the North Sea data effectively represents a partially mapped Mesolithic landscape in topographic terms, and the notional resolution of the data supports mapping of generalised economic/landscape units which, may, ultimately, reflect broad land use patterns within a Mesolithic economy. Whilst unencumbered by later cultural development the landscape's post-depositional taphonomy should also be considered part of the landscape's character. In this sense the data seems to possess the potential for a successful HLC implementation On this basis the HLC was undertaken on the basis of geomorphological and hydrological characteristics to provide broad landscape zones' (Gaffney *et al* 2007, 111-112).

The data produced by such research are valuable to inform HSC on the earliest examples in a potential sequence of 'Previous HSC Types' before the present. It may also inform the historic character of the sub-sea floor. Where models do not exist or cannot be mapped with any degree of certainty, HSC projects would benefit by alluding to the presence or absence of the potential for these submerged landscapes. Given the current concerns about climate change and associated sea-level rise, including palaeolandscapes in HSC assessment allows these prehistoric landscapes, once the habitat of Palaeolithic and Mesolithic hunter-gatherer peoples, to be better understood and presented.

Models of sea-level change, where they exist, should be used where feasible to inform the HSC database on the part of the previous historic character of the area concerned.

Geoprocessing: As noted above creating sea-level models is not a function of HSC projects. Various of those which do exist are also problematic for a number of reasons. The use of modern bathymetry as an analogue for prehistoric topography and elevation is misleading since Holocene sediment deposits associated with marine transgression and modern sediment transport systems and local trends of erosion and deposition have changed the topography of

the sea floor. Similarly accurately estimating and removing isostatic movement from sea-level calculations is beyond the scope of HSC projects.

Evidence for prehistoric submerged landscapes has an important role to play in HSC projects where it is available. Projects, such as North Sea Palaeolandscapes are going to improve our knowledge of these submerged landscapes and crucially map and characterise them within a GIS. It is these interpreted and mapped results that can be most readily be used to inform HSC projects assessments.

The terminology often employed by such research projects requires further interpretation and definition before assimilation by HSC. Currently, at best, very broad areas and generic labels can be applied that classify the whole project area as having the potential for palaeolandscape remains. Some assessments of archaeological potential may be made on the basis of marine bathymetry, bedforms, geological cores and dredged material from the sea floor.

Copyright: Variable. Originator's copyright.

5.3.5.6 FUTURECOAST DATA

Description: The Futurecoast study, commissioned by Defra, identifies the geomorphology of the coastline and active coastal processes. The main outputs from this research are an improved understanding of coastal behaviour; an assessment of future shoreline evolution and supporting information and data.

Role in character assessment: Informs HSC assesment of coastal morphology and stability information. The study provides predictions of coastal evolution over the next century, which are to be considered in the updating of other strategic plans targeted at determining broad scale future coastal defence policy for the open coast shorelines of England and Wales. This information provides a mapped knowledge base that can be used by coastal managers to help define sustainable policies.

Geoprocessing: None. Used to inform character type text descriptions.

Copyright: Defra.

5.3.5.7 SHIPPING DATA

Description: Information on modern and historic shipping lanes and traffic can be identified from a number of sources. Historic shipping activity is usually represented on historic charts and by sailing directions or may be drawn from other sources such as England's Historic Shipping Project (Wessex Archaeology 2003). Shipping channels are often named on historic charts although their limits, if defined, tend to be roughly demarcated by buoyage and other navigation aids.

Modern shipping channels and lanes can be inferred from SeaZone's Hydrospatial 'Socio-economic and Marine Use' and 'Transportation and Routes' topics as can navigation areas and restricted navigation areas, piloting areas, ferry crossings etc. NMR and UKHO wreck and obstruction data can also indicate historic navigation routes and areas. Modern shipping activity can also be drawn from Anatec UK Ltd ShipRoutes data. Anatec maintain a ship routes database which provides information on shipping movements within UK waters. The data records shipping routes with details on the numbers of vessels using each route and is expressed as a grid with density of shipping in each cell recorded per annum.

Role in character assessment: Modern shipping data directly informs modern sea-use and is useful for identifying possible threats or likely impacts from modern shipping to and on the

historic environment. It may be used primarily to inform inshore and offshore sea surface character.

The coastal and offshore waters of Britain have been navigated since prehistory. Historically vessels generally 'coasted', that is, hugged the coastlines they were navigating on their journeys. This is likely to be true for most craft up to the 14th century and even later into the early modern period. The distribution of wrecks clearly demonstrates this tendency with the overwhelming majority being recorded within 12 or so miles (20km +) of the coast. Linear, open sea, routes are essentially an early modern invention.

From the 18th century until the mid-20th century, the territorial waters of Britain were three nautical miles (5.6km) wide. Today territorial water extends to 12 nautical miles (22.2km) from the shoreline.

Geoprocessing: Shipping channels, navigation routes and areas can be digitised from historic charts, individually by chart date and later be summarised as areas taking into account spatial change and longevity of use. Digital data for offshore areas may be directly referenced against the marine grid or resampled from grid data supplied (such as Anatec data).

Copyright: Originator organisation. For SeaZone data see section 5.3.4.1. UKHO historic charts, historic surveys, historic sailing directions over 50 years old are out of copyright, see section 5.3.5.3.

5.3.5.7.1 ENGLAND'S SHIPPING PROJECT

The experience and GIS methodology developed by Wessex Archaeology's ASLF funded England's Shipping project (Wessex Archaeology 2003, ref. 51552.03 and 2004, ref. 51552.05) provides a useful source for the characterisation of historic navigation activity in English waters.

Description: The project's GIS and associated database represents records of individual ship voyages spatially, based on historical data contained in documentary sources relating to pre-1730 shipping activity. The network of shipping routes created produces an artificial representation of shipping voyages between historical ports and enables the spatial characterisation of shipping between ports whilst also contextualising known wreck sites. The traffic data for ports arranged by period allows the assessment of the commercial and naval importance of a port and by extension inferences to be made as to the density of traffic approaching and leaving ports. Through the collation of information pertaining to hazards and destinations, as recorded on historical charts, and numbers of casualties/shipping losses held by the NMR, it is possible to achieve a more informed assessment of the maritime archaeological potential of the seabed in these areas (*ibid*, 20).

Role in character assessment: The character of England's shipping is reflected in the movement of traffic around the coastline and the location of known wrecks on the seabed. It is also reflected in the commercial importance of ports, naval conflict, and casualty events that did not lead to wrecking' (*ibid*, 1). The project provides a network of shipping routes, which can be used to visualise the data on shipping movements (*ibid*, 10). The dataset can be used to inform the character of medieval and post-medieval inshore and nearshore navigation within 27 nautical miles.

By providing a database containing information on the nature of traffic in UK waters and being able to visualise it spatially via an artificial network of ship routes, it is possible 'to query the database for patterns of information and the combination of casualty, wreck and battle data can be used to identify areas with a higher frequency of events, thereby suggesting higher-

shipping activity.' (*ibid*, 13). The primary application of the data gathered for England's Shipping is to overcome the bias towards the analysis of post-1700 shipping currently seen in Environmental Assessments.' (*ibid*, 26).

However the network is not designed to give an accurate representation of where vessels travelled historically as over 90% of the data recorded in the database contains incomplete information. Instead it primarily represents the relationships between ports. The routes network is limited to 50 kilometres from the UK coastline (*ibid*, 26). Nevertheless the data contained in the database provides a representation of the character of shipping in an area.

Geoprocessing: None. The mapping available from this project allows the assessor to characterise and assign time-depth to navigation practices, as the source data dictates, in inshore and nearshore waters (within 50km).

Copyright: English Heritage. The content of the project is available to users via the National Monuments Record.

5.3.5.7.2 NAVIGATIONAL HAZARDS PROJECT

Description: The experience and GIS methodology developed by Bournemouth University's ALSF funded Navigational Hazards Project (Merritt *et al* 2007) for English Heritage may provide a useful starting point for HSC projects.

The project used historical records (including charts, sailing directions and pilotage notes) of navigational hazards to interpret and characterise the hazardous nature of the marine environment. Combining these records with a model of the preservation potential of marine geology sediments has identified areas where there may be a high potential for ship losses coinciding with a high potential for preservation of archaeological materials – areas known as 'Areas of Maritime Archaeological Potential (AMAPs) (*ibid*, 4-5).

Fig 31 RMS Mulheim aground at Castle Zawn, Sennen, Cornwall © Dave Hooley

The types of hazards recorded include banks and spits; rocks, cliffs and ledges; navigational marks; anchorages and sea state (currents). Other features relating to navigational safety such as buoys and beacons are also recorded as their presence suggests that the feature is important enough or dangerous enough to warrant marking to warn seafarers away from the risk. Historic anchorages recorded from historical charts was provides a useful insight into areas perceived as being less hazardous or "safer", even in dangerous sea conditions (*ibid*, 10-11).

Role in character assessment: The mapping available from this project may be used to define navigational hazard areas around the coast allowing broad trends to be mapped in the character assessment. The project's results suggest that 'the highest potential for risk is predominantly inshore with a higher potential for loss and preservation on approaches to estuaries inshore and shallow fine-grained sandbanks offshore' (*ibid*, 33).

The hazards data may be used to inform the HSC Type Navigation Hazard whilst allowing comments to be made on likely areas of good or poor archaeological preservation in character type texts.

Geoprocessing: None. The mapping available from this project may be used to define navigational hazard areas around the coast allowing broad trends to be mapped in the character assessment.

Copyright: English Heritage. The content of the project is available to users via the National Monuments Record.

5.3.5.8 GEOPHYSICAL DATA

Description: Acoustic benthic mapping techniques that include bathymetric surveys, sub-bottom profiling and side-scan sonar data.

Accurate bathymetry data are essential for nautical charting and although packages such as SeaZone's Hydrospatial and UKHO Admiralty Charts provide the most consistent and detailed coverage other survey data may be able to provide further information, especially locally.

Sub-bottom profiling data identify and measure various sediment layers that exist below the sea floor and can be useful for characterising potential buried landsurfaces (see also section 5.3.5.5), since they provide information about sub-seafloor sediment structure and morphology.

Side-scan sonar data identify the results of sound pulsed across the seabed picking up reflections off the bottom or off objects on the seafloor. Side-scan sonar systems are very accurate for mapping large areas of the seafloor.

Role in character assessment: The advantage of geophysical data is that it can penetrate through recent sediments to the underlying bedrock geology identifying series of superimposed original land surfaces and features such as river channels, lakes, basins and marine estuaries. The detailed results from studies like this will allow better models of archaeological potential and their attendant threats to be assessed.

Geoprocessing: This type of data usually requires analysis and interpretation, by originator or expert, prior to being incorporated into HSC character assessment.

Copyright: Sources are usually the copyright of the holding institution, organisation and the direct reproduction of images, extracts and such like requires permission and referencing.

5.3.5.9 BIBLIOGRAPHIC AND DOCUMENTARY SOURCES

Description: Bibliographic and documentary sources play an especially important role in HSC projects. This will require extensive searches of local libraries, museums, record offices and archives to gather sources on general historic, archaeological, contemporary and environmental information.

Role in character assessment: The relative lack of detailed mapping for the marine environment necessitates supplementary research to provide the historical context for the character assessment. These sources are important to help build character text narratives and can inform decisions on character dominance. Such research although supplementary is highly informative and in conjunction with limited fieldwork can greatly inform seascape characterisation.

Geoprocessing: Principally used as background information bibliographic and other sources may nevertheless inform the identification of local trends and practices, such as fishing techniques, and areas that can be transposed and reflected in character assessment mapping.

Copyright: Sources are usually the copyright of the holding institution and the direct reproduction of images, extracts and such like requires permission and referencing.

5.3.6 ADS ALSF MARITIME ARCHIVE

The ALSF scheme has enabled English Heritage to support a range of timely initiatives, providing new insights into mitigation, assessment, evaluation and potential of the marine historic environment through remote survey and field investigation in English Territorial Waters. The relevance of the ALSF scheme is highlighted through the wide variety of projects being undertaken and a demonstration of how these are directly reducing the impact of aggregate extraction on the historic environment.

A list of current projects available for consultation can be found on the ADS ALSF maritime archive webpage http://ads.ahds.ac.uk/catalogue/projArch/alsf/search_maritime.cfm.

5.3.7 MARINE ALSF GIS DATABASE

Future HSC projects will benefit by consulting the Marine ALSF GIS database (www.MarineALSF.org.uk). Set up in 2004 it comprises a customised website where marine aggregate research project information may be accessed. The database currently holds (March 2008) over 900 records including:

- Over 12, 000 separate items of information
- Over 450 individual project metadata records
- Over 175 spatially located projects
- Over 275 generic research projects that are relevant to the UK sector
- Research projects from over 110 different organisations
- Over 450 separate report records
- Over 300 PDF reports available for direct user download

It is envisaged that the content will be extended to provide access to survey datasets from all existing and future marine ALSF funded research projects.

5.3.8 MARINE DATA AND INFORMATION PARTNERSHIP (MDIP) DATA ARCHIVE CENTRES

The Marine Data and Information Partnership (MDIP) was established in 2005 to develop harmonisation in the management of UK marine data and information. It seeks to establish a network of integrated marine Data Archive Centres (DACs) and a prototype Internet "discovery" portal which provides a single point of access to UK marine data and information resources, especially those priority datasets required to underpin UK and EU legislative and obligatory requirements for marine planning. It intends to facilitate full access to the MDIP DAC network for the public, government and industry and projects undertaken in the marine and coastal zone environment thereby reducing the proportion of project budgets spent on locating, accessing and retrieving marine data.

Many of the datasets required by HSC projects may be accessible through MDIP DACs and this will be increasingly the case in future.

5.4 HSC SPATIAL DATA MODEL(S)

Whilst methods developed and used in terrestrial and near shore HLC are useful guides to HSC they need to be adapted and adjusted in order to be directly transferred to offshore areas. Some of the issues associated with the latter include:

- Working without fixed boundaries: in HLC field boundaries, roads, railways, patterns of landownership etc create divisions of the landscape which express, discretely,

different types of human activity. In offshore and inter-tidal areas, divisions reflecting zones of human activity are much more diffuse and very rarely have hard or defined boundaries

- The sea has multiple vertical levels which can influence the definition of historic character: the sub-sea floor, sea floor, water column and sea surface. In the inter-tidal and coastal areas there is a single land surface.
- Dynamic marine environment: the natural environment of the inter-tidal and marine zone is dynamic and constantly changing due to natural physical processes such as currents, tidal range and sediment mobility. Evidence of human activity in this type of environment can easily be eroded, covered, uncovered and transported

5.4.1 MULTI-MODE METHOD APPROACH TO CHARACTERISATION

The experience of HLC projects, since the first project carried out in Cornwall in 1994, has identified important developments not only in the methodology of character assessment itself but also the technical developments and use of GIS to map historic character. HSC takes advantage of this experience and the best practice methodology identified by an HLC Review Project undertaken in 2003 (Aldred and Fairclough, 2003). The Review identified the various stages in the evolution of HLC and discussed the successive development of 'waves' of HLC projects from early paper-based classification methods to more recent GIS-based attribute-led ones.

Multi-mode method has become established best practice for terrestrial HLC projects. Whilst essentially interpretative the subjective decision-making inherent in the method is framed and controlled, being qualified and quantified by the use of attribute-based approaches, documenting sources and providing explanatory descriptions, within (or linked to) GIS. The multi-mode method uses the best elements of both descriptive (ascribing attributes to polygons without initially assigning interpretations) and prescriptive (interpretation as the main means of identifying character, ie. classification) criteria for establishing HLC. GIS is used for the manipulation of the attribute data to produce models of landscape character, assuming that patterning will highlight areas with similar attributes that can be brought together to define a particular historic character 'type' (Aldred and Fairclough 2003).

Two aspects are employed by HSC, attribute-led description of historic character undertaken during the early mapping stages of character assessment which is then followed by the classification of the attributes into a repeating character type hierarchy and across different perception scales.

5.4.1.1 ATTRIBUTE-LED (DESCRIPTIVE) ELEMENT WITHIN THE MULTI-MODE APPROACH

The descriptive attribute-led method attempts to underpin interpretation with greater 'objectivity', relying on analyses of descriptive character attributes to generate character types, a 'bottom-up' approach. This method is applied during the data capture stage of the project during the preparation and creation of source-based layers for incorporation into the character assessment. Attribute-led methods:

- record attributes (ie. use descriptive criteria) rather than attributing predefined types
- use computer analysis of attributes to derive HSC models and types
- create explicit data structures

Once sites, features and landscapes are identified and recorded they are ascribed to a particular HSC type ie. classified.

5.4.1.2 CLASSIFICATION (PRESCRIPTIVE) ELEMENT WITHIN THE MULTI-MODE APPROACH

The classification-led method uses existing understanding of historical processes in a landscape to predefine the landscape and seascape it characterises, a 'top-down' classificatory approach. This method is applied following the initial attribute-led stage and is used to classify the character type hierarchy; from sub-character, to character and broad character level types. Classification-led methods:

- use prescriptive criteria to assign areas to pre-defined classification of types (this is only possible once the attribute-led stage has identified the variety and detail of the historic landscape and seascape of the project area)
- build models from HSC data rather than recording what documentary or map sources suggest
- have implicit data structures

5.4.2 HSC AND MAPPING THE LAND/SEA OVERLAP

Seaward, HSC projects extend to the limit of UK Controlled Waters. Landward the limit extends at least to the OS-mapped level of Mean High Water (MHW). However MHW should not to be used arbitrarily to truncate character polygons: characterisation should continue above MHW to encompass the full physical extent of any polygons with an essentially marine or maritime character that reach beyond that level from seaward. All estuaries and rivers within the project area should be included to the Normal Tidal Limit along their channels and tributaries, though there may be exceptions justifiable for some longer rivers where that would extend the brief considerably inland.

The landscape-seascape relationship is inevitably one of overlap and gradation. The landward extent of characterisation, should extend inland to encompass any areas which can be shown to possess a maritime character. It is worth noting here that in many places the present line of MHW may be considerably different to that recorded historically as a result of land reclamation, drainage of previous wetland or salt marsh or similar construction of waterside development, industry and sea defences. In order to present the marine historic environment perspective the HSC assessor should identify the line of MHW from historic sources (eg. 1st Edition OS revision) and map according to that. It would normally be expected however that land HLC projects, where completed, will have mapped to the line of MHW. Where possible, existing HLC polygons should be re-used for landward HSC polygonisation to aid integration between HLC and HSC databases.

The definition of historic character is necessarily flexible, accommodating polygons and grids as appropriate, dependent on and guided by the source data available and the geographic location assessed. This would ensure the seamlessness required between HLC and HSC projects. The following mapped representations should be adopted for the following zones covered by HSC:

- Coastal zone (above MHW) : polygons
- Inter-tidal (MHW-MLW): polygons
- Inshore marine and offshore marine (MLW-UK Controlled limit): grids (100m resolution)

5.4.2.1 CREATING MULTI-LEVEL SEASCAPES

Identifying the historic character of the marine environment requires greater emphasis on the multi-dimensional aspects of the sea as a body of water over a sea floor which itself has depth.

Due to the multi layered character of the marine environment to use only the present surface expression of human activity would not capture the full historic character within the marine zone. Many of the historic assets in the marine zone have no water surface expression at all.

On land, landscapes are sensed largely visually from the surface veneer but perceived as 'landscapes' or 'historic landscapes' when coloured by our data, interpretations and experiences: 'landscape' is a perception. A different perceptual basis is required for marine historic landscapes, one that is more strongly cognitive than the visually-dominated landscape perceptions on land. The visual canvas of the marine environment generally lacks landscape-scale material imprints of historic processes. Such imprints are present but are expressed very differently in the environment and to our senses, often with complex, spatially distant relationships to their parent activities. Accordingly, perceptions of marine historic landscapes are largely cognitive with multiple, layered, expression. The character of marine historic seascapes is inevitably perceived more from spatial patterning observed in diverse cognitive inputs than from direct sensory data.

The ability to express HSC by separate levels, that together comprise the marine tier, is highly advantageous, more so than for land HLC, because of the marked discontinuities of activity, process and material impact between those levels in the marine environment. That frequently produces considerable disparity between the sites of activity and the sites of physical impact and location of material remains from that activity, with the material transforms between those sites being dependent on processes present in other parts of the marine environment. So for example, material remains from past maritime trading activity will be found predominantly on or beneath the sea floor while the activity itself took place largely on the sea surface and the transforms necessary to elucidate the relationship between the activity and the remains requires recourse to the sea-surface, water column and sea-floor/sub-sea floor. Each level has its own separate contribution to make in informing our understanding of marine historic landscapes. The three-dimensional aspects should be captured during character assessment by recording attributes that reflect the following:

- Sub-sea floor HSC: identifying the dominant historic character within the seabed
- Sea floor HSC: identifying the historic character on the seabed, of the benthos
- Water column HSC: identifying the historic character of the pelagic zone
- Sea surface HSC: identifying the historic character of the surface of the water

Fig 32 Differences in the visual 'perceptions' of landscapes and seascapes (© English Heritage)

The multiple levels are recorded to the line of MLW only. Above MLW character is represented using polygons, in two dimensions, analogous to HLC practice. The HSC GIS can

be displayed to present a seamless two-dimensional map of coastal, inter-tidal and marine historic character (at every marine level and conflated level).

5.4.2.2 CONFLATING MULTI-LEVEL SEASCAPES

A conflated layer can also be produced, identifying the dominant HSC from analysis of all the marine levels including the area landward of MLW. This requires 'dominance' to be assessed from the attributes of four levels of the marine tier to indicate which of the several differing 'character strands' present in any given area will take precedence in portrayal. If this assessment is undertaken, decision-making criteria on character dominance must be transparent.

The derivation of a single HSC layer from the tiered database will be of broad strategic value although it is anticipated that most users of the HSC material will concentrate on the 'level(s)' most relevant to their immediate interests and the attributes queried according to the variety of intended applications.

The conflated layer is perhaps the most direct equivalent of the 'iconic' land HLC map generated for each county: one map of many that can be produced from queries on the attributes, but it is also a map that provides a relatively uncomplicated entry point to the database for new users and for outreach purposes.

5.4.3 HSC DATABASE STRUCTURE

The precise way in which GIS conceptualises, stores and manipulates spatial information is referred to as its 'spatial data model'.

Although various standards and guidelines which should be observed as a minimum in the definition of the national HSC database are recommended, inevitably standards develop (eg. due to software developments etc). The definitions outlined in this document are therefore a point-in-time statement: a preliminary guidance on a minimum range of standards to be observed at this stage of the HSC development.

The GIS polygon mapping and attribute data produced by HSC projects are to be stored in a flat file format, that is, no relationship classes are used. A flat file database is designed around a single table where all the information is stored on the table, with attribute fields representing all the parameters and their values – one polygon equals one record. Designing flat file databases is simple and requires little design knowledge and can be developed using most database engines. They are simple to create, populate and maintain. They can be created in relational database engines by not taking advantage of relational design concepts but may be split up at a later date if a relational design is required. Flat files offer the functionality to store information, manipulate fields, print or display formatted information and exchange and distribute information with relative ease by users not familiar with complex GIS database designs.

The only attribute fields and information that require a relational structure in the HSC Information group are those for 'Previous Character' where a character polygon may have more than one previous character, eg. based on assessment of x-number of historic sources. One area may comprise a dumping ground in the present, an anchorage area on an historic C19th chart and a submerged palaeolandscape in the early post-glacial. Nevertheless the one-to-many relationship can be accommodated in the flat file structure as repeating attribute fields differing by numbered increment ie. previous character 1, previous character 2 etc.

With regard to standards for GIS, mapping, and terminology, HSC databases need to adhere to Guidelines for English Heritage Projects involving GIS (Froggatt 2004), utilise English

Heritage's online thesauri (INSCRIPTION) where appropriate, and provide metadata files detailing the datasets produced.

5.4.3.1 GIS APPROACHES

There are two types of spatial data model in common archaeological usage - vector and raster GIS. Vector describe something in the real world, usually in the form of geometric objects or primitives (eg. point, line or polygon) defined in terms of their locations and properties within a given co-ordinate system. Raster sample something usually at regularly spaced intervals in a rectangular matrix of cells, each of which contains a measurement that relates to one geographic location. Raster data therefore constitute a 'sampling' and interpolated approach to the representation of spatial information; the more samples that are taken, the closer the representation will be to the original (Wheatley and Gillings 2002, 32).

The combination of two approaches may be used during the characterisation process:

- Using the principle of the raster spatial data model but employing a vector format, grid cells, acting as a data frame, are used to capture marine components, below MLW of HSC
- Vector polygons are used to digitise terrestrial and inter-tidal components, above MLW of the HSC where OS base mapping is sufficiently detailed to provide accurate extents

5.4.3.2 GRID CELLS

The adoption of 'grid cells', over the marine area (below MLW) acts as a fault-line between source data used to inform character assessment and the mapping of the results of character assessment:

- It separates the source data from the interpretative exercise of historic seascape characterisation, thus preventing the process becoming purely a mapping exercise; the grid allows the character assessment to be separate from the mode of expression
- It provides an independent 'polygon' network for the marine environment by which to express character. Though data intensive, the use of a vector grid data model and representation defines geographical space in a simple and predictable way, the spatial extent of any given attribute is always represented as a rectangular grid. As a result such a model is ideally suited to problems that require the routine overlay, comparison and combination of locations with thematic layers
- It easily incorporates source data in either vector or raster format (either discrete objects or patterns of behaviour). Much source data, especially offshore eg. fishing effort, wreck density is necessarily diffuse, tending to be raster analysis and interpolated rather than precisely defined – a grid would enable such patterns, trends and behaviour to be included and brought to the assessment in a clear and readily updatable way. The use of a grid provides a clearly stated 'grain' deployed in mapping the character assessment, reflecting the uncertainty and lack of detailed archaeological and historical information, especially offshore, currently available
- Such models cope much better with data that changes continuously across a study area, ie. data that has no clear-cut edge or boundary. The grid allows varyingly sourced information to be spatially correlated with relative ease without the need for extensive digitising or re-digitising. The texture created by the grid also goes some way towards

introducing fuzzy boundaries which reflect the often imprecise nature of aspects of the seascape in that there are rarely definitive, immovable lines

Guidelines for English Heritage projects involving GIS (Froggatt 2004) provides important guidelines for the use of raster data models.

- For raster data (ie. vector grid) derived from vector format the size of the pixels (grid cells) should not be smaller than the uncertainty in the vector
- It is important to make sure that the spatial resolution of the final dataset is not greater than those used to create the dataset

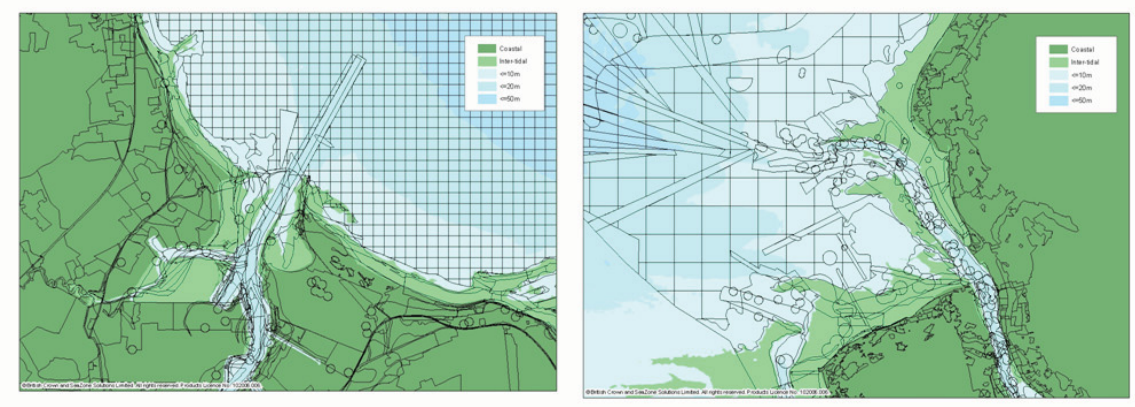


Fig 33 Examples of use of grid cells to map character assessment (l – Scarborough-Hartlepool project, Tees Bay; r – Liverpool Bay project) © English Heritage

Some flexibility in approach may be required in the inter-tidal and immediately near-shore zones and should be assessed case-by-case, dependent on the resolution of available source data and evidence. Finer grid resolutions may be appropriate in these areas where finer detail is observable. Inevitably information becomes increasingly diffuse further offshore and is most appropriately represented by coarser resolution grids.

5.4.3.3 POLYGON UNIONS

Landward of MLW, polygons should be used to map character assessment. Polygons may be digitised, by source, as separate layers and used to inform the final character assessment.

Some sources, such as historic UKHO charts require multiple GIS layers to be digitised (ie. per chart) which may then be combined into a single polygon layer on the basis of same historic character(s) mapped or period(s) covered, before being used to inform the historic character in the final character assessment.

'Unions' are the topological overlay of two or more polygon spatial datasets that preserve the features that fall within the spatial extent of either input dataset; that is, database attributes, classifications, and geographic extents are retained. All features from both datasets are retained in a new polygon dataset. Where polygons in the themed mapping overlap, decisions have to be made as to which of the attributes dominate in the overall character of the area. The resulting characterisation is displayed as irregular polygons which reflect shapes cutting other shapes. In coastal areas, in particular, the grain size is comparable to neighbouring terrestrial HLC projects.

5.4.3.4 BUFFERS

Buffers are a zone of a specified distance around features in a geographic layer, usually being applied to point and line data. Buffers can be set at constant or variable distance based on

feature attributes or set distance input manually by the use. The resulting buffer zones form polygonal coverages.

The use of buffers in HSC, especially for point data needs to be recorded in the data layers created during the character assessment (usually during the creation of intermediate source-based layers) and carried forward into the metadata of the final HSC GIS where appropriate. Distances applied and other geoprocessing parameters are required to be explicitly stated so that future users are able to follow the decision-making process taken by the HSC assessor.

5.4.3.5 GRAIN OF HSC

Grid cell size and resolution depends on the presentation scale of the specific HSC project and the applications envisaged. The appropriate size of the mesh will vary according to the intended purpose and presentation scale of the characterisation. Choosing an appropriate cell size requires a balance to be found between the HSC's need for spatial resolution and the practical requirements for quick display, processing time, and storage. Essentially, in a GIS, the mapped results will only be as accurate as the least accurate dataset used (see 3.2.3.2), though it should be borne in mind that for marine areas, HSC does not transpose the mapping of data sources but uses them to inform an assessment of character, which is then ascribed to grid squares.

Finalising a working scale for the project also raises questions regarding evenness of the final characterisation. 1:50,000 is the scale of modern coastal charts published by the UKHO which gives complete coverage of England's coastal waters. As a result some offshore mapping uses smaller scales than the preferred 1:25,000 used in land HLC. The use of OS mapping on the adjacent coastline and mapping from other sources at scales varying from 1:10,000 to 1:250,000 adds to this issue. As a general rule if the scale of capture is known then the spatial resolution can be estimated by dividing the scale of capture by 2000. Spatial resolution refers to the area on the ground that the data layer can identify accurately. The following table (Fig 34) sets out a range of map scales and their associated levels of spatial resolution (after Froggatt 2004).

Scale of data capture	Spatial resolution (metres)
1:10,000	5
1:25,000	13
1:50,000	25
1:100,000	50
1:250,000	125
1:625,000	312

Fig 34 Table showing a range of map scales and their associated levels of spatial resolution (after Froggatt 2004)

The comparison with land HLC is difficult to make because HLC 'takes' data from much finer grained maps and because its polygons are created by generalisation at the time of digitisation. However in the coastal, inter-tidal and inshore areas character is busier and more diverse, also based on much more and finer grained data – creating smaller sub-divisions of character. The coastal, inter-tidal and inshore zones provide a transition between HLC and HSC further out to sea, where character types become increasingly large, and giving a form of seamlessness.

A vector grid system can be used to process certain datasets acting as a network of polygons within which to map historic character. The accuracy of the grid can be exact where the whole area of the grid square coincides with a single value in the underlying dataset. However where the boundaries between two or more polygons/areas in the underlying data source(s) are encompassed by grid square, a decision has to be made by the assessor with regard to which is predominant (this may be achieved automatically by assuming that any cell 'intersected' by an underlying dataset is included or by manual selection on the part of the assessor). This is the value which is then assigned for that particular attribute to the grid square. Hence the accuracy can vary as much as half the total area of the square (eg. 1km² would give accuracy of 0.5km²).

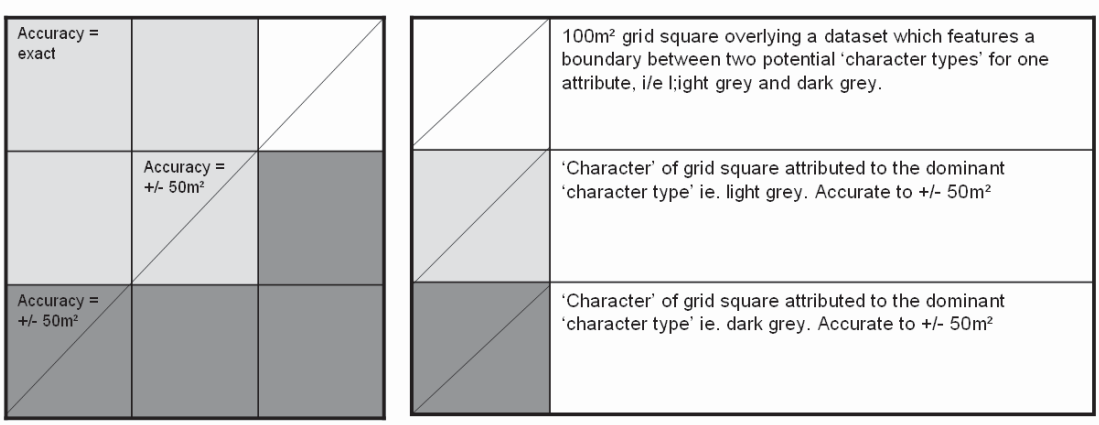
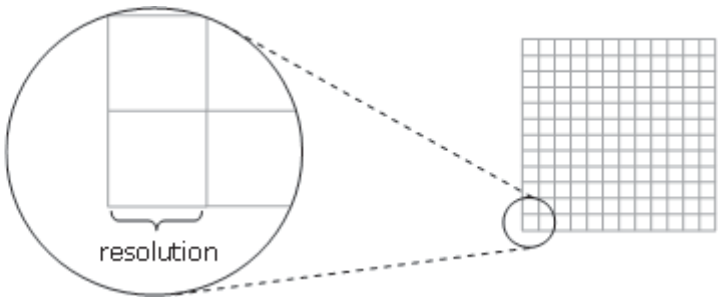


Fig 35 Variauion in the accuracy of grid cellss

The spatial resolution of a grid cell is dictated by its size. This value gives the maximum error/accuracy of the gridded representation.



(after ESRI, http://webhelp.esri.com).

Fig 36 Spatial resolution of grid cells

The following table identifies the spatial resolution of the grid cell to indicate a notional map scale for ease of comparison with land HLC perception scales and guides the user at which scale the HSC may be 'read'. It also provides a reference against which the appropriate use of source data, and their associated capture scales, can be made.

Resolution of GRID CELLS	Polygon size (hectares)	Area +/- error	Linear +/- error	Scale of map
50mx50m	2500sq metres = 0.25 hectare	25m²	≤50m	1:100, 000

Resolution of GRID CELLS	Polygon size (hectares)	Area +/- error	Linear +/- error	Scale of map
100mx100m	10,000sq metres =1 hectare	50 m²	≤100m	1:200, 000
250mx250m	62,500sq metres= 6.25 hectares	125 m²	≤250m	1:500, 000

Fig 37 Showing the spatial resolution of grid cells to indicate a notional map scale

The use of a grid is explicitly just that: a gridded portrayal of historic character designed to inform strategic level considerations. It does not purport to be an accurate mapped depiction and any attempt to runs into the problem that character boundaries in the marine environment don't have hard boundaries.

If finer definition is needed for particular applications, a more detailed HSC, as with HLC on land, can be carried out – requiring a finer resolution grid mesh appropriate to the specific work in hand.

5.4.4 HSC DATABASE ATTRIBUTES

Alongside the conventional GIS mapping of character assessment, an attribute table needs creation, from which the single HSC polygon layer will be created. The attribute component refers to the non-geographic content of the database. The table is populated by a combination of attributes brought forward from the intermediate source-based layers and by observation, interpretation and manual entry by the HSC assessor. The content and structure of attributes deployed is of critical importance as it determines the range and structure of queries that will be possible on the final HSC database.

Aldred and Fairclough (2003) suggest that the criteria used to determine historic landscape character are dependent upon the attributes drawn from the following themes:

- Time-depth
- Previous land-use
- Present day land-use
- Morphology (eg. shape of field)
- Enclosure process
- Documentary sources

The criteria used to determine historic seascape character are similarly dependent on the attributes of the themes outlined above with the exception that morphology and enclosure process are difficult, if not impossible, to define where they have meaningful application in the marine environment at all. In reviewing the themes determining historic seascape character the following themes are observed:

- Time depth
- Previous sea-use (and land-use for coastal areas)
- Present day sea-use (and land-use for coastal areas)
- Maritime cultural processes
- Documentary sources

Following the Guidelines for English Heritage Projects involving GIS (Froggatt 2004), the attribute names are in capital letters, no spaces are used, underscore applied instead. ArcGIS imposes a character limit on attribute names, thus some names have been shortened (the abbreviated attribute names are explained in the following table (Fig 38).

Attribute Name	**Description and guidance, terminology**	**GIS database Alias**	**Population Method**	**Format**	**Width**
ObjectID	Unique reference number for HSC polygon/grid cell	FID	automated		
Name (Sea Area)	Name of sea area or topographic identifier, local or popular name	NAME	manual	string	100
Broad Character Type (conflated)	Broad Character Type (present, dominant; national strategic level)	PRSNT_TY	automated	string	100
Character Type (conflated)	Character type (present, dominant; regional level)	PRSNT_TY	automated	string	100
Sub Character Type (conflated)	Sub character type (present, dominant; local level).	PRSNT_SBTY	automated	string	100
Character Area (1-∞)	Unique character area	CA1, CA2 etc	manual	string	100
Sub-sea floor HSC	Sea-bed historic character (present, dominant; sub-character level)	SBFLR_SBTY	manual	string	100
Sea-floor HSC	Sea-floor historic character (present, dominant; sub-character level)	SFLR_TY	manual	string	100
Water Column HSC	Water column historic character (present, dominant; sub-character level)	WTRCL_SBTY	manual	string	100
Sea-surface HSC	Sea surface historic character (present, dominant; sub-character level)	SSRFC_SBTY	manual	string	100
Previous Character Type (1-∞)	Previous historic character for which evidence is available. Recorded for multiple time-slices on basis of source dataset.	PRVS_SBTY1, PRVS_SBTY2 etc	manual	string	100
Period	Benchmark period of origin of the area represented in the polygon. Recorded for present historic character levels and previous historic character	SBFLR_PRD, SFLR_PRD, WTRCL_PRD, SSRFC_PRD, PRVS_PRD1 etc	manual	string	50
Location	General location (eg. Offshore marine, inshore marine, estuary, coast etc)	LCTN	manual	string	50
Confidence	Degree of certainty/confidence of HSC interpretation of present and previous historic character (recorded per HSC level and time-depth).	SBFLR_CNF, SFLR_CNF, WTRCL_CNF, SSRFC_CNF, PRVS_CNF1 etc	manual	string	25
Source	Sources used to identify present and previous historic character (recorded per HSC level and time-depth). Attribute values to record Supplier, Date, precise GIS file name. To include reference to the scale of original data used.	PRSNT_SRC, SBFLR_SRC, SFLR_SRC, WTRCL_SRC, SSRFC_SRC, PRVS_SRC1 etc	manual	string	250
Links	URL hyperlink to Character Type texts and multi-media	LINK	manual	string	250
Notes	Further background information on history of the polygon. Expansion on	SBFLR_NTS, SFLR_NTS,	manual	string	250

	information recorded at broad character and sub-character levels.	WTRCL_NTS, SSRFC_NTS, PRVS_NTS1 etc			
Shape_Area	Area in map units (usually metres square) covered by polygon.	AREA	automated	string	9.9
Cell/grid size	Size of grid used for marine zone (eg. 100mx100m, 500mx500m etc)	CELL_SZ	manual	numeric	5
Creation Date	Date of dataset /polygon creation/completion	CRT_DT	manual	string	10
Creator	Name of the person who compiled the HSC	CRTR	automated	string	250

Fig 38 Abbreviated attribute names explained

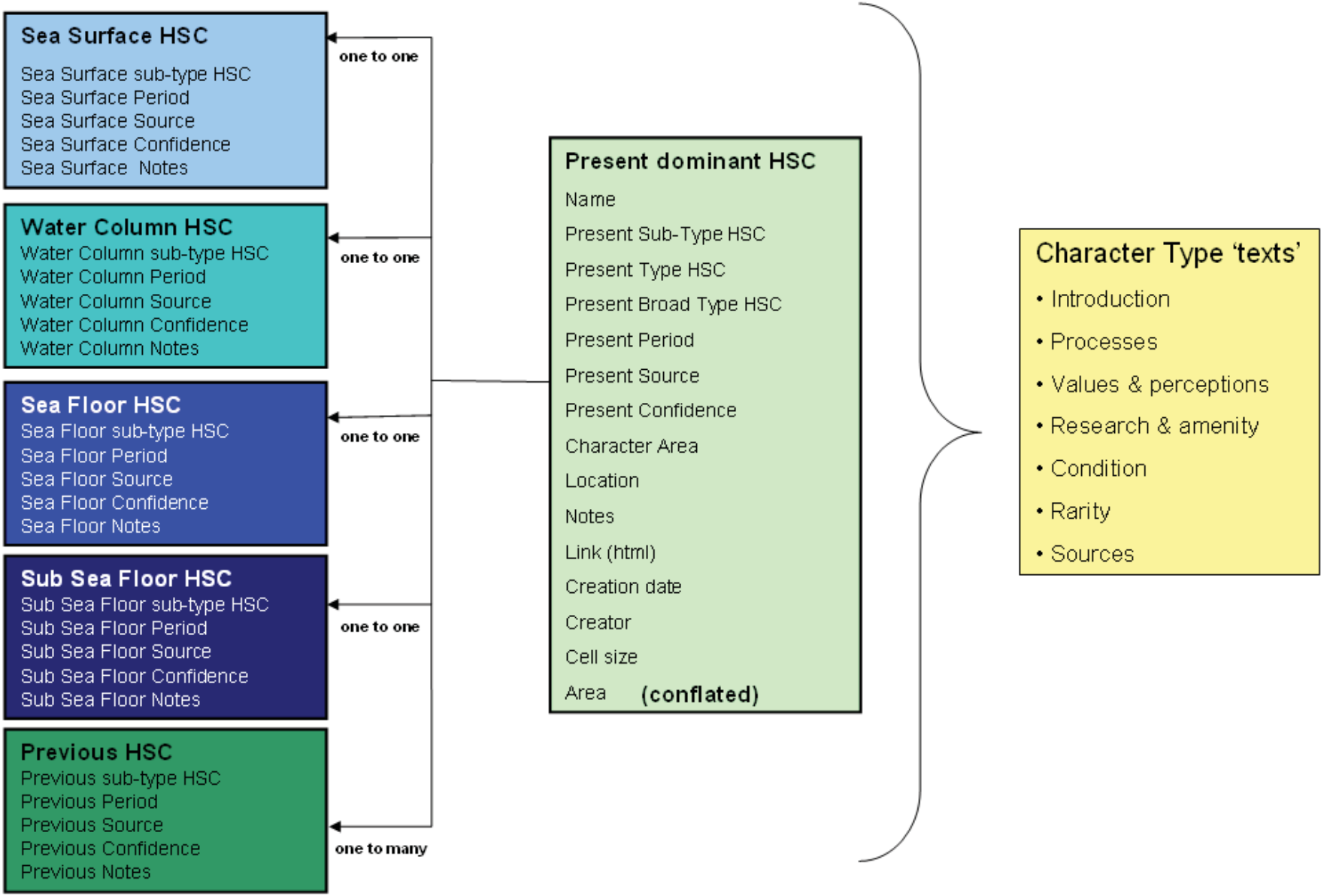


Fig 39 Diagram outlining the relationships between the HSC database attributes identifying where one-to-one (1-1) or one-to-many (1-∞) relationships occu.

5.4.4.1 MIDAS HERITAGE 2007

The MIDAS Heritage: The UK Historic Environment Data Standard (English Heritage 2007) outlines the data standard for information about the historic environment. It states what information should be recorded to support effective sharing and long-term preservation of the knowledge of the historic environment. It lists what information should be recorded and how it should be recorded.

The content of MIDAS Heritage 2007 has been extended and reworked in comparison with the 1998 standard in order to better reflect the wider range of heritage sector information. A series of new (or renamed) Information Groups have been developed including the group 'Area' (MIDAS Heritage 2007, 11) of prinipal relevance to historic landscape and seascape characterisation. The standard recommends that future plans for the updating of Information Groups includes the proposed development of 'more detailed standards for capturing the understanding of landscapes, urban and sea areas from Historic Landscape Characterisation … based on the Area, Research and Analysis and Management Report information groups' (*ibid*, 12).

MIDAS Heritage sets out the change process for updating Information Groups (either schemes or unit of information) via FISH (Forum for Information Standards in Heritage) (*ibid*, 14-15).

An initial HSC information group and units of information have been identified by the national method (section 5.4.5 below) but future practitioners of HSC projects should refer to MIDAS Heritage for the latest situation regarding HSC Information Group.

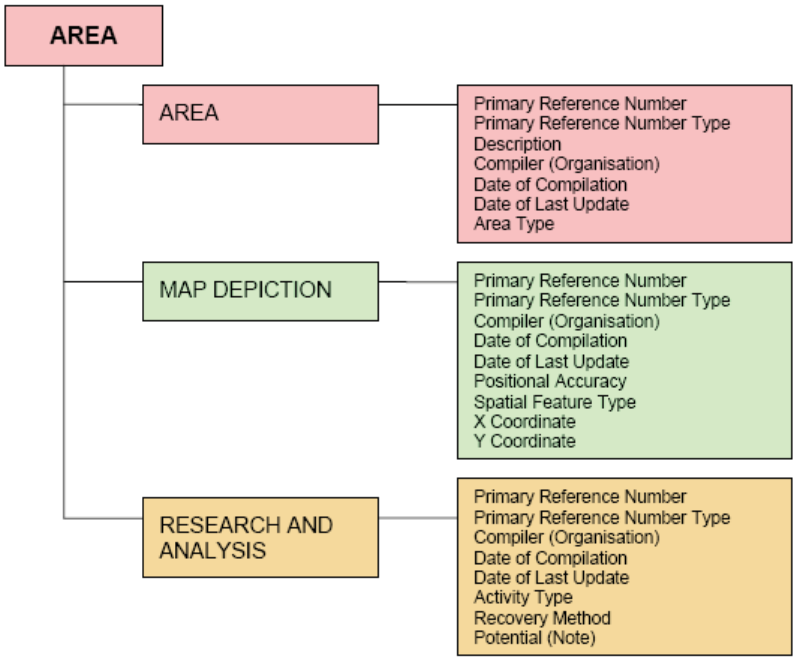


Fig 40 The mandatory Units of Information which area required for the Area Information Group (MIDAS Heritage 2007, 31)

5.4.5 HSC UNITS OF INFORMATION

The following section describes in further detail the 'units of information' that comprise the HSC Information Group. These include recommended HSC attribute information content, wordlists and values; listing existing and recognised preferred terminology and developing new content. Attribute values, where possible, should be controlled using standard terminologies and wordlists including MIDAS and INSCRIPTION wordlists and adapting, through character assessment, SeaZone's Hydrospatial, terminology. To facilitate matching to adjacent county HLC projects, HLC Character Types lists should also be consulted. This should ensure that any merging between the HSC and HLC data in areas of overlap could be easily undertaken and achieved.

The following 'units of information' are listed with their initial component terminology lists.

5.4.5.1 NAME (SEA-AREA)

Attribute Name: NAME

Description: The local name of the area often derived from OS and Admiralty Charts. Often named areas associated with topographic features such as hazards (banks, shoals etc), fishing grounds or industry (hydrocarbon fields etc).

Terminology: Free text.

5.4.5.2 BROAD CHARACTER WORDLIST

Attribute Name: PRSNT_BDTY

Description: Conflated from marine levels on basis of dominance (see section 3.3.3) in the marine zone or dominant character identified in inter-tidal and coastal zones. Broad Character Type is the highest, most generic level of characterisation summarisation. It is the aggregation of Character Types, mapping blanket and generic seascapes. This may be the most useful for distinguishing and perceiving HSC at the regional to national level.

Terminology: See Appendix 1 for full descriptions and the relationships in the Character Type hierarchy.

5.4.5.3 CHARACTER TYPE WORDLIST

Attribute Name: PRSNT_TY

Description: Conflated from marine levels on basis of dominance (see section 3.3.3) in the marine zone or dominant character identified in inter-tidal and coastal zones. Character Types are functionally related groupings of Sub-Character Types. They provide the baseline mapping for the descriptive and interpretative text. It is the standard level of HSC (equivalent to terrestrial HLC character types) and may be the most useful for distinguishing and perceiving HSC at the local to regional level. It may therefore be the level to which local and regional strategies can be attached. Character Texts are associated with this level of characterisation but exemplify the more detailed sub-character level whilst providing a generalised context at the generic broad character level.

Terminology: See Appendix 1 for full descriptions and the relationships in the Character Type hierarchy.

5.4.5.4 SUB-CHARACTER TYPE WORDLIST (SUB-SEA FLOOR, SEA FLOOR, WATER COLUMN AND SEA SURFACE)

Attribute Name: PRSNT_SBTY

Description: Conflated from marine tiers on basis of dominance (see section 3.3.3) in the marine zone or dominant character identified in inter-tidal and coastal zones. This is the finest and most detailed mapping in the HSC dataset, being the level at which most areas of land or sea are not readily divisible at the scale of mapping used in strategic level HSC, although more detailed HSCs may be envisaged for specific areas. It is the base map from which the higher, more generic levels of character are derived. In terms of applications, this may be most useful for distinguishing and perceiving HSC at the very local level, and can be expected to be of high value when assessing the likely impact of particular developments.

Terminology: See Appendix 1 for full descriptions and the relationships in the Character Type hierarchy.

5.4.5.5 CHARACTER AREA

Attribute Name: (1-∞) CA1, CA2 etc

Description: The character area attribute allows a range of users to record their 'perception' of the historic marine environment, which may differ according to particular users and groups. This attribute field will be left blank by the historic character assessor when compiling most HSCs but is required 'for future use' (see 3.5 below). It represents the unique perceptions of different people and is an important way to include others in the understanding and 'reading' of the historic marine environment.

Terminology: Free text to accommodate the range of alternative perceptions of distinct areas.

5.4.5.6 SUB-SEA FLOOR HSC

Attribute Name: SBFLR_SBTY

Description: Dominant sub-character of this level of the marine tier. This is the finest and most detailed mapping in the HSC dataset, being the level at which most areas of land or sea are not readily divisible at the scale of mapping used in HSC, although more detailed HSCs may be envisaged for specific areas. It is the base map from which the higher, more generic levels of character are derived. In terms of applications, this may be most useful for distinguishing and perceiving HSC at the very local level, and can be expected to be of high value when assessing the likely impact of particular developments.

Terminology: See Appendix 1 for full descriptions and the relationships in the Character Type hierarchy.

5.4.5.7 SEA-FLOOR HSC

Attribute Name: SFLR_BTY

Description: Dominant sub-character of this level of the marine tier. This is the finest and most detailed mapping in the HSC dataset, being the level at which most areas of land or sea are not readily divisible at the scale of mapping used in HSC, although more detailed HSCs may be envisaged for specific areas. It is the base map from which the higher, more generic levels of character are derived. In terms of applications, this may be most useful for distinguishing and perceiving HSC at the very local level, and can be expected to be of high value when assessing the likely impact of particular developments.

Terminology: See Appendix 1 for full descriptions and the relationships in the Character Type hierarchy.

5.4.5.8 WATER COLUMN HSC

Attribute Name: WTRCL_SBTY

Description: Dominant sub-character of this level of the marine tier. This is the finest and most detailed mapping in the HSC dataset, being the level at which most areas of land or sea are not readily divisible at the scale of mapping used in HSC, although more detailed HSCs may be envisaged for specific areas. It is the base map from which the higher, more generic levels of character are derived. In terms of applications, this may be most useful for distinguishing and perceiving HSC at the very local level, and can be expected to be of high value when assessing the likely impact of particular developments.

Terminology: See Appendix 1 for full descriptions and the relationships in the Character Type hierarchy.

5.4.5.9 SEA SURFACE HSC

Attribute Name: SSRFC_SBTY

Description: Dominant sub-character of this level of the marine tier. This is the finest and most detailed mapping in the HSC dataset, being the level at which most areas of land or sea are not readily divisible at the scale of mapping used in HSC, although more detailed HSCs may be envisaged for specific areas. It is the base map from which the higher, more generic levels of character are derived. In terms of applications, this may be most useful for distinguishing and perceiving HSC at the very local level, and can be expected to be of high value when assessing the likely impact of particular developments.

Terminology: See Appendix 1 for full descriptions and the relationships in the Character Type hierarchy.

5.4.5.10 PREVIOUS HSC

Attribute Name: PRVS_SBTY

Description: Dominant sub-character at conflated level. The previous characters of the current seascape are assessed from source data indicating past differences from present character; they may reflect a single previous character or sequence of characters evidenced by a range of sources, from prehistoric sea-level maps and identification of submerged landscapes to the study of documentary sources and map regression. This is the finest and most detailed mapping in the HSC dataset, being the level at which most areas of land or sea are not readily divisible at the scale of mapping used in HSC. It is the base map from which the higher, more generic levels of character are derived. In terms of applications, this may be most useful for distinguishing and perceiving HSC at the very local level, and can be expected to be of high value when assessing the likely impact of particular developments.

Terminology: See Appendix 3 for full descriptions and the relationships in the Character Type hierarchy.

5.4.5.11 PERIOD WORDLIST

Attribute Name: Period is recorded for the following HSC sub-character levels:

- Present conflated HSC: PRSNT_PRD

- Sea surface HSC: SSRFC_PRD
- Water Column HSC: WTRCL_PRD
- Sea Floor HSC: SFLR_PRD
- Sub-sea floor HSC: SBSFLR_PRD
- Previous (conflated) HSC: PRVS_PRD1, 2 etc

Description: Reflects time-depth. Benchmark period of origin of the area represented in the polygon, ie. 'Post-Medieval'. For coastal areas, land HLC 'periods' may be used. For offshore, an estimate of when the polygon began to adopt its particular 'sub-character' on the basis of dates and periods recorded in documentary and secondary sources. Where available the broad period suggested by models of sea-level change may be used to assess when the seabed was last exposed as dry land prior to the last marine transgression.

Terminology: Date ranges from MIDAS Heritage 2007 Information group 'Date and Period', (www.fish-forum.info).

- Lower Palaeolithic (500,000BC – 50,000BC)
- Upper Palaeolithic (50,000BC – 10,000BC)
- Mesolithic (10,000BC – 4000BC)
- Neolithic (4000BC – 2500BC)
- Bronze Age (2500BC – 800BC)
- Iron Age (800BC – AD43)
- Romano-British AD43 – 410)
- Early Medieval (AD410 – 1066)
- Medieval (AD1066 – 1540)
- Post Medieval (AD1540 – 1750)
- Early Modern (AD1750 – 1900)
- Modern (AD1900 – Present)
- Unknown

5.4.5.12 LOCATION WORDLIST

Attribute Name: LCTN

Description: The 'Location' attribute describes the geographical, topographical and morphology area of the present character mapping.

Terminology:

- Offshore Marine: The marine zone is the area where the inter-tidal zone ends and the sea begins. It is the zone relating to or characteristic of the sea; existing, originating, or found in the sea; produced by the sea; inhabiting or growing in the sea. Offshore waters are those beyond 12 nautical mile limit of UK territorial waters.
- Inshore Marine: The marine zone is the area where the inter-tidal zone ends and the sea begins. It is the zone relating to or characteristic of the sea; existing, originating, or found in the sea; produced by the sea; inhabiting or growing in the sea. Inshore waters are those within the 12 nautical mile limit of UK territorial waters.
- Inter-tidal (between MLW and MHW): The inter-tidal zone is the area exposed between low and high water marks.

- Coastal Zone: The coast is where the land and water meet and overlap. The coastal zone is an environment of ecological and economic contrasts and dynamism reflecting the interplay of fluctuating terrestrial and maritime influences. Therefore the coastal zone is the landward area susceptible to damage from coastal processes which begins where the inter-tidal zone ends.
- Estuarine: Low energy environment characterised by an inlet of the sea reaching into a river valley as far as the upper limit of tidal rise.

5.4.5.13 CONFIDENCE WORDLIST

Attribute Name: Confidence is recorded for the following HSC sub-character levels:

- Present HSC: PRSNT_CNF (for inter-tidal and coastal HSC only)
- Sea surface HSC: SSRFC_CNF
- Water Column HSC: WTRCL_CNF
- Sea Floor HSC: SFLR_CNF
- Sub-sea floor HSC: SBSFLR_CNF
- Previous (conflated) HSC: PRVS_CNF1, 2 etc

Description: Confidence is informed by the level of detail observed from sources, whether cartographic or textual. It relates to and reflects the HSC assessor's confidence in the HSC interpretation. For the marine zone the confidence value given to the dominant level in the marine tier is carried over to PRSNT_CNF at conflated level, otherwise the PRSNT_CNF value is populated for historic character in the inter-tidal and coastal zones where only one level is mapped.

Terminology:

- Certain: established as true or sure; unquestionable; indisputable
- Probable: having more evidence for than against, but some room for doubt
- Possible: some evidence for, but considerable room for uncertainty

5.4.5.14 SOURCE

Attribute Name: Source is recorded for the following HSC sub-character levels:

- Sea surface HSC: SSRFC_SRC
- Water Column HSC: WTRCL_SRC
- Sea Floor HSC: SFLR_SRC
- Sub-sea floor HSC: SBSFLR_SRC
- Previous (conflated) HSC: PRVS_SRC1, 2 etc

Description: Originator core datasets used to inform characterisation including map source and scale or bibliographic reference. As marine mapping data has come from a variety of sources, even unified mapping datasets (eg SeaZone's Hydrospatial) present a wide variation in mapping scale. As a result, features located within the same layer may be mapped at widely differing scales, leading to breaks and discontinuities. It is important to note that data quality, even from the same source, may change throughout the study area. As a result, reference scales can be presented as ranges, as well as single values within the source descriptions. Re-sampled data such as that originating from density or frequency maps should also be recorded.

Terminology: Source datasets will vary according to project study area. It is recommended that data sources are recorded consistently.

5.4.5.15 CELL SIZE

Attribute Name: CELL_SZ

Description: the resolution of the vector grid used to map the marine zone below MLW.

Terminology: The 'grain' of level of resolution deployed depends on the required scale of the overall characterisation.

5.4.5.16 LINK

Attribute Name: LINK

Description: Path to hyperlink to offline/online HTML resource holding character texts, images and other multimedia information relevant to the present CHARACTER TYPE level.

Terminology: The path mapped to the HTML resource will depend on location of the GIS HSC database and the html files, images, descriptive text etc. The HTML resource should comprise a web-based GIS version of the raw HSC GIS database linked to the character type texts with images and associated media and links included.

For delivery of the specific HSC projects the path is to be mapped to a stand alone CD or DVD. The HSC resource, as a whole, can then be archived by EH as appropriate.

5.4.5.17 NOTES

Attribute Name: Notes is recorded for the following HSC sub-character levels:

- Present conflated HSC: PRSNT_NTS
- Sea surface HSC: SSRFC_NTS
- Water Column HSC: WTRCL_NTS
- Sea Floor HSC: SFLR_NTS
- Sub-sea floor HSC: SBSFLR_NTS
- Previous (conflated) HSC: PRVS_NTS 1, 2 etc

Description: Notes attribute allows further information of relevance and interest to the character assessment to be briefly recorded. It is not a substitute to for the Character Types texts themselves or the LINKS attribute field that hyperlinks to them.

Terminology: Free text.

5.4.5.18 SHAPE_AREA

Attribute Name: SHAPE_AREA

Description: Area of polygon in local map units, usually expressed in metres squared.

Terminology: Numeric.

5.4.5.19 CREATION_DATE

Attribute Name: CRT_DT

Description: Date of character assessment and database, polygon population.

Terminology: dd/mm/yyyy

5.4.5.20 CREATOR

Attribute Name: CRTR

Description: Name of the originator/compiler of the character assessment and database.

Terminology: Personal name, initials or organisation and project code etc.

5.4.6 PROJECTIONS

For projects based in terrestrial England, all data should be in the OSGB 1936 projection. For maritime projects GIS data can be in WGS84.

UK reference datum for terrestrial datasets are typically in the Ordnance Survey British National Grid based on the Ordnance Survey Great Britain 1936 (OSGB36) datum which is intended to provide as little distortion as possible for the UK as a whole. However distortion increases the further one gets away from the centre of the UK, and for this reason, maritime datasets use the World Geodetic System 1984 datum (WGS84) which gives a better fit for the earth as a whole. In Europe ETRS89 datum may also be used and although based on WGS84 it is centred on Europe and diverges from WGS84 reflecting the specific variation, geography and topography of this landmass on the Earth's surface.

All source data should be transformed into British National Grid co-ordinates (OSGB36) prior to inclusion in the character assessment. The OSGB36 co-ordinate system is compatible with terrestrial datasets and therefore HLC projects facilitating the seamless overlap between land and sea. It is worth noting however that although convergence with terrestrial HLCs is desirable the extent of some HSCs will fall outside of the British National Grid (eg. especially UK Controlled Waters, the Western Approaches off south-west England and north-west Scotland).

Conversion algorithms can be used to translate between datums although standard GIS transformation algorithms from OSGB36 to WGS84/ETRS89 will need to be assessed according to the specific GIS software used.

ESRI have released support for the OSTN02 transformation in ArcGIS, which will allow the user to transform between WGS84 and British National Grid on-the-fly. Both Ordnance Survey and SeaZone recommend that this transformation is always used when translating between WGS84 and British National Grid. (http://www.seazone.com/reference-zone.php?ref=6).

5.4.7 SOFTWARE

At the time of writing (March 2008) English Heritage prefer data to be supplied in ESRI ArcGIS format with vector data supplied in geodatabase or shapefile format. However this list will increase as EH's GIS develops. Files generated by ESRI's software are interoperable with other GIS software and it is important that there is a degree of flexibility regarding the use of software and file types given that many users and curators often do not wish to be 'locked' into specific software packages and the associated licensing implications.

The HSC assessor must ensure that GIS mapping and databases can be delivered to EH in the formats required: that format should be ascertained from liaison with the EH GIS Co-ordinator. Within that requirement, it should be preferable for the assessor to be able to use the GIS with which they are most familiar. At the time of compiling this document, a

philosophy of software-agnosticism is most appropriate for what is likely to be a long-term programme of characterisation undertaken by a number of different organisations. The emphasis is on the adherence to methodological processes, rather than the stipulation of specific software packages.

5.4.8 METADATA

Metadata standards may evolve through time and liaison with the EH GIS Co-ordinator is necessary to ascertain those prevailing at any given time. At the time of compiling this document, HSC projects should use UK GEMINI Discovery Metadata Standard that conforms to ISO 19115. MIDAS Heritage complies with this data standard which is used by the GIgateway™ metadata service run by the Association for Geographic Information (AGI) and also to the UK e-Government Metadata Standard (e-GMS) which is based on Dublin Core. It is designed for use in GIgateway™, and for other metadata applications in the UK.

Metadata specific to the creation of GIS data should follow the guidelines set out in MIDAS Heritage 2007, which identifies Information Groups, thematic groupings of related Units of Information which together answer key questions about aspects of the historic environment and its management. The Information Groups 'Area', 'Map Depiction and 'Research & Analysis' include 'information units' relevant to creation, maintenance and curation of GIS data (see 3.2.4 above). As a minimum the 'Area' and 'Map Depiction' information schemes should be recorded in the source-based GIS datasets produced during the character assessment (see 3.2.10 below).

5.4.9 DATA CAPTURE AND PROCESSING

The capture and processing of data sources within the HSC assessment must be consistent and even-handed, following clearly stated workflows. Source data is often in varied format and coverage. In order to bring it to a common format that can be used to inform character assessment many require processing, cleaning and formatting.

Georeferenced data is that data whose position in geographical space is fully recorded. Georeferencing usually requires two steps. Firstly the data will be digitised in whichever coordinate system is used in the HSC GIS project (usually OSGB36). Most vector data will be georeferenced. For scanned data (image raster) the initial stage of georeferencing involves, at a minimum, locating the corners of the scanned data in geographic coordinate space.

Where spatial data is in hard-copy (paper) format and there is a need to generate GIS themes from it there are two choices: scanning (which produces raster data) and digitising (which produces vector data). As a generalisation, scanned data is useful for visualisation and for making maps, and is increasingly useful as a preliminary step in digitising. 'Heads up digitising' refers to the two step process where maps are scanned (as raster data) and then vector data are traced from the scans on the computer screen and captured as vector polygons, lines or points as appropriate. This is a relatively easy method for acquiring information from hard-copy sources, such as historic charts. Data derived in this manner may be regarded as 'new' project data, although the originator's intellectual copyright may still apply - this should be assessed case by case.

Digital source data may be provided as vector (points, polygons and polylines) and can be directly used to inform character assessment through 'spatial joins' and/or 'unioning' if extents can be determined in the inshore, inter-tidal, and coastal zones. Any data of point or line feature class can be converted to polygons using appropriate buffers where clusters or groupings of what would normally be regarded as individual sites and monuments, can be shown to constitute areas of historic character.

Grid data may be used 'as is', with cell-size assessed and sampled. Generally such datasets represent density and frequency maps and their resolution may be maintained in the marine grid if necessary. GIS are able to calculate the Mean values of such graduated value datasets, with values equal to or greater than (<=) the Mean value being used to produce maps showing 'predominant' character.

It is important that the methodology of data capture is carefully recorded; this includes details of pre-processing, methods of geoprocessing and classification techniques. Intermediate source-based layers generated during character assessment, as a minimum, should be attributed according to the MIDAS Heritage 2007 'Area' and 'Map Depiction' information groups and units of information (MIDAS Heritage 2007, 29-31). Further, extra 'new' attribute fields entered by the HSC assessor are permitted where appropriate.

As Guidelines for English Heritage projects involving GIS identifies, it is important that the resolution of the derived character assessment dataset is not greater than those used to create the dataset. It is not sensible, for example, to digitise from a small-scale map and present it on a large-scale map; datasets can not be used in contexts greater (ie. larger-scale) than the scale at which they were created (Froggatt 2004).

5.4.9.1 SPATIAL PRIMITIVES: POINT AND LINE DATA

Many attributes of landscapes and seascapes are captured by digitising as point and line format. For inclusion in character assessment such data requires preparation and conversion on the basis of their geographic location. Such information can be brought to polygon format through the appropriate and sensitive use of distance buffers eg. pipelines, telecommunications cables, offshore industrial installations and maritime daymarks and represented in the grid mesh. Other forms of point and line data are required to be characterised to produce density maps that can then be polygonised on the basis of numeric tolerances, buffers and zones indicating 'probability of occurrence' eg. shipwreck data and obstructions.

Fig 41 The laying of a cable in the River Esk © Sutcliffe Gallery (www.sutcliffe-gallery.co.uk)

For features mapped and identified below MLW point and line data should be buffered and spatially referenced against the mesh of grid cells deployed. For any point or line that passes within the extent of a cell, that cell will receive the value of the attribute identified in the conversion. Such features will adopt the width of the grid cells deployed. In this respect it is important that the HSC assessor makes the necessary judgements necessary to allow point and line data and the historic character they inform to be represented in such a fashion.

Point data can be analysed when considered for inclusion in HSC, typically it can be assessed for clustering of particular features contributing to the 'character' of an area. Essentially this perception occurs at varying mapped scales but character assessment should map the clustering of point data distribution according to:

- the grain of the particular zone: coastal, inter-tidal, inshore (typically less than 1:25,000) and offshore marine zones (typically greater than 1:50,000)
- mapped scale of intended use, essentially 1:50,000 or 1:100,000 scale

Therefore to capture point clusters at scales less than 1:50,000 HSC should undertake a frequency count for the number of points falling within any grid cell where a value >= 2 means that cell can be considered to have historic character.

For scales greater than 1:50,000 point data should be analysed and mapped 'free-hand' by the character where appropriate. For features mapped and identified in the inshore and inter-tidal zones (eg. wrecks and obstructions) and above MLW (eg. navigation aids) 'buffers' should be generated for point and line data.

It is debatable whether many of the features captured as point and line data merit inclusion in historic character assessment given the site and monument based nature of their depiction, but some discretion is appropriate here. The impact on the sea floor and sub-sea floor of pipelines and cables, for example, merits their inclusion given the activity associated with their laying, maintenance and use. Pipeline and cable laying also impacts on the character of the sub-sea floor and seafloor and offer potential for further archaeological investigation. Concentrations of features mapped as points and lines may be used to inform character assessment where appropriate, mapped as areas on the strength of their influence and impact reflecting human use of the sea and their potential for further revealing and informing our understanding of the historic marine environment. The importance of many of these features (ie. telecommunications cables and pipelines) is also reflected in strategic documentation.

The following diagram sets out the process flow for the preparation and conversion of source data to common format for inclusion in the character assessment.

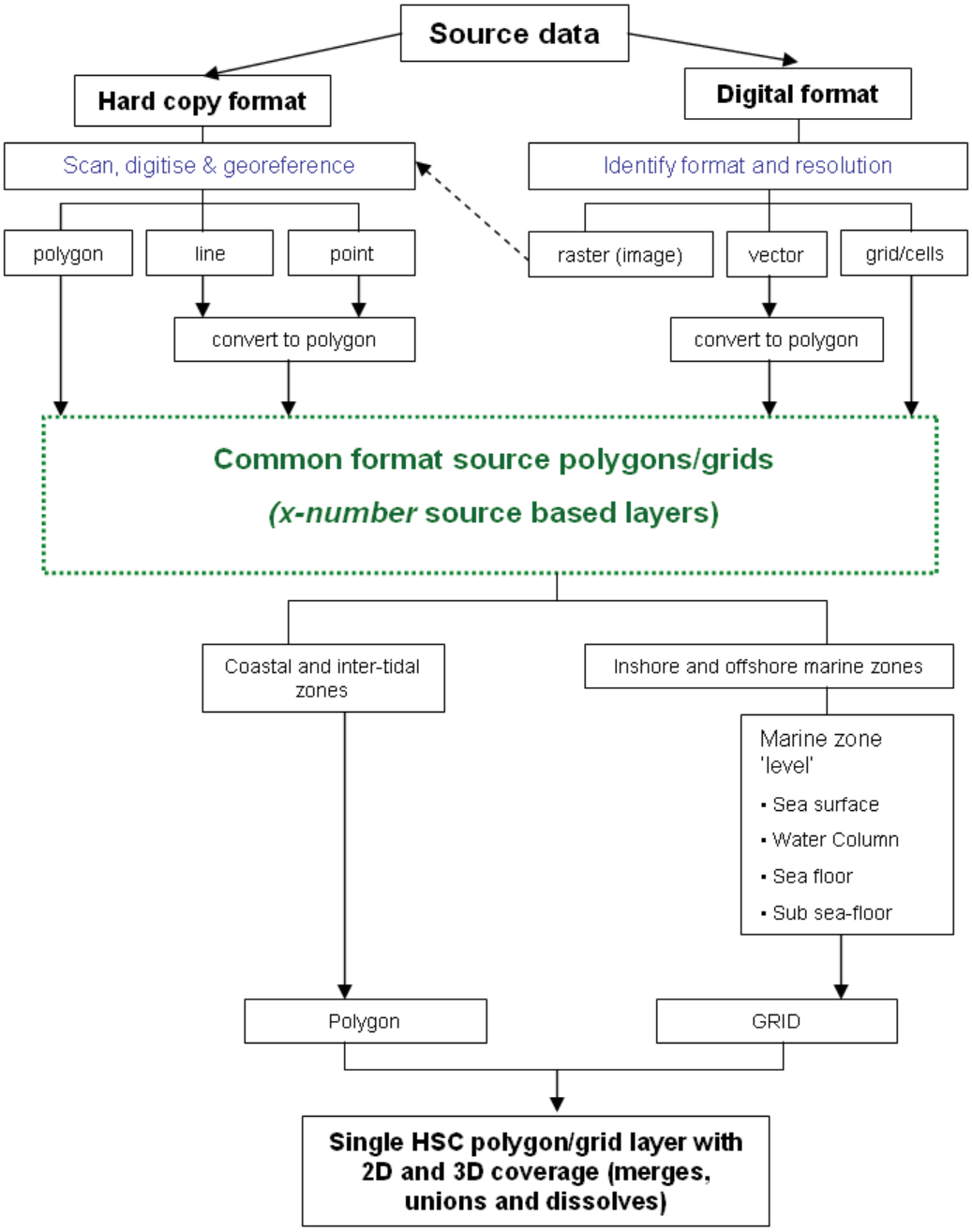


Fig 42 Process flow for the preparation and conversion of source data to common format for inclusion in the character assessment

5.4.9.2 COPYRIGHT AND SIMPLE AND COMPLEX DERIVED DATA

Key issues and considerations surrounding the use and derivation of data in terms of copyright are:

- much data within the marine zone is subject to strict copyright or intellectual property right (IPR) restrictions which means it can't be put on-line or freely distributed to non-license holders without the appropriate copyright licences
- attempting to avoid copyright restrictions by manipulating copyright data may conflict with established data standards due to:

- the ethics of manipulating data just to avoid copyright
- best practice dictates that data should be derived and not drawn

In purely methodological terms, maintaining the HSC free from source-data copyright restrictions should not be an issue provided the HSC characterisation process observes the clear separation in process between source data and character assessment. The HSC process should have sufficient methodological integrity to produce its own new product. The same integrity however needs also to apply to the expression of the character assessment. Quite apart from the issues relating to data licensing, it is clear that most marine areas are not covered by comprehensive networks of mapped subdivision for any application that are analogous to the fine-grained mapping offered by OS maps on land, and again for many areas, there are relatively few comprehensively mapped datasets at all. To adopt others' GIS polygon frameworks in such areas would inevitably 'shoe-horn' variation in assessed character, informed from a variety of sources beyond those solely with GIS mapping, into mapped areas designed for entirely other purposes: the integrity maintained throughout the method would be compromised.

Although EH holds the licences necessary to use source providers' data the HSC also needs to have application, for example in raising public awareness, in situations where such licences may not be held or affordable. To require such licences as a precondition of using HSC layers may well restrict its vital roles in promoting public engagement with their coastal and marine historic environment.

The definition of derived data is any data which uses any part of the original information source mapping framework in its creation. Originating organisations hold the IPR – a different form of copyright – in its own data and depending on the nature of any derived data, may claim to have IPR in that data as well.

Derived data falls into two categories:

- Simple derived data – points, lines and polygons digitised in a layer above the originator's mapping, where the mapping simply provides context; or, large polygons copied from originator's data where originator's line work representing detail within the polygon has been dissolved.
- Complex derived data – a digital mapping product that could be considered a copy or equivalent of an originator's digital mapping product and which serve as a substitute.

HSC mapping needs to comprise 'simple derived data' in order to satisfy the needs and applications envisaged by HSC projects.

Marine and maritime projects, funded by English Heritage, that produce GIS outputs should, when the material is reproduced as digital (image and non-GIS format) or hard copy maps, include at least the following statement: © English Heritage 2***, NOT TO BE USED FOR NAVIGATION.

5.4.9.3 POLYGON RULES AND TOPOLOGY

GIS good practice recommends that HSC polygons be defined by the following rules:

- Polygons are to be discrete (No overlaps)
- Polygons are to be contiguous (No gaps)
- All attributes are to be filled in where possible with 'NA' used for empty entries as appropriate

- Every feature (point, line and polygon) should have at least one attribute record.
- There should be no slivers, dangles, knots or cross-overs.
- Multi-part polygons are acceptable; they should have one set of attributes associated with them.

Topological rules may be applied automatically or manually within the GIS. All polygon data sets should be topologically clean and correct.

5.5 MAPPING THE RESULTS OF CHARACTER ASSESSMENT

The analysis of character attributes and identification of character types is a perceptual process and relies on the knowledge and understanding of the character assessor to articulate the historic character from the combined features of the HSC GIS attributes. Generalisation and extrapolation from data are key tools: characterisation is an interpretation not merely a collection of data. There should be a clear separation between the data sources which may in whole or part feed into lists of character attributes, and the identification and mapping of character types at various levels.

5.5.1 Character assessment

The assessment and mapping of historic character types is fundamental in the characterisation of the historic land/seascapes. It treats landscape and seascape as historic cultural artefacts: the cumulative results from the interaction of human activity with other processes, whether intentional or not, to produce the outcomes we perceive today. Character assessment seeks to identify repeating patterns in those dominant cultural influences on present landscape-scale form and appearance, grouping them into 'historic character types'. Those types may themselves be grouped into a hierarchy relating to the scale of perception, from local to regional to national: Sub-type, Type and Broad Type.

Every part of an area under consideration is assessed from a systematic and consistent range of sources viewed from an archaeological perspective and is assigned to the type which best represents its predominant historic character. Contiguous areas sharing the same historic character type are mapped as polygons on a GIS database, the types and their polygonal expressions being accorded equal status without ascribing value-judgements of importance or significance. The mapping of character-type polygons is complemented and amplified by consistently structured texts detailing various aspects of each character type.

Retaining the archaeological perspective is essential when bringing data sources into the assessment. For example, in their treatment of character types in semi-natural environments, the structured texts will emphasise the historic cultural dimension in their formation. Many data sources are not designed or intended to account for the impact of human activity on their datasets; the relationship of those to historic land/seascape character will inevitably rest on the archaeological knowledge and understanding of the assessor, with confidence ratings attached to the assessments to indicate the degree of certainty to be attached to the result.

But underpinning that, it is important to recognise that character assessment is a matter of perception, not the creation of 'objective data'. In HSC, it is a marine and maritime archaeological perception built from a range of sources and seen through the broader historical and cultural understanding that the assessor brings to bear on those sources. That understanding will draw on other material aspects of the marine environment but will also derive from the less tangible attitudes and beliefs that are embedded in any study of human cultural expressions, including those of the assessor. The strength is that it enables an inclusive

approach to the management of future land/seascape change: the resulting HSC characterisation can be set alongside those reflecting others' perceptions, whether bearing on other environmental aspects, such as geologists, sedimentologists and ecologists, or from other users of the area in question, such as local coastal communities, inshore fishermen, seasonal tourists, divers, and the yachting community.

5.5.2 TIME-DEPTH

Time-depth refers to the period or date of origin of the area represented in the polygon or grid cell, ie. 'Post-Medieval'. For coastal areas, land HLC 'periods' may be used. For offshore, an assessment is needed of when the polygon began to adopt its particular 'sub-character' on the basis of dates and periods recorded in documentary and secondary sources. Where available the broad period suggested by models of sea-level change may be used to assess when the seabed was last exposed as dry land during the last marine transgression. Time-depth provides important understanding of the chronological depth, continuity and persistence of the historical and archaeological processes evident within an area and the cultural artefacts likely to remain.

Traditionally HLC projects have established time-depth in two principle ways:

- Benchmarking – recording the date of origin of a stated historic character as obtained from different editions of OS maps and UKHO charts resulting in multiple attributes relating to map editions in the data structure each allowing landscape character at that particular point in time to be recorded
- Interpretative – recording against a single attribute a value representing the known or estimated date/period of origin of the present-day character type, based on the periods associated with certain landscape features, historical research and professional judgement

Once so established, time-depth can be recorded in the HSC database through the population of the relevant attribute fields:

- Present HSC – establishes the present dominant historic character of an area on the basis of available sources
- Previous HSC – can record previous dominant historic character
- Period – when the area began to adopt it present or historic character (usually based on map comparison and regression except for models of sea-level change)

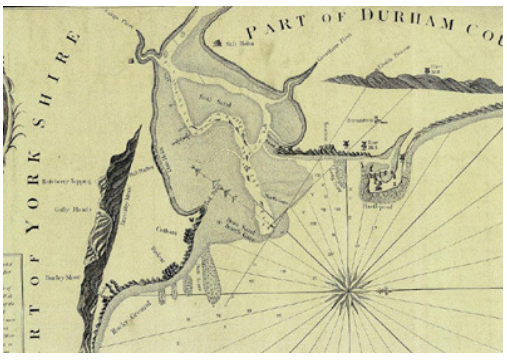


Fig 43 Extract from historic chart for the River Tees, Dobson 1802 (© UKHO)

By recording the period of historic character it is possible to produce time-slices and therefore it is unnecessary to qualify sub-character types with a chronological prefix (eg. historic anchorage area, modern shipping lane etc). It is worth noting that, as with HLC, the mapping of 'time-slices', or indeed of any previous HSC/HLC, will not necessarily give comprehensive coverage: it will only show areas where information is available.

5.5.3 IDENTIFYING DOMINANT HISTORIC SEASCAPES CHARACTER

Determining predominant character in the multi-dimensional seascape is a key aim of the character assessment. Dominant character is determined at the individual levels of the marine tier and the conflated HSC.

Assessment of predominance is essentially the HSC assessor's perception of 'what is dominant' however it is informed by a number of factors:

- Evidence for directly observable anthropogenic activity take precedence over indirectly observable anthropogenic activity. Largely in archaeological terms this is represented by artefacts, definable landscapes and seascapes usually found on the seafloor and within the sub-sea floor, over the cultural uses of the sea which may occur more ephemerally in the water column and sea surface

- Those sea-uses that are most likely to disturb, threaten or impact on the seafloor and sub-sea floor predominate over less intrusive ones. The impact of aggregate dredging has more directly observable implications than less directly observable non-intrusive activity such as commercial shipping (it is of course relative however)

- Confidence in the interpretation of character assessment as represented by confidence value

Assessment of dominance is undertaken at a number of stages in the character assessment workflow:

- Initially during the descriptive attribution (Stage 3, see section 5.5.7.3) when source data is used to describe the historic character for each level of the marine tier; at Sub-character Type level. The HSC assessor is required to identify which source data is relevant to which marine level and for those areas where more than one activity is identified, at a particular level, what is the dominant character
- Secondly during the prescriptive classification (Stage 4, see section 5.5.7.4) of the character type hierarchy in preparation of a conflated 2-dimensional map or conflated HSC layer from an assessment of the dominant character between all the levels of the marine tier and which normally requires that one HSC layer be imposed over another, except however in instances where dominant character may be identified and reinforced between different marine levels that share similar or the same historic character

5.5.4 CONFIDENCE RATINGS

The inclusion of the 'Confidence' field is an essential part of the HSC attribute structure, as in all HLC-related databases and forms a key element in the method's transparency and bench-marking. Through time, changes in confidence ratings may also contribute to monitoring developments in the physical and subject areas reflected in the HSC, and in the state of research and knowledge about marine historic environment.

Confidence ratings are given to the polygons comprising the HSC dataset. Confidence is itself an assessment based on the level of detail observed from sources, whether cartographic or textual and its bearing on the HSC assessment. Essentially it provides a basis for qualifying the certainty or otherwise that can be ascribed to the character interpretation (rather than the location and extent of polygon), and therefore by extension, the archaeological and historical potential of any given area. The following confidence values are used:

- Certain: established as true or sure; unquestionable; indisputable

- Probable: having more evidence for than against, but some room for doubt
- Possible: some evidence for, but considerable room for doubt

5.5.5 ASSESSMENTS OF VULNERABILITY AND SIGNIFICANCE

As in HLC, HSC does not in itself seek to incorporate context-driven, point-in-time assessments of vulnerability, sensitivity and significance, although it does seek to contextualise and inform the decision-making processes that form part of such assessments. Assessment of vulnerability, sensitivity and significance are a common, often necessary, second stage in the overall characterisation process, for which HSC provide the neutral information base.

To provide an initial stimulus and link to those secondary applications of the HSC, and complementary to the characterisation itself, each HSC Character Type is accompanied by a linked, structured text relevant to the date of the HSC compilation and covering such aspects as historical processes, values and perceptions attributed by various groups, condition and forces for change, rarity and vulnerability. Rather than assigning absolute 'values' to the types this is designed to allow users to independently assess significance and sensitivity from their perspectives and remit as a secondary process, as and when required.

5.5.6 CHARACTER ASSESSMENT WORKFLOW

The initial stage of character assessment involves the description and mapping of historic character at a detailed level (attributed at character sub-type level) and the production of a series of intermediate source-based datasets/layers. The second stage involves the classification of the character type hierarchy and development of the final characterisation layer.

The staged GIS workflow using source data to describe the character attributes and GIS analysis to derive (prescribe) a character type hierarchy. In practical terms the multi-mode method is an iterative process (with definitions and classifications of character hierarchy being developed from the very beginning). Nevertheless the character assessment can be guided by a staged workflow that employs both attribute-led ('describe') and classification-led ('prescribe') aspects. The GIS workflow is described in section 5.5.7.

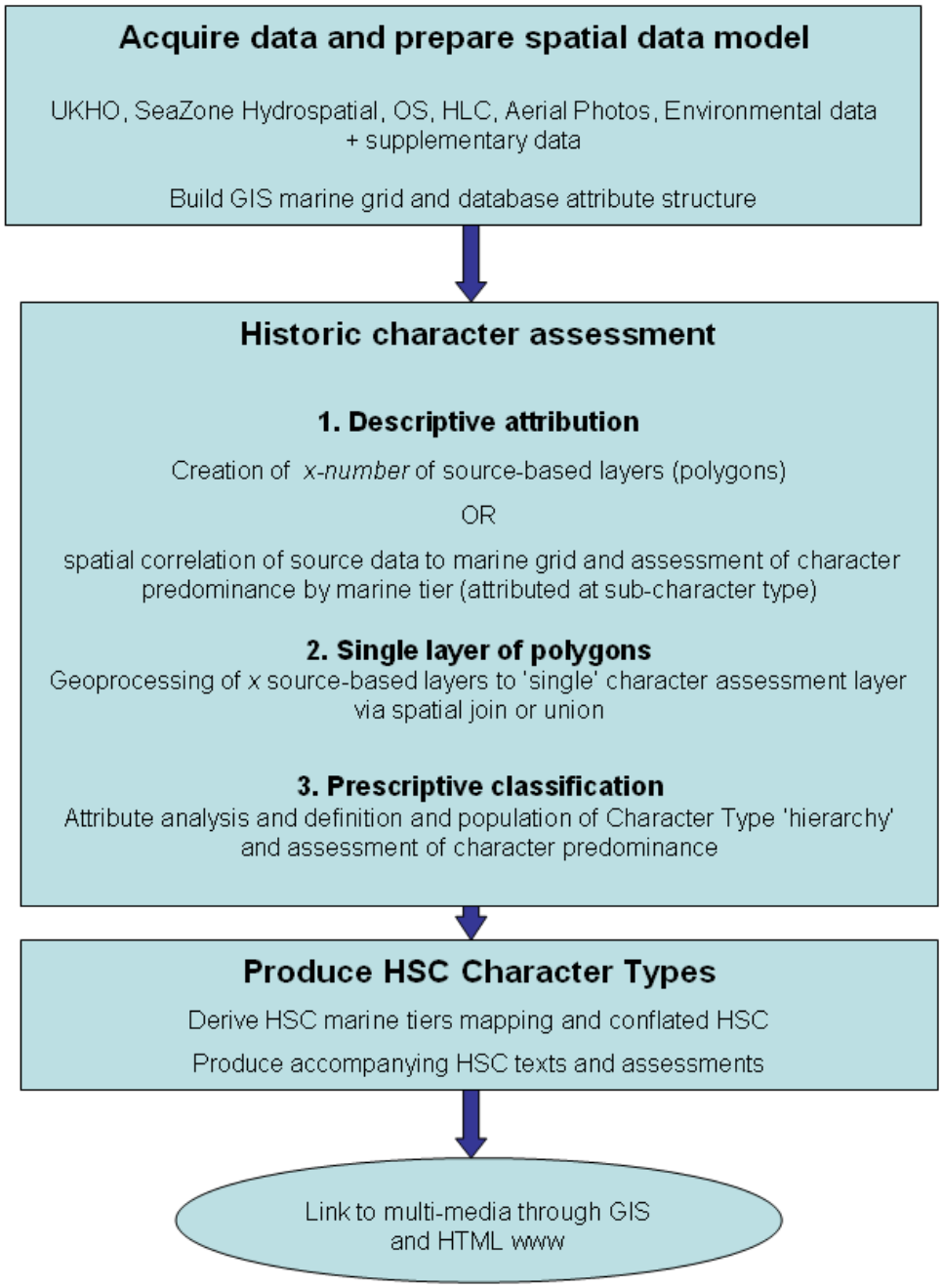


Fig 44 Overview of HSC character assessment workflow

5.5.7 GIS WORKFLOW

The following sections provide an overview of the stages taken in the creation of the HSC GIS database. The workflow provides a guide to understanding the process and application of the approach in future projects. The stages are presented as generic GIS processes which can be adopted across both hardware and software platforms and need not be restricted to any specific GIS software products.

All spatial data, from intermediate source-based layers to the final HSC GIS layer and derived layers should be stored in a geodatabase (ESRI ArcGIS software).

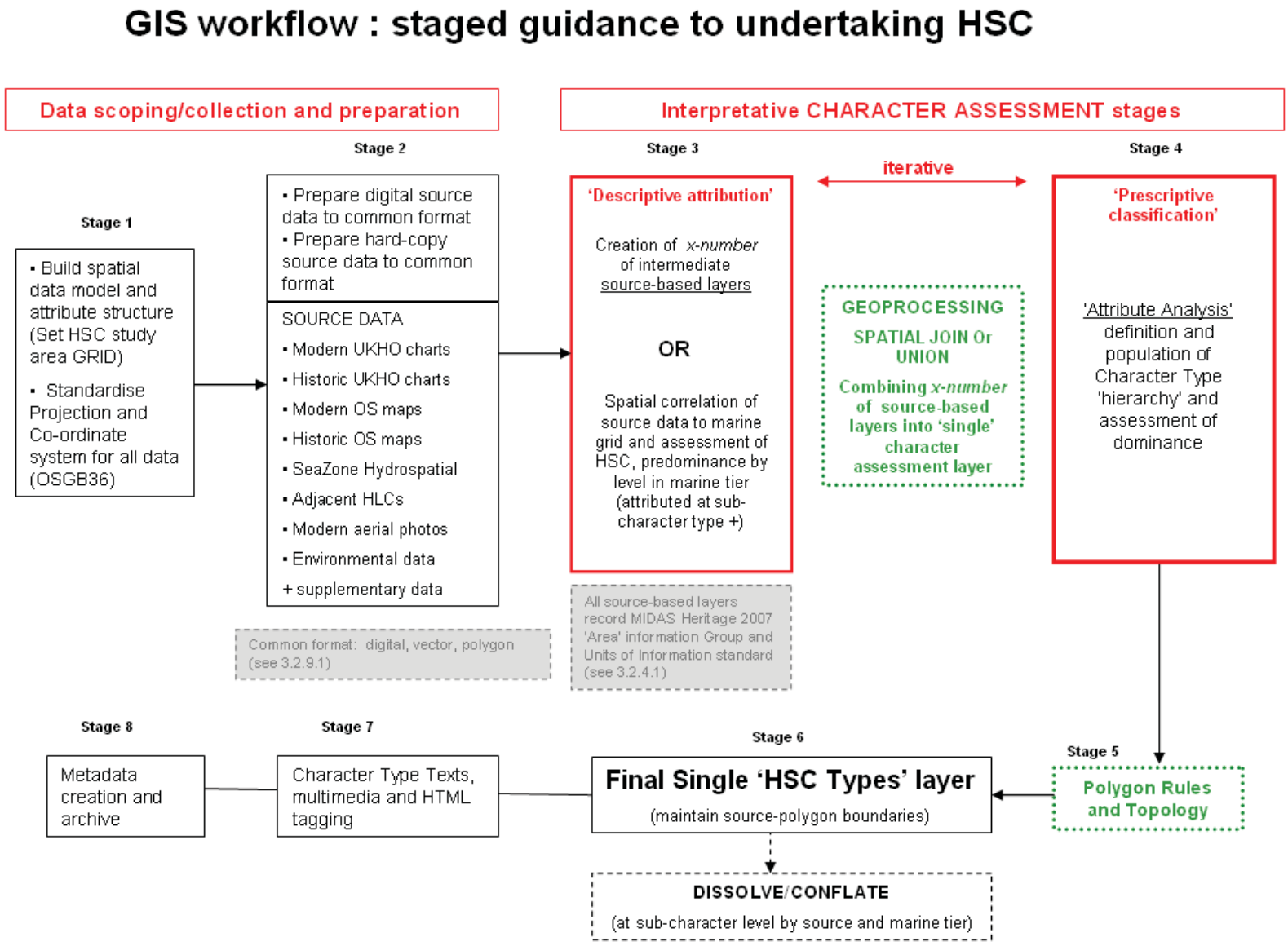


Fig 45 GIS workflow stages taken during character assessment

5.5.7.1 STAGE 1: PREPARING THE HSC SPATIAL DATA MODEL AND ATTRIBUTE STRUCTURE

This stage involves the creation and preparation of the HSC polygon layer with the recommended attribute fields ensuring the projection and coordinate system is set to British National Grid (OSGB36).

A vector grid of cells (polygons) is created covering the marine zone below Mean Low Water (MLW) in the HSC polygon layer. This creates a rectangular matrix of grid cells across the study area. The resolution of the grid cell size will depend on the intended application and scale of the character assessment. Once created the grid is clipped by the study area boundary layer to remove cells and part cells that lie outside.

A separate study area zones layer is created ie. a polygon layer that maps coastal, inter-tidal (between MLW and MHW), inshore marine (within 12nm limit) and offshore marine (beyond 12nm). This layer is unioned with marine grid and the 'Location' attribute field populated according to marine zone (note. Coastal polygons will be appended to the HSC polygon layer as their coastal 'extent' is characterised.

5.5.7.2 STAGE 2: PREPARING SOURCE DATA

All source datasets require various forms of preparation, processing and/or digitisation to bring them to a common digital format, projection and coordinate system and map units. All digitisation should be carried out in British National Grid and all data received either transformed or projected to this prior to processing.

The format of the source data dictates how it is rendered and can be used in the HSC GIS project. Vector data can be manipulated in the GIS and assessed for their applicability and use in the character assessment process. Digital raster data usually require georeferencing with derived layers digitised from them producing vector polygons, lines or points suitable for inclusion or further geoprocessing. Existing grid data may be used 'as is' and generally represent density and frequency maps. The way source data is manipulated and used to inform character assessment is required to be recorded at every stage.

Heads-up digitisation of hardcopy maps should be carried out at a scale of least 1:25,000 although many historic charts and surveys may be smaller scale than this. Digital data sources acquired externally, or captured through the digitisation process in point or line format, should be converted to polygon format through a process of buffering or identifying spatial extent of features from base mapping. Details of this are presented in Section 3.2.10 (ie. source datasets section and sub-headings geoprocessing).

Data capture to be undertaken by source with attribute structure guided by the 'Area' and 'Map Depiction' information groups advocated by MIDAS Heritage 2007.

Metadata accompanying source data is crucial if it is to be fit for purpose in the character assessment.

5.5.7.3 STAGE 3: CHARACTER ASSESSMENT – 'DESCRIPTIVE ATTRIBUTION'

This stage involves the assessment of source-based datasets as they pertain to the coastal, inter-tidal or marine zones. Once processed to a common format of 'source polygon layers' or spatially referenced against the marine grid, a range of observational, interpretative and system administrative attributes can be identified for each source's polygons or representations in the

grid. This is where the assessment of what is the 'character relevance' of the data sources is undertaken and where character assessment departs from the source data. For the coastal, inter-tidal and near-shore zones, where seascapes can be more accurately mapped, the combination of source-based polygon data layers is achieved through the GIS 'Union' function. The union function is a topological overlay of two or more polygon spatial datasets which preserves the features, and associated attributes, from both coverages.

Assessment of predominance is undertaken at a number of stages in the character assessment workflow (see 3.3.3); firstly during the descriptive attribution when source data is used to inform the assessment of historic character for each level of the marine tier and secondly during stage 4 when the attribute population is completed. The HSC assessor is required to identify which source data is relevant to which marine level and for those areas where more than one activity is identified, at a particular level, assess what is the dominant character.

It is during this stage that the initial historic sub-character wordlist is introduced (at attribute level) and developed according to the particular study area. The associated sub-character type attributes (including Period, Source, Confidence and Notes values) are also populated, as relevant and appropriate during stages 3 to 4.

By the end of this stage a single layer of polygons and grids should be produced.

5.5.7.4 STAGE 4: CHARACTER ASSESSMENT – 'PRESCRIPTIVE CLASSIFICATION'

Once the source-based datasets have been correlated and combined into a single HSC polygon layer the historic character type hierarchy can be developed and implemented and the completion of the attribute population achieved. Sub-character types having been attributed during stages 3 and 4 (to the relevant level in the marine tier or present sub character type in the case of coastal and inter-tidal zones) are used to populate the broad character and character type attributes.

An assessment of the overall dominant character between all levels in the marine tier is undertaken during this stage in preparation of a conflated HSC layer and which normally requires that one HSC marine level sub-character be imposed over another. An assessment is made to carry the dominant sub-character type from one of the four sub-character types recorded in the levels of the marine tier across to the present sub-character type attribute. The broad character type and character type attribute fields are then populated by means of a two stage attribute query. Firstly features are selected on the basis of present sub-character type and then the attribute fields for broad character and character type are auto-populated.

5.5.7.5 STAGE 5: POLYGON RULES AND TOPOLOGY

The generation of a single polygon layer from various source-based datasets means that this layer will require cleaning. This is applied by applying topological rules that mean polygons must be discrete (No Overlaps) and are to contiguous (No Gaps). Some manual correction may also be necessary to tidy the final polygon layer. All attributes are to be filled in where possible with 'Unknown' used for empty entries where appropriate. The final HSC mapping should not include 'blank' values unless a value is genuinely unknown (eg. 'period' value for character type).

5.5.7.6 STAGE 6: FINAL HSC POLYGON/GRID LAYER, DERIVED LAYERS

The final HSC sub-types layer maintains the character assessment polygon boundaries and may be displayed according to the historic character of the individual levels of the marine tier

or by previous historic character (where identified). Derived HSC maps may be queried and generated on the basis of the attributes without affecting the integrity and detail of this layer.

A conflated layer can also be produced; identifying 'dominant HSC' from analysis of all the marine levels and including the area landward of MLW (see stage 4).

5.5.7.7 STAGE 7: CHARACTER TYPE TEXTS AND MULTIMEDIA

The character type polygons are given a hyperlink to an offline HTML page including descriptive texts, images, photos and other multi-media resources. Brief consistently-structured summary texts, compiled at character type level, relate to the character type hierarchy allowing them to inform users of all levels of the HSC GIS database (from sub-sea floor through to sea-surface and sub-character through to broad character). Focussing the texts on character type gives them a clear relationship to HSC's assessment of shared character: they are integral to, and have direct relevance across all parts of the GIS database. Complementing the HSC GIS mapping, the texts' content is inevitably a point-in-time statement designed to provide a connection and stimulus for various applications of the database. Those texts can and should be updated periodically, perhaps most appropriately at times of future benchmarking. Details of the structure and content of the texts can be found in 5.6.4 below.

The offline HTML pages containing these texts also include interactive maps based on the HSC mapping to allow the user to access the results of the HSC as a stand-alone application if required, without recourse to bespoke software and hardware.

5.5.7.8 STAGE 8: METADATA

Metadata should be created for every dataset layer produced during the HSC assessment. The HSC assessor should liaise with the EH GIS Co-ordinator regarding the prevailing metadata standard to be used. The metadata files should be exported to XML format and stored with the HSC project database archive.

5.6 HSC CHARACTER TYPE HIERARCHY

By defining areas of the marine environment that share similar historic character as 'types' of historic seascape it is possible to identify historic trends, processes and patterns of activity to be mapped systematically and consistently. The identification of character types involves the recognition of regular, repeating patterns of attributes. Classifying aspects of character in this way emphasises characteristics which are shared between non-contiguous areas - area characterised as belonging to 'Types'. The identification of the repeating historic seascape character types, on the basis of repeating attributes means the character type hierarchy is referred to as being 'bottom up'.

From the outset it was anticipated that a new range of character types unique to HSC would be required, but the hierarchy of such types accords with that used in land-based HLC, consisting of three levels: Broad character type, Character type and Sub-character type.

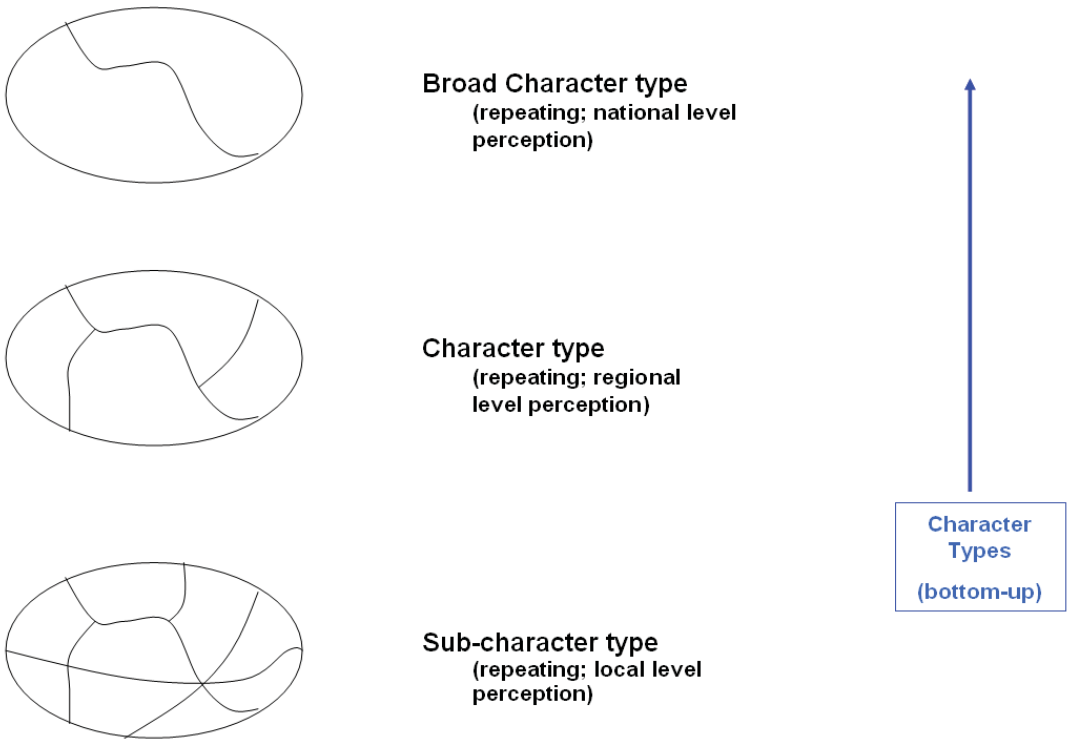


Fig 46 Diagram showing the character type hierarchy, from complex to generalised, being derived from a 'bottom-up' process of attribute analysis

5.6.1 SUB-CHARACTER TYPE LEVEL HSC

This is the finest and most detailed mapping in the HSC dataset, being the level at which most areas of land or sea are not readily divisible at the scale of mapping used in strategic level HSC. It is the base map from which the higher, more generic levels of character are derived. In terms of applications, this may be most useful for distinguishing and perceiving HSC at the very local level, and can be expected to be of high value when assessing the likely impact of particular developments.

5.6.2 CHARACTER TYPE LEVEL HSC

Character Types are functionally related groupings of Sub-Character Types. They provide the baseline mapping for the descriptive and interpretative text. It is the standard level of HSC (equivalent to HLC Character Types) and may be the most useful for distinguishing and perceiving HSC at the local to regional level. It may therefore be the level to which local and regional strategies can be attached. Character Texts are associated with this level of characterisation but exemplify the more detailed sub-character level whilst providing a generalised context at the generic broad character level.

5.6.3 BROAD CHARACTER TYPE LEVEL HSC

Broad Character Type is the highest, most generic level of characterisation summarisation. It is the aggregation of Character Types, mapping blanket and generic seascapes. This may be the most useful for distinguishing and perceiving HSC at the regional to national level.

5.6.4 COMPILING HSC 'TYPES' TEXTS

Descriptive and explanatory texts to accompany the historic character assessment's GIS mapping. The table below identifies the varying themes and aspects discussed and covered by the texts and the level at which they were associated with the mapping.

5.6.4.1 HSC TYPE TEXTS

Brief structured summary texts relating to the character type hierarchy allows them to inform users of all levels of the HSC GIS database (from sub-sea floor through to sea-surface and sub-character through to broad character). By grouping and focussing the texts at the Character Type level means they relate more wholly to HSC's assessment of shared character, reflecting sub-character level components that may be read at finer levels to the more generalised broad-character level: they are integral to, and have direct relevance across all parts of the GIS database.

The texts anchor the mapping to statements about historic processes, forces for change, observed values and perceptions, opportunities for engagement with education, outreach, future development and regeneration etc, which lie within the knowledge of those compiling the HSC. In these respects, they are designed to provide a connection and initial stimulus for various future applications of the database. Inevitably point-in-time statements made at the time of the HSC compilation, updates of the HSC GIS database should include parallel updates of the linked texts.

The current configuration of most GIS limits the database attribute fields to a maximum of 250 characters which obviously restricts the use of textual descriptions to qualify and exemplify the character mapping. Accordingly, the texts should be compiled in common text formats (eg. Microsoft WORD etc and readily converted to web enabled formats such as HTML etc) and linked to the GIS via one of the attribute fields (LINK).

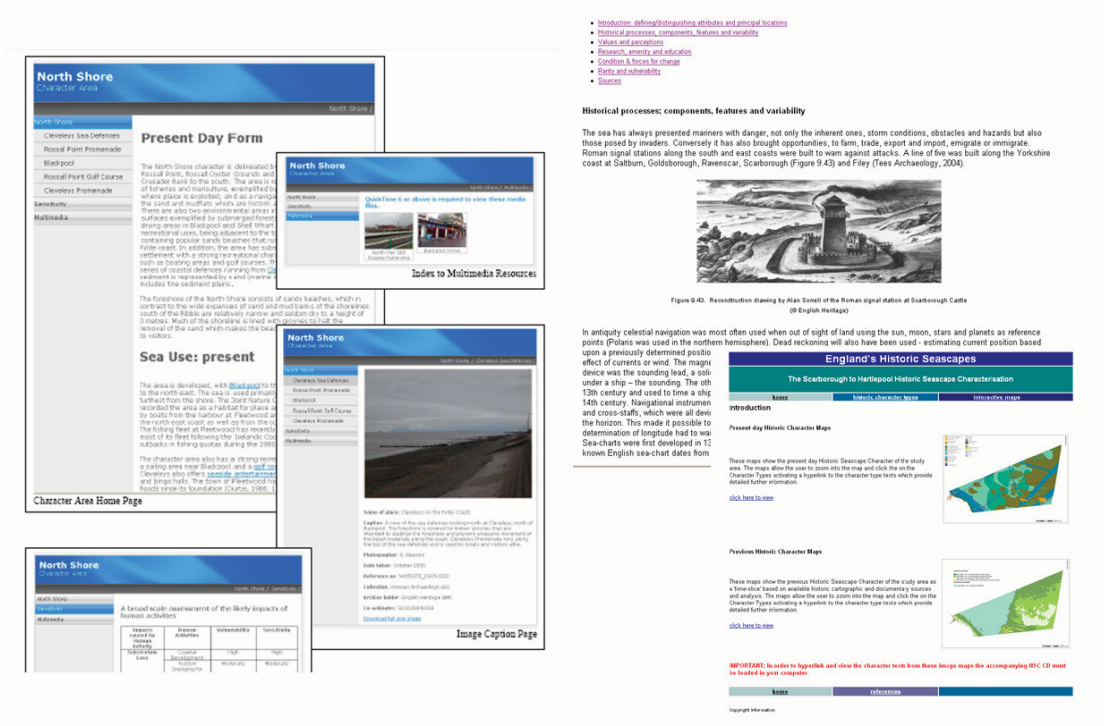


Fig 47 Examples of character texts and interactive mapping produced by pilot projects

The texts should be compiled and arranged to cover the following aspects of historic character:

5.6.4.2 INTRODUCTION: DEFINING/DISTINGUISHING ATTRIBUTES AND PRINCIPAL LOCATIONS

Basic defining or distinguishing attributes and principal locations (reflecting the distribution of the Type through the study area).

5.6.4.3 HISTORICAL PROCESSES; COMPONENTS, FEATURES AND VARIABILITY

A brief review of the historical development of the Type, including an outline chronology where appropriate. Emphasis is laid on the processes which have produced surviving historical or semi-natural features. This is in some ways an elaboration of the Introduction and is important in allowing a place in the characterisation for particular landscape/seascape features and below-ground/submerged remains a place in the characterisation. Semi-natural habitats are presented here in light of the historic processes which have contributed to them.

Includes comment on major differences in extent and components of the Type in different parts of the study area, with brief explanations where appropriate.

5.6.4.4 VALUES AND PERCEPTIONS

An inevitably subjective and observed account of the various ways local people and visitors appear to perceive the Type and the values they give to it and its components. It is recommended that others undertaking characterisation projects treat this as an important part of the text, identifying variances in attitudes, and disputes over interpretations.

5.6.4.5 RESEARCH, AMENITY AND EDUCATION

A statement on the extent of archaeological and historical research on the development of both the Type itself and also its typical components. Includes a discussion of the likely interest visitors and educators may find in the Type, its components, and its history, and the practical problems that might be encountered in developing that interest. Also a discussion of the directions future research might take to help understand the development of both the Type itself and its components.

5.6.4.6 CONDITION AND FORCES FOR CHANGE

Statements on the typical condition of both the Type as a whole and its defining components; the influences currently affecting the Type (note: these need not be negative); and the typical survival of historical/archaeological and semi-natural components and features within this Type. In some cases the survival of the whole Type is also considered. May also include a statement on the typical extent that inter-related components from specified periods survive to be seen and understood in the Type.

5.6.4.7 RARITY AND VULNERABILITY

A statement of the relative frequency of occurrence regionally and nationally of both the Type itself and the features typically found within it..

5.6.4.8 SOURCES

Lists key bibliographic, image and other sources utilised to generate descriptive texts. In some cases these include webpages. May be used to reference further information that may provide more detail and advice to the HSC user.

5.6.5 MULTIMEDIA

The character type texts can be presented in a number of ways to facilitate access to and use of the HSC:

- as a hard copy textual document to be read alongside the GIS mapping
- as a text-based web-enabled resource (HTML etc) directly linked to GIS mapping either remotely or locally (ie. online or offline). The web enabled resource will also include links to images, video, websites etc
- as a derived web-enabled mapping resource (ie. non GIS format, HTML etc) linked to HSC type texts that can stand alone and does not require bespoke GIS software in order to be read. The web-enabled resource will also include links to images, video, websites etc

5.7 HSC CHARACTER AREAS

There are other ways in which 'seascape' can be approached, notably by identifying discrete areas that can be seen to possess a uniquely distinctive historic character reflecting their physical location and unique combinations of historic and natural environmental influences - areas characterised as being distinctive because of their particular combinations (or absences) of different types.

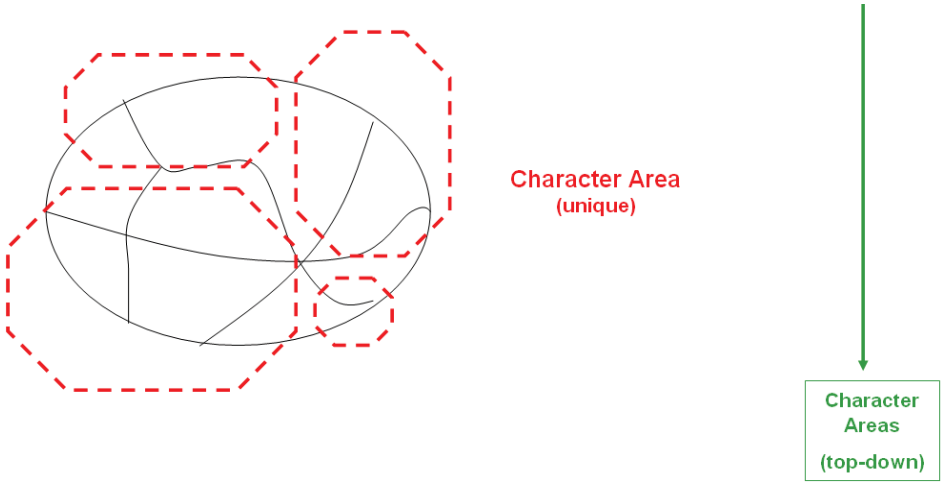


Fig 48 Diagram showing how character areas (red) may overlie character types (grey) and are created through subjective 'top down' assessment

The concept of 'Character Areas' is designed to accommodate this distinctive 'sense of place' and express it as a GIS layer linked into the HSC database via the HSC attribute table. It is based on subjective personal perceptions about what makes an area distinctive and where the break-points lie between such areas. Character Areas are not derived from 'bottom-up' processes of attribute analysis and they may use various frameworks to define their boundaries. As personal perception plays a dominant role in defining these areas, they will be defined differently across any given sector of our marine environment by differing interests, groups and communities within society. In providing a means of capturing and accommodating that diversity of perception in a form readily inter-operable with the HSC character type mapping, Character Areas offer a ready route for other groups than archaeologists, for example local fishermen, diving groups, coastal communities or tourists, to offer their understandings of areas of 'distinctive character' and for those perceptions to be

correlated with variation in historic character. This form of mapping of the historic marine environment offers valuable potential for engagement with outreach programmes and wider community involvement with HSC.

5.8 FIELDWORK

Limited fieldwork is advantageous when undertaking seascapes. Primarily to familiarise project staff with the project area's coast and, if resources allow, it's marine environment. It is also an invaluable opportunity to visit the HERs for each county bordering the project area; to visit archives and museums, collecting further information relevant to the study and discussing the project area with those already familiar with its historic environment. It is also an opportunity to meet stakeholder interests including local heritage professionals who may provide important guidance and understanding; also to acquire field notes and photographs to compliment the final characterisation texts.

Stakeholder meetings also provide an opportunity to gauge local people's responses to the characterisation project and collect, ideas and thoughts they may wish to contribute. Consultation is an important aspect of HSC projects in order to draw the experience and expertise of stakeholders with vested interests in the result of HSC projects. The composition of Project Advisory Groups, Stakeholder Groups and other contacts with industry and trade, tourism and information bodies should be identified at an early stage of HSC projects.

5.9 PROJECT PRODUCTS

An HSC Project's main products should include:

- A Project Report, produced in hard copy and on CDROM or DVD. The number of copies required of each, and to whom they should be submitted on project completion should have been specified in the Project Brief. One hard copy and one CD/DVD copy will form part of the Project Archive (see below). As in all projects, the Report plays an essential role in the project's transparent operation, documenting the execution of the project as a whole: the project's background, aims, objectives and approach, its manner of meeting those, and the extents to which it fulfilled them. The Project Report will also contain a particularly important section: a clear, detailed description of the project's practical implementation of the national HSC method, including for example the source datasets used, its stages of data processing and manipulation, details of the attribute analyses, any additional sources sought to compile the Character Type texts, and any additions to the National HSC Method Statement's list of Sub-character Types and Character Types which were generated by the Project Area. This section of the Report will complement the National HSC Method Statement: together they will build a body of methodological and practical guidance to future HSC practitioners.

- A mapped GIS, related database and linked texts, produced on CDROM or DVD, using software such as ArcView or MapInfo, MS Access and MS Word, and holding the HSC of the Project Area. Again, the number of copies and submission details should have been specified in the Project Brief. One copy shall form part of the Project Archive (see below).

- An offline Web Resource, in .html format or similar, produced on CDROM or DVD, drawn from the GIS polygonisation of the project area, its accompanying structured texts based around the Character Types, and other sources as appropriate. This will provide a user-friendly interactive resource suitable for web-dissemination of the HSC approach and the project area's character, forming a tangible demonstration of the potential of the HSC for raising public awareness and understanding about the coastal and marine historic

environment. Copies on CDROM or DVD shall be submitted according to the Project Brief specification, one copy forming part of the Project Archive (see below).

- An Archive containing copies of: the Project Brief; the contractor's Project Design minus costings; the Project Report; the GIS, relational database and linked texts of the project area HSC; the offline Web Resource; all correspondence relating to the project; all text and mapped data produced and/or copied as part of the project unless restricted by copyright constraints; any other reports, articles and publicity material produced as part of the project. Archive contents available in digital format should not also be submitted in hard copy. On completion of the project, the Project Archive should be deposited with the NMR by the project contractor, having made arrangements with the NMR Head of Heritage Data Management for its delivery.

5.10 PUBLICITY AND DISSEMINATION

HSC projects should publicise the results of character assessment in easily accessible formats and materials. Publicity should ideally include notice of the project on the web, either on contractor's website or through a website dedicated to the project. Other publicity opportunities may include conference lectures and seminars, and articles in the national and selected local journals, the mainstream period journals and more specialist publications. Briefings may be aimed largely at professionals but any more popular press opportunities and website features should be taken up, especially if linkage can be made with other related projects and initiatives. On completion of the project, dissemination of the project products should accord with the specifications of the Project Brief and any restrictions imposed by the derived data conditions of the data suppliers. Within those constraints all effort should be made to ensure appropriate formats of the project's products reach those professional and popular end-users capable of fulfilling the broad potential of HSC.

6 CONTEXTS OF HSC

This section reviews and discusses the national and international contexts which, at the time of writing (March 2008), predicate the need for HSC. Also the various applications in which the national HSC methodology for England offers potential, often uniquely so, in informing the sustainable management of change in the coastal and marine environment nationally. These contexts and applications will inevitably evolve, in some cases quite rapidly, but HSC will meet and compliment many of their requirements as long as they need an area-based presentation of the historic dimension of our environment appropriate to strategic level decision-making: that need is likely to remain for the foreseeable future.

6.1 EU MARITIME POLICY

6.1.1 EIAs AND SEAs

Environmental Impact Assessment (EIA) is a procedure that must be followed for certain types of development before they are granted development consent. The requirement for EIA comes from a European Directive (85/33/EEC as amended by 97/11/EC). The procedure requires the developer to compile an Environmental Statement (ES) describing the likely significant effects of the development on the environment and proposed mitigation measures. The ES must be circulated to statutory consultation bodies and made available to the public for comment. Its contents, together with any comments, must be taken into account by the competent authority (eg local planning authority) before it may grant consent http://www.communities.gov.uk/planningandbuilding/planning/sustainabilityenvironmental/environmentalimpactassessment/

The EU Directive 2001/42/EC (the SEA directive) introduced the Strategic Environmental Assessment process to ensure that significant environmental effects arising from policies, plans and programmes are identified, assessed, mitigated, communicated to decision-makers, monitored and that opportunities for public involvement are provided http://www.sea-info.net/content/overview.asp?pid=94. The Directive was integrated into UK law in 2004.

On national or regional level, the SEA framework should set the context for the plan or programme and identify archaeological mitigation requirements to be addressed by EIA. Such information will then provide the basis for determining a planning consent by a local authority or other statutory consent by a government department.

Historic Seascape Characterisation will enable area-based, as well as point-based, historic environment inputs to EIAs and SEAs, allowing their contextualisation against the typical historic development of an area in addition to noting potential impacts on the special. From its evidence for the character of historic processes in an area, HSC will provide the basis for judging the forms of historic environment expressions likely to survive and be impacted by developments in areas still to be explored in detail. Character Type texts can also inform assessments of significance pertaining to EIA and SEAs.

6.1.2 Integrated Coastal Management

Integrated Coastal Zone Management (ICZM) is the adoption of an integrated or joined up approach towards the many different interests in both the land and marine components of the coast. It is the process of harmonising the different policies and decision making structures, to encourage concerted action towards achieving specific goals arising from the 2002 EU recommendation on implementing ICZM

Successful integrated coastal zone management may involve adopting the following principles:

- A long term view
- A broad holistic approach

- Adaptive management
- Working with natural processes
- Support and involvement of all relevant administrative bodies
- Use of a combination of instruments
- Participatory planning
- Reflecting local characteristics

In close accord with many of those principles and because it encompasses coast, estuaries, inter-tidal and marine zones, HSC can assist and inform the stategic overview necessary in implementing Integrated Coastal Zone Management

6.1.3 EU Integrated Maritime Policy

In October 2007, the Commission of the European Committee presented its vision for an Integrated Maritime Policy for the European Union accompanied by a detailed Action Plan (http://ec.europa.eu/maritimeaffairs/).

This document (also referred to as the 'Blue Book') asserts 'The first goal of an EU Integrated Maritime Policy is to create optimal conditions for the sustainable use of the oceans and seas, enabling the growth of maritime sectors and coastal regions.' (Commission of the European Committee 2007, 7). It continues, 'Availability and easy access to a wide range of natural and human-activity data on the oceans is the basis for strategic decision-making on maritime policy. Given the vast quantity of data collected and stored all over Europe for a wide variety of purposes, the establishment of an appropriate marine data and information infrastructure is of utmost importance. This data should be compiled in a comprehensive and compatible system, and made accessible as a tool for better governance, expansion of value-added services and sustainable maritime development. The Commission will take steps in 2008 towards a European Marine Observation and Data Network, and promote the multi-dimensional mapping of Member States' waters, in order to improve access to high quality data.' (*ibid*, 6-7).

The EU Integrated Maritime Policy has a vital relationship with an ambitious strategy to raise the quality of, and conserve more effectively the marine environment across Europe. The Thematic Strategy on the Protection and Conservation of the Marine Environment aims to achieve good environmental status of the EU's marine waters by 2021 and to protect the resource base upon which marine-related economic and social activities depend. The Marine Strategy will constitute the environmental pillar of the future maritime policy the European Commission is working on, designed to achieve the full economic potential of oceans and seas in harmony with the marine environment.'

(http://ec.europa.eu/environment/water/marine/index_en.htm)

The aspirations of the EU Maritime Policy can be supported through the implementation of directives such as INSPIRE (Infrastructure for Spatial Information in the European Community) that aims to overcome the general situation on spatial information in Europe which is one of fragmentation of datasets and sources, gaps in availability, lack of harmonisation between datasets at different geographical scales and duplication of information collection. These problems make it difficult to identify access and use data that is available. http://www.ec-gis.org/inspire/index.cfm

INSPIRE intends to trigger the creation of a European spatial information infrastructure that delivers to the users integrated spatial information services. These services should allow the users to identify and access spatial or geographical information from a wide range of sources, from the local level to the global level, in an inter-operable way for a variety of uses. The target users of INSPIRE include policy-makers, planners and managers at European, national

and local level and the citizens and their organisations. Possible services are the visualisation of information layers, overlay of information from different sources, spatial and temporal analysis etc.

Historic Seascape Characterisation will provide area-based spatial information on the historic environment which can be integrated with the proposed multi-dimensional mapping of England's waters and the European spatial information infrastructure.

6.2 EUROPEAN LANDSCAPE CONVENTION

The European Landscape Convention (ELC) is a Council of Europe convention and has been in force in the UK since 1 March 2007. Specifically included within its scope are the coastal waters and territorial seas of the states that ratify it. The ELC contains a range of measures aimed at the promotion of landscape protection, management and planning, underpinned by principles of sustainable development. It specifically recognises the role of landscape as a basic component of cultural heritage and identity and as an important contributor to quality of life, from which its management is a legitimate object of public interest. It particularly insists that landscape policies should be integrated with all spheres of government policy.

The ELC embodies many concepts already at the heart of historic landscape characterisation (HLC), including the central roles of human perception in defining landscapes and of human activity in creating them. This is clearly expressed in the ELC definition of landscape as 'an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors'. Similarly with HLC, it embraces the need for a territorially comprehensive approach, encompassing commonplace and poorly regarded landscapes as well as the rare and special. The ELC obliges us to engage in understanding and managing our dynamic landscapes everywhere in a way that recognises their diversity and the complex interplays of cultural and natural forces that influence their perception.

The ELC provides a highly relevant context for developing the methodology for characterising coastal and marine landscapes. In embodying the principles of HLC, historic seascapes characterisation (HSC) will offer an effective tool in meeting our ELC obligations, building a comprehensive, landscape-scale understanding capable of accommodating and informing a range of perceptions.

The European Landscape Convention, which aims to promote the protection, management and planning of all landscapes in Europe, and encourage and facilitate European co-operation on landscape issues, recognises the cultural role and significance of 'landscape'. The Convention states that the landscape:

- … has an important public interest role in the cultural, ecological, environmental and social fields, and constitutes a resource favourable to economic activity and whose protection, management and planning can contribute to job creation;
- … contributes to the formation of local cultures and … is a basic component of the European natural and cultural heritage, contributing to human well-being and consolidation of the European identity ;
- … is an important part of the quality of life for people everywhere: in urban areas and in the countryside, in degraded areas as well as in areas of high quality, in areas recognised as being of outstanding beauty as well as everyday areas;
- … is a key element of individual and social well-being and its protection, management and planning entail rights and responsibilities for everyone.'

Further information on the European Landscape Convention can be found on the Council of Europe website at: (http://www.coe.int/t/e/Cultural_Co-operation/Environment/Landscape/.)

The ELC provides a highly relevant and receptive context for deploying the HSC methodology for characterising coastal and marine landscapes. In embodying the principles of HLC, HSC provides a similarly effective vehicle by which we can meet our ELC obligations, building a comprehensive, landscape-scale, area-based understanding of the marine historic environment capable of accommodating and informing a range of perceptions.

6.3 UK MARINE PLANNING

6.3.1 CHARTING PROGRESS

Charting Progress, an integrated assessment of the state of UK seas' was prepared jointly, in 2005, by Defra, the Scottish Executive, the Welsh Assembly Government and the devolved administration in Northern Ireland on behalf of the United Kingdom Government. This report illustrates the extent to which the seas round the UK continental shelf are currently known to meet the vision as set out in the 2002 Marine Stewardship Report *Safeguarding Our Seas*, alongside a range of recommendations for moving closer to that vision and for improving our knowledge-base for monitoring the state of our seas.

Charting Progress is a step towards adopting an ecosystem approach to managing the impact of human activities on the marine environment. It brings together the results of marine monitoring programmes in order to provide the best assessment possible to make of the waters around the shores of the UK.

The next 'Charting Progress' is due to be published in 2010.

(http://www.defra.gov.uk/environment/water/marine/uk/stateofsea/.)

Charting Progress highlighted the need for more and better area-based datasets for the marine environment and HSC will provide this for the historic environment, giving holistic coverage in a form inter-operable with analogous datasets for the natural environment.

6.3.2 MARINE BILL WHITE PAPER: A SEA CHANGE

In March 2007, publication by the UK Government of the Marine Bill White Paper, *A Sea Change* signalled radical changes to the frameworks governing economic activity and conservation in the marine environment, confirming the forthcoming introduction of a system of marine spatial planning (MSP) to promote the sustainable management of our seas and proposing a new Marine Management Organisation (MMO), which will deal with a range of functions including marine planning, licensing and enforcement that will together provide a holistic approach to marine management (Defra 2007, 62).

(http://www.defra.gov.uk/corporate/consult/marinebill-whitepaper07/index.htm.)

The changes proposed by the Marine Bill White Paper provide one of the main national contexts for the development of HSC and the benefits of implementation of the consolidated national methodology across the full extent of England's coastal and marine zones and adjacent areas to the UK continental shelf. HSC will be of particular value for its deployment in MSP, its role in enabling EH to provide strategic advice to the MMO, in informing the designation of Marine Conservation Zones (MCZs) and the reformed marine aggregate licensing system (these are discussed further in section 7 of this report).

6.3.3 THE NATIONAL HERITAGE ACT (2002)

The National Heritage Act (2002) enabled English Heritage to assume responsibilities for maritime archaeology in English territorial waters, modifying the agency's functions to include securing the preservation of ancient monuments in, on, or under the seabed, and promoting the public's enjoyment of, and advancing their knowledge of ancient monuments, in, on, or under seabed. Initial duties include those formerly undertaken by the Government's Department of Culture, Media and Sport (DCMS), in respect to the administration of The Protection of Wrecks Act 1973.

English Heritage aims to discover, enhance and make more widely available knowledge about our maritime culture, whether it be in the form of discrete remains such as shipwrecks, harbours, coastal defences, fish-traps etc or extensive areas of seascapes and landscapes. In order to relate to our maritime cultural heritage and understand how it has shaped our society today it is necessary to understand the significance, meaning and function of the traces of maritime activity left to us in the archaeological record. This needs to be done in a way which integrates seamlessly with what we know of our past derived from terrestrial investigations and initiatives.

Historic Seascape Characterisation will provide area–based information on the historic processes that have shaped the environment in England's Territorial Sea and in doing so, will contextualise the point data held in other datasets such as the UKHO or NMR wreck records. Because HSC is based on the same principles it will integrate fully with the national land-based HLC programme.

6.3.4 TAKING TO THE WATER

English Heritage's initial policy for the transition of responsibility under the 2002 Act was set out in 'Taking to the Water: English Heritage's Initial Policy for the Management of Maritime Archaeology in England' (Roberts and Trow 2002). In this policy document the priorities for research and development were described thus: Subject to the provision of adequate resources, English Heritage will undertake a programme of research designed to provide a more robust basis for the understanding and management of the maritime historic environment. In doing so we will place the greatest emphasis on work designed to strengthen the national record of maritime sites and landscapes, and work designed to enhance the practical and theoretical basis for site management.

It goes on to identify the need for 'national evaluation studies to characterise poorly recorded or little understood elements of the seamless maritime cultural landscape. Such studies are a proactive way of identifying sites and site types or related activities and industries likely to merit protection and management, including sites and landscapes not currently represented in the record' (*ibid*, 24).

Historic Seascape Characterisation will fulfil this need for characterisation, with comprehensive coverage across the marine culture landscape, placing its attributes and special features in their wider context and enabling the better-informed management of the whole marine historic environment.

6.3.5 CLIMATE CHANGE AND THE HISTORIC ENVIRONMENT

The current English Heritage position on climate change is set out in Climate Change and the Historic Environment, published in January 2008. This statement is intended both for the heritage sector and also for those involved in the wider scientific and technical aspects of climate change; in the development of strategies and plans relating to climate change impacts; or in projects relating to risk assessment, adaptation and mitigation.

English Heritage has set out a number of policies responding to climate change, which HSC is able to inform, including:

- Continue to undertake strategic studies to identify historic assets at risk from climate change and related processes
- Encourage improved understanding of past climate change and human adaptation to it
- Support research tools to support decision-making for the long term (such as appropriateness of investment in particular coastal defence schemes)

Historic Seascape Characterisation will benefit the implementation of those policies with the area-based understandings of the historic environment necessary for well-informed decision-making about the sustainable management of change and conservation planning affecting the coastal and marine zones. In examining forecast future impacts of climate change on, for example, rates of coastal erosion, HSC will enable a broader understanding of potential impact on the typical historic character of our countryside, complementing the estimates of threats to the rare and special in the histioric environment.

6.3.6 WELSH- IRISH SEASCAPES APPROACH

A different approach, similarly entitled 'seascape assessment' has been developed and trialled in the Irish Sea, including research pilot projects in both Ireland and Wales (Hill *et al* 2001). The Welsh-Irish Seascapes approach is primarily a method for conducting visual impact assessment of coastal and offshore developments. Subsequently developed and now being implemented by CCW, it has important differences from HLC/HSC, adopting a perspective of the marine landscape focussed on the sea surface, emphasising the unique distinctiveness of specific areas rather than their shared characteristics and, certainly in its expression to date, a perspective firmly ground in views from and towards the coastline. This methodology has important and valuable guidance to offer particularly concerning the creation of zones of visual influence, viewsheds, lines of sight and the importance of local perceptions, traditions, myth and folklore associated with the coastal and marine environments.

Embodying a necessarily coastal focus, the methodology recognises the historic and cultural aspects of the marine environment noting 'beneath the sea itself there are the remains of many ships, tragedies that are remembered along the coasts. Information is available from recognised sources on all of these matters and this should be supplemented with local lore and tradition' (*ibid*, 5). It goes on to note 'Seascapes assessment is an extension of landscape character assessment rather than a specialism in its own right. It does not replace the need for a thorough landscape assessment on land' (ibid, 3). Indeed its emphasis on areas' uniqueness flows from those roots in Landscape Character Assessment (LCA). The method also notes, though with a differing usage of 'HLC' from that developed by English Heritage, that 'Historic landscape characterisation is relevant to seascapes and can cover hinterland, coastal and marine components. Bearing in mind the large numbers of shipwrecks, lost villages, disused docking, industrial and fishing infrastructure that can be seen along and off our coasts, historic and cultural aspects can play an important underlying role in defining the character of seascape' (*ibid*, 28).

The Welsh-Irish Seascapes and English HLC/HSC approaches are complementary, bearing n different perspectives and aspects of the marine environment but each valid and valuable within its own terms of reference and objectives, as noted in a recent article (Hooley 2007c). Although they could not be usefully merged as a 'single GIS database' they should be presentable as interoperable GIS layers and used in conjunction, for example in informing EIAs and SEAs.

7 APPLICATIONS OF HSC

Taking account of the current national and international contexts described above, HSC can be seen to have a wide range of practical applications analogous to the successful application of HLC in a breadth of circumstances on land (Herring 1998; Clark et al 2004), because it provides a comprehensive area-based overview of historic seascapes capable of manipulation tailored to many needs.

Like HLC it can promote a framework, a background understanding and a better informed starting point from which to consider issues and proposals. It can provide baseline information designed to inform, not supplant, judgements, allowing decision-making to be made at the appropriate time in the light of proposed change. HSC does not seek to answer every question about historic seascapes but it conveys the cultural, historic and archaeological attributes that underpin our present seascapes and the importance of change through time as their primary characteristic (cf Clark *et al* 2004, 11).

In this section we examine some likely practical applications of HSC, with exemplars, under the broad headings:

- Informing Marine Spatial Planning (MSP)
- Marine Planning, development control and aggregate licence applications
- Coastal Management
- Marine Protected Areas (MPAs)
- Regional Research Frameworks
- Outreach and education
- Users of HSC

7.1 INFORMING FORTHCOMING SPATIAL PLANNING (MSP)

'The Marine Bill proposes the introduction of a new system of marine planning which will provide a strategic approach to the use of marine space and interactions between its uses. It will encompass all activities and deliver sustainable development by facilitating forward looking decision-making. Marine plans will guide decisions on licence applications and other issues, and provide users of the sea with more certainty' (Defra 2007, 3).

The aim is 'to create a strategic marine planning system that will clarify our marine objectives and priorities for the future, and direct decision-maker and users towards more efficient sustainable use and protection of our marine resources (*ibid*, 18).

The marine plans will cover the whole of UK waters and would need to represent the 3-dimensional of the marine environment by addressing the seabed and the area below it, the whole of the water column and area above it. The plans would exist from Mean High Water Springs (MHWS) to the fullest extent of the UK's marine jurisdiction (the UK continental shelf and fisheries limits). Marine planning will thus overlap with the terrestrial planning system between MHWS and the Mean Low Water Mark (MLWM). It is likely that marine plans will be created gradually in a phased approach, in line with the available resource of the planning body and where it is felt plans are needed most or earliest. Plans would be reviewed on a regular basis (*ibid* 27).

The Plans will have relevance to a wide range of issues relating to human activities, their associated infrastructure, and their impacts on the natural resources, features and processes in the marine and coastal environment. This gives considerable potential for HSC to be deployed in the proposed marine spatial planning system. As a comprehensive area-based database, inter-operable with analogous databases for the marine natural environment, HSC has relevance far beyond the traditional concerns of historic environment curators. It can

demonstrate the relationships between historic human activities and processes and the present expressions of the natural environment, informing our knowledge of the latter by a better understanding of the impact of man's activities through time. It enables the historic environment to contribute to the full to our understanding of how and why the environment as a whole has its present form, an understanding necessary if we are to address successfully the many concerns and imbalances which the forthcoming MSP is designed to resolve.

In the management of the historic environment itself, HSC will convey the the typical historic processes that have borne upon any given area, setting into broader context the known locations of the rare and the special, thereby guiding the development of conservation strategies, guidelines and decision-making on the attachment of status (designations) and zoning based on archaeological potential. The understanding of those typical historic processes through HSC will also allow estimation of the typical forms of material remains likely to be revealed in any given area, of considerable value to those planning development in areas previously poorly explored.

7.2 DEVELOPMENT CONTROL / PLANNING ADVICE /AGGREGATE EXTRACTION LICENCES

7.2.1 THE PROPOSED MARINE MANAGEMENT ORGANISATION

The Marine Bill White Paper proposes a new Marine Management Organisation (MMO), which will deal with a range of functions including marine planning, licensing and enforcement that will together provide a holistic approach to marine management (Defra 2007*,* 62).

The role of role of EH includes providing advice on the historic environment, including designated or scheduled sites in or on the seabed in the UK territorial sea adjacent to England. Beyond 12 nautical miles EH gives heritage advice on a voluntary basis. The MMO will look to EH for advice on these matters when discharging its functions (*ibid*, 145).

The MMO may also need access to appropriate heritage advice beyond 12 nautical miles in order top fulfil its functions and ensure that protection of the historic environment is given adequate consideration. The UK Government is considering the most appropriate mechanism to achieve this (*ibid,* 145).

In the formulation of appropriate marine heritage advice by EH, HSC would be the most appropriate starting point as it provides extensive coverage of areas otherwise containing little point data relating to the more traditionally understood marine historic environment. The marine zone of the Scarborough to Hartlepool Seascapes pilot area extended some 300 km from the shore, covering an area of some 35,000 km^2; that pilot HSC's evidence for the historic processes that have shaped its area and produced the present expression of its natural environment also provides an indication of the historic environment potential of any area within it and contextualises other datasets such as the UKHO or NMR wreck records, in a similar way to that which HLC has been used in Cornwall to contextualise HER point data (cf Herring 1998).

7.2.2 DEVELOPMENT CONTROL / PLANNING ADVICE

English Heritage policy towards archaeology in marine waters was initially set out in *England's Coastal Heritage* (English Heritage 1996) which stated that 'the principles set out in Planning Policy Guidance Note 16: archaeology and planning (PPG16) should be applied to the treatment of sub-tidal archaeological remains in order to secure best practice'. PPG 16 advises that the preservation of archaeological remains is a material consideration within the planning process and sets out a presumption in favour of the physical preservation of nationally important archaeological remains. Where preservation *in situ* is not justified, PPG16 states that

it is reasonable to require the developer to make appropriate and satisfactory provision for excavation and recording.

The new version of the JNAPC *Code of Practice for Seabed Development* was published in 2006. It notes that 'the Government is committed to sustainable development in which archaeology is given appropriate assessment and consideration. Within this context there is responsibility upon the developer to protect the UK's coastal and marine historic assets which may remain as archaeological material. The JNAPC Code, jointly developed by marine archaeologists and industry provides a framework within which the protection of these asserts as part of our cultural heritage, and he legitimate interests of maritime development can be reconciled.' (JNAPC 2006).

A responsible approach to management of the cultural heritage is required under the *European Convention on the Protection of the Archaeological Heritage (Valletta Convention) 1992*. The Convention, which applies to European States, stipulates that the protection of the cultural heritage must form an integrated component of the planning process from its outset.

Historic Seascape Characterisation can be utilised by developers (scoping studies), curators and archaeological contractors (desk-based assessments, briefs, and evaluations, recommendations for mitigation) for projects such as offshore windfarms or wave hubs, in the same way that terrestrial HLC is currently used, for example in Cornwall, to provide a good indication of the likely historic environment potential of any given area proposed for development, as well as giving context to NMR or HER records. The HSC Broad Character texts provide quick access to a synthesis of what is currently known to help better inform advice and comment on proposed mitigation schemes. Significance and sensitivity can be assessed independently when required as a secondary process using the Broad Character Texts.

7.2.3 EXAMPLE - EIA FOR THE FALMOUTH CRUISE PROJECT

To demonstrate the role that HSC might play in development process we have considered how it could have been applied to a real-life scheme, the Falmouth Cruise Project, if that area had been covered by HSC. Falmouth Harbour Commissioners and Falmouth Docks & Engineering Co Ltd propose to undertake a joint scheme to improve the cruise terminal facilities and navigation at Falmouth, to allow a greater range of cruise vessels to access the Docks. The scheme includes improvement of the cruise terminal facilities, capital dredging to deepen the new berth and deepen and straighten the navigation channel between Carrick Roads and the harbour and Docks and disposal of some dredged material at a licensed offshore disposal ground within Fal Bay.

In March 2007, HES were commissioned to undertake an historic environment assessment of the proposed scheme, which will contribute to the EIA being prepared by Royal Haskoning UK Ltd. The methodology will follow a staged approach recommended by English Heritage involving an initial desk-based assessment, inspection and interpretation of vibrocores geophysical surveys and investigation of geophysical anomalies, culminating in a final report.

The first stage of the desk-based assessment would have been to consult the HLC and HSC for the historic landscape and seascape context. The HLC for Cornwall reflects the historic processes that have shaped the Cornish landscape and involved dividing the county into a series of HLC Types, simplified in a second stage into HLC zones, each of which reflects a particular set of historic processes and tends to contain a predictable range of archaeological sites and historic features. The HLC Character Type of the terrestrial part of the study area for the Falmouth Cruise Project is mapped as 'Urban and Residential Development'. Similarly the HSC Character Type for the marine part would be 'Navigation Channel'.

In the national Seascapes method, each Type has an associated text covering criteria such as Defining/Distinguishing attributes and Principal Locations, Historical Processes, Values and Perceptions, Condition and Forces for Change, Rarity and Vulnerability. Rather than assigning an absolute 'value' to the Types, users will independently assess significance and sensitivity as a secondary process in accord with the timing, purpose and context of their application, informed by the Character Type texts. Study of the Character Texts for Navigation Channel in the hypothetical South Cornwall HSC area would provide a basic background to the history of navigation and dredging in the Fal Estuary and the present HSC marine GIS layer would indicate where dredging had taken place and the previous HSC marine layer would indicate where there might be potential submerged forests or Mesolithic land surfaces.

The next stage of the desk-based assessment would be to consult the HER, the NMR and the UKHO for known sites within the study area; this would be provided as point data, eg findspots and wrecks, which would be given context by previous study of the HLC and HSC. HSC Character Texts also contain useful bibliographies as a starting point for the desk-based assessment.

Similarly, HSC would provide the context for interpretation of the marine geophysical survey results and the assessment of vibrocores from the area undertaken as part of the historic environment assessment.

7.2.4 MARINE AGGREGATE EXTRACTION LICENSING

The Crown Estate owns the mineral rights to the seabed extending to the edge of the UK continental shelf and issues consents for non-exclusive samples and licences for commercial aggregate extraction. To obtain a licence, companies that have been successful in a tender round run by The Crown Estate must at present go through a Government View procedure which includes the submission of an Environmental Impact Assessment (EIA). On 1 April 2007 the Marine and Fisheries Agency (MFA) took on responsibility for the administration of statutory licences and consents for marine works together with marine pollution response, marine renewables and marine aggregates, previously the responsibility of the Marine Consents and Environment Unit (MCEU) within Defra and the marine aggregates team within the Department for Communities and Local Government (CLG). The teams are known as the Marine Environment Team. The main aim of this merger was to bring together within the MFA all Government's delivery functions covering the control of coastal and marine developments, including coast defences, wind farms, wave and tidal power, disposal of marine dredgings at sea, contingency planning for oil spills and other marine pollution, and marine sand and gravel extraction (http://www.mfa.gov.uk/).

There are currently over 70 production licences in operation around Britain's coast producing approximately 22 million tonnes of material per annum (http://www.thecrownestate.co.uk/40_aggregates.htm).

Government policies on marine mineral extraction are set out in *Marine Minerals Guidance Note 1* (MMG 1). MMG 1 states that all applications for dredging permission in previously un-dredged areas will require an EIA. The CLG can also ask the Applicant to provide such further information relating to environmental effects as might be reasonable. Among such information is a description of the aspects of the environment likely to be significantly affected by the proposed project. The application process is characterised by a series of consultation stages eliciting comments from organisations identified by the CLG (BMAPA/EH, 2003). English Heritage is one of the organisations consulted and provides curatorial advice with regard to appropriate archaeological mitigation.

The reformed marine licensing regime proposed by the Marine Bill White Paper will include all forms of dredging, including marine minerals dredging and currently unregulated forms of

dredging. The changes are intended to simplify marine licensing processes and provide for a rationalised and more integrated approach (Defra 2007, 3, 41).

The Government propose that all the functions currently undertaken by Defra's Marine Consents and Environment Unit (MCEU) and the MFA, including regulation of aggregate dredging will be transferred to the MMO. The statutory nature conservation agencies and the MMO will be proactively collecting and collating data and information on the marine area and will provide it to developers where necessary to minimise the cost of undertaking EIAs.

HSC will have considerable benefits in informing the current 'Government View' system, although under the reformed licensing system this likely to be superseded by MSP in the short to medium term. At a Regional level HSC could be used in Strategic Environmental Assessments (SEAs) to identify sensitive areas and issues that could then be targeted by EIAs for specific licence applications.

7.2.5 EXAMPLE – EIA FOR MARINE AGGREGATES EXTRACTION AREA IN THE SOUTHERN NORTH SEA

To demonstrate the role that HSC might play in the process of marine aggregates licensing extraction we have explored the hypothetical scenario of an EIA for a marine aggregates extraction area on the periphery of the Dogger Bank (Test-bed area 1).

The hypothetical extraction area might extend over an area containing the following Character Types: Extractive Industry (hydrocarbon), Fishery (trawling, netting and lining), Military Facility, Navigation Route and Area, Navigation Hazard, Palaeolandscape and Telecommunications.

The locations of potential Palaeolithic or Mesolithic remains are mapped on the previous HSC marine GIS layer and current areas of current activity on the present HSC marine GIS layer, which shows areas of fisheries, hydrocarbon extraction, navigation routes etc.

As described above the HSC containing the study area would be one of the one of the first sources to be consulted by the contractor undertaking the assessment of the historic environment for the EIA to provide a good indication of the likely historic environment potential of any given area proposed for development and give context to NMR and HER records and other desk-based research. The HSC Broad Character texts would be referred to for a synthesis of what is currently known about the area to help better inform advice and comment on proposed mitigation schemes. Significance and sensitivity could be assessed independently when required as a secondary process using the Broad Character Texts.

Historic Seascape Characterisation would not be a stand-alone tool for advising on the mitigation for the licence application but would be used with other datasets such as wreck records from the NMR and UKHO and the results of projects such as the ALSF-funded 3D Seismic Survey for Mitigation Mapping of the Southern North Sea (Gaffney *et al* 2007). HSC would provide the context for these datasets and a good initial indication of the likely historic environment potential the licence application area. It can also assist in the designing of alternative extraction strategies to minimise impact on areas with high preservation potential and continue to permit responsible mineral extraction and development.

7.3 COASTAL MANAGEMENT

This section discusses two aspects of coastal management; Rapid Coastal Zone Assessment Surveys and Shoreline Management Plans.

'Although the offshore zone is not well covered [currently] in terms of management frameworks, this situation improves closer to the shore in coastal, inter-tidal and estuarine environments. A tranche of planning and management approaches have been developed for

variety of specific concerns. Seascapes [HSC] is well placed to add an enhanced marine heritage dimension to such plans, many of which are subject to review and revision processes that provide an opportunity to include new or updated knowledge or understanding to future decision making' (HWTMA *et al* 2007a, 57).

7.3.1 RAPID COASTAL ZONE ASSESSMENT SURVEYS

The latest rationale and methodology for RCZAS are set out in the EH document *A Brief for English Heritage Rapid Coastal Zone Assessment Surveys* (English Heritage 2007b). RCZAS essentially comprise a discrete desk-based assessment of readily accessible sources, (Phase 1) either as the principal project deliverable or as a preliminary to field survey (Phase 2).

The first aim of the RCZAS is to provide heritage information which can be fed directly into Defra's Shoreline and Estuary Management Programme, at the levels of Plans, Strategies, and Schemes, thereby helping to ensure appropriate protection, or mitigation of damage, to historic assets.

The broad aims are to:

- provide an enhanced SMR/HER and NMR record for coastal heritage assets, to a nationally agreed common minimum data standard, in order to permit an improved curatorial response to strategic coastal planning or management initiatives at a national and regional level;
- provide a factual basis for the initial curatorial response to individual applications for commercial developments or schemes, in advance of more detailed evaluation and mitigation related to EIAs and/or planning applications;
- provide data which is compatible with the needs of other coastal managers, parallel coastal surveys, industry and researchers;
- provide an overview of coastal change from the Late Upper Palaeolithic onwards;
- provide an assessment of the degree and nature of threat to coastal historic assets which has regard to the models of future coastal change presented in Defra's *FutureCoast* study (2002), and relevant Shoreline Management Plans;
- provide a broad assessment of the likely archaeological potential and vulnerability of all stretches of the coast;
- provide a sound basis for developing management and research priorities in respect of sites and areas of potential with different levels of importance and under different levels of threat;
- enhance public understanding and enjoyment of the coastal heritage.

The broad aims of HSC and RCZAS are comparable and complimentary in most instances; for example , although HSC does not create or update individual NMR/local SMR monument records themselves, it can provide the context and background to these records. It can assist in formulating curatorial responses to commercial and planning applications, it provides an overview of coastal change and a good initial indication of archaeological potential and vulnerability as well as being a useful tool to enhance public appreciation of the coastal, inter-tidal and marine historic environment. HSC also contains useful bibliographies and the information gaps noted would help to identify research priorities.

7.3.2 SHORELINE MANAGEMENT PLANS

Shoreline Management Plans (SMPs) aim to provide long-term policies for managing the coastline in a practical way, including a large-scale assessment of the risks associated with coastal processes and presents a framework to reduce these risks to people and the developed, historic and natural environment into the 22nd century (Defra 2001).

Under Section 7 of the Environment Act 1995 and Sections 61a and 61B of the Land Drainage Act 1992 an environmental appraisal, which includes the historic as well as the natural environment, is required for all flood and coastal defence schemes prior to application for grant aid. These requirements also extend to Section 5 approvals under the Coast Protection Act 1949, even where a grant is not provided (English Heritage 2003, 7).

English Heritage's guidance note *Coastal Defence and the Historic Environment* stresses that 'the key to ensuring proper consideration of the historic environment within the shoreline management planning process is to ensure that adequate and properly interpreted information is integrated into all stages of the shoreline management plan', (English Heritage 2003, 7-8).

The normal stages in the archaeological assessment procedure are appraisal, desk-based assessment and field evaluation, following which it is possible to define a mitigation strategy. A detailed archaeological appraisal is likely to be the most appropriate response in the process of formulating a Shoreline management Plan. At a minimum this should involve the systematic gathering together of readily accessible sources on the historic environment including local authority HERs, NMR records, UKHO data, Scheduled Monuments, historic wrecks, listed buildings, registered parks and gardens, registered battlefields etc; and, of particular relevance to HSC, reference to any historic character appraisals. The work should also include a broad brush assessment of the archaeological potential of lengths of coast based on their geomorphology and relationship to recorded terrestrial archaeological remains. The work should be carried out in accordance with a brief provided by local authority Historic Environment Planning Advice (HEPA) officers and by a qualified consultant and in consultation with the appropriate EH regional team. In certain circumstances an environmental impact assessment may be required, the most appropriate response to which is a desk-based assessment, which is more detailed than an appraisal, taking into account archival and secondary sources for information on the recorded historic resource within a given area. In some cases where it is clear that a scheme will affect historic remains, the detailed design of the scheme should be informed by an archaeological field evaluation and should include a mitigation strategy to reduce damage to those remains (English Heritage 2003, 7-8).

Currently SMPs consider only the 'special historic assets' in the historic environment to be affected by future coastal erosion etc: the specific, the special, rare and atypical: there is nothing about areas and the characteristic outcomes of the typical historic processes that have shaped an areas present historic character. HSC (and HLC) can give that extra dimension. This will allow discussion of the historic environment in SMP reports to be on a par with that of the natural environment, where texts relate both to rare species that might be affected and the typical habitats which provide their context.

Historic Seascape Characterisation is also able to provide the maritime perspective, the coast as understood from the sea, rather than purely from a terrestrial perspective, and the opportunity of giving a landscape-scale perspective rather than identifying separate 'assets'. For new rounds of SMPs, HSC can help in raising awareness of the archaeology which is present and may be impacted by various schemes.

Historic Seascape Characterisation also could be used in modelling the likely impacts of new coastal development and infrastructure and to highlight of the human dimension of close inshore areas.

7.3.3 EXAMPLE – INPUT INTO SHORELINE MANAGEMENT PLAN

Shoreline Management Plans are meant to be working documents, reviewed and, where appropriate, revised at regular intervals to incorporate new information and reflect changes in policy guidance. Since 1995, when Defra first published guidance on the preparation of SMPs by operating authorities, the first generation of SMPs covering the entire coastline of England

has been completed. Defra subsequently commissioned a review of their defences and in some areas work on second generation plans has commenced.

We might take any of the second generation or future SMP as an example. In an ideal situation the local authority HEPA Officer will be consulted by whoever is preparing the SMP for a particular sub-cell. The HEPA officer will engage a consultant to assist in the preparation of a brief for an archaeological appraisal, and seek advice from the regional EH team in the formulation of the brief, which should include sections on: project background, location, planning background, archaeological and historical background, requirement for work, aims and objectives, methodology and principal sources to be consulted. In preparing the brief, the HEPA officer and consultant will themselves need to carry out a desk-based study and a broad assessment of the potential and significance of the area to be assessed to inform the brief. In order to this they would consult the usual sources including HLC, but if HSC was available they also consult this to give an immediate, broad indication of the historic potential and significance of the study area from the marine perspective.

The detailed archaeological appraisal itself would then be put out to tender and an archaeological contractor appointed to undertake the appraisal and produce a report. During the initial stage of the appraisal the contractor would consult the HLC and HSC for an overview of the study area, its present and previous historic character. During the next stage they would consult the HER, the NMR, UKHO etc for known sites within the study area, again this would be provided as point data which would be given context by study of the HLC and HSC. Significance and potential could be assessed by studying the GIS mapping and using the Character texts.

7.4 MARINE CONSERVATION ZONES (MCZs)

The Marine Bill White Paper provides proposals 'for new mechanisms that will supplement existing tools for the conservation of marine ecosystems and biodiversity. This will include a new approach to protected areas for important species and habitats (Defra 2007, 3).

The Government has a duty under European law to designate areas in our seas to protect small number of species and habitats considered of European importance and consequently propose a parallel mechanism to designate and manage a new type of Marine Protected Area (MPA) which will be called Marine Conservation Zones (MCZs). These are intended to provide protection for species and habitats considered of national value that cannot be protected under European law (*ibid*, 65).

They will continue to develop a suite of Marine Objectives that will clarify what they want to achieve for marine ecosystems, including biodiversity and human activities within them. They do not propose giving these objectives a statutory basis due to their developing nature and the need for a flexible approach to the dynamic marine environment…they will form an integral component of marine plans and will therefore influence decision-making processes (*ibid*, 65-6).

In Lancashire and Suffolk HLC has been a recognised dataset helping to provide information with important uses including helping to identify the location and extent of former habitats for English Nature's Lifescapes initiative (Clark et al, 2004). In the marine zone HSC would be potentially useful in a similar way in helping the MMO and Natural England to identify the location and extent of former habitats for MCZs, amplifying their understanding and description with the historic processes that have helped to form semi-natural Character Types such as Cliff, Coastal Rough Ground, Dunes, Saltmarsh and Sandflats, Foreshore Woodland and Water.

7.5 REGIONAL RESEARCH FRAMEWORKS

In 1996, English Heritage's review document *Frameworks for our Past* identified the need for a greater emphasis on research within modern archaeology. The recommendation was for the formulation of Research Frameworks for each of the regions of England to provide a context and a common focus for archaeological work. Many local authorities have recognised that incorporating agreed research priorities in management and conservation plans and Written Schemes of Investigation (WSIs) enhances the credibility of the development control process.

The document noted that frameworks should:

- Provide an infrastructure and means of validating the decision making inherent within the planning process;
- Assist in the formulation of priorities for the distribution of resources (on a national scale);
- Couple curation and research.

English Heritage suggests that Research Frameworks should comprise three parts:

- *Resource Assessment* – a statement of the current state of knowledge and a description of the archaeological resource;
- *Research Agenda* – a list of the gaps in that knowledge, of work that could be done, and the potential for the resource to answer questions;
- *Research Strategy* – a statement setting out priorities and method (English Heritage 1996, 5, fig 5).

Research frameworks for maritime archaeology in particular remain poorly developed for the study of shipwrecks and maritime landscapes. As such, the inclusion of the maritime landscape in regional research frameworks is seen as a high priority by English Heritage (Roberts and Trow 2002, 23). Making HSC available to local curators would provide a significant step forward in improving access to the maritime information base.

Historic Seascape Characterisation Increase awareness of the coastal and marine resource, by adding an area-based dimension focussing on the typical historical development of those areas and can direct or assist with research themes/subjects and recommendations for further maritime and coastal research, for instance:

- **Ship-building techniques**: the Character Type 'Shipping Industry' includes the sub-types 'Boat Yard' 'Commercial Shipping Route/Area and 'Ship Yard'. The texts will provide an overview of ship-building and indicate aspects about which little is known, for instance, the difficulty in finding field evidence for documented ship yards.
- **Wrecks**: enhancing and providing a context for NMR, UKHO and maritime HER data; and a background for appraisal of known wreck sites and research agendas; improving our understanding of patterns in shipping and ability to predict the possible location of as yet undiscovered wrecks by assimilating coastal topography, Navigation Features, Navigation Hazards (including Caution Areas, Obstructions, dangerous and non-dangerous Wreck Clusters and Natural Marine Conditions) in a single GIS database.
- **The changing coastline**: the core datasets for HSC include modern and historic Admiralty charts and OS maps and aerial; photographs and the supplementary datasets include palaeoenvironmental data (sea-level index points, submergence models) and coastal morphology (FutureCoast), interrogating HSC database and studying the Present and Past HSC layers provides synthesised map regression and clear indication of the historic pattern of coastal change and the historic processes that have influenced these changes eg reclamation of the 'Semi-Natural Environment' (salt

marsh, wetlands, mudflats) for Settlement or Industry or erosion of Cliffs or Coastal rough ground by natural or industrial processes.

- **Dune systems**: the Character Type 'Semi Natural Environment' includes the sub-type 'Dunes' ; the texts define 'dune' and the historical processes that have contributed to their formation and typical historic components of this sub-type. Dunes will be mapped on the Present and Previous HSC layers, map regression will indicate changing patterns of sand dune distribution and indicate areas of rapid change and medium to long term stability.

- **Maritime infrastructure:** there are many potential research topics for maritime infrastructure eg developments of dock and harbour installations and survivals of early navigational features such as Roman lighthouses and signal stations. The Character Type texts 'Navigation Activity and 'Maritime Safety' and their respective sub-types will provide a background and broad context for these, for example in the networks of shipping and trading routes and their ports. The mapping itself will indicate the location of such features or can be used as a predictive tool to suggest where currently undiscovered locations for them might be. Sites on land used by mariners as navigational aids, such as church spires, can be clearly indicated on HSC by buffering.

- **Submerged prehistoric landscapes:** the Character Type 'Palaeolandscapes' includes the sub-types Palaeo-chananel, Sub-marine forest and Peat deposit. The locations and extent of such features and deposits, where known, will be mapped on the Previous HSC layer and as such will provide an important research tool and can help to indicate other areas of high archaeological potential.

7.6 OUTREACH AND EDUCATION

An important role of HSC will be to act as a framework for outreach and improved community awareness of and access to the marine historic environment. HES have given many presentations on the Cornwall HLC which consistently meet with much interest, enthusiasm and interactive discussion. This is largely because HLC contributes towards the democratisation of data by mapping and demonstrating the historic character of locally familiar landscapes not just designated areas. It makes everyone's home, backyard and familiar locale a recognised part of the historic environment: the relevance is immediate and clear.

The project's main products are the GIS mapping, archived and curated by the Archaeological Data Service (ADS) and the NMR, Swindon, and the reports, issued as hard copy and deposited in local authority historic environment services and also included on the English Heritage web pages. These allow users to access both mapping and text.

Care has been taken to ensure that the names of Character Types and their associated text are jargon-free to ensure that as wide a range of audiences as possible can make full use of the material.

Historic Seascape Characterisation, and presentations of it to professionals and the wider public, will help raise the profile of the historic environment of the sea and shore. It will help develop a greater understanding that all is historic and that heritage interests lie not just in the individual sites and wrecks but in the wider sea and landscapes, and also in the semi-natural aspects of the environment, those created or influenced by a range of human activities. Building on such increased awareness, the concept of Character Areas, discussed in 7.6.1 below, provides a mechanism whereby differing groups and interests in society can record those areas which they perceive as possessing distinctive and meaningful historic character.

7.6.1 CHARACTER AREAS

Character Areas are unique areas that local people and others may recognise and readily identify with, and may refer to a stretch of coastline, for example Scarborough to Cayton Bay, or an offshore area, such as the Dogger Bank (see above, section 4.5 for fuller discussion). They have generally not developed from the HSC mapping and consequently they may contain a range of HSC Types. In the consolidated national HSC method, compilation of Character Areas is not an integral part of producing the HSC database. They are compiled in a secondary process using local knowledge and perceptions of areas understood to be uniquely distinctive, though these perceptions may well have been informed by the Character Types and their Texts in outreach programmes.

7.6.2 EXAMPLE – INPUT INTO OUTREACH AND EDUCATION

A secondary school class or a local history society in a coastal town, such as Whitby, may decide to undertake a project on the maritime history of their home town. Some of the teachers or members of the society may have attended the stakeholders meetings held by HES in September 2006 or February 2007 or the [future] stakeholders meeting at the end of the project to apply the national method to the pilot HSC. Their local Historic Environment Service holds a copy of the North Yorkshire HSC, provided by EH and the study group make appointments to consult the HER and HSC database.

They are instructed how to use the HER by the HER officer and how to interrogate the HSC by the GIS officer. The GIS HSC mapping presents the data in a way which is visually interesting and accessible; the students are able to view the present marine HSC layer and click to refer the texts for the various Character Types. They are then able to view the present HSC for the coastal and inter-tidal zone and to investigate the Character Types that that comprise it. Finally they are able to view the previous marine and coastal and inter-tidal layers and view the associated Character Texts. They can also consult the texts linked to the area's HSC via the ADS website.

In their study area, the Scarborough to Hartlepool pilot project identified the Character Areas of 'Skinningrove to Ravenscar', a long stretch of coastline that includes the fishing villages of Staithes, Robin Hood's Bay and Runswick Bay as well as Whitby, the 'Whitby and Hartlepool [Fishing} Grounds offshore and, further out to sea, the 'Dogger Flanks', 'Straits of Dogger – The Hills' and 'Dogger Bank' (Val Baker *et al* 2007, 258-290). Each Character Area was described briefly with short statements on geography, principal Character Types included and a range of Values and Perceptions, although it was noted that these were necessarily limited due to restricted research time and unfamiliarity with local views and feelings. It was considered that they could be elaborated on by those with greater local knowledge and understanding *(ibid*, 258).

The students are likely have their own ideas of what the local Character Areas should be and may wish to name them and, as part of their project could create an additional uppermost layer showing their Character Areas and creating new Character Area texts. Copyright issues being resolved the GIs could be used to generate illustrative material for their project

Hard copies of the HSC report would be held by the local library service, which would also be available online at the ADS website, so the students would be able to refer to the Character Texts in the report and also to refer to the sources listed in the bibliographies.

7.7 USERS OF HSC

Without attempting to be exhaustive, the following bullets list a range of the main anticipated users for the HSC database and the main purposes to which it might be put.

- Landowners: especially The Crown Estate who own around 55% of the foreshore, approximately half of all estuary beds and tidal rivers and the seabed out to the 12 mile territorial limit The Crown Estate is committed to sustainable and long-term management of these unique assets. HSC will assist in this by providing extensive area-based mapping of the marine historic environment and the historic processes that have shaped the contemporary form of the natural environment, enhancing our understanding of that form, contextualising our point data records of the rare and the special in the historic environment, and guiding the development of management strategies which take into account the full breadth and potential of the historic environment .

- Curators: processing offshore or coastal planning applications and contributing to SEAs and EIAs - predictive modelling (sites and monuments), also impacts of coastal developments, identifying gaps in HERs and local knowledge. Informing data collection policies etc. In a future MSP system, providing inputs and advice to Marine Plan compilation and review.

- Regional authorities: assisting strategic regional planning initiatives eg the archaeological components of Shoreline Management Plans, Maritime Historic Environment Action Plans (HEAPs), Integrated Coastal Zone Management (ICZM);

- Central government strategic planning: responses to Govt View system and, for the future, providing inputs to the MMO and marine spatial planning; advice to the consents units of DEFRA and the MFA;

- Other agencies: English Heritage – contextualising NMR Maritime Record and Rapid Coastal Zone Assessment Survey data; providing better contextualised historic environment advice on the management of change to Government agencies and the wider public, Natural England (eg MPAs and MCZs, management of change), National Trust, National Parks, UKHO, local fisheries eg NESFC, the Environment Agency – SMPs; responses to SEAs, EIAs and Govt View process; in the future MSP system, providing inputs and advice to Marine Plan compilation and review.

- Maritime researchers: exploring a wide variety of historical and prehistoric maritime themes; International, Regional and Local Research Frameworks

- Developers: concerned with coastal and offshore projects, needing to anticipate the impacts, and thereby the costs, of their proposals to ensure compliance with environmental legislation

- Archaeological contractors: consulting HSC at an early stage during archaeological and historic assessments to give broad context to and guide future contract work and feed into EIAs.

- Lecturers and teachers: helping to develop schools projects linked to environment and archaeology; using HSC as a framework for outreach and improved community understanding and access to marine historic environment, leading to a greater democratisation of data with benefits to all in doing so.

- General Public: especially coastal communities, users and visitors: for general awareness-raising and education but also to enable better-informed responses to the many environmental and development issues which have

and will increasingly become matters of public concern. In line with that, HSC will enable greater public accountability for the forthcoming system of marine planning.

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9 PROJECT ARCHIVE

The formal Project Archive for this project is deposited at the National Monument Record (NMR) Centre in Swindon.

The Cornwall HES project number is **2007078**. The project's documentary archive is also housed at the offices of the Historic Environment Service, Cornwall County Council, Kennall Building, Old County Hall, Station Road, Truro, TR1 3AY. The contents of this archive are as listed below:

1. A project file containing site records and notes, project correspondence and administration and copies of documentary/cartographic source material (file no 2007078).
2. GIS database stored in the directory: L:\CAU\HE_Projects\Sites_S\Seascapes_HSC_National_Method
3. This report text is held in digital form as: G:\CAU\HE PROJECTS\SITES\MARITIME\SEASCAPES HSC NATIONAL METHOD 2007078\REPORTS\FINAL REPORTS\HSC PROJECT REPORT 2008R023 FINAL.DOC

APPENDIX 1: HSC CHARACTER TYPE DESCRIPTIONS

The following section outlines the Character Type hierarchy and describes the Character Types developed during the piloting and consolidation of HSC in further detail. This cannot be an exhaustive list: further Character Types will undoubtedly be added by future work in new areas. The Character Type descriptions are grouped according to Broad Character Type, with associated Character Type and Sub-character Types explained within.

Each Type is discussed in the following way:

- description of the historic character, time-depth, typical components
- principle sources used and geoprocessing and digitisation techniques employed
- horizontal and vertical expression (the level in the marine tier where the character type may usually be expressed)

For Character Types relating to exclusively land-related activity found in the coastal zone, recourse to existing HLC mapping definition and terminology is required.

Terminology for the marine and maritime environment should be guided by the NMR Thesaurus' 'Maritime Class Listing' http://thesaurus.english-heritage.org.uk.

9.1 NAVIGATION

Related to the action or practice of travelling on water in a ship or other vessel. This Broad Type is primarily informed from digitised modern and historic charts and projects such as *England' Shipping* (Wessex Archaeology 2003, 2004) and *Navigation hazards project* (Merritt et al 2007).

9.1.1 NAVIGATION FEATURE

Material features with a distinctive navigational aspect mainly related to passage of shipping traffic. This Type is usually found where active management has been undertaken in order to maintain the accessibility of a stretch of water for safe passage. It has close associations with the Types Navigation Area/Route and Navigation Hazards.

Components of this Character Type include active, disused and buried navigation channels, dredged channels and entrances to harbours. Increased sea trade particularly from the 19th century onwards, saw greater volumes and larger vessels seeking access to what had been often traditionally been hazardous and restricted river and estuary channels. Industrialisation forced port authorities to improve and maintain navigation access by dredging, the spoil often dumped out to sea. Creating channels also often involved the reclamation of adjacent land, including sand banks and saltmarsh, and the construction of retaining walls.

9.1.1.1 Navigation channel

Description: Includes active historic navigation channels, active modern channels and disused historic navigation channels. Navigational watercourse or channel used in the past and which is currently in use by modern commercial traffic. Time-depth will reveal if the channel is modern having not been in use pre-1900.

Sources and geoprocessing: Navigation channels are named on historic charts although their limits, if defined, tend to be roughly demarcated by buoyage rather than by continuous lines. The dynamic nature of the seabed means that these shipping channels move spatially, and, in some cases, fall out of use altogether. They can be digitised from individual charts by chart date and later be summarised as areas taking into account spatial change and period of use. Often recorded in bibliographic references and sailing directions.

Expression in marine tier: sub-sea floor, sea floor, water column and sea surface.

9.1.1.2 Disused navigation channel

Description: Time-depth will reveal if the channel is historic and disused and no longer in use in the present.

Sources and geoprocessing: see 9.4.1.1.

Expression in marine tier: sub-sea floor, sea floor, water column and sea surface.

9.1.1.3 Disused buried channel

Description: Navigational watercourse or channel used in the past, which is currently buried and therefore not in current use.

Sources and geoprocessing: see 9.4.1.1.

Expression in marine tier: sub-sea floor, sea floor.

9.1.1.4 Dredged channel/area

Description: Referring to the removal of accumulated sediments from harbour channels and berths to ensure a safe depth of water for navigational purposes, or similar maintenance works to remove sediment to restore an adequate flow of water to mitigate risk of flooding or protect a sensitive habitat. Maintenance dredging refers to the excavations of material to deepen or create navigational channels and berths to provide additional harbour infrastructure or provide access fro deeper draught vessels. The difference between capital and maintenance dredging is that capital dredging reduces the seabed to level (relative to Ordnance Datum) lower that it has been at anytime during the preceding 10 years

(www.mceu.gov.uk/MCEU_LOCALE/FEPA/FEPA-capital.htm).

Sources and geoprocessing: see 9.4.1.1.

Expression in marine tier: sub-sea floor, sea floor, water column and sea surface.

9.1.2 NAVIGATION ACTIVITY

Intangible statuses and features, often not physically demarcated, related to the human activities linked to navigation such as anchorage areas, port quarantine areas, waterways, navigation routes and areas.

9.1.2.1 Anchorage area

Description: An area of sea or coast where ships, vessels and craft anchor often provided by sheltered conditions afforded by the topography of the nearby coast. They are often located along coastlines within bays or areas sheltered from predominant winds, strong currents and turbulent waters, which are known and regularly re-used by vessels for safe anchoring and sheltering from bad weather. They could potentially be areas where archaeological potential may be higher than usual as the regular occupation of these areas would increase the likelihood of finding vessels that had sunk in bad weather despite seeking shelter, and debris discarded or dropped from ships.

Sources and geoprocessing: Historic anchorages areas can be mapped as points in historic charts, although they represent an area of activity. The data can be converted to polygons to reflect the role of anchorages as areas of maritime activity and to prepare the data for querying with other vector polygons. The centre points of the anchorage areas are digitised and a 500m buffer created.

Expression in marine tier: sea surface, water column, sea floor and sub-sea floor.

9.1.2.2 Ferry route

Description: Related to a route across a river of lake or an area of port, dock or harbour. Often include associated buildings for passengers and vehicles and customs control; and embarkation and disembarkation area. May include fixed chain-link ferry crossings.

Sources and geoprocessing: historic and modern charts. Buffered as polygons or line of navigation set against marine grid.

Expression in marine tier: sea surface.

9.1.2.3 Harbour area

Description: Area of water including and adjacent to port or harbour that falls under the jurisdiction of the port/harbour authority. Will include traffic areas and restricted navigation areas.

Sources and geoprocessing: historic and modern charts.

Expression in marine tier: sea surface, water column.

9.1.2.4 Navigation route/area

Description: Identifies areas of navigation activity as opposed to those areas that have been actively dredged or managed and in this sense the archaeological potential, apart from known wrecks, is inferred rather than certain.

Sources and geoprocessing: historic and modern charts, sailing directions, shipping data.

Expression in marine tier: sea surface, water column.

9.1.2.5 Port quarantine area

Description: A historical area linked to a port where a period of detention was imposed on travellers or voyagers before they are allowed to enter a country or town. Commonly quarantine is also defined as the period during which a ship, capable of carrying contagion, is kept isolated on its arrival at port.

Sources and geoprocessing: historic and modern charts.

Expression in marine tier: sea surface.

9.1.2.6 Shipping lane

Description: Commercial and trade shipping route.

Sources and geoprocessing: shipping data.

Expression in marine tier: sea surface.

9.1.2.7 Waterway

Description: A course or passage of water related to any navigational practice eg river, estuary.

Sources and geoprocessing: OS maps, historic and modern charts.

Expression in marine tier: sea surface, water column.

9.1.3 NAVIGATION HAZARD

Features that represent a risk of collision, stranding, foundering, etc. leading to damage or complete loss of a vessel such as caution areas, wrecks, drying areas, submerged rocks, shoals and banks, debris and obstructions and natural marine conditions etc.

Historic navigation hazards are difficult to map with any precision although essentially this is the purpose of nautical and maritime charts. Major navigation hazards have figured on the earliest Admiralty charts and are often mentioned in historic sailing directions. Early charts obviously contain less detail and use less accurate survey methods to record features instead tending to depict those hazards that mariners most need to be aware of and which are most easily identifiable. Modern charts depict far more accurate and precise information. The majority of the features associated with this Type are typically found on or immediately adjacent to the coast, although wrecks have a far wider distribution but with a distinct focus in inshore waters.

9.1.3.1 Caution area

Description: Areas requiring considerable care to be taken during navigation indicating natural hazards, or restrictions imposed by shipping traffic and military exercise and practice.

Sources and geoprocessing:

Expression in marine tier: sea surface, water column, sea floor, sub-sea floor.

9.1.3.2 Dangerous wreck

Description: Dangerous wrecks in shallow water are those either exposed and/or found above 10m below the sea-level (based on UKHO definition).

Sources and geoprocessing: historic and modern charts. NMR Maritime Record.

Expression in marine tier: sea floor, water column in shallow areas.

9.1.3.3 Drying area

Description: Historic charts show the detail of drying areas or sandbanks as surveyed at the time the chart was produced. Historic drying areas such as sand banks exposed in the past. Areas subject to change and exposure at low tide due to the mobility of sediments.

Sources and geoprocessing: historic and modern charts. Drying areas as surveyed in separate charts can be digitised, copied and combined into a single layer.

Expression in marine tier: sea surface, water column, sea floor.

9.1.3.4 Maritime debris

Description: An area dominated by obstructions and fouls that may not be associated with a wreck.

Sources and geoprocessing: historic and modern charts.

Expression in marine tier: sea floor.

9.1.3.5 Obstruction

Description: An area dominated by obstructions and fouls that may not be associated with a wreck.

Sources and geoprocessing: historic and modern charts, sailing directions.

Expression in marine tier: sea floor.

9.1.3.6 Rocky outcrop

Description: Area dominated by submerged rocks rising above the general level of the seabed and which breaks the surface of the water posing a risk for navigation.

Sources and geoprocessing: historic and modern charts, sailing directions.

Expression in marine tier: sea surface, water column, sea floor, sub-sea floor.

9.1.3.7 Shoals and flats

Description: Shallow areas of sand banks, shoals, bars and spits as surveyed at the time the chart was produced. Areas subject to change and exposure at low tide due to the mobility of sediments.

Sources and geoprocessing: historic and modern charts, sailing directions.

Expression in marine tier: sea surface, water column, sea floor, sub-sea floor.

9.1.3.8 Submerged rocks

Description: Area dominated by submerged rocks rising above the general level of the seabed, but do not break the surface of the water, which poses a risk for navigation.

Sources and geoprocessing: historic and modern charts, sailing directions.

Expression in marine tier: sea surface, water column, sea floor, sub-sea floor.

9.1.3.9 Water turbulence

Description: Areas of heavy swell and breaking waves exacerbated by prevailing winds.

Sources and geoprocessing: historic and modern charts, 'Navigational hazards project'.

Expression in marine tier: sea surface, water column.

9.1.3.10 Wreck cluster

Description: An area dominated by submerged wrecks representing a hazard or risk for navigation.

Sources and geoprocessing: historic and modern charts, NMR maritime record.

Expression in marine tier: sea floor.

9.1.4 MARITIME SAFETY

The Type Maritime Safety includes structures usually erected at important or dangerous points on or near the coast for the warning and guidance of mariners, but can also be erected inland for the guidance of travellers. Usual components include marine navigation aids such as areas of buoys, beacons and lights. It also encompasses a broad range of land-based navigation aids, some deliberately erected for that purpose, others simply adopted for navigational guidance; these include lighthouses, fog stations, landmarks (eg churches, beacons, chimneys, hills), daymarks, topmarks, distance marks and lights). Safety Services such as coastguard stations, lifeboat stations are also included.

For obvious reasons the majority of the features associated with this Type are typically found on or immediately adjacent to the coast though some may be sited well-inland. The entrance to estuaries and rivers, submerged hazards and foul areas are often demarcated by tracks of posts, buoys, lights, beacons, bells and topmarks. The sites of some navigation aids have a long history being continually represented on Admiralty charts and maps since their inception. Landward, numerous landmarks were often used to sight and survey and navigate from, often

providing the basis for maritime charts, triangulation and folios (hand drawn profiles of the coast with prominent features annotated).

A further aspect of maritime safety comprises the coastguard and lifeboat stations and lookouts dotted strategically along the coast, many former coastguard stations now operated as National Coastwatch Institution lookouts. Some areas of the sea itself are 'restricted navigation areas' and are in place to facilitate navigation into and out of areas whilst others are exclusion zones for safety reasons, for example around offshore oil or gas installations.

9.1.4.1 Daymarks

Description: Landward, numerous landmarks were often used to sight and survey and navigate from, often providing the basis for maritime charts, triangulation and folios showing the 'view from sea'. Include lighthouse towers, fog stations, impromptu landmarks such as churches, beacons, chimneys and prominent hills.

Sources and geoprocessing: OS maps, historic and modern charts. Identified as areas or as point data buffered appropriately (200m). Based on the interpretation of the HSC assessor.

Expression in marine tier: coastal.

9.1.4.2 Lighthouse

Description: A tower or structure, with a powerful light or lights at the top, usually erected at an important or dangerous point on or near the sea-coast for the warning and guidance of mariners, but can also be erected inland for the guidance of travellers (http://thesaurus.english-heritage.org.uk/).

Sources and geoprocessing: OS maps, historic and modern charts.

Expression in marine tier: coastal.

9.1.4.3 Buoyage

Description: Marine navigation aids such as areas of buoys, beacons and lights. The entrance to estuaries and rivers, submerged hazards and foul areas are often demarcated by tracks of posts, buoys, lights, beacons, bells and topmarks.

Sources and geoprocessing: historic and modern charts. Identified as areas or as point data buffered appropriately (200m).

Expression in marine tier: sea surface.

9.1.4.4 Safety area (offshore))

Description: Some areas of the sea itself are 'restricted navigation areas' and are in place to facilitate navigation in and out of areas whilst others are exclusion zones for safety reasons, for example around offshore oil or gas installations.

Sources and geoprocessing: UKHO, SeaZone Hydrospatial.

Expression in marine tier: sea surface.

9.1.4.5 Safety services

Description: Coastguard and lifeboat stations and NCI lookouts dotted strategically along the coast to monitor the coastline.

Sources and geoprocessing: OS maps, historic and modern charts. Identified as areas or as point data buffered appropriately (200m).

Expression in marine tier: coastal.

9.2 INDUSTRY

Industrial activity is or has been the dominant influence on the character of the seascape such as hydrocarbon fields, aggregate dredging. Informed primarily from SeaZone Hydrospatial and UKDEAL data.

9.2.1 EXTRACTIVE INDUSTRY (MINERALS)

Referring to industrial activity at sea that continuously disrupts and impacts on the marine environment (particularly the seabed) through time. Includes coastal mining and quarrying, aggregate dredging and spoil dumping grounds

This Type is usually an imposition onto other earlier Types, as extractive industries and their components are generally determined by the location of their object. Most mines, quarries and dredging works develop over some time and there are usually traces of earlier technologies, plant, dumps, scours etc, among the remains of the latest. In some types of site, particularly quarries, the earlier features may be partly devoured by later workings.

9.2.1.1 Aggregate dredging

Description: Sand and gravel removal through mining and quarrying of sand, gravel, clays, ceramic and refractory minerals, including the associated facilities required for washing, screening, and preparing the mined aggregates. The principal activity of this industry is the production of sand and gravel for use as aggregates in the construction of buildings and infrastructure (eg roads).

Sources and geoprocessing: SeaZone Hydrospatial and UKDEAL. Historic and modern charts, historic and modern OS maps.

Expression in marine tier: sub-sea floor, sea floor, coastal.

9.2.1.2 Dumping spoil ground

Description: Used for dumping or depositing loads of dredging spoil, drilling waste and cuttings, treated sewerage and other land waste.

Sources and geoprocessing: SeaZone Hydrospatial and UKDEAL. Historic and modern charts, historic and modern OS maps.

Expression in marine tier: sea floor, coastal.

9.2.1.3 Quarrying

Description: Open cast mining for stone and other minerals. Often coastal due to outcrops and ease of access and transport.

Sources and geoprocessing: historic and modern OS maps, HER and NMR records.

Expression in marine tier: coastal.

9.2.1.4 Mining

Description: Subterranean mining for stone and other minerals but excluding hydrocarbons which are covered by the 'Energy Industry' Type. Often coastal due to outcrops and ease of access and transport.

Sources and geoprocessing: historic and modern OS maps, HER and NMR records. Historic and modern charts.

Expression in marine tier: sub-sea floor, coastal.

9.2.2 ENERGY INDUSTRY

The Type Energy Industry includes Hydrocarbon Fields (oil and gas); associated installations, pipelines and refineries. Power stations of all fuels are also included as are renewable energy installations such as wind farms and wave hubs.

The output from the largest hydrocarbon producers - the UK and Norway - has peaked and entered a period of long term decline. Nevertheless there are still almost 500 platforms and 10,000 kilometres of rigid and flexible oil and gas pipelines running between offshore production wells and terminals on land, mostly found in the North Sea (DTI 2001).

9.2.2.1 Hydrocarbon field (gas))

Description: Offshore production area for reserves of natural gas. When organic-rich rock such as oil shale or coal is subjected to high pressure and temperature over an extended period of time, hydrocarbons form.

Sources and geoprocessing: SeaZone Hydrospatial, UKDeal.

Expression in marine tier: sub-sea floor, sea floor.

9.2.2.2 Hydrocarbon field (oil))

Description: Offshore production area for reserves of oil. When organic-rich rock such as oil shale or coal is subjected to high pressure and temperature over an extended period of time, hydrocarbons form.

Sources and geoprocessing: SeaZone Hydrospatial, UKDeal.

Expression in marine tier: sub-sea floor, sea floor.

9.2.2.3 Hydrocarbon installation

Description: An installation involved in the extraction of oil and natural gas. Associated structures include pipelines, platforms, tanker moorings, storage containers, warning signals and lights. Unauthorised navigation is prohibited within 500m of all such structures.

Sources and geoprocessing: SeaZone Hydrospatial, UKDeal.

Expression in marine tier: sub-sea floor, sea floor, water column, sea surface.

9.2.2.4 Hydrocarbon pipeline

Description: An installation involved in the transport of oil and natural gas.

Sources and geoprocessing: SeaZone Hydrospatial, UKDeal.

Expression in marine tier: sub-sea floor. sea floor.

9.2.2.5 Hydrocarbon refinery

Description: A building or structure that refines oil and gas, such as a gas works. An oil refinery converts petroleum crude oil into motor, aircraft and heating fuels. A gas refinery purifies and converts raw natural gas into residential, commercial and industrial fuel gas.

Sources and geoprocessing: historic and modern OS maps.

Expression in marine tier: coastal.

9.2.2.6 Power station

Description: A power station, fuelled by coal, gas or nuclear fusion, is an industrial facility for the generation of electricity. Includes associated infrastructure such as pipelines etc (eg. pipelines for cooling water discharges from nuclear stations).

Sources and geoprocessing: modern OS maps.

Expression in marine tier: coastal.

9.2.2.7 Renewable energy installation

Description: Installations built to generate energy from natural resources such as wind and water. Includes wind farms, wave hubs etc. Also their associated infrastructure: sea-floor anchoring and cabling to onshore distribution points.

Sources and geoprocessing: SeaZone Hydrospatial, modern charts.

Expression in marine tier: sub-sea floor, sea floor, water column, sea surface.

9.2.3 PROCESSING INDUSTRY

9.2.3.1 Chemical works

Description: An industrial complex involved in the production of chemicals (http://thesaurus.english-heritage.org.uk).

Sources and geoprocessing: historic and modern OS maps.

Expression in marine tier: coastal.

9.2.3.2 Production area

Description: General industrial area where materials are produced and/or processed.

Sources and geoprocessing: historic and modern OS maps.

Expression in marine tier: coastal.

9.2.3.3 Sewage works

Description: A group of buildings in which local sewage is filtered and purified in large rectangular or circular tanks (http://thesaurus.english-heritage.org.uk). Including associated outfalls, pipelines and diffusers.

Sources and geoprocessing: historic and modern OS maps, modern charts.

Expression in marine tier: coastal, sub-sea floor, sea floor.

9.2.3.4 Warehouse

Description: A building or part of a building used for the storage of goods or merchandise (http://thesaurus.english-heritage.org.uk).

Sources and geoprocessing: historic and modern OS maps.

Expression in marine tier: coastal.

9.2.4 SHIPPING INDUSTRY

Referring to any industrial sea-borne activity that does not have a continuous and incremental intrusive impact on the seabed such as commercial shipping.

9.2.4.1 Boat yard

Description: A place where boats are built and stored (http://thesaurus.english-heritage.org.uk).

Sources and geoprocessing: historic and modern OS maps, historic and modern charts.

Expression in marine tier: coastal.

9.2.4.2 Commercial shipping route/area

Description: Non intrusive offshore industry and area where ships travelling through are principally related to commerce or trade.

Sources and geoprocessing: historic and modern OS maps, historic and modern charts, shipping data.

Expression in marine tier: sea surface.

9.2.4.3 Ship yard

Description: A place where boats or ships are built or repaired (http://thesaurus.english-heritage.org.uk).

Sources and geoprocessing: historic and modern OS maps, historic and modern charts.

Expression in marine tier: coastal.

9.3 FISHERIES AND MARICULTURE

Activities associated with the business, occupation, or industry of harvesting or cultivating fish and shellfish from the sea or rivers and estuaries.

The fisheries represent the 'farming use of the sea' and more tends to be known about their practices rather than the exact locations of specific areas of activity. Some fishing practices will impact on physical remains more than others – the obvious distinction being between the more damaging sea-floor trawling methods and less damaging pelagic netting and long-lining methods. The material evidence left by trawling activities includes, most noticeably, the trawl scars on the seabed itself.

9.3.1 FISHERY

Description: An area where fish are naturally present (http://thesaurus.english-heritage.org.uk). Areas of the sea exploited by fishermen using specific methods and techniques targeting particular species. Includes demersal and pelagic fisheries as well as inshore shellfish dredging and fish farming.

Sources and geoprocessing: historic and modern charts, Cefas, JNCC, bibliographic references.

Expression in marine tier: sea surface, water column, sea floor.

9.3.1.1 Bait digging area

Description: Areas used to acquire bait for fishing including sandy and rocky foreshores.

Sources and geoprocessing: bibliographic references.

Expression in marine tier: coastal, inter-tidal.

9.3.1.2 Demersal trawling

Description: Fishing methods that involve trawling the bottom of the sea and often result in the disturbance of the sea floor itself. Most widely used examples are bottom (also referred to as otter trawls) and beam trawling.

Bottom Trawling is a widely used method where trawl nets are funnel shaped, with sides extended forward to form wings to guide fish into the funnel. The net is held open horizontally and floats attached to the upper edge of the net mouth provide lift. Weights distributed along the lower edge (ground rope) ensures good contact with the sea bottom and disturbs the fish for catching.

Beam-trawling, taking its name from the beam of wood or metal keeping the net mouth open. The beam itself runs over the sea-bed on stirrup-shaped runners which have the effect of keeping the beam itself a few feet above the sea floor and allowing the lower part of the mouth of the net to funnel and billow out behind it. When the trawl is in motion, the fish disturbed by ground ropes are caught in the net as it passes. However the trawl also indiscriminately bags anything else in the way as it swept by. This fishing method is widely used by fishermen for 'flat fish' species.

Sources and geoprocessing: historic charts, bibliographic references, Cefas, regional Sea Fisheries Committees, JNCC.

Expression in marine tier: sea floor, water column, sea surface.

9.3.1.3 Cockling area

Description: An area where bivalve molluscs are exploited.

Sources and geoprocessing: historic and modern OS maps and charts.

Expression in marine tier: sea floor.

9.3.1.4 Set netting

Description: Netting is predominantly carried out in two ways, using set nets and seine nets. Set nets are walls of netting up to 3m high and 70m long used singly or as a series joined end to end moored on the sea bottom. Fish are caught either by gilling or entanglement. As with longlining (9.6.1.5 below), netting is confined for the most part to inshore vessels.

Sources and geoprocessing: historic charts, bibliographic references.

Expression in marine tier: sea floor, water column, sea surface.

9.3.1.5 Longlining

Description: A demersal fishing method, in long-line fishing a number of strings, each consisting of a main line with baited hooks on branch lines are connected end to end and placed on or just off the seabed with an anchor and marker buoy at each end. Vessels engaged in this fishery are typically small inshore vessels, 10m or less, generally operating on grounds near their home port.

Sources and geoprocessing: historic charts, bibliographic references.

Expression in marine tier: sea floor, water column, sea surface.

9.3.1.6 Seine Netting

Description: Seining is carried out for demersal and pelagic species. Fish are 'herded' into the path of the net as the gear is hauled. Seining for pelagic species uses purse seiners that capture shoaling fish that aggregate into large, dense concentrations near the surface by surrounding the shoal with a deep curtain of netting supported at the surface by floats. The net is then pursed under the shoal by heaving on a wire that runs through rings attached to the bottom edge of the net.

Sources and geoprocessing: historic charts, bibliographic references, Cefas

Expression in marine tier: water column, sea floor, sea surface

9.3.1.7 Pelagic trawling

Description: Mid-water or pelagic trawls are towed at the appropriate level in the water column to intercept shoaling fish such as mackerel, herring or sprats.

Sources and geoprocessing: historic charts, bibliographic references, Cefas.

Expression in marine tier: water column, sea surface.

9.3.1.8 Potting area

Description: Trunks and pots are small traps baited with fresh or salted bait and set on the sea bed in coastal waters to catch lobsters, crabs etc. The frames, constructed from wood, metal or plastic, are netting covered with an entrance through one or both sides, or through the ends. A laced slit in the netting allows baiting and removal of catch. The fishing ground was rarely more than a mile offshore and almost invariably on a rocky bottom.

Sources and geoprocessing: historic charts, bibliographic references, Cefas, regional Sea Fisheries Committees, JNCC.

Expression in marine tier: sea floor, water column, sea surface.

9.3.1.9 Shellfish dredging

Description: Shellfish trawls differ very little from demersal trawl gear apart from being generally more lightly rigged. Scallop dredges consist of a ruggedly constructed triangular steel frame and tooth-bearing bar, behind which a mat of linked steel rings is secured. A heavy netting cover joins the sides and back of this mat to form the bag in which the catch is retained. Scallops, which usually lie in sand or fine gravel, are raked out by the teeth and swept into the bag.

Sources and geoprocessing: historic and modern charts, bibliographic references, Cefas, regional Sea Fisheries Committees, JNCC.

Expression in marine tier: sea floor, water column, sea surface.

9.3.2 MARICULTURE

Mariculture is the cultivation of marine species within coastal waters and includes fish farming, oyster beds, mussel scalps and cockling where the beds are 'seeded' and 'cultivated' with young mussels/oysters which are managed over several seasons until they are big enough to

harvest. Fish traps are more related to a form of fishing but are included here as their locational expressions are similar to areas of mariculture.

9.3.2.1 Shellfish and fish farming

Description: A farm with a pond, river, lake or tanks where fish are kept and bred for commercial purposes (http://thesaurus.english-heritage.org.uk). Oyster beds, mussel scalps and cockling where the beds are 'seeded' and 'cultivated' with young mussels/oysters which are managed over several seasons until they are big enough to harvest.

Sources and geoprocessing: modern OS maps and charts.

Expression in marine tier: sea floor, water column, sea surface.

9.3.2.2 Fish market

Description: A market where fish is sold (http://thesaurus.english-heritage.org.uk).

Sources and geoprocessing: modern OS maps.

Expression in marine tier: coastal.

9.3.2.3 Fish warehouse

Description: A large building where fish are stored before sale (http://thesaurus.english-heritage.org.uk).

Sources and geoprocessing: modern OS maps.

Expression in marine tier: coastal.

9.3.2.4 Fish trap

Description: A device for catching fish, sometimes a fence or enclosure of stakes made in a river, harbour, etc (http://thesaurus.english-heritage.org.uk).

Sources and geoprocessing: modern OS maps.

Expression in marine tier: inter-tidal, inshore marine, coastal.

9.4 PORTS, DOCKS AND HARBOURS

Related to functioning of ports, docks and harbours such as dock and port related industry. Port related industry: Buildings or structures that combine dock, harbour and terminal facilities at the interface between land and water transportation systems. These areas also involve receiving ships for purposes of shelter from storms, loading and unloading and/or building, maintaining and repairing ships.

A port is a facility for receiving ships and transferring cargo to and from them. Some ports have facilities particularly suitable for landing and distributing fish. Often processing facilities will be located very close by. Harbour pilots, barges and tugboats are frequently used to safely manoeuvre large ships in tight quarters as they approach and leave ports. The presence of deep water in channels or berths, the provision of protection from the wind, waves and storm surges and access to intermodal transportation such as trains or trucks are critical to the functioning of ports.

9.4.1 PORTS,DOCKS AND HARBOURS

See above.

9.4.1.1 Dockyard

Description: An enclosure in which ships are built and repaired, and all sorts of ships' stores are brought together (http://thesaurus.english-heritage.org.uk).

Sources and geoprocessing: historic and modern OS maps, historic and modern charts.

Expression in marine tier: coastal.

9.4.1.2 Landing point

Description: A place where vessels can land passengers and goods (http://thesaurus.english-heritage.org.uk).

Sources and geoprocessing: historic and modern OS maps, historic and modern charts.

Expression in marine tier: coastal.

9.4.1.3 Pier

Description: A structure of iron or wood, open below, running out into the sea and used as a promenade and landing stage (http://thesaurus.english-heritage.org.uk).

Sources and geoprocessing: historic and modern OS maps, historic and modern charts.

Expression in marine tier: coastal.

9.4.1.4 Port

Description: A settlement area that combines a harbour and terminal facilities at the interface between land and water transportation systems (http://thesaurus.english-heritage.org.uk).

Sources and geoprocessing: historic and modern OS maps, historic and modern charts.

Expression in marine tier: coastal.

9.4.1.5 Quay

Description: An artificial paved bank or solid landing place built parallel to, or projecting out from, the shoreline to serve in the loading and unloading of vessels (http://thesaurus.english-heritage.org.uk).

Sources and geoprocessing: historic and modern OS maps, historic and modern charts.

Expression in marine tier: coastal.

9.4.1.6 Terminal building

Description: A building within a transport terminal, often associated with the registration and clearing of incoming and outgoing passengers or freight (http://thesaurus.english-heritage.org.uk).

Sources and geoprocessing: historic and modern OS maps, historic and modern charts.

Expression in marine tier: coastal.

9.4.1.7 Warehouse

Description: A building or part of a building used for the storage of goods or merchandise. Use more specific type where known (http://thesaurus.english-heritage.org.uk).

Sources and geoprocessing: historic and modern OS maps, historic and modern charts.

Expression in marine tier: coastal.

9.4.2 SEA DEFENCES

9.4.2.1 Sea defences

Description: A sea defence can be defined as a non-military structure protecting the coast from the destructive and erosive forces of sea and from flooding

Sources and geoprocessing: historic and modern OS maps, historic and modern charts.

Expression in marine tier: coastal.

9.4.2.2 Flood defence

Description: Manmade constructions used to prevent water flooding the surrounding area. Often taking the form of a bank or wall but may be more elaborate (http://thesaurus.english-heritage.org.uk).

Sources and geoprocessing: historic and modern OS maps, historic and modern charts.

Expression in marine tier: coastal.

9.5 COMMUNICATIONS

9.5.1 TRANSPORT

Areas characterised as important communication routes linking areas of industry, recreation, settlement, etc. Only major and extensive areas of this type are mapped.

9.5.1.1 Canal

Description: An artificial navigable waterway used for the transportation of goods. Nowadays also used for recreational purposes (http://thesaurus.english-heritage.org.uk).

Sources and geoprocessing: historic and modern OS maps, historic and modern charts.

Expression in marine tier: coastal.

9.5.1.2 Railway/tramway

Description: Railway - A line or track consisting of iron or steel rails, on which passenger carriages or goods wagons are moved, usually by a locomotive engine. Tramway - A track inlaid into a surface, on which tram cars run for the conveyance of passengers and/or goods or raw materials (http://thesaurus.english-heritage.org.uk).

Sources and geoprocessing: historic and modern OS maps, historic and modern charts.

Expression in marine tier: coastal.

9.5.1.3 Road

Description: A way between different places, used by horses, travellers on foot and vehicles (http://thesaurus.english-heritage.org.uk).

Sources and geoprocessing: historic and modern OS maps, historic and modern charts.

Expression in marine tier: coastal.

9.5.2 TELECOMMUNICATIONS

Historic and modern telegraph stations and associated cables, civic listening devices. Modern cables also transfer mass media such as the internet, telephone systems etc.

9.5.2.1 Submarine cable

Description: Cables or pipes used to transmit or communicate by submarine telegraph.

Sources and geoprocessing: historic and modern OS maps, historic and modern charts.

Expression in marine tier: coastal, sub-sea floor, sea floor.

9.6 MILITARY

Used by or connected with the army, navy or air force for defence, operational bases, or for supply and provisioning. Includes firing ranges, practice areas, coastal batteries, ordnance factories and dumps, naval dockyards etc.

9.6.1 MILITARY DEFENCES

Physical built defences, commonly grouped as parts of larger systems of defences and usually found along the coastline to prevent invasion from sea. Includes anti-landing defences, decoy sites and other fortifications. During WWI the Defence of the Realm Act 1914 enabled vast tracts of land to be requisitioned for camps, airfields, munitions production, and storage. At the outbreak of the Second World War in 1939 a similar act was passed, the Emergency Powers (Defence) Act 1939 and coastal defences were greatly extended.

9.6.1.1 Military coastal defences

Description: Buildings, sites and structures associated with the defence of the coastline from invasion (http://thesaurus.english-heritage.org.uk/).

Sources and geoprocessing: historic and modern OS maps, historic and modern charts.

Expression in marine tier: coastal.

9.6.1.2 Fortification

Description: A usually permanent defensive work. Use specific type where known (http://thesaurus.english-heritage.org.uk/).

Sources and geoprocessing: historic and modern OS maps, historic and modern charts.

Expression in marine tier: coastal.

9.6.2 MILITARY FACILITY

Area used by a variety of military functions, buildings and structures. May include, or be demarcated by, physical structures or may simply be an area of designated status.

9.6.2.1 Barracks

Description: A building used to house members of the armed forces (http://thesaurus.english-heritage.org.uk/).

Sources and geoprocessing: historic and modern OS maps

Expression in marine tier: coastal.

9.6.2.2 Firing range

Description: A piece of ground over which small arms or large artillery may be fired at targets (http://thesaurus.english-heritage.org.uk/).

Sources and geoprocessing: historic and modern OS maps

Expression in marine tier: coastal.

9.6.2.3 Military airfield

Description: A landing and taking-off area for military aircraft. Often includes ancillary structures and buildings for the maintenance and storage of aircraft, etc (http://thesaurus.english-heritage.org.uk/).

Sources and geoprocessing: historic and modern OS maps

Expression in marine tier: coastal.

9.6.2.4 Military base

Description: A building or group of buildings, often surrounded by a system of fortifications, used as a residential and training site by members of an armed force (http://thesaurus.english-heritage.org.uk/).

Sources and geoprocessing: historic and modern OS maps.

Expression in marine tier: coastal.

9.6.2.5 Ordnance dumping

Description: Area of military ordnance dumping usually found on the sea floor.

Sources and geoprocessing: historic and modern charts.

Expression in marine tier: sea floor.

9.6.2.6 Military practice area

Description: Area used by navy, air force and army for training purposes and exercises.

Sources and geoprocessing: historic and modern charts.

Expression in marine tier: water column, sea surface.

9.6.2.7 Naval dockyard

Description: A naval base that builds, repairs, docks or converts warships, and is manned by civilian engineers and workers and administered by engineer duty officers (http://thesaurus.english-heritage.org.uk/).

Sources and geoprocessing: historic and modern OS maps, historic and modern charts.

Expression in marine tier: coastal.

9.7 SETTLEMENT

9.7.1 SETTLEMENT

Description: Nucleated areas of built environment where people live, including historic and modern towns, coastal villages and hamlets. Settlement development can be based on analysis of historic OS maps which enable the HSC assessor to identify 'historic cores' etc

Sources and geoprocessing: historic and modern OS maps, historic and modern charts, HLC.

Expression in marine tier: coastal.

9.7.1.1 Hamlet

Description: Small settlement with no ecclesiastical or lay administrative function (http://thesaurus.english-heritage.org.uk/).

Sources and geoprocessing: historic and modern OS maps.

Expression in marine tier: coastal.

9.7.1.2 Village

Description: A collection of dwelling-houses and other buildings, usually larger than a hamlet but smaller than a town with a simpler organisation and administration than the latter (http://thesaurus.english-heritage.org.uk/).

Sources and geoprocessing: historic and modern OS map, historic and modern charts.

Expression in marine tier: coastal.

9.7.1.3 Town

Description: An assemblage of public and private buildings, larger than a village and having more complete and independent local government (http://thesaurus.english-heritage.org.uk/).

Sources and geoprocessing: historic and modern OS map, historic and modern charts.

Expression in marine tier: coastal.

9.8 RECREATION

Areas where human activities are undertaken for pleasure or amusement. Tourism is an important source of income and employment for many coastal regions. The coastline attracts many people in pursuit of open-air leisure activities including public parks, holiday parks, sports grounds, playing fields, sailing and boating areas, marinas, dive sites and other seaside entertainment. Many places on the coast have been visited historically for such purposes.

9.8.1 RECREATION

9.8.1.1 Aquarium

Description: A zoo building containing artificial ponds or tanks in which aquatic plants and animals are kept alive for purposes of observation and study (http://thesaurus.english-heritage.org.uk/).

Sources and geoprocessing: historic and modern OS map.

Expression in marine tier: coastal.

9.8.1.2 Bathing/swimming area

Description: Area used by people to bathe and swim.

Sources and geoprocessing: historic and modern OS maps.

Expression in marine tier: coastal, inter-tidal.

9.8.1.3 Dive site

Description: Area used by recreational divers, sometimes concentrated on wreck sites and other areas of natural environment or historic environment interest.

Sources and geoprocessing: historic and modern charts, bibliographic references.

Expression in marine tier: inshore marine, sea floor, water column.

9.8.1.4 Golf course

Description: A prepared area of ground used to play the game of golf on (http://thesaurus.english-heritage.org.uk/).

Sources and geoprocessing: historic and modern OS maps.

Expression in marine tier: coastal.

9.8.1.5 Holiday park

Description: Recreational holiday parks, caravan parks, chalets etc used by visitors to the coast.

Sources and geoprocessing: historic and modern OS maps.

Expression in marine tier: coastal.

9.8.1.6 Leisure fishing area

Description: Area used for recreational fishing and angling.

Sources and geoprocessing:

Expression in marine tier: coastal, inshore marine, sea surface

9.8.1.7 Leisure sailing area

Description: Area used for recreational sailing, yachting, and other small craft pursuits.

Sources and geoprocessing: modern OS maps, modern charts.

Expression in marine tier: sea surface.

9.8.1.8 Marina

Description: A dock or basin, often inland, used for mooring yachts and other small pleasure craft (http://thesaurus.english-heritage.org.uk/).

Sources and geoprocessing: modern OS maps, modern charts.

Expression in marine tier: coastal, sea surface.

9.8.1.9 Parks and gardens

Description: Public parks and gardens for the use of the public for entertainment and relaxation.

Sources and geoprocessing: historic and modern OS maps.

Expression in marine tier: coastal.

9.8.1.10 Seaside entertainment

Description: Arcades, fun fairs etc used for public entertainment and relaxation.

Sources and geoprocessing: historic and modern OS maps.

Expression in marine tier: coastal.

9.8.1.11 Sports site

Description: Buildings, areas and structures associated with sporting activities including watersports.

Sources and geoprocessing: historic and modern OS maps, historic and modern charts.

Expression in marine tier: coastal, sea surface.

9.9 PALAEOLANDSCAPE

The Type Palaeolandscape includes ancient landscapes and palaeo-environmental deposits now submerged beneath the sea, buried beneath post-transgression sediments or buried deep in the muds and silts of estuaries and rivers; it also includes submerged forests exposed in the inter-tidal zone.

9.9.1.1 Palaeochannel

Description: The course or channel of a river or stream preserved as a geological feature (http://thesaurus.english-heritage.org.uk/).

Sources and geoprocessing: bibliographic references.

Expression in marine tier: sub-sea floor, previous HSC.

9.9.1.2 Submarine forest

Description: tracts of submerged land with evidence for forests, woodland and other vegetation cover. Submerged forests are strong indicators of submerged early land surfaces and contain important information relating to past human activity and habitats.

Sources and geoprocessing: HER, NMR, bibliographic references, historic and modern OS maps, historic and modern charts.

Expression in marine tier: coastal, inter-tidal, sub-sea floor, previous HSC.

9.9.1.3 Peat deposit

Description: Peat deposits are exposures of unconsolidated semi-carbonised plant remains formed in freshwater-saturated environments. Peat deposits contain important information relating to past human activity and habitats.

Sources and geoprocessing: HER, NMR, bibliographic references, historic and modern OS maps, historic and modern charts.

Expression in marine tier: coastal, inter-tidal, sub-sea floor, previous HSC.

9.10 SEMI-NATURAL ENVIRONMENT

Landscapes and seascapes whose character is identified as being semi-natural, the result of the interaction of natural and cultural processes, whether in the past or present. See section 3.1.4.7. The Sub-types and descriptions given below may be subject to future change and refinement as further evidence for cultural processes within them become apparent from detailed research and survey.

9.10.1 CLIFF

Description: A high steep face of a rock or other geological deposit; largely unvegetated. In coastal areas typical components of this type include military defences and structures and maritime safety aids, and industrial mineral works.

Sources and geoprocessing: historic and modern OS maps, HER and NMR.

Expression in marine tier: coastal.

9.10.2DUNES

Description: A hill or ridge of unconsolidated wind-blown sand. In coastal areas typical components of this type include military defences and structures, recreation facilities and many other types of buildings and features, along with old land surfaces of prehistoric and later date buried within their fabric.

Sources and geoprocessing: historic and modern OS maps.

Expression in marine tier: coastal.

9.10.3FORESHORE

The part of the shore between the high-water mark and low-water mark. Foreshore comprises the sandy, silty or rocky areas running up from low-water mark and can contain important archaeological remains either at its surface (eg quays, breakwaters, industrial workings) or buried beneath it (eg old land surfaces, overwhelmed quays). The present extents of foreshores and their constituent Sub-types have often been considerably influenced by man's activities, whether for example by the erection of groynes to retain sand along certain portions (and starve it from others) or by the impact of fixed sea walls resulting in coastal squeeze on salt-marshes unable to expand inland in response to rising sea levels.

What are now often desolate foreshores were once thronged by seaweed gatherers, bait gatherers, wildfowlers, salt-makers, unloading cargo ships, miners, kelp burners and fossil collectors. There would have also been numerous fishermen drying their nets, people gathering driftwood and other flotsam and jetsam washed ashore.

9.10.3.1 Sandy foreshore

Description: The part of the shore between the high-water mark and low-water mark comprising fine sediments. Typical historical components of this type are often ephemeral yet include kelp harvesting areas, shellfish and bait gathering activities, alongside more obvious features such as sewage outfalls and pipelines, sea defences and military defences, landing places, potential for buried palaeo-environmental deposits and recreational areas. The sand itself has been, and in some areas still is, widely quarried for use in building construction.

Sources and geoprocessing: historic and modern OS maps, historic and modern charts.

Expression in marine tier: coastal, inter-tidal.

9.10.3.2 Rocky foreshore

Description: The part of the shore between the high-water mark and low-water mark comprising rocky outcrops. Typical components of this type include shellfish and bait gathering activities, industrial extractive remains, sewage outfalls and pipelines, sea defences and military defences, landing places and recreational areas.

Sources and geoprocessing: historic and modern OS maps, historic and modern charts.

Expression in marine tier: coastal, inter-tidal.

9.10.4 WOODLAND

Although woodlands are not an obviously maritime type, they may be included where they come down to the water's edge in tidal rivers, and on the coast where they have been established on the cliffs and former coastal rough ground, often managed to minimise erosion. They were important places, managed to provide timber and other materials for boat building and other activities carried out by local coastal communities.

9.10.4.1 Ancient woodland

Description: Land that has had continuous woodland cover since at least 1600 AD and may be: Ancient semi-natural woodland - ancient woodland sites that have retained the native tree and shrub cover that has not been planted, although it may have been managed by coppicing or felling and allowed to regenerate naturally. Ancient replanted woodland - ancient woodland sites where the original native tree cover has been felled and replaced by planting, usually with conifers and usually this during the 20th century (http://www.english-nature.org.uk/pubs/gis/tech_aw.htm).

Sources and geoprocessing: historic and modern OS maps, environmental data.

Expression in marine tier: coastal.

9.10.4.2 Plantation

Description: Recent plantations, often cyclically-replanted conifer woods and forests created to supply industrial and domestic demands for wood.

Sources and geoprocessing: historic and modern OS maps.

Expression in marine tier: coastal.

9.10.5COASTAL ROUGH GROUND

9.10.5.1 Rough ground

Description: The Type Coastal Rough Ground includes the following sub-types: rough ground, scrub and heathland. Typical components include military defences, prehistoric and historic sites, finds and field systems; maritime safety services, navigation aids, industrial extraction and processing sites and recreational facilities. Historically such areas may have been used widely as common grazing.

The semi-natural habitats here are, to a considerable extent, the product of thousands of years of human activity, particularly summer grazing and extractive industry. Long distance coastal footpaths often pass through the Type.

Sources and geoprocessing: historic and modern OS maps, environmental data.

Expression in marine tier: coastal.

9.10.5.2 Salt marsh

Description: Salt marshes are common along areas of coastal rough ground. They are a type of marsh that is a transitional zone between land and salty or brackish water (eg, sloughs, bays, estuaries). It is dominated by halophytic (salt tolerant) herbaceous plants. Historically, salt marshes have been used for grazing and wildfowling, or have sometimes been treated as 'wastelands', along with other wetlands. The tide is the dominating characteristic of a salt marsh. The salinity of the tide defines the plants and animals that can survive in the marsh area. They usually are developed on a sinking coastline, originating as mud flats in the shallow water of sheltered bays, lagoons, and estuaries, or behind sandbars. In the present landscape their area may be restricted by 'coastal squeeze', unable to expand inland due to fixed sea defences while losing extent to an encroaching sea.

Sources and geoprocessing: historic and modern OS maps, environmental data.

Expression in marine tier: coastal.

9.10.5.3 Wetland

Description: A lowland area, such as a marsh or swamp, that is saturated with moisture, often regarded as a natural habitat for wildlife.

Sources and geoprocessing: historic and modern OS maps, environmental data.

Expression in marine tier: coastal.

9.10.5.4 SAND AND MUDFLATS

9.10.5.5 Sandflats

Description: A sandy tidal flat barren of vegetation.

Sources and geoprocessing: historic and modern OS maps, environmental data.

Expression in marine tier: coastal, inter-tidal.

9.10.5.6 Mudflats

Description: An expanse of mud or muddy sediment in the inter-tidal zone predominantly composed of clay, silt and to a lesser extent very fine sand (www.ukmarines.org.uk).

Sources and geoprocessing: historic and modern OS maps, environmental data.

Expression in marine tier: coastal, inter-tidal.

9.10.6 WATER

9.10.6.1 Lake, pond

Description: An inland body of fresh water or salt water.

Sources and geoprocessing: historic and modern OS maps, environmental data.

Expression in marine tier: coastal.

9.10.6.2 Lagoon

Description: A shallow bay totally or partially enclosed by a sand bar, spit or reef running across the entrance.

Sources and geoprocessing: historic and modern OS maps, environmental data.

Expression in marine tier: coastal.

9.10.6.3 Reservoir

Description: A large natural or artificial body of water sometimes covered, used to collect and store water for a particular function (http://thesaurus.english-heritage.org.uk).

Sources and geoprocessing: historic and modern OS maps, environmental data.

Expression in marine tier: coastal.

9.10.6.4 Watercourse

Description: A channel for water.

Sources and geoprocessing: historic and modern OS maps, environmental data.

Expression in marine tier: coastal.

9.10.7MARINE FEATURES

9.10.7.1 Coarse sediment plains

Description: Extensive areas of seabed containing predominantly different grades of pebbles, rocks, boulders etc with lower sand and very low silt and clay contents. The predominant archaeological interest is likely to be isolated wrecks, and as yet unconfirmed potential for submerged landscapes to be preserved beneath later Holocene deposits. Also spawning grounds for some commercial fish species.

Sources and geoprocessing: BGS.

Expression in marine tier: sea floor, sub-sea floor.

9.10.7.2 Fine sediment plains

Description: Large areas of seabed containing predominantly different grades of sand and very low silt and clay content. The predominant archaeological interest is likely to be isolated wrecks and as yet unconfirmed potential for submerged landscapes to be preserved beneath later Holocene deposits. Also spawning grounds for some commercial fish species.

Sources and geoprocessing: BGS.

Expression in marine tier: sea floor, sub-sea floor.

9.10.7.3 Sand banks with sand waves

Description: A ridge of sand that is partially or totally submerged and may pose a hazard to shipping. Often with extensive wavelike structures formed by rapidly moving currents of water on their surface. The predominant archaeological interest is likely to be isolated wrecks and as yet unconfirmed potential for submerged landscapes to be preserved beneath later Holocene deposits. Also spawning grounds for some commercial fish species.

Sources and geoprocessing: historic and modern charts.

Expression in marine tier: sea floor, sub-sea floor.

9.10.7.4 Reclaimed land

Description: land reclaimed from the sea, wetlands etc.
Sources and geoprocessing: historic and modern OS maps.

Expression in marine tier: coastal.

APPENDIX 2: PILOT PROJECT HSC TERMINOLOGY COMPARISON

The following section sets out the character type lists (Broad Character, Character, sub-character TYPE levels) used by the pilot projects. From this cross-comparison a finalised character type lists was created (see Appendix 1).

NAVIGATION

Liverpool HSC Broad Type	Liverpool HSC type	Liverpool HSC subtype	Solent HSC broad type	Solent HSC type	Solent HSC subtype	Clacton-Southwold HSC Broad Type	Clacton-Southwold HSC Type	Clacton-Southwold HSC subType	Withernsea-Skegness HSC Broad Type	Withernsea-Skegness HSC Type	Withernsea-Skegness HSC subtype	Scarborough-Hartlepool HSC Broad Type	Scarborough-Hartlepool HSC Type	Scarborough-Hartlepool HSC subtype
Navigation	Navigation feature	Active historic channel	Navigation	Navigation feature	Active historical channel	NAVIGATION	Navigation feature		Navigation	Navigation feature	Active historic channel	Navigation	Navigation Channel	Active Sea Channel
		Active modern channel			Active modern channel			Channel			Active historic anchorage			Active Navigable River Channel
		Disused buried historical channel			Disused buried historical channel			Channel (disused, buried)			Disused historic channel			Disused Sea Channel
		Disused historical channel			Disused historical channel			Channel (disused)			Traffic control			Disused Navigable River Channel
					Bridge						Modern channel			
											Modern dredged channel			Dredged Area/Channel
											Deep water route			
											Modern anchorage			
											Modern deep water anchorage			
											Disused historic quarantine area			
											Spoil ground			
	Navigation activity	Disused historical anchorage		Navigation activity	Disused historical anchorage		Navigation activity			Jurisdiction area			Navigation Area/Route	Navigation Route
		Ferry			Ferry			Ferry route						Ferry route
					Cable ferry									
		Historical anchorage			Historical anchorage			Anchorage (disused)						
					Modern anchorage			Anchorage						Anchorage Area
		Historical anchorage in			Historical anchorage in									

		active historical channel			active historical channel									
		Historical anchorage in active modern channel			Historical anchorage in active modern channel									
		Historical anchorage in disused buried channel			Historical anchorage in disused buried channel									
		Historical canal			Historical canal			Canal			Exclusive economic zone			Harbour area
		Historical port qurantine area			Historical port qurantine area						12 nautical mile territorial sea area			Administration and Regulation
		Waterway			Waterway						6 nautical mile fishery zone			Harbour Administration Area
					Restricted area						3 nautical mile territorial sea area			Restricted navigation area
								Maritime safety installation			Environmental protection limit, normal baseline			
								Safety area (offshore)			Environmental protection limit, low water baseline			
								Shipping lane						Shipping Lane
	Navigational hazard	Historical drying area		Navigational hazard			Navigation hazard			Coastal hazard	Historic drying area			
		Maritime debris												
		Modern drying area						Drying area			Modern drying area			
		Shipwreck cluster								Seabed hazard	Knoll			
		Rocky outcrop									Spit			
					Submerged rock			Submerged rocks			Overfalls		Maritime Safety	Navigation Aids (Sea)
														Navigation Aids (Land)
					wreck						Coastal wreck cluster, wreck cluster		Navigation Hazard	Wreck Cluster, Dangerous Wreck (cluster)
					Obstruction									Obstruction
					Sandbanks						Sands, Ridge, Bank, Ridge and bank			

					Caution area			Caution area						Caution Area
					Cliffs						Shoal, Flats		Maritime Safety	Safety Services
								Water Turbulence						Tidal
								Restricted area (unspecified)						

COASTAL INFRASTRUCTURE

Liverpool HSC Broad Type	Liverpool HSC type	Liverpool HSC subtype	Solent HSC broad type	Solent HSC type	Solent HSC subtype	Clacton-Southwold HSC Broad Type	Clacton-Southwold HSC Type	Clacton-Southwold HSC subType	Withernsea-Skegness HSC Broad Type	Withernsea-Skegness HSC Type	Withernsea-Skegness HSC subtype	Scarborough-Hartlepool HSC Broad Type	Scarborough-Hartlepool HSC Type	Scarborough-Hartlepool HSC subtype
	Ports, docks and harbours	Boatbuilding yard		Ports, docks and harbours	Boatbuilding yard		Ports, docks & harbours	Ship/boatbuilders yard	Coastal industry	Docks ports and terminals	Modern cargo dock	Coastal Infrastructure	Port	Administration and Regulation
		Dock and port related industry			Dock and port related industry			Port-related industry, Port-related industry (disused)			Historic cargo dock			Landing Place
		Shipbuilding yard			Shipbuilding yard			Shipbreakers yard			Historic fish dock			Pier
			Engineering	Coastal defence	Coastal defence			Quarantine area			Gas terminal and works			Port Area
					Sea wall			Administrative region			Oil terminal and works			Quay
					Groyne									Warehouses/Storage Area
				Harbour Defence	Breakwater									
													Sea Defences	Breakwater

FISHERIES AND MARICULTURE

Liverpool HSC Broad Type	Liverpool HSC type	Liverpool HSC subtype	Solent HSC broad type	Solent HSC type	Solent HSC subtype	Clacton-Southwold HSC Broad Type	Clacton-Southwold HSC Type	Clacton-Southwold HSC subType	Withernsea-Skegness HSC Broad Type	Withernsea-Skegness HSC Type	Withernsea-Skegness HSC subtype	Scarborough-Hartlepool HSC Broad Type	Scarborough-Hartlepool HSC Type	Scarborough-Hartlepool HSC subtype
	Fisheries and mariculture	Cockling area		Fisheries and mariculture		Fisheries and Mari-culture	Coastal industry	Coastal fisheries	Generic coastal fishing area	Fishing and Mariculture	Fishery	Seining		
		Historic fisheries			Historic fisheries						Generic coastal fishery			Netting and Lining
		Modern fisheries			Modern fisheries			Fisheries			Sole trawling area			Shellfishing

								Fish farming			Whitefish longlining			Beam Trawling
								Fisheries (shellfish)			Crab and lobster potting			Hazardous Fishing Ground
											Salmon and sea trout fishing		Mariculture	
											Eel fishing		Fish Processing	Fish Market
										Coastal mariculture	Active licensed shellfish beds			Storage Sheds
											Inactive licensed shellfish beds			
											Bait digging area			
											Samphire picking			
									Offshore industry	Offshore fisheries	Crab fishery			
											Historic fishing ground			
											Restricted fishing area			
											Offshore fishing area			
										Offshore mariculture	Lemon sole nursery area			
											Sprat nursery area			
											Plaice nursery area			
											Cod nursery area			
											Sandeel nursery area			
											Whiting nursery area			
											Lemon sole spawning area - April to September			
											Sprat spawning area - May to August			
											Herring spawning area - August to October			
											Sole spawning area - March to May			
											Sandeel spawning area November to February			

INDUSTRY

Liverpool HSC Broad Type	Liverpool HSC type	Liverpool HSC subtype	Solent HSC broad type	Solent HSC type	Solent HSC subtype	Clacton-Southwold HSC Broad Type	Clacton-Southwold HSC Type	Clacton-Southwold HSC subType	Withernsea-Skegness HSC Broad Type	Withernsea-Skegness HSC Type	Withernsea-Skegness HSC subtype	Scarborough-Hartlepool HSC Broad Type	Scarborough-Hartlepool HSC Type	Scarborough-Hartlepool HSC subtype
Industry	Intrusive offshore activity	Aggregate dredging	Industry	Intrusive offshore activity	Aggregate dredging	INDUSTRY	Intrusive offshore industry	Dredging (aggregates)	Offshore industry	Aggregate	Licensed aggregate dredging area	Industry	Extractive Industry (Hydrocarbon)	Hydrocarbon Field (Gas)
		Capital dredging			Capital dredging						Active aggregate dredging zone			Hydrocarbon Field (Oil)
		Dumping ground			Dumping ground			Dumping ground (industrial)			License application aggregate dredging area		Extractive Industry (Minerals)	Alum Works
		Gas installation								Wind farm	Licensed wind farm area			Ironstone Works
		Maintenance dredging			Maintenance dredging			Dredging (unspecified)			Active wind farm area			Jet Works
		Oil and gas installation								Oil industry	Oil field			Salt & Potash Works
		Oil terminal			Oil terminal					Gas industry	Gas field			Quarries
		Submarine cable									Offshore production area		Energy Industry	Gas Refinery
					oil and gas field			Mineral extraction (oil/gas)			Template			Oil Refinery
					pipeline						Subsea structure			Power Station
								Mineral extraction (other, offshore)			Wellhead			Renewable Energy Installation
								Energy installation (offshore)			Platform		Processing Industry	Production Area
											Manifold			Sewage and Water Works
											Proposed gas pipeline		Shipping Industry	Boat Yard
											Active pipeline			Dockyard
											Active gas pipeline			Ship Yard
											Active chemical pipeline			
											Active mixed hydrocarbon pipeline			
											Active other fluid pipeline			
											Precommissioned			

											gas pipeline			
											Disused pipeline			
											Disused chemical pipeline			
											Active power cable			
	Coastal industry	Brickworks			Brickworks	INDUSTRY	Coastal industry		Coastal industry	Coastal processing industry	Warehouses			
		Gas works			Gas works						Dock and port related industrial area			
		Kiln			Kiln						Scrap metal storage			
		Modern industry			Modern industry						Oil storage and works			
		Pottery works			Pottery works						Chemical works			
		Renewable energy installation			Renewable energy installation						Historic ship breaking area			
		Reservoir			Reservoir						Disused historic salterns			
		Sewage works			Sewage works					Coastal power generation	Land based wind farm			
		Warehouse			Warehouse					Haven	Historic haven			
					Quarry									
					Tank Farm									
					Container Depot									
					Power Station									
					Timber Yard									
					Old works									
					Salt works			Salt industry						
					Quayside Development									
					Osier beds									
					Watercress beds									
								Energy installation (coastal)						
								Industry (coastal, disused)						
								Industry (coastal, unspecified)						
								Mineral						

								extraction (other, coastal)						
	Non-intrusive offshore industry	Commercial shipping			Commercial shipping		Non-intrusive offshore industry							
					Fishing area									
					Shellfishing area									
					Submarine cable			Submarine cable/pipeline						
					Offshore recreation									
									Flood defence and reclamation	Flood defended area	Modern flood risk area			
										Historic reclaimed land	Post medieval reclaimed land			
											Medieval and earlier reclaimed land			

RECREATION

Liverpool HSC Broad Type	**Liverpool HSC type**	**Liverpool HSC subtype**	**Solent HSC broad type**	**Solent HSC type**	**Solent HSC subtype**	**Clacton-Southwold HSC Broad Type**	**Clacton-Southwold HSC Type**	**Clacton-Southwold HSC subType**	**Withernsea-Skegness HSC Broad Type**	**Withernsea-Skegness HSC Type**	**Withernsea-Skegness HSC subtype**	**Scarborough-Hartlepool HSC Broad Type**	**Scarborough-Hartlepool HSC Type**	**Scarborough-Hartlepool HSC subtype**
Recreation	Coastal recreation	Beach	Recreation	Coastal recreation	Beach	Recreation	Coastal recreation	Beach	Recreation	Designated area	Nature reserve	Recreation	Recreation	
		Coastal golf course			Coastal golf course						NNR			Coastal Heritage
		coastal parkland			coastal parkland						RAMSAR			Parks & Gardens
		coastal recreation			Coastal recreation						SAC			Holiday Park
		coastal way			coastal way			Coastal way			SSSI			
		marina			marina			marina			SAM			Marina
		marine lake			marine lake						SPA			
		marine reserve			marine reserve					Archaeological interest area	Submerged forest			
		nature reserve								Amusements	Leisure beach			
		protected reacreation area			protected reacreation area			protected reacreation area			Marina			
		sailng club									Angling			

		seaside entertainment			seaside entertainment			Seaside leisure area			Water sports			Seaside entertainment
		sports ground			sports ground						Holiday camp			Sport Facility
		water park									Caravan park			
					sailing area			sailing area			Holiday village			
					Piers, jetties and wharfs						Historic canal			
											Historic sand dunes			
											Aquarium			
											Golf course			
	Offshore recreation	dive site		Offshore recreation	dive site		Offshore recreation	dive site		Offshore recreation	Dive site			Dive site
		leisure fishing area			leisure fishing area			leisure fishing area						Angling site
		offshore recreation												
		offshore sailing area												
								Watersports area						

PALAEOLANDSCAPES

Liverpool HSC Broad Type	Liverpool HSC type	Liverpool HSC subtype	Solent HSC broad type	Solent HSC type	Solent HSC subtype	Clacton-Southwold HSC Broad Type	Clacton-Southwold HSC Type	Clacton-Southwold HSC subType	Withernsea-Skegness HSC Broad Type	Withernsea-Skegness HSC Type	Withernsea-Skegness HSC subtype	Scarborough-Hartlepool HSC Broad Type	Scarborough-Hartlepool HSC Type	Scarborough-Hartlepool HSC subtype
	Prehistoric landsurface	palaeochannel												
		peat bed												
		prehistoric footprints in drying area												
		submerged forest in modern drying area												
													Palaeo-landscape	Palaeo-environmental deposit
														Submerged Forest
														Palaeochannel
				Submerged Landscapes	Submerged Prehistoric settlement									Peat bed

				Prehistoric land surface	Peat bed									
					Submerged forest									
					Palaeochannel									

SEMI-NATURAL ENVIRONMENT

Liverpool HSC Broad Type	Liverpool HSC type	Liverpool HSC subtype	Solent HSC broad type	Solent HSC type	Solent HSC subtype	Clacton-Southwold HSC Broad Type	Clacton-Southwold HSC Type	Clacton-Southwold HSC subType	Withernsea-Skegness HSC Broad Type	Withernsea-Skegness HSC Type	Withernsea-Skegness HSC subtype	Scarborough-Hartlepool HSC Broad Type	Scarborough-Hartlepool HSC Type	Scarborough-Hartlepool HSC subtype
Environment	Coastal environment	grazing marsh	Natural Landscape	Coastal environment	grazing	Natural Landscape	Coastal environment				Semi-Natural Environment	Cliff	Cliff	
		mudflats		intertidal environment	mudflats			mudflats					Dunes	
		saltmarsh area		intertidal environment	saltmarsh area			saltmarsh					Foreshore	Sandy Foreshore
		sand dunes			sand dunes			sand dunes						Rocky Foreshore
		rocky outcrop												Kelp
		woodland			Woodlands								Woodland	Ancient Woodland
					Coastal floodplain									Plantation
					Heathland									Semi-Natural Woodland
					Ponds								Coastal Rough Ground	Rough Ground
					Wetlands									Scrub
					Landslip								Salt Marsh & Sandflats	Salt Marsh
					Reclaimed Land									Sand & Mudflats
				intertidal environment	Shingle									Sandflats
								Cliff						Mudflats
								Sandbanks					Water	Lake
								Sandwaves						Pond
								River						Spring
								Coastal marsh						Watercourse
								Intertidal					Marine	Coarse sediment

								land (unspecified)					Features	plains
								Named area						Fine sediment plains
								Natural channels						Very fine sediment plains
								Protected area						Sand banks with sand waves
	Offshore environment	coarse sediment plains		Offshore environment										
		fine sediment plains												
					Subtidal sands									

SETTLEMENT

Liverpool HSC Broad Type	**Liverpool HSC type**	**Liverpool HSC subtype**	**Solent HSC broad type**	**Solent HSC type**	**Solent HSC subtype**	**Clacton-Southwold HSC Broad Type**	**Clacton-Southwold HSC Type**	**Clacton-Southwold HSC subType**	**Withernsea-Skegness HSC Broad Type**	**Withernsea-Skegness HSC Type**	**Withernsea-Skegness HSC subtype**	**Scarborough-Hartlepool HSC Broad Type**	**Scarborough-Hartlepool HSC Type**	**Scarborough-Hartlepool HSC subtype**
Settlement	Coastal settlement	ancient field systems	Settlement	Coastal settlement	Settlement	Coastal settlement	Settlement	Maritime town and city	Maritime conservation area	Settlement	Settlement	City/Urban		
		coastal settlement			coastal settlement			Coastal/estuarine settlement			Maritime settlement area			
		coastal village			coastal village					Maritime village	Historic maritime settlement			Village, Hamlet
		historic field systems			historic field systems									
		historic town			historic town			Historic town core (OS 1st edition)						Town
		historic settlemnt												
		medieval town fields												
		modern field systems			modern field systems									
					Reclaimed land									
					Airfield									
								Drained fields						
								Lost settlement						
														Facility/Amenity

MILITARY

Liverpool HSC Broad Type	Liverpool HSC type	Liverpool HSC subtype	Solent HSC broad type	Solent HSC type	Solent HSC subtype	Clacton-Southwold HSC Broad Type	Clacton-Southwold HSC Type	Clacton-Southwold HSC subType	Withernsea-Skegness HSC Broad Type	Withernsea-Skegness HSC Type	Withernsea-Skegness HSC subtype	Scarborough-Hartlepool HSC Broad Type	Scarborough-Hartlepool HSC Type	Scarborough-Hartlepool HSC subtype
Military	Coastal military	army base	Military	Coastal military	army base	Military	Coastal military	Military	Military structure	Disused WWII anti aircraft battery	Military	Military Defences	Anti-tank Defences	
		military area			military area						Disused WWII decoy			Artillery
		military fort			military fort			Military installation, Military Installation (disused)			Disused WWI fort			Fortification
		military practice area			military practice area		Offshore military	Military practice area			Disused WWII airfield			Anti-landing
					military defence area						Disused WWII barracks			
							Offshore military	Dumping ground (military)			Airfield			
	Naval activity	naval dockyard		Naval activity	naval dockyard			Naval dockyard		Military area	Military practice area		Military Facility	Military Airfield
		naval base			navy base						RAF practice area			Military Base
		submarine exercise area									Firing range			Military Dump
														Military Practice Area
											Disused WWII minefield			
											Submarine exercise area			

COMMUNICATIONS

Liverpool HSC Broad Type	Liverpool HSC type	Liverpool HSC subtype	Solent HSC broad type	Solent HSC type	Solent HSC subtype	Clacton-Southwold HSC Broad Type	Clacton-Southwold HSC Type	Clacton-Southwold HSC subType	Withernsea-Skegness HSC Broad Type	Withernsea-Skegness HSC Type	Withernsea-Skegness HSC subtype	Scarborough-Hartlepool HSC Broad Type	Scarborough-Hartlepool HSC Type	Scarborough-Hartlepool HSC subtype
												Communication	Transport	Rail
														Road
														Tram
													Telecommunications	Telecommunications

APPENDIX 3: TECHNICAL GLOSSARY

For more ArcGIS terminology go to the ESRI dictionary webpage at:
http://support.esri.com/index.cfm?fa=knowledgebase.gisDictionary.gateway.

Attribute: Descriptive information about a geographic feature in a GIS, usually stored in a table and linked to the feature by a unique identifier. For example, attributes of a river might include its name, length, and average depth. In raster datasets, information associated with each unique value of raster cells. Cartographic information that specifies how features are displayed and labelled on a map; the cartographic attributes of a river might include line thickness, line length, colour, and font.

Attribute query: A request that selects features or records from a database containing information about a geographic feature in a GIS, generally stored in a table and linked to the feature by a unique identifier.

Attribute table: A database or tabular file containing information about a set of geographic features, usually arranged so that each row represents a feature and each column represents one feature attribute. In raster datasets, each row of an attribute table corresponds to a certain zone of cells having the same value. In a GIS, attribute tables are often joined or related to spatial data layers, and the attribute values they contain can be used to find, query, and symbolize features or raster cells.

Bathymetry: The science of measuring and charting the depths of water bodies to determine the topography of a lake bed, seafloor, or ocean bottom.

Bedforms: Features on the seabed (eg. sandwaves, ripples) resulting from the movement of sediment over it, from seabed erosion, from deposition of stable sediment.

Buffer: A tool within GIS that creates a polygon feature (or set of features) based on an input dataset by extending the boundary by a given distance. Points, lines or polygons can be buffered. For instance, buffering a circular polygon 2km in diameter by 1km will produce a circular polygon with the same centre-point but 4km in diameter (= 1km + 2km + 1km). Buffering points will always produce circular polygons of twice the buffering value. Buffering polylines will produce lozenge-shaped polygons with a width twice the buffering value and a length twice the value + the length of the line.

Cell: The smallest unit of information in (usually raster) dataset, usually square in shape. In a map or GIS dataset, each cell represents a portion of the earth, such as a square meter or square mile, and usually has an attribute value associated with it, such as soil type or vegetation class.

Cleaning: Improving the appearance of scanned or digitized data by correcting overshoots and undershoots, making lines thicker or thinner, closing polygons, and so forth.

Clip: An ArcGIS tool which enables the user to extract a smaller spatial dataset from a large one by using a further dataset to set the maximal bounds of the output features. This method is sometimes compared to the process of (and even referred to as) 'cookiecutting'.

Coordinate system: A reference system used to measure horizontal and vertical distances on a planimetric map. A coordinate system is usually defined by a map projection, spheroid of reference, a datum, one or more standard parallels, a central meridian, and possible shifts in

the x- and y- directions to locate x,y positions of point, line and area features An item in ArcCatalog representing a projection file, which contains the param defining a coordinate system.

Database: One or more structured sets of persistent data, managed and stored as a unit and generally associated with software to update and query the data. A simple database might be a single file with many records, each of which references the same set of fields. A GIS database includes data about the spatial locations and shapes of geographic features recorded as points, lines, areas, pixels, grid cells, or TINs, as well as their attributes.

Data standard: Data standard allows you to describe your digital assets with consistency as well as establishing the use of a common terminology that can be readable both by people and machines.

Datum: In the most general sense, any set of numeric or geometric constants from which other quantities, such as coordinate systems, can be defined. A datum defines a reference surface. There are many types of datums, but most fall into two categories: horizontal and vertical.

Dissolve: A geoprocessing command that removes boundaries between adjacent polygons that have the same value for a specified attribute. Removing unnecessary boundaries between features after data has been captured, such as the edges of adjacent map sheets. A tool in ArcGIS which aggregates all polygons in a dataset that have the same (specified) value(s) into a single polygon. Where such polygons are contiguous any mutual boundary will be removed. Where such polygons are not contiguous, no visible change will occur, but the underlying attribute table will assign them all to a single entity. The dissolving process will allow the output table to maintain the fields (and hence values) upon which the dissolve is based, but any other fields will be lost.

Feature: A representation of a real-world object on a map. Features can be represented in a GIS as vector data (points, lines, or polygons) or as cells in a raster data format. To be displayed in a GIS, features must have geometry and locational information. A group of spatial elements that together represent a real-world entity. A complex feature is made up of more than one group of spatial elements: for example, a set of line elements with the common theme of roads representing a road network.

Field: A column in a table that stores the values for a single attribute.

Geodatabase: A collection of geographic datasets for use by ArcGIS. There are various types of geographic datasets, including feature classes, attribute tables, raster datasets, network datasets, topologies, and many others.

Geoprocessing: A GIS operation used to manipulate GIS data. A typical geoprocessing operation takes an input dataset, performs an operation on that dataset, and returns the result of the operation as an output dataset. Common geoprocessing operations include geographic feature overlay, feature selection and analysis, topology processing, raster processing, and data conversion. Geoprocessing allows for definition, management, and analysis of information used to form decisions.

Georeferencing: Aligning geographic data to a known coordinate system so it can be viewed, queried, and analyzed with other geographic data. Georeferencing may involve shifting, rotating, scaling, skewing, and in some cases warping or rubber sheeting the data.

Grid: In cartography, any network of parallel and perpendicular lines superimposed on a map and used for reference.

HTML: Hypertext markup language. An HTML file contains text and tags instructing an Internet browser application on how to present the text.

Layer: The visual representation of a geographic dataset in any digital map environment. Conceptually, a layer is a slice or stratum of the geographic reality in a particular area, and is more or less equivalent to a legend item on a paper map. On a road map, for example, roads, national parks, political boundaries and rivers are examples of different layers. In ArcGIS, a reference to a data source, such as a coverage, geodatabase feature class, raster, and so on, that defines how the data should be symbolized on a map. Layers can also define additional properties, such as which features from the data source are included. Layers can be stored in map documents (.mxd) or saved individually as layer files (.lyr).

Mean sea level: The average height of the surface of the sea for all stages of the tide over a nineteenyear period, usually determined by averaging hourly height readings from a fixed level of reference.

Merging: Combining input features from multiple input data sources of the same data type into a single, new, output feature class.

Metadata: Information that describes the content, quality, condition, origin, and other characteristics of data or other pieces of information. Metadata for spatial data may document its subject matter; how, when, where, and by whom the data was collected; availability and distribution information; its projection, scale, resolution, and accuracy; and its reliability with regard to some standard. Metadata consists of properties and documentation. Properties are derived from the data source (for example, the coordinate system and projection of the data), while documentation is entered by a person (for example, keywords used to describe the data).

Morphology: The structure, form and arrangement of rocks in relation to the development of landforms.

Point: A geometric element defined by a pair of x,y coordinates.

Polygon: On a map, a closed shape defined by a connected sequence of x,y coordinate pairs, where the first and last coordinate pair are the same and all other pairs are unique.

Polyline: In ArcGIS software, a shape defined by one or more paths, where a path is a series of connected segments. If a polyline has more than one path (a multipart polyline) the paths may either branch or be discontinuous

Projected coordinate system: A reference system used to locate x, y, and z positions of point, line, and area features in two or three dimensions. A projected coordinate system is defined by a geographic coordinate system, a map projection, any parameter needed by the map projection, and a linear unit of measure

Projection: A method by which the curved surface of the earth is portrayed on a flat surface. This generally requires a systematic mathematical transformation of the earth's graticule of lines of longitude and latitude onto a plane. It can be visualized as a transparent globe with a light bulb at its centre casting lines of latitude and longitude onto a sheet of paper. Generally, the paper is either flat and placed tangent to the globe (a planar or azimuthal projection) or formed into a cone or cylinder and placed over the globe (cylindrical and conical projections). Every map projection distorts distance, area, shape, direction, or some combination thereof.

Query: A request that selects features or records from a database. A query is often written as a statement or logical expression.

Raster: A spatial data model that defines space as an array of equally sized cells arranged in rows and columns (eg. images in .TIFF, .JPG, .GIF, .BMP and .PNG file extensions). Each cell contains an attribute value and location coordinates. Unlike a vector structure, which stores coordinates explicitly, raster coordinates are contained in the ordering of the matrix. Groups of cells that share the same value represent the same type of geographic feature.

Shapefile: An ESRI ArcGIS vector data storage format for storing the location, shape, and attributes of geographic features. A shapefile is stored in a set of related files and contains one feature class

Spatial Join: A type of table join operation in which fields from one layer's attribute table are appended to another layer's attribute table based on the relative locations of the features in the two layers.

SQL: Structured Query Language (SQL) is a standardised way of interacting with relational databases. It provides syntax by which to interrogate, create or update one or more tables in a database.

Topology: In geodatabases, the arrangement that constrains how point, line, and polygon features share geometry. For example, street centerlines and census blocks share geometry, and adjacent soil polygons share geometry. Topology defines and enforces data integrity rules (for example, there should be no gaps between polygons). It supports topological relationship queries and navigation (for example, navigating feature adjacency or connectivity), supports sophisticated editing tools, and allows feature construction from unstructured geometry (for example, constructing polygons from lines)

Vector: A coordinate-based data model that represents geographic features as points, lines, and polygons. Each point feature is represented as a single coordinate pair, while line and polygon features are represented as ordered lists of vertices. Attributes are associated with each feature, as opposed to a raster data model, which associates attributes with grid cells.

Union: A topological overlay of two or more polygon spatial datasets that preserves the features that fall within the spatial extent of either input dataset; that is, all features from both datasets are retained and extracted into a new polygon dataset

Union is a tool within ArcGIS that enables the user to take a number of input spatial datasets and combine them into a single dataset which is subdivided in order to preserve all boundaries. This has the inevitable result of creating many more polygons than the original datasets possessed collectively. The attribute table of the output dataset contains at least one field for each input dataset, recording the ID and/or attributes of any polygon that is spatially

co-extensive. In cases where an input dataset has internally overlapping polygons, the union cannot store both values in the same field and so two identically shaped polygons will be created for the overlapping region, but with different attribute data.

XML: Acronym for Extensible Markup Language. Developed by the World Wide Web Consortium (W3C), XML is a standardized general purpose markup language for designing text formats that facilitates the interchange of data between computer applications. XML is a set of rules for creating standard information formats using customized tags and sharing both the format and the data across applications.