

Marine ALSF GIS

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**User Requirements Specification
Ver 1.8: Final**

**Marine Environment Protection Research
MEPF 04/07
Marine ALSF Offshore Geographical
Information System (Marine ALSF GIS)**



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User Requirements Specification

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1 Introduction

1.1 Consultation

This paper invites your comments on the proposal to:

- develop an online metadatabase of aggregate related research projects accessible using a web-enabled Geographical Information System (webGIS);
- on the content, functionality, interface, navigation and accessibility of the web-enabled GIS;
- on the extent of and scope for interoperable services within the development

Background to the scope of the project is provided below and specific questions are asked within the text. When commenting on the proposals, we would particularly welcome your thoughts on specific questions raised, but would invite comments on any other part of the proposal.

Comments can be made online at <http://www.MarineALSF.org.uk/consultation>.

A list of consultees is available online at the above site. A registration system is offered to allow you to enter your details in order to inform you of further stages in the development of this project.

If you have any queries on this consultation, please contact Chris Hill or Jason Sadler on 023 80592719.

1.2 Project Background

Research related to or relevant to marine aggregate exploitation, surveys and investigations is produced by a wide variety of agencies and organisations. These varied sources are derived from industry, coastal authorities, and research organisations and through projects funded under the Marine Aggregate Levy Sustainability Fund (Marine ALSF). However, there is currently no ready way of identifying or accessing this information or to establish to which licensed aggregate areas the information relates. Often reports form part of the 'grey literature', with only an internal circulation and publication.

To ensure this research and survey provides maximum benefit in support of Government policy the Marine ALSF is funding a project to improve 'knowledge management' by making information on such aggregate research available. The concept of this project has been outlined in the June 2004 ALSF Marine Environment Protection Research Programme, MEPF 04/07 and is described as a 'MarineGIS'.

This study, being undertaken by ABPmer and GeoData Institute, has developed an outline specification for the development of a web-based information management and search facility to provide the basis for accessing relevant research information. The system is proposed as a register (metadata) of research studies and structured as a spatial database; allowing a variety of ways of searching for information, including location-based searches and, where available, providing direct links to research outputs.

Anticipated information managed by this structure (content) includes research directly funded by the Marine ALSF, research directly related to marine aggregates or other programmes associated with sectoral interests in the marine environment. Past, current and planned activities are proposed for

inclusion within the resource base and information covering current licensed areas, past and potential marine aggregate resource areas. Any single research project may be a complex of surveys and research outputs and the metadata structure will need to allow for this and for the ways that the users wish to search for this information.

The project was conceived as a 'MarineGIS'; although it is important to qualify what is meant by this term within the context of this project. Spatial data for the marine sector are available from a range of other providers, many of them through online mapping; e.g. Crown Estate, Deal, SeaZone, UK Marine Information Unit, etc. This project does not attempt to duplicate these existing services and their spatial data supply routes. The scope is as a spatial metadata project and it is anticipated that the use of webGIS will be included as a way of assisting spatial searches of the metadatabase and as a way of determining areas which may be data rich or data poor.

The scope of the programme has been extended to include the evaluation of the potential to link to other online data resource programmes within the marine and coastal sector; to broaden the resources identified through search criteria. Such functionality is seen as more than a mere list of links to other sites, but would test the interoperability of searches between metadata-driven online resources. Evaluation of these options therefore examines the level of integration of the links made as the basis for making recommendations for further integration of this functionality within the MarineGIS development.

1.3 Scientific context

1.3.1 Existing spatial metadata resources

The intended project deliverable is aimed at improving the management of information in aggregate related areas (both thematic and geographic). A web-based database tool would support wider dissemination of other ALSF and non-ALSF funded research with the overall benefit of improved take up of the research findings and information resources in marine aggregate areas.

This development is set against the backdrop of a wide range of other activities in marine GIS and web-based GIS applications within the marine sector. In particular, the outcomes of the 'Integrated Mapping of the Marine and Coastal Zone – the way forward' (CEFAS 2000) 'Delivering Integrated Marine Mapping in the UK' (CEFAS 2002) provided a context for coordinated marine information management. The resulting development of the UK Coastal Information Network proposes integrated information management.

A number of other projects and programmes, often with specific, sectoral, activity have already developed web-based marine information resources of relevance to the marine aggregate sector. These include bibliographic search engines, specifically related to the marine aggregate industry, Dredgeline. There is also significant activity in the development of metadata standards and schemas for managing marine information. The Marine Geospatial Data Infrastructure, UK Marine Information Council together with real-time and near real-time data metocean data display and download facilities (e.g. CEFAS Geoinformation Portal, WaveNet and the Channel Coastal Observatory) are enhancing the availability and accessibility of marine data sources.

Metadata is a key area in developing standards and is central to the present proposal, where government (eGMS) and domain specific programmes (Marine XML) metadata and spatial metadata standards are being developed. The Marine XML and ArcGIS Marine Data Model are helping to introduce standard descriptors into the marine geospatial data sector. At the same time, online geospatial data providers include the Crown Estate and Windbase, and collaborative programmes such as the Integrated Hydrography, ICZMap and DTi UK Renewable Energy Resource Atlas are providing fundamental geospatial resources for marine and coastal mapping applications. The scope of online resources is broad covering many environmental sectors; biological, geological and geophysical and legal.

Many of these data systems are well established (e.g. DEAL) others are new initiatives, such as the Marine Works Consent online GIS. Many of these marine GIS activities are indicated in Table 8,

which has formed the basis of the sector functionality assessment and evaluation of the potential to make links between the current proposal and other online data resources.

A number of valuable pilot projects relevant to the current proposal have been developed under EU funding programmes. The breadth of the information management sector means that many of these relevant programmes are cross-sectoral with a common data and information and management goal. For EU pilot programmes, without the commitments to long-term funding, many initiatives are not taken forward (e.g. Mermaid¹, SPIRIT², MAGiC³) and therefore no long-term resource developed.

1.3.2 Justification

At present there is no comprehensive facility to allow the marine aggregate sector to establish what research exists, determine if it is appropriate for their needs, and find out how to access it. Many of the reports developed under research programmes and even those from earlier Marine ALSF funded programmes are within the 'grey literature' without wide distribution and with the strong potential that the information becomes lost (either by lack of awareness, technically obsolete, or physical loss). Effective documentation and access to these resources will allow others to use or at least be aware of a resource. The legacy of information without effective documentation justifies the programme of metadata creation. Development of a well-populated online metadata system will motivate more effective and efficient metadata collection, reducing the burden for recording, promoting data access and sharing, data preservation.

For public bodies at least the Freedom of Information Act and the Environmental Information Regulations make such data accessibility, effective distribution and preservation of records a legal requirement that may be at least partially addressed by the MarineGIS. The scope within the metadata to record the copyright, access constraints and IPR also allows commercial data assets to be referenced within the metadata system.

There is also no portal structure to allow users to support geographic searches across multiple data holdings. Although there are many complementary services and collections of metadata and bibliographic search facilities, the association of spatial metadata with the resource criteria extends the resource discovery capacity. Within the context of this wide range of activities the current proposal attempts to draw upon best practice from past and present programmes, develop an information system based on national working standards for interoperability and focus its activity within an area not currently covered by the other marine GIS developments specifically within the marine aggregate sector. In this way the application is complementary to other services and offers opportunities for links between systems.

1.4 Document structure

This document focuses on the user requirements for the content, functionality, interface and navigation requirements for the information system, based on internal evaluations and limited external consultation. The document therefore forms a consultation draft for which input from potential users is now required to further develop a full user requirement specification for MarineGIS technical specification and development.

The concept of the MarineGIS is based around the management of information on research programmes and project outputs related to the marine aggregate sector, without attempting to directly manage geospatial datasets generated by those projects. In this sense the MarineGIS acts as a repository of metadata, information about the data generated by projects; often these resources will be the 'grey literature', information that is largely produced for internal consumption and for which reference and access may be limited.

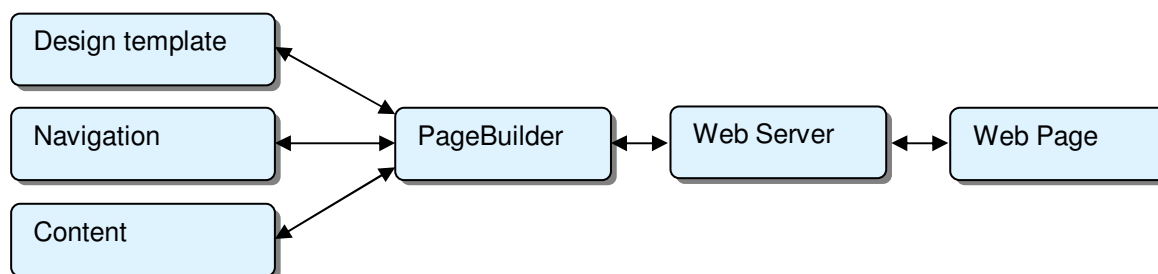
¹ *Mermaid*

² *SPIRIT Spatially aware information retrieval on the Internet*

³ *MAGiC Managing Access to Grey Literature Collections.*

This document considers the components of the content, functions, interface and navigation rather than considering the system architecture and technological specification; which will be the subject of the System and Technical Specification report (Figure 1). Elements of the system security, backup and operating systems and architecture will also be dealt with in the Technical Design Specification.

Figure 1: Process flow diagram for MarineGIS web development



A web-based marine information system may be a very broad objective within which to define a user specification. In order to appreciate the scope of what is proposed, to understand the mandated constraints (project limitations, metadata standards) and to focus user requirement specification to these objectives, Section 1.5 presents the scope of the user requirements and Section 1.6 presents the background to an outline system specification for the MarineGIS. Clearly, at this stage, many aspects are undefined or unrefined and questions are raised within the text where specific user requirement input is required. Section 2 describes the content and functionality; section 3 describes the work plan for development.

1.5 Scope of the user requirements

The purpose of user requirements analysis is to determine a user's needs in sufficient detail to plan the construction of the MarineGIS website to meet those needs. This first stage of the user requirements specification is based on the internal assessment of the requirements, together with input from members of the organisations involved (all in some way involved in the marine research and commercial sector).

Given that the scientific context already defines the need for aspects of the development, a simplified model of the system is presented (section 1.6.2) as the context for further user specification.

The process of requirements analysis is based on the following items:

1. A simplified model of the system environment and its objectives
2. Define and profile the target users – description of who the users will be (e.g. public, technical, government) and how the different categories of user will use it. (takes into account the infrastructure (data repositories and data architectures) and your organisational characteristics)
3. Identify the information requirements (content)
4. Determine the most appropriate information delivery requirements for each group, including required reports, necessary querying functionality, and access methods
5. Evaluate tool options (e.g. web GIS)
6. Performance constraints on the system
7. Constraints on the implementation of the system
8. Resource constraints for the development project – including timing (when and for how long the system is needed and milestones)
9. A specification of the interface of the system

The requirements analysis also identifies the nature and breadth of the user base, although this will partly driven by the scope of the system.

1.6 Simplified model of the system environment

1.6.1 Introduction

The simplified model of the system environment is presented in Figure 2. However, initial discussions with some categories of users (including the Marine Science Coordinator) added perspectives and requirements for a wider Marine ALSF programme information delivery / dissemination system. These issues and the responses to the consultation mean that the system model is likely to change and therefore remain flexible at this stage.

Specific additions to the scope include:

- The role of 'links' with other online marine database systems has been incorporated within a revised scope for the MarineGIS project, which has required extension of the model of the system development.
- The overarching development of a Marine ALSF website to administer and disseminate information related to the current round of Marine ALSF funded programmes.

The system architecture is likely to involve the components described below, and this specification has been used as the basis for programme scheduling and specification as well as the initial discussions with the users.

1.6.2 System components

The core of this approach is the management of Project data via associated geospatial metadata, as applied through an established metadata content standard. The metadata framework will define the channels of access to records and will be enabled by XML⁴ technology. Certain aspects of the technical development are mandated within the project and provide limitations for the development:

- Implementation of a metadata standard
- Metadata records rather than data records
- All records must have geospatial extent information
- All records must conform to the minimum metadata standards compliant with eGMS
- Browser-based interface without client-side downloads

The server application will be hosted using a standard Linux distribution and server-class PC hardware. This provides an extremely cost-effective delivery platform, though, as each of the technologies employed are based on a heterogeneous Open Source model, the system could be delivered using any Unix or Windows platform.

The application would comprise data import to a database, GIS libraries to handle the spatial information and background datasets (map data), web server and web applications to provide map- and form-based web search interfaces.

Database Management System (DBMS)

One of the most important components of the system will be a spatially enabled DBMS. The consortium proposes use of the Open Source PostgreSQL⁵ database with PostGIS⁶ spatial extensions. These are industry standard applications conforming to standards published by the Open GIS Consortium (OGC)⁷, though they could be exchanged with commercial alternatives.

Data Import

In addition to necessary background mapping data, a metadata database will be required from an early stage to provide the required audit trail for all data sources stored and delivered by the

⁴ Extensible Markup Language (XML): <http://www.w3.org/XML>

⁵ PostgreSQL Database, www.postgresql.org

⁶ PostGIS geospatial extension, <http://postgis.refrains.net>

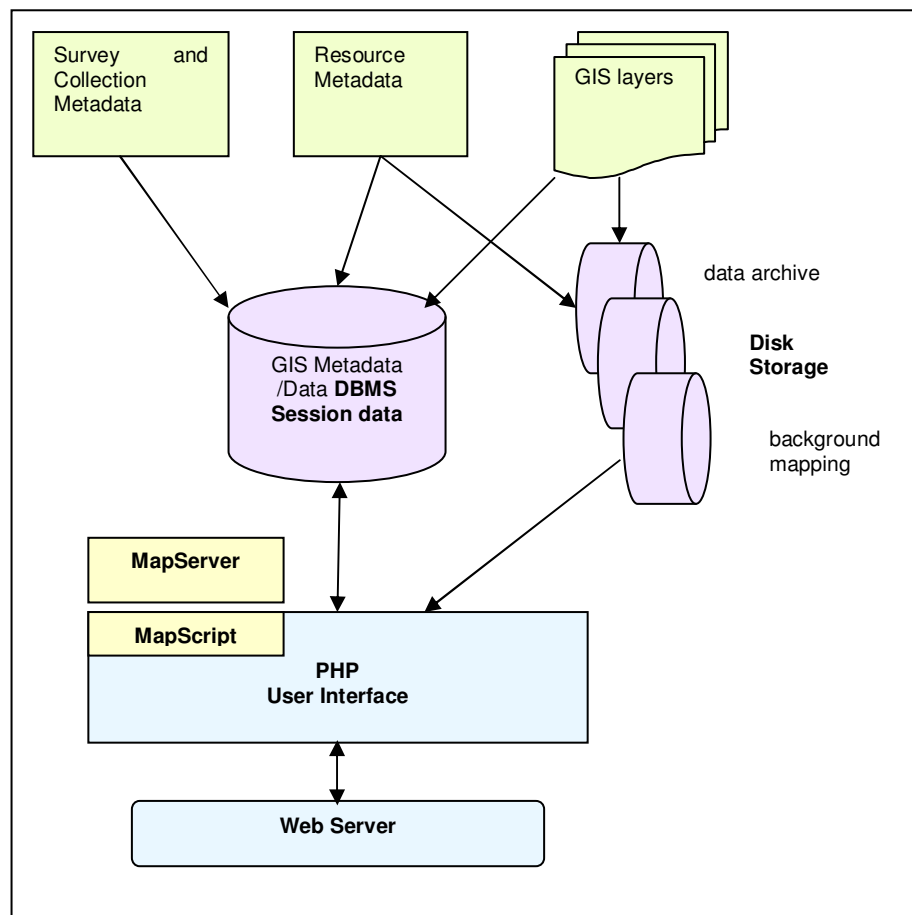
⁷ Open GIS Consortium (OGC), www.opengis.org

system. The application and database will need to manage a constant flow of digital data and metadata in order to carry out their main function.

GIS Libraries

The analysis and display of spatial data in the GIS application will be implemented using the Open Source MapServer⁸ GIS component library. This also integrates a collection of other Open Source software libraries for manipulating and transforming a very wide range of spatial data types. The MapScript scripting extension enables the use of MapServer within the PHP⁹ web scripting language.

Figure 2: Outline system environment



Web Application

The above technologies will be brought together through the main web interface, which will be constructed using the Open Source PHP web scripting language. Standards for XHTML¹⁰ and CSS (cascading style sheets) will be used in conjunction with content management modules (PageBuilder) to enable separation of application, content and design.

Web Server

The Open Source Apache Web Server will be used to execute the web application and deliver web page output to users. No special client-side technologies will be required at the browser end. Apache is an industry standard for serving industrial strength web applications. However, any alternative HTTP server, such as Microsoft Internet Information Server, could be deployed if required.

⁸ UNC MapServer <http://mapserver.gis.umn.edu>

⁹ PHP scripting language: <http://www.php.net>

¹⁰ The Extensible HyperText Markup Language (XHTML): <http://www.w3.org/TR/xhtml1>

Interface

The fundamental front-end will be an intuitive search facility with provision for standard bibliographic keywords (title, subject, date, author, location, etc) with an option for visual 'by location' data queries. A web-enabled Geographic Information System, with basic map layers to help define the spatial context of the aggregate research projects, will provide the visual geographic search facility.

1.7 Potential Users

The potential users of the system and the potential uses and likely ways in which the information will be used are indicated in Table 1. Stakeholders include those involved in the marine aggregate sector, either as policy and funding agencies, regulatory, industrial and research organisations. The stakeholders cross-disciplinary boundaries by virtue of the range of topics involved in the exploration, consents and monitoring process for aggregate exploitation. Other metadata, coastal and marine sector data management organisations are also stakeholders by virtue of the potential for interoperability between metadata systems. It is recognised that a single organisation may have many divisions for which the information is relevant. It is assumed that different users will require different levels of search specificity, from precise location, and map based location facilities to those with more general search requests.

Users may be those contributing content to the system (metadata about geospatial research studies), those merely searching the system and those administering the system. Such distinctions will require different interfaces and functionality where content providers will require registration to upload metadata information. Differing technical levels of user, which varies considerably, will also need to be accommodated. The interface requirements will need to reflect these demands, and the levels at which queries are required; typically these may be as basic and advanced search options. Content providers may also vary in their technical expertise, such that resource submission will need to be carefully interfaced.

Table 1: Potential user groups for the Marine ALSF GIS data

User group	Uses
DEFRA + other Government Departments	<ul style="list-style-type: none"> ▪ Improve co-ordination of sectoral funding for R+D in marine aggregates, Maximise benefits of available funds by targeting research to priorities, supporting policy requirements, ▪ Addressing and demonstrating obligations to Public Access to Environmental Information (Environmental Information Regulations) and Freedom of Information. ▪ Marine Consents systems ▪ Shoreline management planning
RESEARCH FUNDERS	<ul style="list-style-type: none"> ▪ Improve co-ordination of sectoral funding, maximise benefits of available funds by targeting research to priorities. ▪ Identifying other research priorities, programmes and researchers
RESEARCHERS	<ul style="list-style-type: none"> ▪ More readily identify available research to improve their own scientific / technical understanding. ▪ Become more identifiable as contributors to research. ▪ Improve linkages within the wider research community. ▪ Identify potential funding bodies. ▪ Respond better to research calls.
MARINE AGGREGATE INDUSTRY	<ul style="list-style-type: none"> ▪ More readily identify available research to improve their own scientific / technical understanding. ▪ Improve linkages to other sectors
REGULATORS Defra / Environment Agency	<ul style="list-style-type: none"> ▪ Identify status of present knowledge ▪ Identify inputs to programmes and plans (SMP, CHAMPS etc)
NGOs	<ul style="list-style-type: none"> ▪ More readily identify available research to improve their own scientific / technical understanding. ▪ Provide a resource link.
LOCAL AUTHORITIES	<ul style="list-style-type: none"> ▪ Integration with the landward planning system, ▪ Development of marine spatial planning application. ▪ Shoreline management planning and other coastal planning initiatives (e.g. ICZM).
PUBLIC	<ul style="list-style-type: none"> ▪ Responding to environmental concerns of projects and proposals ▪ Access to technical resources – facilitating public access to Environmental Information.

2 Content and functionality

2.1 Introduction

The objective of the MarineGIS is to provide information relevant to the marine aggregate sector. However, legislative and operational procedures mean that the licensing, exploration and development of marine aggregates covers all aspects of the physical, natural environment and socio-economic marine and coastal environment. Increasingly the legislative and planning domains are also relevant to knowledge management, and cover research within these sectors related to the marine aggregate industry. A key question is the scope of the coverage of resources – the data themes and subjects that are encompassed by the metadata programme.

The anticipated data content relevant to developing the MarineGIS service comprises four elements:

- Data types and data subjects (thematic coverage of the research project resources)
- Metadata and spatial metadata elements
- Ancillary data (resources associated with the metadata record)
- Background data (spatial data enabling mapping and webGIS based searches)

Web-based facilities already exist which host or sell spatial marine data for a multitude of marine and coastal environmental parameters. These resources include many of the sites to which the Marine ALSF GIS may seek to link and interoperate with, to a greater or lesser degree. The MarineGIS project does not attempt to replicate these products, services and data delivery sites.

The main objective for the present research is to structure an online spatial database of research studies, rather than provide multiple geographic layers. The content and functionality user requirements specification is to determine what aspects of these research projects, what search and data analysis functions are to be supported. The following sections present proposals for the content and functionality and pose some specific questions.

2.1.1 Data types / data subjects

The scope of the MarineGIS is to assist in locating resources on research projects that may be of relevance to the marine aggregate sector. The GIS element is incorporated within the proposed ability to use webGIS to enable spatial search and spatial representation of textual searches. Determining the scope of the coverage and the elements that are relevant to register within the metadatabase is a primary requirement in setting the user requirements. Figure 3 illustrates the likely components of a research and development project.

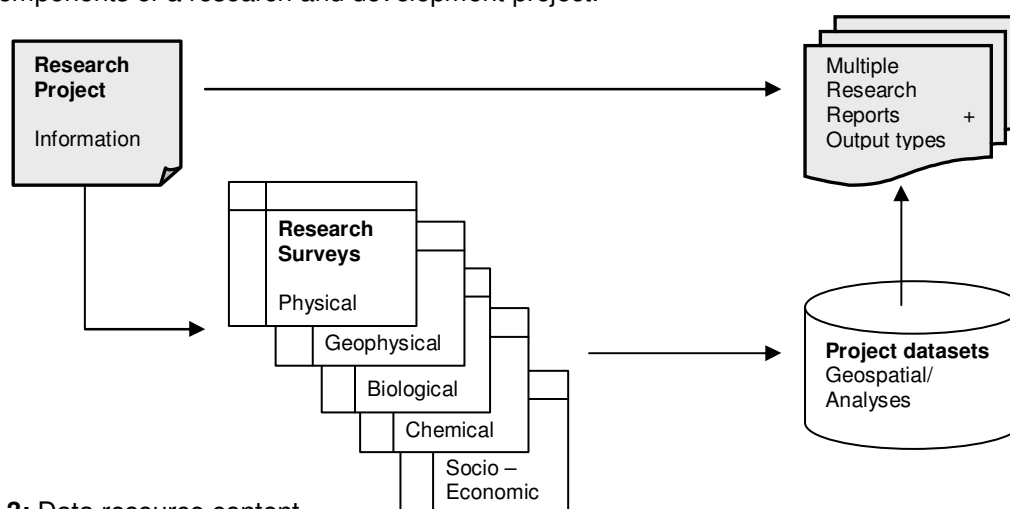


Figure 3: Data resource content

The components that the MarineGIS seeks to record from the R+D activities are limited to the project records and descriptions of the outputs and reports, rather than making the research surveys and project data available online.

Data types and data subjects are key targets for specifying the records that are covered within the scope of the MarineGIS project and for the population of the metadatabase. The adoption of a thesaurus, the terms and relationships between data types, is also central to the effective discovery of the research materials through metadata search criteria. These terms are specific within the metadata and distinguish between the type of resource and the subject matter of the resource. In metadata elements searching on the subject matter may be by a hierarchical use of topic and subject (or keywords where there are multiple subjects). Data types are generally generic whilst the data subjects may be marine specific, but may fall into categories (e.g. geophysical, geological, physico-chemical, biological).

- 'Types' may be a classification of the output form: maps, survey results, reports
- 'Types' descriptors may also cover the survey techniques and data models: point, line, area features and measurements, grid and raster, interpolated areas and surfaces, 3 and 4 dimensional (time series), marine areas (administrative boundaries, zones), basemaps, image and graphics
- 'Subjects': geophysical, geological, chemico-physical, biological, socio-economic, legislative, management.

A number of spatial and spatio-temporal data models have been prepared for the marine environment (e.g. ESRI marine data model¹¹ and the EU marine XML initiative¹²) that may help to define the scope of such data types and subjects.

A wide range of data themes/subjects are relevant to the marine aggregate industry/management sectors. The scope of the resources for which metadata records are anticipated is research and development reports and surveys related to the marine aggregate industry. The scope of the information is envisaged to have a geographic dimension (point, line or area) that allows for locational searches. Often within the scope of marine survey data the information is collected along routes and areas and the surveys are within defined geographic regions.

Datasets will also have a temporal dimension, covering both instantaneous and time series records. It is not the intention of the metadata project to attempt to store the raw data or to generate a spatial and temporal data model to manage such data, but understanding the scope of the data is necessary to describe the metadata records.

The geographic focus of the MarineGIS suggests records will have varied dimensions within the marine context - data layers, basemap, bathymetry, water column, time and depth measurements, coastal and marine boundaries as well as non-physical boundaries (administrative, legal and regional boundaries).

The development of EIA/SEA and licensing and operating requirements for marine aggregate consents suggest that the objective of the study (marine aggregate research and development) is very broadly based and that the metadata system needs to be flexible enough to cover data types and data subjects.

The choice of themes affects both the metadata and the requirements for the metadata population. A number of broad subject indices are available for environmental data, and the ISO metadata standard includes topic entries that are at a broad scale and mandatory within the metadata. However, the ISO data topic list is very limited with respect to the marine data resources and many data resources would be unlikely to be adequately defined, thus a more refined listing would help to deliver effective queries. A metadata subject value list is used by the BODC metadata, which records hierarchical, discipline and data theme levels. Table 2 indicates the BODC divisions, the ISO standard topic reference and the divisions used within the Strategic Environmental Assessment programme.

¹¹ <http://www.mcmcweb.er.usgs.gov/sdts/>

¹² http://ioc3.unesco.org/marinexml/categories.php?category_no=1

The groupings may be hierarchical, with a discipline and a secondary subject classification as in the BODC list – how can these be represented within the metadata such that the data can be searched effectively? Also within the BODC list is a classification of the presentation type (atlases and maps) and the survey form (hydrographic surveys). Such a mixed categorisation within a single listing may be more effectively broken down into separate data elements, of discipline, subject, methodology and output (although the latter may be covered by the metadata element ‘presentation type’).

The system should support a hierarchical spatial search capabilities based on hierarchical thesauri. This will allow for detailed item level record criteria and higher-level definition of the subject within the higher-level metadata. Returning information at the data item level should identify resources at overlying higher levels, but perhaps with reduced confidence of the validity of the resulting resource identification.

The data subjects are a mix of categories of environment variables (e.g. physical oceanography, marine biology) and techniques and surveys (seabed samples, hydrographic surveys, sub-bottom profiling) and geographic representation and output formats (points, lines, areas, grids, maps). Many marine geographic datasets will also be the products of analyses, interpolated surfaces and modelling outputs.

Q. Does the BODC value list provide the level of division for the subject coverage anticipated by the MarineGIS records? If not what other subject keywords might be added?

Table 2: Examples of data subject and data topic value lists

BODC (discipline and theme levels - copyright BODC)	ISO 19115 (topic)	SEA (subject)
COASTAL STUDIES (e.g. shores, estuaries) METEOROLOGY Near surface meteorology, Upper air observations, Atmospheric composition, Sea ice PHYSICAL OCEANOGRAPHY Hydrography (e.g. T,S) - near surface only, Hydrography (e.g. T,S), Currents - drift - dispersion - tracers, Waves - swell, Sea level (& bottom pressure, IES), Underwater acoustics, Optical measurements OCEAN COMPOSITION Suspended matter - turbidity, Bulk chemistry (e.g. pH, TCO ₂), Dissolved gases, Nutrients, Other inorganic chemistry MARINE BIOLOGY Pigments (e.g. chlorophyll), Organic (& bio-) chemistry, Productivity - biomass, Plankton, Benthos, Birds - mammals - reptiles, Fish, Invertebrates, Ecology - biodiversity, Flora (e.g. algae, bacteria) ENVIRONMENTAL QUALITY/IMPACT Site assessments/surveys, Pollutant levels & monitoring FISHERIES Aquaculture, shellfish, Fish stocks/catches/taggings, Exploratory fishing - gear research GEOLOGY - GEOPHYSICS - SEDIMENTATION Bathymetry - sonar	Farming Biota Boundaries Climatology/meteorology Elevation Environment Geoscientific information Health Imagery/Basemap/Earthcover Intelligence/Military Inland/Waters Locations Oceans Planning/cadastre Society Structure Transportation Utilities/communication	Archaeology Benthos Conservation Birds Geology Marine mammals Other users Plankton Shellfish, fish and fisheries Socio-economics Consultation

BODC (discipline and theme levels - copyright BODC)	ISO 19115 (topic)	SEA (subject)
imaging, Magnetics - gravity, Seismic profiles, Sediments - rocks - pore waters, <i>In-situ</i> . (near) seafloor data SEAFLOOR SAMPLES (e.g. core, dredge, grab) UNDERWATER PHOTOGRAPHY HYDROGRAPHIC SURVEYS (navigation/engineering) REMOTE-SENSING (satellites or aircraft) COMPUTER MODELS ATLASES & MAPS		

Considering the scope of the resources a number of data considerations are relevant:

- a single resource may cover multiple themes (i.e. have multiple subjects and keywords)
- resources may cover multiple licensed areas (cover more than one defined geographic area)
- resources may be geographically specific or cover a general area or be generic
- overseas data materials may be included (may reference relevant resources outside the core study area).

The user specification proposal is to cover all subject areas that relate to the defined geographic area of licensed blocks, and thus is not restricted by the discipline.

Q. Does the range of disciplines proposed pose a problem for the MarineGIS programme?

2.1.2 Metadata

Metadata is structured data about data. Metadata allows for the cataloguing or indexing of an online resource and acts as a mechanism for finding, retrieving and transferring information resources. To be effective, metadata should comply with metadata standards and adopt an agreed syntax. Metadata syntax is based on agreed structures such as the ISO metadata standard. A metadata standard consists of a set of elements with defined formats and constraints. Metadata can include a wide range of elements to describe the information resource and can include geographic information – spatial metadata.

Metadata used to describe resources assists in resource discovery and resource management. Consistent cataloguing of online resources means maximised opportunities for searchers to find the most relevant and comprehensive set of resources for their purposes. Metadata can also be used to organise, store and retrieve items for information management purposes.

Metadata standards ensure that data will interoperate with others that use the same standard, hence there is the potential to find resources across a wide range of online services. Most metadata initiatives adopt a generic framework, but often add application specific data elements to make the information more effective for the users and the theme.

Within the Marine GIS a spatial metadata framework is proposed - MetaGenie which can be used to store geographic resource information. This standard complies with eGMS standards and emerging ISO standards.

2.1.3 Metadata specification

Many metadata and spatial metadata standards are being adopted, and local variants around a core metadata specification are often used. The metadata standards are often closely derivative and often with a common core of mandatory metadata records with optional variants. These standards present options for the adoption of a metadata system for the MarineGIS information. All of these are spatial metadata standards where the geographic elements will be essential within the location-based searches proposed by the Marine ALSF GIS.

Other implementations evaluated include:

- Glgateway – AGI-based metadata, based around MetaGenie currently being updated replacing the Glgateway Discovery Metadata Specifications (the NGDF Standard) (Cabinet Office 2004)¹³
- SPIRE¹⁴ Defra based spatial metadata Spatial Information Repository
- FGDC¹⁵ - Channel Coast Observatory coastal and marine spatial data index
- ISO19115/19139
- *e-Government Metadata Standard (eGMS)*¹⁶.

The selection of a metadata profile and the elements to include within the metadata has evaluated these different standards. The criteria for the profile and standard selection include:

- Compatibility with eGMS standards (the e-Government Metadata Standard promoted by the cabinet office)
- Transferability to NGDF/ FGDC
- Translation ability to ISO standards once these are complete

Based on this evaluation the MetaGenie profile has been selected as the basis for the user requirement specification proposal.

UK GEMINI (Geospatial Metadata Interoperability Initiative) is a standard that establishes the profile for metadata. MetaGenie is Glgateway's specially developed metadata creation software. This freely available tool enables easy creation of spatial metadata compliant with the *Glgateway Discovery Metadata Specifications* - the standard created and delivered by the UK's National Geospatial Data Framework (formerly the NGDF Standard). Glgateway is currently working on redevelopment of MetaGenie so that it creates metadata in line with this new national profile

The metadata profile is needed for the MarineGIS metadata to provide a subset of one or several information standards which adopts elements, structures or rules for different user communities.

The specification of the metadata standard and the proposed mandatory and optional fields are presented in Table 3. Some of the fields within the standard are optional. All mandatory fields will have a data entry record, whilst optional fields will not necessarily contain a record. These metadata standards are based on the MetaGenie standard, but will be subject to update based on the reworking of this standard.

The rationale for this selection is:

¹³ Cabinet Office (2004) E Government Unit / AGI UK GEMINI Standard version 1.0. A geospatial metadata interoperability standard.

¹⁴ SPIRE Defra Metadata Standard.

¹⁵ Content Standard for Digital Geospatial Metadata (CSDGM) www.fgdc.gov/metadata/contstan.html

¹⁶ e-Government Metadata Standard. UK Cabinet Office (see www.govtalk.gov.uk/metadata.asp).

- The metadata will be compatible with national initiatives
- There will be a longer term route to the translation to newly adopted standards in the future (specifically ISO 19115/19135)

There are a number of other metadata elements that are considered here and included within the specification for the overall metadata fields to constrain the data entries and create consistency of recording. Those anticipated as being necessary for the operation of the Marine GIS to meet the project objectives have been included (Table 3). These fields may be considered to be either mandatory or optional.

Where there are potential user requirements that are not fulfilled by the proposals for mandatory and optional fields, the user requirements evaluation will identify additional fields.

Q. Do you agree with our assessment of the metadata standards and profile selection using UK Gemini?

Q. Are there additional fields not in either the mandatory or optional categories that should be added to the field list? Should these additional fields be mandatory or optional?

Q. For the existing fields, is their obligation for inclusion (mandatory or optional) correct?

2.1.4 Mandatory metadata elements

Adopting the UK GEMINI profile as the standard identifies the main data elements that are outlined in Table 3. Obligations are either Mandatory (M) or Optional (O). This implies that although these elements are in the profile they may not be completed for all datasets. The Number of occurrences indicates if a value is single (1) or multi valued (N). For example, the date field is multi-valued as the resource may cover multiple date ranges.

Table 3: Options for metadata records, record format and descriptions Mandatory Metadata Elements (UK GEMINI)

Element number	Element name	Element Description	Domain	Obligation	Number of occurrences
1	Title	Name given to the dataset (N.B. this should not be the digital filename)	Free Text	M	1
2	Alternative title	Short name, other name, acronym or alternative language title by which the cited information is known e.g. SSSI for Sites of Special Scientific Interest etc	Free Text	O	N
3	Dataset language	Language(s) used in the dataset e.g. ENG for English.	Free Text - recommended that a value from a controlled vocabulary is used	M	N
4	Abstract	Brief narrative summary of the dataset (This should be a clear statement of the content of the dataset and not general background information)	Free Text	M	1
5	Topic category	Main theme(s) of the dataset e.g. environment or oceans.	Topic Category Code List (ISO 19115)	M	N
6	Subject	Topic of the content of the dataset - typically it will be expressed as keywords or key phrases or classification codes that describe the main subject of the dataset Other terms may also be added, however it is recommended best practice to select a value from a controlled vocabulary/thesaurus).	Free Text Term from User defined list to reflect the main subject of the resource.	M	N
7	Date	Date and time for the content of the dataset (N.B. not its creation or publication date)	Duration of period	M	1
8	Dataset reference date	Reference date for the dataset (Notional date of 'publication' of the dataset, rather than the actual date of the currency of the data)	Date format as defined in MetaGenie	M	1
9	Originator	Person or organisation having primary responsibility for the intellectual content of the data	Free Text	O	N
10	Lineage	Information about the events or source data used in the construction of the dataset. Dataset history i.e. how the dataset was created or any processes used to create the dataset. Could include the scale of capture and how the digital dataset was created	Free Text	O	1
11	West bounding coordinate	Western most coordinate of the limit of the dataset extent, expressed in longitude in decimal degrees (positive east)	Real	M	1
12	East bounding coordinate	Eastern most coordinate of the limit of the dataset extent, expressed in longitude in decimal degrees (positive east)	Real	M	1
13	North bounding coordinate	Northern most coordinate of the limit of the dataset extent, expressed in latitude in decimal degrees (positive north)	Real	M	1
14	South bounding coordinate	Southern most coordinate of the limit of the dataset extent, expressed in latitude in decimal degrees (positive north)	Real	M	1

Element number	Element name	Element Description	Domain	Obligation	Number of occurrences
15	Extent	Extent of dataset by subdivision of country e.g. GBN for Great Britain, ENG for England.	Code list as defined in MetaGenie	M	N
16	Vertical extent information	Vertical domain of the dataset – to include lowest vertical extent, highest vertical extent, vertical units and the origin from which the elevation values are measured	ISO 19115 EX_Vertical Extent table	O	N
17	Spatial reference system	Name or description of the system of spatial referencing, whether by coordinates or geographic identifiers, used in the dataset e.g. National Grid of Great Britain, Regional Sea.	Code list Spatial Reference System from UK Gemini	M	1
18	Spatial resolution	Measure of the granularity of the data (in metres) For data captured in the field, it will be the precision to which the data is captured. For image data, it will be the resolution of the image. For data taken from maps, it will be the positional accuracy of the map	Real - equivalent to ground sample distance	O	1
19	Spatial representation type	Method used to represent the spatial aspect of the data e.g. vector, grid.	Spatial Representation Type Code list from ISO 19115	O	N
20	Presentation type	Mode in which the data is represented e.g. digital map, digital table etc	Presentation Form Code List from ISO 19115	O	N
21	Data format	Format in which the digital data can be provided e.g. ArcView Shapefile.	Free Text	M	N
22	Supply media	Type of media in which the data can be supplied e.g. CD or online.	Medium Name Code List from ISO 19115	O	N
23	Distributor	Details of the organisation(s) from which the resource can be obtained		M	N
24	Frequency of update	Frequency with which modifications and deletions are made to the data after it is first produced – revision regime of the dataset	Maintenance Frequency - Code list from ISO 19115	M	1
25	Access constraint	Restrictions and legal prerequisites for the access of the data e.g. copyright, license etc	Restriction Code List from ISO 19115	O	N
26	Use constraints	Restrictions and legal restraints on using the data – as above	Restriction Code List from ISO 19115	O	N
27	Additional information source	Source of further information about the dataset – may include a reference (e.g. URL) to external information	Free Text	O	1
28	Online resource	Information about the online sources from which the resource can be obtained – may be a URL	Free Text	O	N
29	Browse graphic	Graphic that illustrates the data - this may be the locate of, or a pointer to, a picture or a sample of the data	Free Text	O	N
30	Date of update of metadata	Date on which the metadata was last changed – this is the date at which the metadata can be considered current, rather than the dataset itself	Single Date as specified in MetaGenie	M	1
31	Metadata standard name	Name of the metadata standard (including profile name) used	Free Text	O	1
32	Metadata standard version	Version (profile) of the metadata standard used	Free Text	O	1

2.1.5 Optional elements and metadata extension

Metadata should be sufficient for the user to assess whether the resource is appropriate for selected use. The basic metadata elements may not be sufficient in all cases and therefore may need to either incorporate optional elements or be extended. Optional metadata elements are described in Table 3. These optional elements may be populated but may not be populated for all data. Optional elements may be drawn from a wide range of metadata extensions within the available metadata standards.

The Marine ALSF and GIS functions may require additional metadata elements, based on the potential user requirements. Table 4 identifies a list of additional metadata elements derived from an extended list from within other metadata standards and from assessment of the anticipated Marine ALSF GIS programme. The list is not exclusive and additional elements may be added subject to a requirements case.

Table 4: Metadata not in the specification for MetaGenie

Element Name	Element Description	Domain	Obligation
Distributor	Person or group distributing the resource. Included in MetaGenie, but not broken down into constituent elements, which would allow more specific formatting and search criteria.	Free Text	Mandatory
Distributor Contact Title	Role or position of the responsible person	Free Text	Mandatory
Name of Distributor	Name of organisation supplying the dataset	Free Text	Mandatory
Postal address of distributor	Postal address of distributor	Free Text	Optional
Tel No of distributor	Telephone number by which individuals can talk to the organisation or individual	Free Text	Optional
Fax No of distributor	Fax no which individuals can use to contact the organisation or individual	Free Text	Optional
Email address of distributor	Email address - as above	Free Text	Optional
Web address of distributor	Distributing organisation's World Wide Web (WWW) address	Free Text	Optional
Purpose	Summary of the intentions with which the resource(s) was developed - the rationale for creating a dataset and information about its intended use	Free Text	Optional
Use Limitation	Limitation affecting the fitness for the use of the resource or metadata. E.g. 'not to be used for navigation'.	Free Text	Optional
Completeness	Presence and absence of features, their attributes and their relationship e.g. notes of any missing data or 100% coverage.	ISO 19115 Specified Class	Optional
Positional Accuracy	Accuracy of the position of features e.g. +/- 5m.	ISO 19115 Specified Class	Optional
Temporal Accuracy	Accuracy of the temporal attributes and temporal relationships of features e.g. the date of the data compilation was August 1990.	ISO 19115 Specified Class	Optional
Thematic Accuracy	Accuracy of quantitative attributes and the correctness of non-quantitative attributes and of the classifications of features and their relationships e.g. areas have been classified according to remotely sensed imagery as green land although, in reality, they are swamps.	ISO 19115 Specified Class	Optional
Bibliography	Standard bibliographic records	?	Optional

Q. Do the proposed mandatory and optional metadata fields provide the right levels of information needed for recording and searching the research undertaken within the Marine ALSF and other marine/coastal programmes?

Q. Is any of the information proposed by the metadata records redundant? What additional record information should be added?

A single project may generate multiple records; these may be as a collection record or as separate thematic surveys. For example, as collection of aerial photographs within a flight campaign may be treated as a single collection record or as individual scene records. Such collection level records would be relevant to the MarineGIS although the individual inventories are beyond its scope, other than as linked resources. The MarineGIS is directed towards recording relevant research projects rather than individual datasets. Metadata is directed towards holding information about individual datasets whereas a complete project contains information from many datasets and associated reports. It is essential that the metadata record for the parent dataset (project) is generated and that sufficient information is recorded to identify the scope of the individual resources included. However, it may be highly desirable that the individual records and their specific record attributes are also recorded. The 'lineage' fields within the metadata records allow for the cross-association of multi-record programmes. The overheads of creating metadata records for each dataset need to be balanced against the potential to effectively discover relevant data resources.

Q. Within the scope of the metadata records within the MarineGIS is it necessary to record all individual survey datasets or is it sufficient to create metadata for the research project sufficient to locate records related to the component surveys?

2.1.6 Ancillary data and information

Ancillary information is described here as information relating to the research projects that would not normally form part of a metadata record, but that may still be of value to the objectives of the MarineGIS project. These datasets may assist the users in finding or accessing geo-related data, either as metadata or by linking to the geospatial data referenced by the metadata.

Table 5: Ancillary information that may be provided with the resource information

Information / data class	Requirement
Copies of reports generated through the project, (e.g. as PDF files)	Online documentation, potentially in a range of formats where copyright and access rights allow.
Online access to the geospatial data generated by the project	MarineGIS is metadata-centric but ideally the metadata would link to sites where the user can access the geospatial data and potentially non-spatial data records.
Data for online download	MarineGIS does not initially consider managing and maintaining project data records. The optional extension, at least for marine ALSF funded projects, exists if the development environment remains flexible.

Q. Are the ancillary data needed or is there additional information that should be added to the list of records?

2.1.7 Background data

MarineGIS includes a geospatial search facility, and background data layers are proposed that help the user identify the area of study, such as a basic map of the UK and bathymetry. Spatial metadata assumes that the search facilities will also allow spatial searching, either through defining the coordinates of the search or through a map-based search facility. Many metadata services offer spatial searches driven solely by the entry of the latitude and longitude coordinates, which would not be intuitive to many users. MarineGIS proposes a map-based interface to help locate geographic resource searches. This section explores the background map data against which the spatial searches could be operated.

The background data may include both spatial and attribute data describing these boundaries. For example, it may be relevant to be able to query the location of a licensed block, the licensee, block number, dates of operation, permitted activities/volumes etc.

Background map data proposals shown in Table 6 provide context and selection boundaries for information resources. This does not attempt to create a marine aggregate GIS capability online, which is fulfilled partly by other online resources.

- Spatial searches are generally based on the coordinates or a map-based query (bounding box) drawn on screen. The proposal is to enhance this search criterion to allow for searching within defined geographic areas (e.g. regional seas, licensed areas). Such searches will require the bounding polygons of such areas.
- More general textual geographic search criteria may be based on a coastal and marine geographic gazetteer. To develop such a capability a suitable marine gazetteer would be needed, but could be built up from the accumulation of the entered metadata records. The 1:50,000 scale gazetteer from the Ordnance Survey may provide the suitable coastal gazetteer.
- The system should support scale visibility for background data and allow the users to add and subtract layers.

Table 6: Background geospatial data source options

Information / data class	Requirement
Licensed dredging areas	<ul style="list-style-type: none"> ▪ Past licensed sites ▪ Current licensed sites ▪ Proposed resource areas ▪ Windfarm blocks
Administrative areas / Coastal authorities	<ul style="list-style-type: none"> ▪ Local Authority boundaries ▪ Regional sea boundaries ▪ SMP boundaries ▪ MNCR¹⁷ sectors
Heritage sites – wreck database	<ul style="list-style-type: none"> ▪ HO wreck sites
Gazetteer	<ul style="list-style-type: none"> ▪ Coastal and marine gazetteer to allow spatial searches
Conservation designations	<ul style="list-style-type: none"> ▪ Coastal SSSIs ▪ European Marine Sites (SAC/SPA/Ramsar)
Spatial backgrounds <ul style="list-style-type: none"> ▪ Bathymetric Chart data ▪ Coastal Ordnance Survey data 	<ul style="list-style-type: none"> ▪ Raster chart (EC) ▪ Vector chart data (e.g. SeaZone, GeoTopo/IBACO) ▪ ICZMap data ▪ Coastline

Q. What spatial data should be prioritised as background data for the Marine ALSF?

2.1.8 Access

The objectives of the MarineGIS project are to provide free access to information resources and resource discovery. The proposal is to make the web-based information available freely to the public and other classes of user.

The value of access login for the project is that it allows users to declare their interests and thereby receive updates, and potentially to obtain additional services through the website, for example, to

¹⁷ MNCR Marine Nature Conservation Review coastal sectors

provide invitations to the proposed workshop or launch. Registration and login also provide the basis of data entry and update by service providers and potentially for submitting reminders to suppliers for data update.

It is proposed to have two levels of access:

- Anonymous user login should have access to metadata records without supplying registration information
- Personal login based on user name and password

It is not proposed to store any data with restricted access, although this may be recommended by the user requirements where the MarineGIS provides a suitable mechanism for identifying a resource which may only be acquired through contact with the originator or supplier. It is proposed that any restricted access would direct the user to the relevant site wherever possible.

Q. Are there any services that you think should be restricted access?

2.1.9 User data entry and update

The present study will capture aggregate research project metadata for projects completed post 2000. Projects within the scope of the most recent Marine ALSF funding are proposed to enter their own records as a direct input to the programme. This will require a suitable project metadata entry form that is 'front-ended' to allow external user entry, edit and update. The rationale for this approach is based around the aspiration for the project to be self-maintaining, as far as possible following the development stage, with a light administrative, and entry validation support function.

A filter system based around quality assurance procedures is envisaged for ongoing metadata update. In the first instance, archive data will be uploaded into the database structure by the contractors. Subsequently, new metadata records are envisaged as being input by the contractor, along with any associated documents. Uploaded metadata will then be quality assessed by staff with relevant access rights who will have the ability to edit metadata and make any data accessible to users.

The entry options envisages a password protected login that allows the Marine ALSF project managers (or other projects if the system is opened more widely) to enter and update project records, to create new project records, commit changes and to upload or reference documentation URLs.

Specific user requirements:

- The metadata system should have an online interface to allow the entry, edit and update of metadata records by registered content providers. Such an interface should allow reference to value lists and thesauri to ensure compliant metadata. It is assumed that a metadata tool would **not** be needed for download to assist with metadata entry if an online resource is available.
- Inputting geospatial data through coordinates (lat long bounding boxes) need to be facilitated through the site if the service providers do not have access to GIS or automated metadata generation. Within the context of metadata for a whole R+D project, the bounding area may encompass a number of datasets requiring calculation of the coordinates.
- Initial data entry of archive resources (past research programmes) will be by the project team.
- Originators should have the ability to update and edit those records entered by the project team.
- MarineGIS administrators should have the ability to moderate records before record upload. The quality of the records is important to maintain if the MarineGIS is to be effective. It is proposed that the administrators would check the completeness of submitted records.
- Automated checks of link viability could be incorporated within the technical specification.

Q. Are other classes of data entry and update required?

2.1.10 Search functionality

The principles of the specified search routines are that they will be driven by the query of the metadata records. Hence, any search criteria need to have representation in the metadata records, be picked up by the free search strings or, in the case of the webGIS application, intersect the selected search boundary.

Spatial interfaces allow more generalised searches to be generated based on a range of geographic boundaries, rather than just searches on physical, textual data entries. A list of potential search functions is presented in Table 7. It is assumed that multiple geographic search capabilities would be enabled, allowing multiple geographic search criteria.

Locational searches, based on geographic areas, such as licence blocks or sea areas, require the availability of spatial datasets to drive search criteria. For items like licensed areas, the boundaries are legally defined and boundaries are available for download from Crown Estates. For other less well-defined areas, a geospatial dataset will be needed both to define the bounding coordinates for search and to provide a background map for the webGIS server. The source data for the background mapping (2.1.7) has yet to be defined (to be part of the technical specification), but would seek to use non-commercial sources to reduce the reliance on licensed data products within the site development.

A range of options are available for defining sea area search criteria, and appendix A identifies various limits for the sea and ocean areas.

Table 7: Potential search criteria and search options

Proposed Search options	Criterion / options	Qualifier
Spatial searching – by geographic textual location 'Search by maps'	<ul style="list-style-type: none"> ▪ by bounding box drawn on screen ▪ by regional seas ▪ by aggregate licensed areas ▪ by other geographic textual descriptor 	Defined regional sea list – see Appendix A for proposed look-up lists BODC list of sea areas SEA regional seas
Coordinates 'Search by textual location'	<ul style="list-style-type: none"> ▪ Lat/Long (decimal degrees) ▪ British National Grid 	Bounding coordinates
Locational	<ul style="list-style-type: none"> ▪ Sea areas ▪ Licence block 	See appendix A
Marine areas type	<ul style="list-style-type: none"> ▪ Coastal / Offshore 	
Subject / Topic / sub topic / data theme 'Textual search by fields'	<ul style="list-style-type: none"> ▪ Defined data theme list 	Topic field may be coastal specific or by ISO standard
Licence holders	<ul style="list-style-type: none"> ▪ Dredging licence holders information 	License holders
Data source holder	<ul style="list-style-type: none"> ▪ Organisation name 	Originator or supplier
Date range	<ul style="list-style-type: none"> ▪ Start and end date range 	Or potentially duration
Depth range	<ul style="list-style-type: none"> ▪ Depth of surveys of sites 	Based on chart datum or absolute records
Free search	<ul style="list-style-type: none"> ▪ All records containing a character string. ▪ Boolean search mechanism 	
Keyword	<ul style="list-style-type: none"> ▪ Defined list ▪ User-allocated 	Based on the 'subject' categories
Sort by	<ul style="list-style-type: none"> ▪ Parameters for sorting 	Varied sort parameters may be required, e.g. date of record

Q. What search functionality is required and what is the priority? Are the proposed search criteria relevant? Are there any that are less relevant to the objectives of the MarineGIS, or others that are more relevant than those proposed?

Search functionality is driven by the metadata and the thesauri used and it will be important to develop search criteria that effectively discover resources. For example, search of the interoperable NERC metadata gateway has limited search options (free search, time and geographic area); using the free text search will find locations within the heading of originators as well as data survey locations. A free text search finds no resources for the search criterion 'Solent' but finds 8 records for 'Southampton', yet examining the records indicates datasets are relevant to both sea areas. The geospatial search based on bounding coordinates would overcome these limitations of geographic descriptions. There is no map based search facility on the NERC metadata gateway.

The technical specification and system architecture will partially define the approach to the geospatial map searches. Map based searches assume that:

- The user should have access to basic map navigation tools – pan, zoom levels, scale visibility of base data
- That spatial search area can be defined by a range of techniques, through bounding box marquee tools, specifying geospatial boundaries (e.g. regional seas, licence areas etc)

Records that do not have coordinate information will need to be provided with the coordinates as part of the mandatory metadata. For generic research the bounding coordinates may be recorded as covering the whole of the area. For international resources there is a further issue of whether searches can be run against a map base. Users will need to understand the metadata and resource structure to get the best out of the resource searching.

2.1.11 Resource view and download

Search results returned from the query are considered a result set that meet the criteria. These results may be displayed in a number of ways:

- List of resources from a textual or map-based search
- Map based results from a text-based search

Having returned the result set, the records may be further queried or processed:

- To return individual metadata record from the listing, either as full record or as a summary
- To download information or documentation associated with the metadata
- To allow link to originator / organisation or online resource
- To allow search extension to external sites (e.g. linked sites)

What data, if any, should be available for download through the site? This question is clearly related to the data content proposed and the scope of the service. The current proposal is for no data downloads other than through linked services that identify remote servers where data may be available for download. There is potential for such data download from the MarineGIS site, but this lies outside the scope of the current project but would require additional data management architecture.

The proposed outputs are:

- MarineGIS metadata records with the potential for export of metadata entries (as XML) from within the system and various presentation outputs.
- If the MarineGIS stores information, such as the project documentation (e.g. pdf files) generated by these projects then these could be available for download.

- The current proposal is to allow download of the project documentation where this is held on the system and where copyright conditions allow. In other circumstances and wherever possible the site would act as a portal directing the user to the remote download site.
- The MarineGIS provides a spatial query function based on mapping the extent of the surveys, through bounding coordinates. Results from spatially-defined metadata queries can be displayed on the map base and there would be an option to print the resulting map of the location of specific resources and their identifiers.
- For metadata records located through other search criteria and through textual coordinate searches there should be an option to locate the identified resources against the map base.
- The webGIS server should provide the option to display relevant background data within the metadata record outputs.

Q. What data download formats would be best and would server-side translation be required?

- A number of metadata search engines allow records of searches to be accumulated (into a 'basket') with functions to clear, overwrite and export (the 'bucket', in the case of the MNCR marine field surveys created by JNCC). It is proposed that the searches within MarineGIS would allow for the accumulation of search results, with options to overwrite and clear the records to store and save metadata records.
- Recording and reporting the applied search criteria with the records produced provides a useful basis for managing the output when many searches may be run. It is proposed that the search criteria used within a specific search would be recorded within the scope of the data presentation and outputs.
- The standards used within the development of the MarineGIS service need to be documented and the records need to be available online and available for download.

2.2 Additional application areas - links

2.2.1 Introduction

Additional application areas include the evaluation of the potential to make links with other marine information servers. This application was conceived as a separate element, and has now been incorporated within the overall MarineGIS programme and further evaluation of the user requirements will be undertaken at this stage. The evaluation has assessed a wide range of Marine Information Systems (MIS) providers and is summarised in Table 8.

The word 'link' may imply a range of levels of interaction and integration; from merely adding a simple website link, to direct links to similar sectoral databases through to fuller integration (real-time data feed). The option here is for the metadata-based search criteria to be submitted to multiple online data resource catalogues to allow searches over a range of remote metadata catalogues. Interpretation of the term 'links' here is thus taken to be: the simultaneous searching of different metadata, relevant to the content themes of the MarineGIS where the data is maintained by other organisations and is held on remote servers.

This is the principle of a data portal or gateway, where the user is not required to run separate searches for relevant information feeds. The principles of such approaches are seen as important in reducing duplication of records, allowing growth of specific domain record input and in enhancing access to more comprehensive records.

2.2.2 Options

Providing links is important ultimately to the delivery of a useful product, as well as in future-proofing the development and integrating it within the wider community of marine information

systems. This interoperability is implemented within other (MIS) systems, for example a search from MARLIN may link to NBN Gateway – providing a ‘family’ of information resources for the marine zone – including others such as MEDAG, UKMED BODC etc. It is logical to conceive of the Marine GIS as contributing to an overarching framework.

The opportunity to reduce overlap between the system and these existing databases should help both us, as developers, and the user community. Closer links with the UK Marine Data Gateway and similar projects will be valuable in properly positioning the work, such that it becomes an important and non-duplicating contribution, and integrates effectively with other systems.

The proposal for linking to additional online databases requires a knowledge of the main marine metadata programmes – potentially both in the UK and overseas. The concentration at present has been within UK waters, although overseas links may be appropriate where there is best practice to evaluate. A shortlist of groups has been selected for further assessment of the potential links. The initial list of potential links has been assessed in terms of the data products that are available and the data delivery mechanism. From this long list (Table 8) a shortlist of the most relevant and complementary to the Marine ALSF GIS project have been selected for further evaluation.

Potential links within MarineGIS with existing marine information portals in the UK are proposed. Given the metadata standards employed there is potential to search using the same criteria across a number of separate databases. This has been employed in a number of existing coastal and marine metadata systems, such as the NERC Gateway. Currently all such examples use textual searches to submit search criteria across the distributed servers. However, there is no inherent limitation as to why this search capacity should not extend to map based spatial searches. Whether standards and which standards are used by other metadata systems will define the scope and ease of such interoperability. XML based schemas for metadata are now becoming the standard and therefore widening the potential to establish the MarineGIS as a portal based system.

The three essential link options that are considered here are:

- To reference other marine information providers (e.g. MarLin)
- To allow the user to select the databases that they wish to search when submitting a query (e.g. NERC Metadata Gateway), using the search criteria to allow linkage to sites where information sources are found (as a gateway).
- To use the search criteria and filters from the MarineGIS to search other ‘linked’ metadatabases automatically – to allow display of non-MarineGIS hosted data where the search returns records (as a portal with direct display of records).

The former approach is illustrated by the MarLin (SEARchable BEntnic Data – SEABED) (Figure 4). In this instance the users are directed to sites with potentially relevant data sources, there is no direct interoperability.

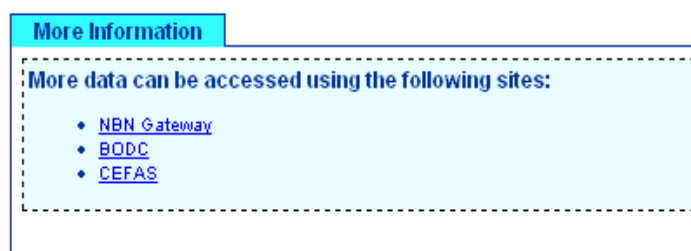


Figure 4: links page within Seabed metadata search process

The limitations of the current metadata searches are user understanding of the level of comprehensiveness of the records held in and returned by queries for any one data archive. These issues mean that searching of a metadatabase raises issues of:

- whether the records are held on only one metadatabase or whether records are repeated
- whether a search in one sea area returns records for a similar geographic area when using textual searches for other metadatabases
- sensitivity of the search query to the filters and criteria used

Q. Which of the link options outlined above would be essential or useful?

Q. Is the long list of potential products for linkage correct and complete? Which products are essential/missing/irrelevant?

The tasks involved in the evaluation:

1. Understand more fully which other metadata and data management systems are most relevant to 'link' to: (e.g. MARLIN, UKOOA, JNCC, BODC, UKMED, NBN, OceanNet etc). Given the scale of the tasks involved it may be necessary to prioritise the sites selected. This stage would rapidly review the relevant systems and their scope of coverage (spatial and thematic), and issues that need to be considered in interoperating. The output will be a brief review report, recommending the most relevant databases to investigate further.

2. Metadatabase interoperability is not something that can be delivered without the discussion and agreements with the data holders and data management organisations. In order to establish the scale of the interoperability development, a pilot will be developed with the Channel Coastal Observatory. Given that the MarineGIS under Marine ALSF is a new initiative, it does not form part of the wider body of organisations that are contributing to the management of marine and coastal information. Whilst there are some important initiatives in this area (ICAMST, DIMM etc) there is no agreed route to centralising or creating a fully interoperable portal.

It will be necessary to hold discussions with the key organisations to understand the structure and interoperability issues surrounding these other online databases. The outcome of these meetings will be the examination of data structures, interoperability mechanisms and standards compliance used within these other systems to evaluate technical issues for linking.

3. Develop a proposal and costing for the Marine Aggregate GIS development options for greater interoperability with other key metadatabase providers relevant to the marine aggregate sector.

Search functionality and returning results from interoperable metadatabases assumes that the source of the records is identified and that subsequent exploration and downloads of resources are driven from the host server by linking to the resource. Having agreed interoperability with other sites there is the option to refine the search across specific metadata resources by allowing selection of the data resources within the search criteria.

Table 8: Listing of organisations, information and scope of data and information delivery within the marine sector. ‘Interoperability’ is defined as those sites that return searches (map and metadata) from remote servers – rather than more simple links to other resources. The inclusions in this table of data, metadata and facilities are the result of our marine dredging focused investigation of sites. Sites and data services may include other programmes that do include other features that we have not assessed in this review.

Database	Name	Information	Metadata (standard)	Data view	GIS output search /	Project Documents	Interoperability	Data download
MarLIN	Marine Life Information Network UK & Ireland www.marlin.ac.uk	368 Surveys providing descriptions of where particular habitats, communities and species occur, and descriptions of the features of those habitats, communities and species which indicate sensitivity in relation to natural events and human activities. Marine node of NBN contributing to the NBN Gateway.	NBN Metadata	Data Benthic species data	Adobe SVG - output	No	No	No
Mermaid (JNCC)	Marine Environmental Resource Mapping and Information Database. www.jncc.gov.uk/mermaid/	Marine habitat and species information around Britain	NBN	Data Sites, habitats and species	Link to NBN	No	With NBN as pilot	No
NBN	National Biodiversity Network www.nbn.org.uk	Biodiversity, wildlife, species and habitats information	NBN Metadata	Data	Yes	Yes	With other biodiversity sites	No
UKOOA	UK Offshore Operators Association www.ukooa.co.uk	UK Offshore Operators Association (UKOOA) is the representative organisation for the UK offshore oil and gas industry. Its members are companies licensed by the Government to explore for and produce oil and gas in UK waters.	Metadata	No	via DEAL	Via DEAL	No	No
DEAL	DEAL Data Registry (owned by UKOOA) www.ukdeal.co.uk	Data and information about offshore Oil & Gas Exploration & Production for the U.K. Well, seismic and other baseline data. Developed by CDA a subsidiary of UKOOA	Metadata	Data	Web GIS	Data descriptions etc	Developing XML schemas BGS, CDA, DTi and POSC. Data submission by spreadsheet URL to vendors	No
UKMED	UK Marine Environmental Data (OceanNET) www.oceanet.org	Inventory of marine environmental data, sea level data, cruise information, marine monitoring, moored current meter data.	Metadata	Data	No	Reports	Yes – links to multiple metadatabases through OceanNET	No
BODC	British Oceanographic Data Centre	Tide gauge network, wave data index, research vessel cruise information, GLOSS sea level stations,	Metadata	Data	Web, map and paper	Yes	NERC Metadata Gateway	Yes

Database	Name	Information	Metadata (standard)	Data view	GIS output search /	Project Documents	Interoperability	Data download
	www.bodc.ac.uk	DODS sea level model data, CTD profile index, current metre inventories. Hosted by Proudman Oceanographic Laboratory part of the NERC Data Centre for Marine Sciences Part of the NERC Metadata Gateway – allows searches across NERC sites (BODC, EIC, BGS etc)			formats		Extensive – but EDMED collates records	
NERC Metadata Gateway	Natural Environmental Research Council Metadata Gateway www.nmp.rl.ac.uk	Searches Metadata from British Atmospheric Data Centre (BADC) British Oceanographic Data Centre (BODC) Environmental Information Centre (EIC) British Geological Survey (BGS) NERC Earth Observation Data Centre (NEODC) Important example of interoperability of metadata searches.	Metadata	Yes	No	No – but may be available through to linked organisations	NERC Metadata Gateway – linked resources from 6 data centres (not all marine)	No
Sea-Search	BODC Sea-Search www.sea-search.net	European directory of marine environmental data. All national directories within EDMED are assembled into a single centralised system managed by the BODC and are made available here and via the Sea-Search. Important, well populated European scale metadata holding.	Metadata	No	No	No	No	No
EU-SEASED	EUMARSIN, EUROCORE and EUROSEISMIC, www.eu-seased.net	Searchable catalogue of over 220.000 seafloor samples Three projects Seafloor samples Cores, Seismic and sonar Euroseismics provides detailed web GIS features. Hosts data from contributing agencies rather than interoperates to acquire. Offers an online data purchase option	Metadata	Data download (pilot)	Map based search	Documents	No	Demo of download
Crown Estates	Crown Estates www.thecrownestate.co.uk/40_aggregates_04_02_07	Documents relating to marine aggregates, cables, energy, fish farms, offshore wind farms, pipelines. Marine sector licences and the licence areas are available from Marine Estate. See also Windbase	Metadata	No	GIS (not online) – planned	Documents	No	No
SNS2	Southern North Sea Sediment Transport Study www.sns2.org	Sediment movement in the southern North Sea. HR Wallingford based project to support SMP and dredging application licensing. Built on earlier ABP/GeoData Southern North Sea database study.	Metadata (FGDC)	No	No	Documents	No	No

Database	Name	Information	Metadata (standard)	Data view	GIS output search /	Project Documents	Interoperability	Data download
		Difficult search criteria and no map search. Provides for online update.						
CCO	Channel Coastal Observatory www.channelcoast.org	Coastal survey and research data for the South Coast, supported by Defra and coastal authorities. Real-time and near real-time data feeds from survey instruments, project and source metadata for surveys and aerial photographic coverage.	Metadata	Data	Spatial Data	Documents	No	Yes
ICES	International Council for the Exploration of the Sea www.ices.dk	ICES Oceanographic and Database Services Marine ecosystem information for the North Atlantic. Comprehensive range of data management, metadata and data display and download (through full download or searchable download selection). Operate as ICES Environmental Data Centre. Linked with other major initiatives (e.g. HELCOM).	Metadata	Data	No – but image maps	Documents	Yes	Yes
IACMST	Inter-Agency Committee on Marine Science and Technology	IACMST maintains an overview of marine activities across Government. Global Ocean Observing Action Group (GOOSAG) defining a coordinated UK marine monitoring programme and the national contribution to Global Ocean Observing System (GOOS). The Marine Environmental Data Action Group (MEDAG) initiates activities relating to the development, management and exchange of data inventories.	No	Info exchange	No	No IACMST publications (pdf)	No	No
UK Marine Portal	UK Marine portal www.marineuk.com	Database of marine related companies and websites	No	No	No	Information Events, companies etc	No	No
EN	English Nature www.english-nature.co.uk/pubs/gis/gis_requester.asp	Data about environmental designations and habitats Nature on the map	Yes	Data	Maps	Documents	No	Yes (Spatial)
MAGIC	MAGIC www.magic.gov.uk	Environmental data mapping and download	Metadata	Data	Maps	Documents	No	Yes
EA	What's in Your Backyard http://216.31.193.171/asp/1_introduction.asp	Online access to EA data – water quality, flooding, flow	Metadata	Data	Maps	No	No	Yes
CCW	Landmap http://landmap.ccw.gov.uk/map/Map.aspx	Geological and habitat mapping for Wales – example of land based programme. EU supported programme to develop online information for Wales	No	No	Maps	Documents	No	No

Database	Name	Information	Metadata (standard)	Data view	GIS output search	Project Documents	Interoperability	Data download
		on landscape decision-making. Still under construction. Has relevance to marine / seascape approaches						
SCOPAC	Standing Conference on Problems Associated with the Coastline (SCOPAC) www.scopac.org.uk	Downloadable documents and maps for the south coast of England covering all data areas.	No	No	non GIS map images	Documents	No	No
BMAPA	British Marine Aggregate Producers Association (BMAPA) www.bmapa.org	Downloadable documents about all aspects of marine aggregates. Also supplies licence areas from Marine Estates	No	No	Licence areas	Yes (pdf)	No	Yes (docs)
EMSAGG	European Marine Sand and Gravel Group (EMSAGG) www.ciria.org/emsagg	Downloadable documents of relevance to the marine sand and gravel industry. CIRIA based service	No	No	No	Documents	No	No
JNCC	Joint Nature Conservation Committee [JNCC] www.jncc.gov.uk	Joint Nature Conservation Committee Agency supporting other initiatives, NBN, etc Developing new initiatives under Mapping European Seabed Habitats' or MESH – online metadata catalogue (see below)	See NBN Plans to deliver GIS layers for international sites					
MESH	Mapping European Seabed Habitats. http://www.searchmesh.net	EU Interreg IIIB programme for the mapping of European seabed habitats. Aims to be a metdatabse of mapping studies	Yes	No	Planned	Documents	Planned	Planned
MCEU	Marine Consents and Environment Unit (MCEU)	Consents information – on Public register and with GIS data to become available shortly.	No		Planned	Documents	No	No
CEFAS	CEFAS www.cefas.co.uk	Centre for Environment, Fisheries and Aquaculture Science, CEFAS, is a UK-based research and consultancy centre. We provide services in fisheries science and management, environmental monitoring and assessment, fish farming, fish health, disease and hygiene to clients around the world.						
	iSEA	an interactive mapping server providing online access to environmental and fisheries data for the UK shelf and beyond. (currently unavailable)	Yes	Yes User selectable by area and date range	Yes W. Europe)	No	No	Yes (map output)
	WAVENET	real time wave data from around the coast of England and Wales.	No	Yes	No (overview map)	No	No	Yes (via login)

Database	Name	Information	Metadata (standard)	Data view	GIS output search /	Project Documents	Interoperability	Data download
	National Marine Monitoring Programme	Spatial data for contaminants in UK coastal waters. Covering themes of marine pollution – chemistry, biology and biological effects	No	Yes	No (overview map selection)	Yes	No	Yes (docs)
	Southern North Sea Data www.cefas.co.uk/monitoring/page-b4.asp	from CEFAS automated <i>in situ</i> instrumentation for monitoring a range of physico-chemical and environmental variables. Basic and advanced data options. UK and S North sea buoy data	No	Yes	No (overview map)	No	No	Yes
SEISCAN	http://www.soc.soton.ac.uk/CHD/seisweb/SEISCAN.html	SEISCAN was a MAST III funded project to rescue early seismic reflection profiles, that exist only as paper records, computer scanning and archiving to a CD-ROM database of image files.	Yes	Yes	No	No	No	Yes
MIRO	Mineral Industry Research Organisation [MIRO] www.miro.co.uk	Industry funded research and information organisation for the international minerals industry. Specialises in assisting member organisations to locate, develop and transfer innovative technology.	No	No	No	Yes Past and ongoing MIRO projects	No	Yes (reports)
CIRIA	www.ciria.org.uk	Provider of performance improvement products and services in the construction and related industries. Host to the European Marine Sand and Gravel Group http://www.ciria.org/emsagg/	No Publication database	No	No	No (purchase)	No	No
CEDA	Central Dredging Association [CEDA] www.dredging.org	CEDA, an independent, non-profit, non-governmental, professional society, aims to provide such a forum for all those involved with any kind of activity related to dredging and who live or work in Europe, Africa or the Middle-East.	No	No	No	Documents Guideline Bibliography	No	No
MAGIS	Marine Sand and Gravel Information Service [MAGIS] www.sandandgravel.com	Electronic market and central focal point for information and data on the marine sand and gravel, dredging and concrete industries. Links to dredging related information, many through OPL. See also Dredgeline	No	Licence sites and holders	Extraction licences online GIS	Online project reports	No	No
WODA	World Organisation of Dredging Associations [WODA] www.woda.org	A non-profit professional organisation, dedicated to the exchange of knowledge and information related to dredging, navigation, marine engineering and construction.	No	No	No	Documents policies	No	No
EH	English Heritage	English Heritage make sure that the historic	No	No	No	Documents	No	No

Database	Name	Information	Metadata (standard)	Data view	GIS output search /	Project Documents	Interoperability	Data download
	www.english-heritage.org.uk	environment of England is properly maintained and cared for						
Marine Estate	The Marine Estate www.crownestate.co.uk/estates/marine	The Crown Estate owns around 55% of the foreshore (between mean high and mean low water) and approximately half of the beds of estuarial areas and tidal rivers in the United Kingdom. It also owns the seabed out to the 12 mile territorial limit, including the rights to explore and exploit the natural resources of the UK Continental Shelf, excluding oil, gas and coal. Other CE sites include management of data/GIS.	No	No	Yes	Dredging areas diagrams (pdf)	No	No
UKHO	United Kingdom Hydrographic Office [UKHO] www.ukho.gov.uk	The UKHO is a government Trading Fund and part of the Ministry of Defence. Our primary activity is the provision of navigational products and services to the Royal Navy and the merchant marine in compliance with Safety Of Life At Sea (SOLAS) Regulations. Commercial services site for data (e.g. charts, wrecks)	No	No	UKHO Hydrospatial vector data and ECDIS raster charts	NO	NO	NO
MCA	Maritime and Coastguard Agency [MCA] www.mcga.gov.uk	The MCA is responsible throughout the UK for implementing the Government's maritime safety policy. That includes co-ordinating search and rescue at sea through Her Majesty's Coastguard, and checking that ships meet UK and international safety rules.	No	Lists	None	Documents Guidance and regulations	No	
Dredgeline	CEDA, IADC and VBKO funded online database – hosted by MAGIS http://www.dredgeline.net/	Dredgeline is an on-line bibliographical reference database. It provides an easy access to the vast body of knowledge existing worldwide in the fields of dredging and dredged material managements Oilfield Publications Limited. Grey literature, research reports, conference proceedings, Documents from TUDelft Library	None	Bibliographic reference	None	Documents Listing + Conference proceedings Grey literature	No	No
E2-D2	<i>(Environmental Effects & Dredging and Disposal)</i> http://www.wes.army.mil/el/e2d2/	US Army Corp of Engineers dredging environmental impacts information. Bibliographic search engine for environmental and dredging literature c 5000 references from the Dredging Operations Technical Support Program (DOTS). Maintained by Wetlands and Coastal Ecology Branch of the Environmental Laboratory, U.S. Army Engineer Research and Development Center.	None	Bibliographic references	None	No download	No	No

Database	Name	Information	Metadata (standard)	Data view	GIS output search /	Project Documents	Interoperability	Data download
OceanPortal	OceanPortal http://ioc.unesco.org/oceanportal/index.php	UNESCO supported OceanPortal is a high-level directory of Ocean Data and Information related web sites. Major linked resource sites	No	No	No	Yes	Yes	No
CoastalHydrography	http://www.coastalhydrography.com/	Integrated Coastal Hydrography (ICH) is a practical partnership between the United Kingdom Hydrographic Office (UKHO), the Environment Agency, Ordnance Survey and the Maritime and Coastguard Agency (MCA). It aims to produce both an on-line database of hydrographic metadata and a shared methodology for the definitive measurement of hydrographic data in the sensitive shallow coastal waters around the UK coast.						
ICZMAP	ICZMAP http://www.iczmap.com/	partnership venture between Ordnance Survey, the United Kingdom Hydrographic Office and the British Geological Survey. The project's aim is to enable the integration of terrestrial and marine geographic data held by British Geological Survey, Ordnance Survey and United Kingdom Hydrographic Office across the coastal zone, so that this can be accessed readily by users to satisfy diverse coastal zone applications and services.						

Database	Name	Information	Metadata (standard)	Data view	GIS output search	Project Documents	Interoperability	Data download
SeaNET	http://www.seanet-workshop.org/index.html	Sharing of North Sea hydrological and meteorological data within different countries. European Workshop on Fixed Monitoring Networks in the North Sea Region. Includes the development of SeaNet Data Interface. SeaNet Data Interface Project (SNDI) to define, develop and implement a data interface to facilitate the adequate data exchange between the fixed national monitoring networks. No British partner.						Not operational at present but potential to access data for the North Sea. Objectives to use GIS interface to display wide range of metocean and meteorological parameters. No operational datasets or data download at present.

3 Project timescales

Subsequent stages of the MarineGIS development are set out below. Feedback from the user consultation will be incorporated within the final user requirements specification and subsequent technical specification. These will be published on the Marine ALSF GIS website and will define the MarineGIS development.

- Spring 2005
 - Consultation with end users including other marine ALSF projects and feedback via online user forum
 - Publication of user specification
 - Publication of metadata specification
 - Publication of technical specification
- Summer/Autumn 2005
 - Metadatabase and webGIS development
 - Preparation of historic project metadata and digital reports
- Winter 2005/Spring 2006
 - Population of metadatabase
- Summer 2006
 - Launch pilot webGIS for testing by users including other ALSF projects, feedback provided by online user forum
- Winter 2006
 - Launch public webGIS
- Spring 2007
 - Incorporate metadata and deliverables from other marine ALSF projects into database

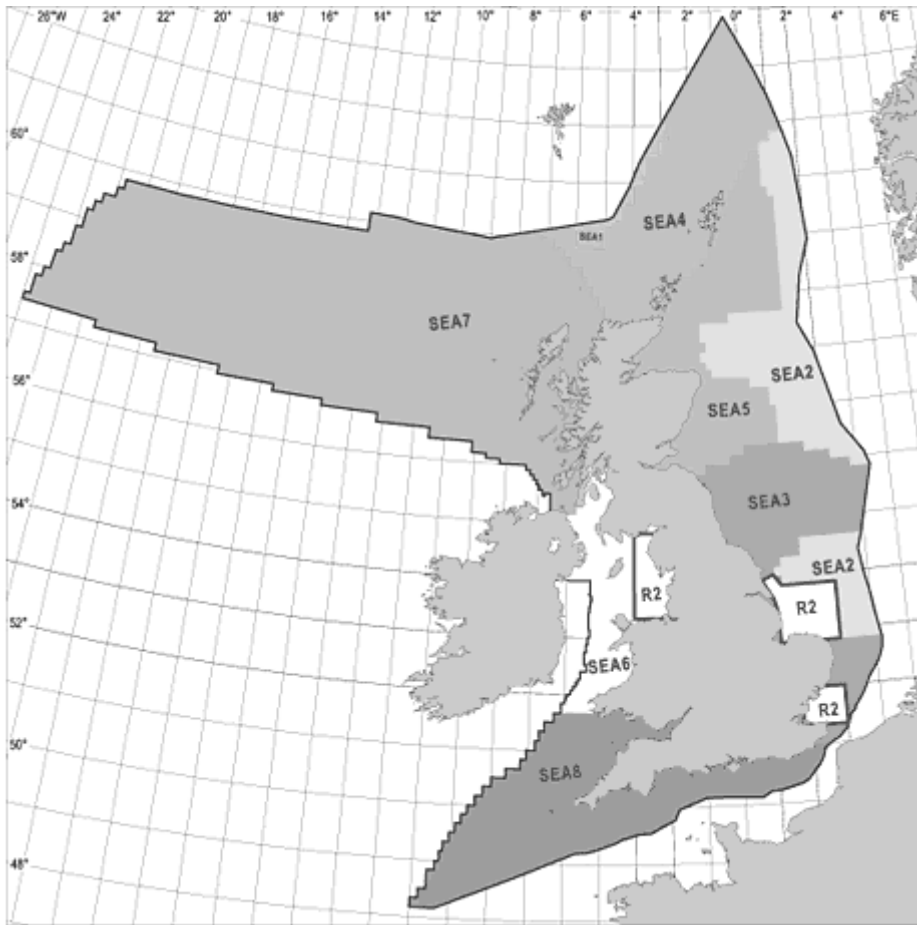
Appendix A Look-up table options & Regional Sea Areas (from BODC)

This table presents various options for marine area descriptions. The development of the metadata records assumes that the research surveys included within the metadata records may extend outside UK waters.

BODC Ocean/Sea Areas	BODC Marine area type	MarLIN sea areas / sectors
<p>3rd Edition of International Hydrographic Bureau Special Publication No.23 published in 1953.</p> <p>A subset of these records may be relevant to the MarineGIS holdings, but the potential to reference overseas data may encourage a fuller catalogue.</p> <ul style="list-style-type: none"> • The Ocean/Sea Area pull-down menu has the following entries: NORTH ATLANTIC REGION <ul style="list-style-type: none"> North Sea Inner Seas - West Scotland Irish Sea Bristol Channel English Channel Celtic Sea Bay of Biscay 'Remaining' North Atlantic Ocean • BALTIC REGION including: <ul style="list-style-type: none"> Kattegat, Sound and Belts Baltic Sea Gulf of Bothnia Gulf of Finland Gulf of Riga 'Remaining' Baltic Sea • MEDITERRANEAN REGION including: <ul style="list-style-type: none"> Mediterranean Sea Strait of Gibraltar Alboran Sea Balearic Sea Ligurian Sea Tyrrhenian Sea 'Remaining' West Mediterranean Ionian Sea Adriatic Sea Aegean Sea 'Remaining' East Mediterranean Sea of Marmura Black Sea Sea of Azoz • SOUTH ATLANTIC REGION including: <ul style="list-style-type: none"> Rio de la Plata 'Remaining' South Atlantic Ocean • INDIAN OCEAN REGION including: <ul style="list-style-type: none"> Gulf of Suez Gulf of Aqaba Red Sea Gulf of Aden Arabian Sea Gulf of Oman Gulf of Iran Laccadive Sea Bay of Bengal Andaman Sea Mozambique Channel Malacca and Singapore Straits Greta Australian Bight 	<p>This search criterion is used to distinguish 'offshore' data from data which is essentially 'coastal, riverine or estuarine'.</p> <p>BODC use a 10 km boundary from the shore to demarcate 'offshore'.</p> <p>The Area Type table in BODC searches contains the following entries:</p> <ul style="list-style-type: none"> • Offshore Areas • Coastal Zones 	<p>Marlin adopts the following sea areas as coverage terms.</p> <p>Bristol channel and approaches Channel islands Clyde Sea East England East English Channel East Ireland East Scotland Irish Sea Isle of Man Liverpool Bay to Solway Firth Northern Ireland North Scotland North west Ireland North-west Scotland Northern North Sea Orkney Isles Other region Outer Hebrides SE Scotland and NE England South West Ireland South-west Scotland Southern North Sea West English Channel West of Scotland</p> <p>Western Approaches</p> <p>SEA Sea areas</p> <p>Figure 9 illustrates the sea area division for the SEA of offshore energy environmental assessment boundaries.</p>

<p>'Remaining' Indian Ocean</p> <ul style="list-style-type: none"> • SOUTH EAST ASIA SEAS REGION including: Gulf of Thailand East Indian Archipelago South China Sea • NORTH PACIFIC REGION including: Philippine Sea Eastern China Sea Yellow Sea Japan Sea Inland Sea Sea of Okhotsk Bering Sea Gulf of Alaska Coastal waters SE Alaska & British Columbia Gulf of California 'Remaining' North Pacific Ocean • SOUTH PACIFIC REGION including: Bass Strait Tasman Sea Coral Sea Solomon Sea Bismarck Sea 'Remaining' South Pacific Ocean • ARCTIC REGION including: Greenland Sea Norwegian Sea Barentsz Sea White Sea Kara Sea Laptev Sea East Siberian Sea Chuckchi Sea Beaufort Sea Northwestern Passages Baffin Bay Davis Strait Hudson Bay Hudson Strait Lincoln Sea 'Remaining' Arctic Ocean • SOUTHERN OCEAN REGION • WORLD WIDE COVERAGE 		
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Figure 9: SEA for offshore energy licensing (http://www.offshore-sea.org.uk/site/scripts/sea_archive.php)





Defra is responsible for the Aggregate Levy Sustainability Fund (ALSF) and appointed CEFAS to distribute the Marine Environment Protection Fund (MEPF) element of the ALSF.

The ALSF has three main objectives:

1. Minimising the demand for primary aggregates.
2. Promoting environmentally friendly extraction and transport.
3. Reducing the effect of local aggregate extraction.

Information about the ALSF MEPF programme can be found on the website <http://www.alsf-mepf.org.uk/default.htm>

Further information about the Marine GIS is available on the website <http://www.marinealsf.org.uk>



The ALSF MEPF programme is administered by CEFAS
<http://www.cefass.org.uk>



Defra is responsible for the Aggregate Levy Sustainable Fund
<http://www.defra.gov.uk/environment/waste/aggregates/>