

A FRAMEWORK TO SUPPORT SEABED HABITAT MAPPING

MESH Maps Come Online

An international team of scientists, working over the last four years, has developed a framework for Mapping European Seabed Habitats (MESH). The project achievements far exceeded those originally planned, and the Partners are eager the standards, protocols, tools, techniques and guides produced are adopted by a wider group of marine surveyors. This article describes some of the key outputs of the project including an online meta-database of over 1,000 seabed surveys; a mapping website – the MESH webGIS launched in January this year; and the first unified seabed habitat map of north-west Europe. The work undertaken through MESH makes an important contribution towards marine spatial planning at a European level.

The seas around north-west Europe support an exceptionally rich and diverse range of seabed habitats from lush kelp forests and seagrass beds to deep cold-water coral reef (Figure 1) and sponge communities. Competition and conflict between seabed users, both in the coastal zone and increasingly offshore in the deep ocean, heightens the demand for marine management and spatial planning to optimise the use of space and resources. Many global challenges such as climate change and biodiversity loss can only be met at an international level, where support for marine spatial planning as a policy tool is gathering momentum. The European Commission's recent marine policy initiatives, the Maritime Green Paper and the proposed Marine Strategy Directive, both require periodic assessment of the state of the seas including the provision of information and maps on marine habitats.

Management of marine resources creates a substantial demand for intertidal and subtidal seabed habitat maps, which have been met by a burgeoning of seabed mapping and sampling studies in recent years, mostly in relation to specific development proposals, licence applications or the designation of protected areas. Unfortunately, such a piecemeal approach has resulted in little co-ordination between studies that, when combined with a lack of agreed standards for habitat mapping, has resulted in an inability to provide a consistent data source to support regional, national and international perspectives on marine resources.

It is the international aspect to marine management that inspired the Mapping European Seabed Habitats (MESH) project, whose outputs intend to contribute to the development of the emerging marine planning mechanisms, by providing accurate, repeatable and standardised methodologies for data collection and interpretation. MESH focuses on establishing standards to produce a framework for quality seabed mapping into the future.

"MESH aims to answer questions about seabed habitats from a wide range of stakeholders. The answers provided will allow managers and policy makers to make more informed decisions on how best to protect and conserve our natural resources for future generations. We can't protect our marine resources until we know what's there", Fiona Fitzpatrick, seabed survey manager, Marine Institute.

MESH began in 2004 and is made up of a consortium of twelve Partners from five European countries led by the UK's Joint Nature Conservation Committee (JNCC), with financial support from the European Community's INTERREG IIB North West Europe Programme. The MESH Partnership draws together scientific and technical habitat-mapping skills, expertise in data collation and its management, and proven practical experience in the use of seabed-habitat maps for environmental management within national regulatory frameworks.

Over the last four years, MESH has created a structure to collate and improve habitat maps at a national level, contributing in turn to the compilation and aggregation of data at international level. Many of the tools and guides can be used to facilitate data sharing and therefore add value to marine survey data you already possess. The products and tools described below cover a wide range of mapping issues and hopefully are useful to anyone engaged in coastal and offshore survey work with the aim of producing seabed habitat maps. All the products developed through the framework are publicly available. One of the first tasks of the project was to build an inventory of existing seabed habitat mapping studies, from MESH Partner countries, ranging from detailed local studies to maps covering national and regional seas. Descriptions of these studies were stored in a meta-database and published via an online catalogue.

Metadata Catalogue

The MESH Metadata Catalogue is a regularly updated reference library containing over 1,000 studies that can be queried by country, region, habitat classification scheme or theme. Where habitat mapping data are available, the Metadata Catalogue provides a link to the MESH webGIS so that users can view the area covered by a particular study in conjunction with all other studies. To facilitate data exchange and promote collaborative working, the MESH project also developed a metadata standard specific to seabed habitat mapping that remains compliant with the recognised international standard for metadata (ISO 19115). The metadata spreadsheets and a guidance document are available on the MESH website.

Confidence Assessment Tools

An important part of the MESH process has been to focus on the integrity of existing maps and to encourage an honest and open

approach to assessing the suitability of each map for the intended purpose. The project has developed a 'confidence assessment methodology' where the evaluation process addresses three main questions:

- 1.How good is the remote sensing?
- 2.How good is the ground truthing?
- 3.How good is the data interpretation?

The maps on the MESH webGIS are presented with confidence ratings so that end-users can determine their adequacy for decision-making. In addition, future survey efforts can be strategically directed to areas where maps have relatively low confidence or no map coverage. For guiding future work, MESH developed a survey-scoping tool that assists the survey planning stage to help assure a project can deliver a final map with the desired confidence rating.

The International Council for the Exploration of the Seas (ICES) Working Group for Marine Habitat Mapping reviewed the MESH confidence assessment tools and commented, "This is considered to be the first multi-criteria, systematic, confidence assessment methodology of its kind to be produced for marine habitat mapping". The tools will be available on the MESH website in July 2006 through the Guide to Habitat Mapping.

Data Exchange Formats

Another key element of the MESH Project was co-operation between Partners at an international level. To be able to share data across the Partnership, it was clear that a single data format had to be agreed upon that was simple and efficient to use. There were a number of different types of data used by the project and so, to further simplify the process, Data Exchange Formats (DEF) were defined for each data type. The DEF are freely available from the project website and we hope these standard formats will be adopted by others to ease the flow of data over a wider network, making data more accessible and, therefore, more valuable and easier to integrate with the existing MESH data to extend the coverage of our maps.

Standards and Protocols

In a bid to improve standards and add an element of quality control to future mapping studies, MESH drew upon experience from across Europe to develop a set of internationally agreed standards and protocols for habitat mapping. MESH initially reviewed the existing literature on survey techniques, from which recommended practises were tested and refined through field studies, to produce comprehensive Recommended Operating Guidelines (ROGs). The Review of Standards and Protocols report, which would be of value to anyone planning a survey or working in the field, details the key seafloor mapping tools currently being used in seabed mapping and is available for download from the project website. The reviews of techniques were subdivided into remote sensing, acoustic systems, in situ sampling, and video and imaging.

Taking the standards further and giving advice on all elements of habitat mapping, from planning to display, is one of the key outputs of the project, the Guide to Marine Habitat Mapping. This interactive guide is delivered through the website and pools all the expertise of the MESH scientists into a readily digestible format. The guide has been skillfully layered to provide information at three levels; from the interested layperson through to the specialist mapping scientist. Each section starts with an overview and introduction to set out the important 'need-to-know' principles, and then progresses through further chapters offering more technical details, culminating in Recommended Operating Guidelines (ROGs) to help the field surveyor or data analyst standardise their work. The Guide is extensively illustrated with case studies and worked examples from the MESH project's field surveys, and is a gateway to all the downloadable interactive tools.

MESH webGIS

The MESH webGIS, an online interactive mapping system, is one of the more accessible and visual deliverables from the project. Habitat maps are displayed in a standard form through a bespoke GIS. Project Partners have converted all the habitat categories used in existing habitat maps to their respective EUNIS habitat class to create a single, consistent habitat map for north-west Europe (Figure 2). Data layers are assigned to seven generic types for display: habitats (EUNIS and original data), modelled (marine landscapes), physical (bathymetry, seabed sediments), boundaries (coastlines and administrative areas), study areas (outlines of areas of habitat mapping), validation samples, and images (acoustic data). Each data layer has a defined 'zoom range' appropriate to the layer; for example, the administrative regions only appear at a broad scale. Maps can be queried to create printable reports describing the habitats in an area of interest and the system links to the online Metadata Catalogue so that the user can retrieve background information about each study (Figure 3). It includes an image catalogue allowing the user to click on the map to reveal images of the seabed at that location. It is also possible to get a direct live data link to your desktop GIS system or other web mapping services such as Google Earth. The MESH webGIS was launched to the public in January 2007 – it is free to use and only a simple registration is necessary to obtain login details.

As the last phase of the MESH project draws to a close, the Partners are still keen to push the work forward and assimilate new datasets into the Metadata Catalogue and MESH webGIS. Feedback on all of the above tools and guides is extremely welcome. Project partners are developing a strategy to continue this work into the future both to maintain and enhance the existing products and pursue new uses for these products within the general framework of marine environmental management.

In an industry sector where data comes at such a high cost, the added value in standardising your product to make it accessible to a larger market is huge and we hope that the MESH standards will help you achieve such goals. If you would like more information on the project and to access any of the guides or tools mentioned above, please visit our website at 1 and/or get in contact with one of the project Partners.