

The EMODnet Seabed Habitats initiative and examples of application of the EUSeaMap broad-scale seabed habitat maps

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Summary

European Directives, such as the Marine Strategy Framework Directive, benefit from full-coverage seabed habitat maps of all European seas. A time- and cost-efficient way to produce such maps is to use low-resolution datasets and models to predict broad-scale seabed habitat types. The EMODnet (European Marine Observation and Data Network) Seabed Habitats project aims to produce broad-scale seabed habitat maps covering all European seas in a consistent way. In its first phase (2009-2012) over two million km² of European seabed were mapped. In the second phase the coverage of these maps will be extended to all European seas by 2016 and the existing maps improved. Predicted seabed-habitat types are mapped by combining a series of proxy measurements, such as water depth and light levels amongst others, using statistical analysis to identify relationships with biology and GIS modelling. The habitats are classified following the EUNIS hierarchical system. The outputs of the first phase of the project are being used across Europe for planning and reporting purposes including supporting the development of coherent Marine Protected Area networks, establishing monitoring programmes for seabed habitats and informing marine planning. A potential application of EUSeaMap products is indicator development for MSFD predominant habitats.

Introduction

Management policies and actions, including marine spatial planning, need to be informed by the best-available data if they are to achieve long-term sustainable use and management of the marine environment and its resources. European Directives, such as the MSFD and Habitats Directive demand for reliable full coverage habitat maps for assessment and monitoring of benthic habitats. However data on the distribution of habitats in Europe is limited as sampling and surveying vast areas of seabed remains a complex, expensive and time-consuming activity, despite advances in methods and technology. As an example, compared with other Member States the UK has one of the largest number of habitat maps from survey data and yet still only around 10 to 20 % of the continental shelf has been mapped in this ways (Aish et al., 2010). EMODnet Seabed Habitats is a project aiming to produce a broad-scale seabed habitat map (EUSeaMap) covering all European Seas in a consistent way as well as collating, standardised and publishing more detailed habitat maps from surveys from across Europe.

Materials and Methods

EUSeaMap builds on the approach of projects such as BALANCE (Leth, 2008) the broad-scale mapping project within MESH (Mapping European Seabed Habitats; Coltman et al, 2008), and UKSeaMap 2010 (McBreen et al., 2010). Habitats are classified following the EUNIS (European Nature Information System) habitat classification, a 7 tiered hierarchical system (Davies et al., 2004), which provides a common European reference set of habitat types (Vasquez et al., 2015).

The best-available spatial data for several environmental abiotic variables were acquired and harmonised into rasters. These include seabed substrate and depth mosaics provided by the EMODnet Geology and EMODnet Bathymetry projects respectively, and newly commissioned layers such as light attenuation coefficient from satellite data. Depending on the basin, layers of hydrodynamic energy, salinity and/or temperature were also produced. An ESRI™ ArcGIS ModelBuilder model was developed. Rasters were classified using ecologically relevant thresholds.

These values were obtained by analysing available biological data to define meaningful thresholds for likely changes in habitats, where the change in the physical conditions reaches a critical point that defines an expected change in habitat type (at the map-scale adopted in EUSeaMap). For example in the West Mediterranean the lower limit of the infralittoral zone is defined by the growth limit of *Posidonia oceanica* seagrass. Layers of good status *Posidonia* meadows whose lower limits have typical morphologies induced by the lack of light were selected. Values of light percentage at the seabed were extracted at those limits. Those values were used in a statistical analysis to determine an optimal threshold value, which was subsequently used in the raster classification.

Results and Discussion

Before 2015 the model had been applied to the Baltic Sea, the Western Mediterranean Sea, the Greater North Sea and the Celtic Seas to produce three 250m resolution regional-specific EUNIS predictive habitat maps covering nearly 2 million km². A harmonised map was also created, with habitats that are consistent between basins and roughly correspond to the MSFD ‘predominant habitats’. Since being available online (www.emodnet-seabedhabitats.eu) the EUSeaMap regional maps have been downloaded over 500 times. Users are from a wide range of sectors across Europe including NGOs, environment consultancies, industry, research institutes, universities, and government agencies. The outputs are being used for planning and reporting purposes, for example:

- as part of the UK Marine Biodiversity Monitoring Research and Development Programme to begin to develop monitoring options for benthic habitats at the UK-wide scale. The habitat maps can be overlain with maps of human pressures in order to develop sampling designs that focus monitoring effort on those habitats most at risk from human activities;
- as data sources during the creation of the UK’s first marine plan, which was finalised in 2013 for the East of England inshore and offshore area. EUSeaMap biological zones and energy map layers were combined with a local seabed substrate model to create a new map of broad-scale habitats in this area, where more-detailed habitat maps were not available;
- in combination with the latest habitat datasets from survey, to review the developing UK MPA network, where it was used to provide the predicted area of each broad-scale habitat within a given biogeographic region. This information was valuable for assessing the ecological coherence of the current MPA network in terms of progress towards adequate protection of each broad-scale habitat.
- At the Northeast Atlantic scale EUSeaMap is being used in combination with maps of human pressures to develop indicators under the MSFD e.g. against the OSPAR indicator “extent of physical damage to predominant and special habitats”.

A full coverage broad scale map of all European seas is being developed as part of EMODnet Seabed Habitats – release dates: September 2015 (first draft), September 2016 (final maps).

References

- Aish, A. Ashworth, J., Barrio Froján, B., Benjamins, S., Bolam, S., et al. 2010. Section 3.1: Marine Habitats. In: UKMMAS (2010) Charting Progress 2 Healthy and Biological Diverse Seas Feeder Report Ed. by Frost, M & Hawkridge, J. p68-271
- Cameron, A. and Askew, N. (eds.). 2011. EUSeaMap - Preparatory Action for development and assessment of a European broad-scale seabed habitat map final report: www.emodnet-seabedhabitats.eu/
- Coltman, N., Golding, N. & Verling, E. (2008) Developing a broadscale predictive EUNIS habitat map for the MESH study area. In: MESH Guide to Marine Habitat Mapping, www.emodnet-seabedhabitats.eu/pdf/MESH%20EUNIS%20model.pdf.
- Davies, C.E., Moss, D. & Hill, M.O. 2004. EUNIS Habitat Classification. Report to the European Topic Centre on Nature Protection and Biodiversity, Paris for European Environment Agency, Copenhagen.
- McBreen, F., Askew N., Cameron A., Connor, D., Ellwood, H., Carter, A., 2011. UKSeaMap 2010 Predictive Mapping of Seabed Habitats in UK Waters. JNCC report, no. 446. 103 pp <http://jncc.defra.gov.uk/page-5955>
- Vasquez, M., Mata Chacón, D., Tempera, F., O’Keeffe, E. et al., 2015. Broad-scale mapping of seafloor habitats in the north-east Atlantic using existing environmental data. Journal of Sea Research, MeshAtlantic: Mapping Atlantic Area Seabed Habitats for Better Marine Management 100, 120–132.