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Report of the Working Group on Marine Habitat Mapping (WGMHM)

22–25 May 2012

Isle of Vilm, Germany

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CIEM Conseil International pour l'Exploration de la Mer

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Executive summary

The Working Group on Marine Habitat Mapping (WGMHM), chaired by Pål Buhl-Mortensen, Norway, convened on the Isle of Vilm (Bundesamt für Naturschutz) in Rügen, Germany, from 22–25 May 2012.

Two essential topics that were dealt with during the meeting were accuracy and confidence relating to habitat modelling (ToR c) and the use of habitat mapping for management (ToR d). Experts also presented statuses on both national and international mapping projects (ToR a) and b).

There have been recent contacts between three EGs, namely BEWG, WGEXT and WGMHM to start dealing with overlapping issues. These were also discussed during the meeting.

The venue for the 2013 meeting will be Copenhagen.

1 Opening of the meeting

The meeting was held at Bundesamt für Naturschutz, on the Isle of Vilm, Germany from 22–25 May 2012. The meeting was attended by eight delegates from seven countries.

Apologies were received from Dietmar Bürk, Roger Coggan, Martin Isæus, Vladimir Kostylev, Francis O'Beirn, Anu Reijonen, Brian Todd, Koen Vanstaen, Jeroen Wijsman, Jan van Dalfsen, Ibon Galparsoro, Touria Bajjouk, David Connor, and Cecilia Lindblad.

2 Adoption of the agenda

The meeting agenda (Annex 3) was reviewed and revised at the start of the meeting before it was accepted by the group.

3 Progress in international mapping programmes – ToR a)

3.1 MeshAtlantic status report

a) Broad-scale map

Jacques Populus – Ifremer

Depth and substrate data collation for the Atlantic Area have been completed. All data were gridded to the 250m resolution adopted for the map. Datasets came along with their confidence assessed as per EUSeaMap rules. A preliminary model run was made, using default thresholds for Eunis categories also from the EuSeaMap project. Issues with this run were identified at a recent meeting in April in San Sebastian. It was decided that more inputs were needed from the partners for assessing thresholds, since the ones considered in EUSeaMap were for Northern Europe and might be ill-adapted to the southwest part of it.

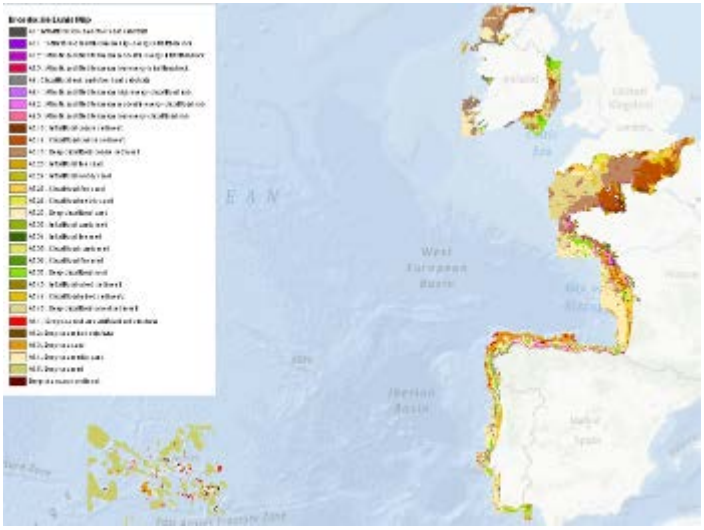
Partners agreed to review thresholds relevance in view of their available biological datasets, namely:

- Photic zone: to further confirm applicability of 1% light threshold
- Circattoral/deep circalittoral boundary: to compute a good quality wavelength layer

to check that the wave base limit fits recent Eunis-qualified samples

- Deep circalittoral/bathyal limit: to draw the shelf edge for the whole MeshAtlantic area and statistically compute a biologically relevant threshold from bathymetry.
- Intra-bathyal depth boundaries: to try to statistically compute from bathymetry biologically relevant divisions and respective thresholds for continental Portugal and Azores areas.
- Bathyal/abyssal boundary: to draw the bathyal-abyssal slope break for the whole MeshAtlantic area and statistically assess it with deep biology datasets.
- Energy thresholds: to further check energy thresholds (low, moderate, high) using local biological samples.

The modelled map (see in initial map below) is due for the end of 2012 and upon delivery there will be talks with JNCC for stitching it to the existing EUSeaMap map.



b) Progress in surveying and mapping

Jacques Populus – Ifremer

There were 22 cruises including one joint cruise for a total amount of 205 days at sea. A Scope of work (SOW) document was produced as a preliminary report on survey strategy. Two workshops were organized on scoping surveys and video survey techniques. The table below shows that SSS, MBES, grabs and video were the surveying tools most used within the partnership. A survey database was built for reporting on surveys and glossy executive summaries produced for publicizing survey work among the wider public.

	ACOUSTICS			RS	GROUNDTRUTH						OTHER
	SS	MB	SB	LiDAR	Grab	Trawl	Dive	Video	Camera	ROV	ADCP
IFREMER	√	√		√	√		√	√	√		
IMA		√					√				
IPIMAR	√		√		√			√ (no)			
AZTI		√			√			√			
U. Av.	√				√						
U.Alg.					√	√	√			√	
U. Az.		√			√						
IEO	√	√			√						
MI		√	√		√			√			√

c) The Eunis classification applicability: future prospects

Ibon Galparsoro – AZTI

The EUNIS (European Union Nature Information System) habitat classification system was designed to give a common European reference set of habitat units with a common description of all units and a common hierarchical classification to allow the reporting of habitat data in a comparable manner for use in nature conservation (in-

ventories, monitoring and assessments). The importance of a univocal habitat classification system is confirmed by the fact that numerous EU initiatives, aimed at marine mapping, assessment and reporting are increasingly using EUNIS habitat categories and respective codes so as to guarantee a common shared path and technical terminology among Member States.

For this reason, substantial efforts have been made to contain information on marine benthic habitats from different regions, thereby advancing the system's exhaustivity for its geographical coverage of European seas. As there are still many concerns on its applicability the MeshAtlantic project organized a workshop in San Sebastian in April 2012, focused upon the experience of different countries and case studies on the use of EUNIS. The aims of the meeting were: (i) to bring together scientists with experience in the use of the EUNIS classification, and representatives from the European Environment Agency (EEA); (ii) to agree on enhancements to EUNIS, that ensure an improved representation of the European marine habitats; and (iii) to establish practices that make marine habitats maps produced by scientists more consistent with managers and decision-makers needs.

During the workshop challenges in the development of EUNIS were identified, which could be classified into five categories: (1) Structure and hierarchy; (2) Biology; (3) Terminology; (4) Mapping; and (5) Future development. The workshop ended with a declaration from the attendees of recommendations to the EEA and ETC-BD about taking into account the discussions of the workshop, identifying weaknesses in the current classification and developing a process to further develop the marine component of the EUNIS habitat classification, with a deadline set at and 2014.

3.2 Progress in mapping habitats on the OSPAR List

Helen Ellwood – JNCC

The OSPAR habitat mapping programme is part of a wider programme to enable Contracting Parties to identify appropriate measures for the protection of the species and habitats on the OSPAR list of threatened and/or declining species and habitats. It should also contribute of the assessment of habitats listed in Annex III of the Marine Strategy Framework Directive. The UKs Joint Nature Conservation Committee (JNCC) coordinates the production of composite habitat distribution maps for the OSPAR area by collaborating with national leads, who compile the relevant data for its own marine waters and submit these to the UK for collation on an annual basis.

The majority of the data are the form of points, with polygons for some habitats in some countries. The distribution of the data are shown in Figure 1.

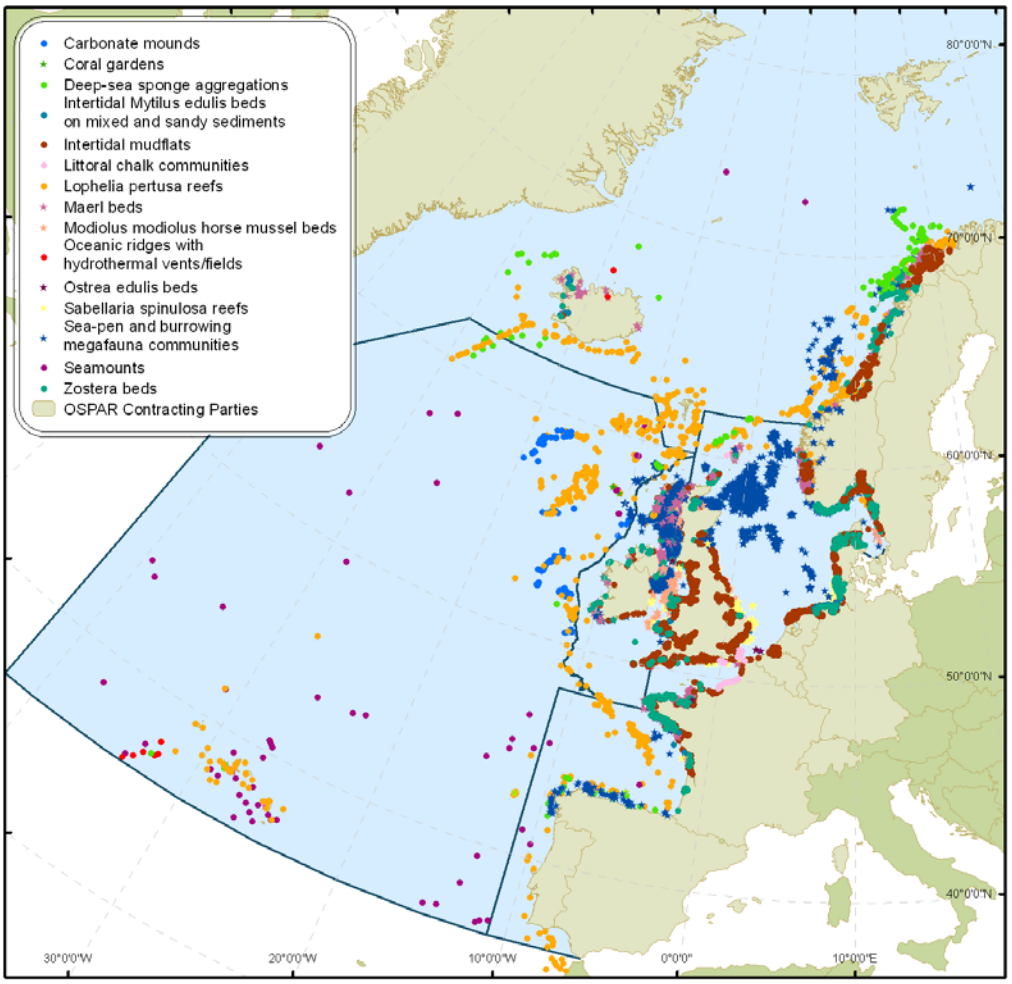


Figure 1. Map showing the distribution of 15 habitats on the OSPAR list of threatened and/or declining species and habitats, as supplied by Contracting Parties and other sources up to January 2012. Note that data for *Cymodocea* meadows are not yet available.

Data and supporting information are available via the OSPAR website and the UK's National Biodiversity Network (www.searchNBN.net/hosted/ospar/ospar.html). However, the data on this site have not been updated since 2008 due to the time required for such a task. The portal is difficult to navigate to, has low usage and is not capable of showing polygon data. JNCC and OSPAR are currently investigating other more suitable solution for disseminating OSPAR habitat data over the Internet. A temporary solution will be to display the data on the MESH Atlantic/MESH webGIS, which will in June replace the MESH webGIS at www.searchMESH.net/webGIS).

3.3 HELCOM activities in the context of habitat mapping

Dieter Boedeker – BfN

HELCOM has no habitat mapping program.

Within the BALANCE project (2005–2007) a map of marine landscapes in the Baltic was compiled, which gives a good overview, but does not include detailed information on sub-basin scales.

In the scope of compiling a Red List of marine and coastal biotopes HELCOM developed a biotope classification system in 1998, which is currently being updated (see ToR d).

4 National programmes (National Status Reports) – ToR b)

4.1 National programme report for Norway

4.1.1 The National Program for Mapping and Monitoring of Marine Biodiversity

Trine Bekkby (NIVA)

The program started in 2003 and is in 2012 funded by the Ministry of the Environment and the Ministry of Fisheries and Coastal Affairs, with a yearly budget of about 1.3 M€. The scientific part of the program is coordinated by the Norwegian Institute for Water Research (NIVA), and mapping is carried out by NIVA, the Institute of Marine Research (IMR) and the Geological Survey of Norway (NGU). I northern Norway Akvaplan-niva (NIVA's daughter company) is doing the field mapping on behalf of NIVA.

The field mapping (which started in 2007) focuses on large kelp forests, ice marginal deposits, soft sediments in the littoral zone, loose calcareous algae, eelgrass/seagrass meadows, carbonate sand, oyster areas, dense scallop occurrences and spawning areas for fish. By the end of 2011, 12 of the 17 counties with coastline were mapped (green areas in the figure on the left). In 2011 we start mapping Nordland (northern Norway), and the mapping in Rogaland (west coast) started in 2012. The program is planned to be finished mapping all counties in 2015. However, this depends on funding, which is decided from year-to-year.

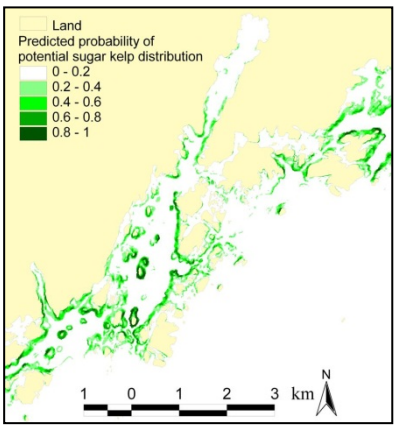
The different habitats require different tools for mapping, and spatial predictive modelling is an important tool for mapping kelp forest, carbonate sand etc (as the Norwegian coast is 100 915 km long, including all 239 057 registered islands). These tools have developed a great deal over the last years, and the group uses both GLMs, GAMs, MaxEnt, BRT (Boosted regression Trees) etc., all integrated in the R package. The NIVA group is testing the use off the free open source GIS packages GRASS and QGIS as a replacement for the ESRI ArcGIS tool.

4.1.2 Sugar kelp natural distribution along the Norwegian coast

Trine Bekkby (NIVA)

Sugar kelp (*Saccharina latissima*) forests have an important ecological function in the coastal zone, as they inhabit a large number and a specific composition of fauna. In 2002, a large-scale disappearance of sugar kelp was observed in Skagerrak and parts of the southwestern coast of Norway and the perennial sugar kelp forests were replaced by opportunistic and ephemeral filamentous algae. For management purposes, including identifying areas for restoration initiatives, maps of where sugar kelp forests are supposed to be found are needed. Based on modelled and field-measured geophysical variables and presence/absence data of sugar kelp, NIVA has developed spatial predictive prob-

ability models (i.e. maps) for sugar kelp potential distribution under natural conditions. These models were developed into maps presented to the managers.



In 2012, NIVA and the Institute for Marine Research are using the knowledge from Skagerrak and existing data along the southwestern part of Norway to develop the model of natural distribution along this part of the coast as part of the Nature index for Norway. The aim with the Nature index for Norway (a project coordinated by Directorate for Nature Management) is to give an indication on the development of the biodiversity in Norway and identify knowledge (mapping and research) needs. This requires knowledge of reference conditions. Fieldwork to fill in data gasp will be carried out in September 2012.

4.1.3 Nature types in Norway (NiN)

Trine Bekkby – NIVA

The Norwegian Biodiversity Information Centre ("Artsdatabanken") presented in 2009 the first version of NiN (Nature types in Norway). For the first time, Norway has a holistic system describing all nature. The same principles for classifying nature are used on land, in lakes, rivers and in the ocean, though the nature types and "sources to variation" in them will differ. The system is under testing and review, and the marine part will be classified at high level during 2012 (many marine species and nature types have already been identified and described).

4.1.4 MAREANO (Marine AREA database for NOrwegian coast and sea areas)

Pål Buhl-Mortensen – IMR

The programme started in 2005 as one of the tools for the process of developing a plan for the integrated management of the marine environment of the Barents Sea. MAREANO aims to map terrain, sediments, benthic habitats, species diversity and sediments pollutants. It is a multidisciplinary collaboration between the Institute of Marine Research (IMR), the Geological Survey of Norway (NGU), and the Hydrographic Service (SKSD). In addition to collecting new data, the partners collate existing information and present it integrated in the web portal www.mareano.no.

The coverage of video-transects is close to 1 per 100 km^2 and for sampling stations 2 per 1000 km^2. Faunistic results from seabed videos are used to classify sampled locations. Together with predictors derived from multibeam echosouder data (terrain variables and backscatter) these results are used to predict biotopes and habitats.

At the end of 2011, 76 000 km^2 have been mapped with multibeam echosounder, and 89 700 km^2 has been sampled (sediments, fauna and pollutants) using MAREANO's standard density of sampling stations during 12 sampling surveys.

4.2 National programme report for France

Jacques Populus – Ifremer

4.2.1 The Natura 2000 Cartham initiative

Seabed mapping in France received a great kick forward in 2009 when the Ministry of the environment realized the country was to a great extent failing to comply to Natura 2000 reporting due for 2012. It then commissioned the MPA Agency to issue a call for tender to cover the French marine Natura 2000 zones. The Objectives were to provide, insofar as possible, a) habitat maps with reasonable coverage, b) an assessment of the state of conservation of seabed habitats.

The initial facts are as follows:

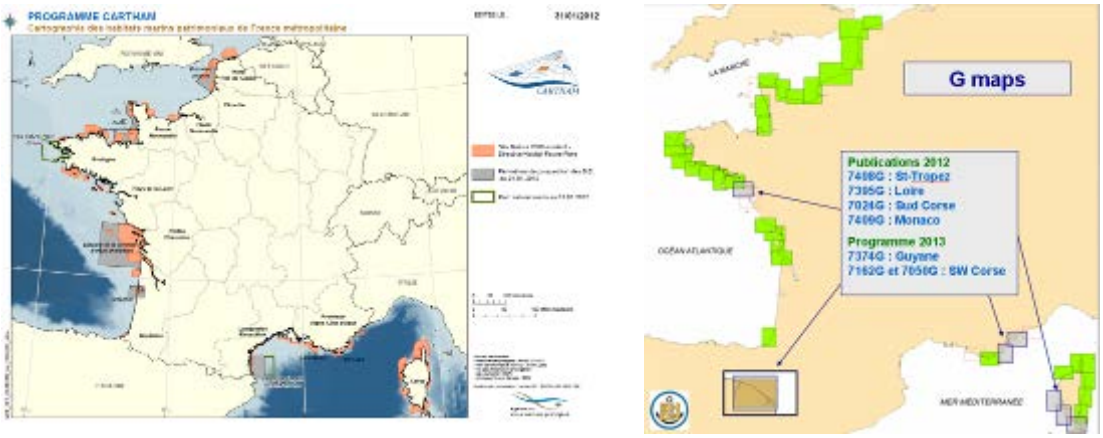
- Deadline: mid-2012 (2 years)
- Participants: 9 consortia, with the assistance of 18 scientific advisers (benthos ecologists)
- 20 lots summarizing the 66 Natura 2000 zones
- Total amount 6M€
- Total surface area: 20000 km²
- Specifications demanded that the Eunis classification was used on top of the Annex I types.

A first debriefing meeting took place in March 2012 where consultants showed their achievements. They were asked to describe the various phases of the work, from scoping to surveying and drafting the maps. The key features are the following:

- There was very little consideration of heterogeneity and not enough tanking into account of previous data and studies. Notably, the work physical Eunis maps commissioned by the MPA Agency were hardly used as backdrop information to give a first level of knowledge of substrate and depth zones.
- Scoping the study and clearly building up a strategy was not often achieved, which to some extent shows that there is little use of past experience (e.g. the Mesh project) and that people mostly go about in their own way.
- Acoustic coverage was overall limited to 5% (which amount to 1000km² of sidescan sonar). There was no use of multibeam which is easily understandable as multibeam is of little cost-effectiveness in coastal areas.
- Sampling density was in the range of 10km²/sample
- Confidence assessment was performed in only one case out of 20.
- There was recourse to habitat mosaics 15 times. The Mesh recommendations were followed in that mosaics were only composed of two habitats.
- "Orphan habitats" (i.e. not present in Eunis) amounted to about 10 (Atlantic and Mediterranean).

The figure below at left shows the distribution of Natura 2000 sites around the coast of France.

All produced maps, along with their metadata (expected to be delivered in the autumn) will be uploaded to the Sextant server hosted by Ifremer and also uploaded to the ICES webGIS (see Section 4.2.3 below).



4.2.2 Production of substrate maps

The production of substrate maps (cartes G) by the hydrographic office SHOM is continuing at a steady pace and the maps have sold to the 22000 thousands since its inception. The figure above shows the forthcoming plans. A big still concerns North Brittany because of data intellectual property issues. It is hopes that French public institutions can overcome this problem in the near future so that cartes G can have a full coverage. Let's recall that cartes G were in many places a key historic layer more than welcome to build the physical Eunis habitat maps (EUSeaMap project).

4.2.3 Production of other habitat maps

The Rebent project (only applying to Brittany) produced two additional detailed maps in the elapsed period, which brings its overall production to about 20 detailed maps. These latest maps have not yet been uploaded to the ICES website as their metadata still need to be captured. Along with historic maps covering the Channel an Atlantic coasts, the maps outlines can be visualized in the ICES discovery website along with their metadata. For French maps, a link can then be made to the French map repository Sextant. From there, according to licensing rights, the maps themselves can be downloaded as shapefiles. The figures below show a geographic query on habitat boundaries and the returned metadata summary sheets including thumbnails.

fid	ID	DATASET	TYPE
wgmhm_surveyed_habitat_maps.210	FR000037	HABITAT	SURVEYED

Title:	Carte des peuplements benthiques du secteur de Concarneau (Source A. Ehrhold, A. Blanchet, D. Hamon, 2007) - Echelle : 1/5 000 à 1/10 000
Abstract:	Cette carte des habitats benthiques de la zone subtidale du secteur de Concarneau est le résultat du traitement, de l'analyse et de l'agrégation de données de ... - A. Ehrhold, A. Blanchet, D. Hamon de ...
Keywords:	habitats et biocoples; habitat; peuplement (biologie); benthos; biocénose; acoustique; sédiment marin; Recherche; Golfe de Gascogne; Bretagne; Concarneau; France; Rebent; biota

Show Metadata

fid	ID	DATASET	TYPE
wgmhm_surveyed_habitat_maps.215	FR000046	HABITAT	SURVEYED

Title:	Atlas des fonds meubles du plateau continental du golfe de Gascogne : cartes biosédimentaires (Source Chassé C., Glémarec M., 1976) - Echelle 1 / 100 000 à 1 / 500 000
Abstract:	Cette carte est la synthèse des cartes de l'atlas de Claude Chassé et Michel Glémarec de l'Université de Bretagne Occidentale, "Atlas du littoral français, atlas des fonds meubles du plateau continent...
Keywords:	Habitat; Peuplement; Benthos; Biocénose; Sédiment; Carte; Rebent; biologie; Habitats et biotopes; France; Bretagne; golfe de Gascogne; biota

Show Metadata

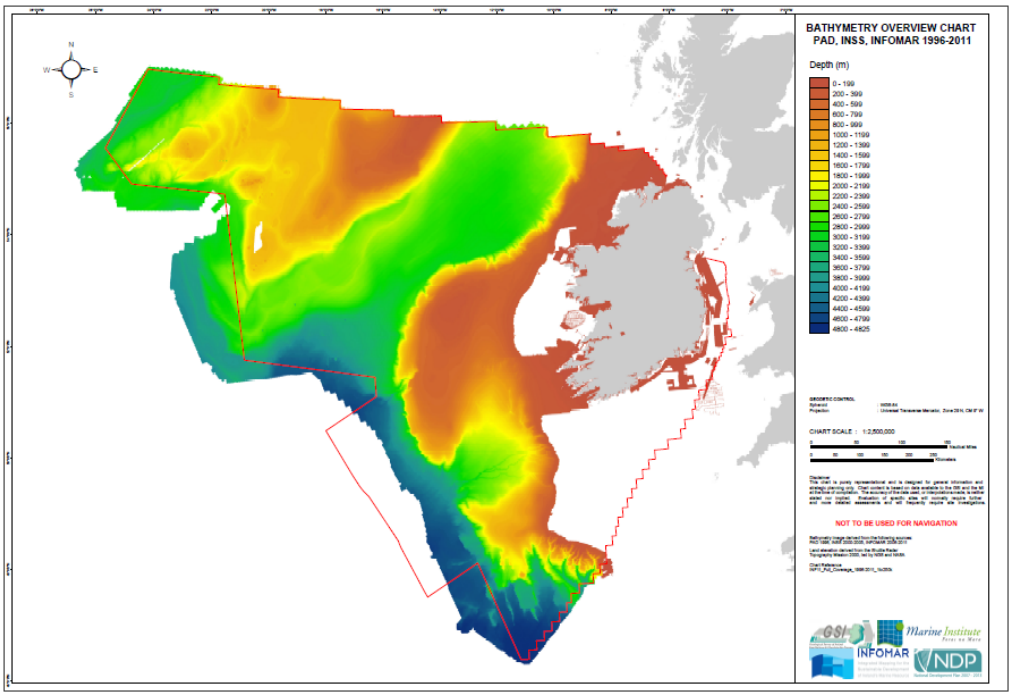
4.3 National programme report for Ireland

Fergal McGrath (INFOMAR Programme) – Marine Institute

Presented an overview of the work currently being undertaken in Ireland.

4.3.1 National Mapping Programme – INFOMAR

INFOMAR (Integrated Mapping for the Sustainable Development of Ireland's Marine Resource) was launched in 2006 as a follow on the successful Irish National Seabed Survey (INSS) which ran from 1999–2005. The INSS mapped over 80% of Irelands offshore EEZ using MBES, sub-bottom profiler, gravimeter and opportunistic sampling. The current coverage map, comprising INSS and INFOMAR is presented below:



INFOMAR is a joint venture between the Marine Institute and the Geological Survey of Ireland (www.infomar.ie). Current annual funding for this programme is €2.9m. INFOMAR is a 20-year programme, which aims to carry out integrated mapping over the entire shelf and coastal waters of Ireland. Through extensive stakeholder consultation 26 Priority Bays and 3 Priority Areas have been identified for mapping during the first 10 – year phase of the project (2006–2016). There will be a mid phase 1 review before the end of 2012. The programme has achieved its target metrics for this period and it is approved to 2013.

The mapping programme includes acquisition of multibeam bathymetry and backscatter data together with a comprehensive geological sampling programme. Equipment used includes EM3002, EM1002, EA400, OLEX, Hull Mounted Pinger, Magnetometer, GeoSpark 200, underwater video, ROV, boxcorer, grab, and vibrocorer. Mapping outputs from the project include bathymetric data and geological maps. All results and raw data from INSS and INFOMAR are available for download and can be accessed at www.infomar.ie.

4.3.2 INFOMAR Activities

By the end of 2011 INFOMAR had acquired data in the Shannon Approaches and Irish Sea onboard the RV "Celtic Voyager". Data from Waterford, Wexford, Youghal and Belmullet were acquired by the RV "Keary". Significant additional data acquisition was undertaken as part of the Value Added Exploitation Programme including the following;

- Hydrographic, geophysical and geotechnical data acquisition offshore Belmullet for SEAI's Atlantic Marine Energy Test Site onboard the RV "Celtic Voyager".
- Hydrographic survey offshore Dundalk under the INTERREG IVA INIS Hydro Project.
- Habitat mapping survey and Water Framework Directive ground-truthing in Kenmare River, under the INTERREG IVB MESH Atlantic Project.

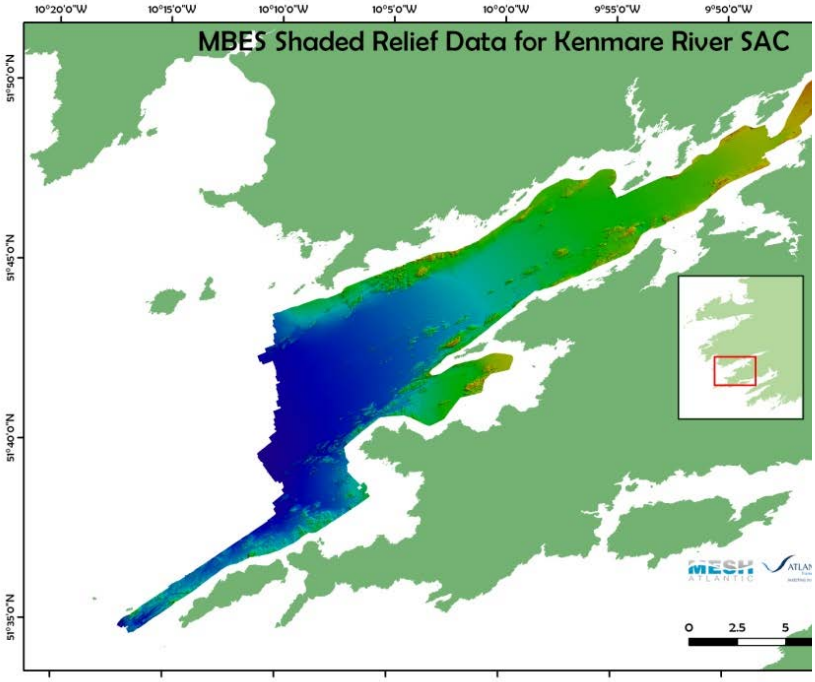


Figure 2. INTERREG IVB MESH Atlantic Coverage.

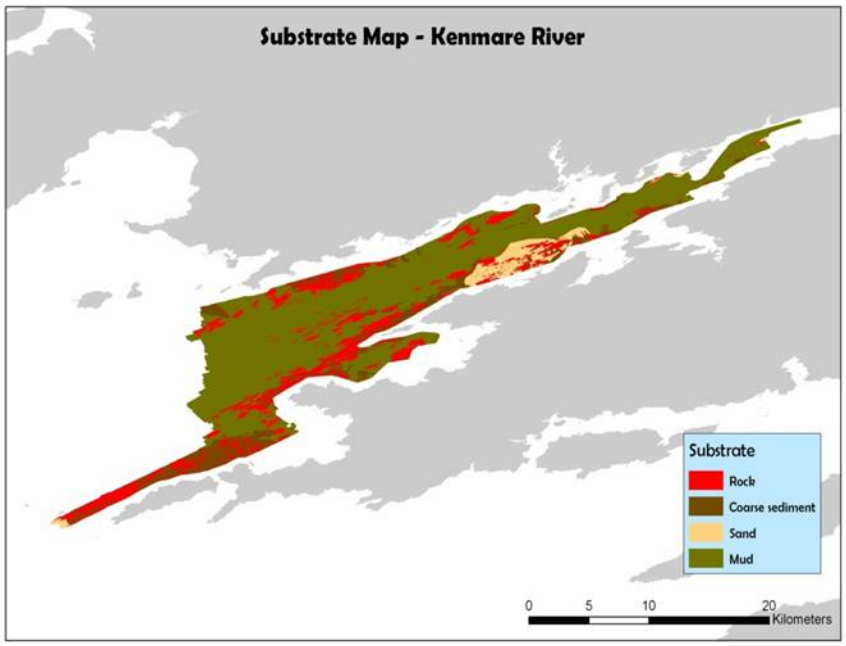
In addition, INFOMAR supported the coordination of the WestWave site surveys for ocean energy device site selection near shore Killard, Co. Clare, and Achill, Co. Mayo for SEAI.

Galway Bay Ocean Energy Test Site and Smart Bay cable route surveys were undertaken for SEAI.

Name	Acquisition	Platform/Dates
Irish Sea. East Priority Area	MBES	Celtic Voyager 04/2011
Waterford	MBES	Keary 04/2011
Wexford	MBES	Keary 04/2011
Youghal	MBES	Keary 05/2011
Blacksod	MBES	Keary 06/2011
Shannon	MBES	Celtic Voyager 07/2011
Kenmare	MBES	Celtic Voyager 08/2011
Dundalk (Shallow)	MBES	Keary 09/2011
Dundalk (Deep)	MBES	Celtic Voyager 09/2011
Celtic Sea. South Priority Area	MBES	Celtic Voyager 09/2011

The annual INFOMAR seminar was hosted in Marine Institute on 16–17 November which demonstrated the cross government and industry support for the programme outputs, support and infrastructure. Over 100 attendees were present, with representatives from academia, government agencies and departments, and Irish and international industries, ranging from oil and gas, environmental, survey technology manufacturers and personnel suppliers.

4.3.3 Habitat Maps



Through the Mesh Atlantic project, comprehensive collation and standardization of existing bathymetric data and existing substrate data in Ireland has been carried out. Existing seabed classification maps created by the INFOMAR programme and other national agencies / projects have being collated and translated into EUNIS classification. This will facilitate integration into the final Mesh Atlantic habitat map which is a deliverable of Mesh Atlantic requirements. The Kenmare Bay area was surveyed and the data interpreted. One of the products is a physical habitat map at EUNIS Level3. This will be brought to EUNIS level 4/5 with the integration of video and biological sample data.

4.3.4 Research Call – Value Added Exploitation

INFOMAR issued its 2011/2012 Research Call under the Value Added Exploitation Programme. 32 project applications were received and externally evaluated, following which 23 projects received Grant Aid Agreement research contracts. Projects were multidisciplinary, and demonstrated good industry research collaboration, with 15 industry partners, 15 research organizations, and 12 public bodies represented. 14 proposals were collaborative and 11 proposals involved technology development related to exploiting the value of the data and programme infrastructure.

4.3.5 Other Programme Activities

INIS Hydro: Ireland, Northern Ireland, and Scotland Hydrographic Survey. The Marine Institute is participating in this MCA led INTERREG IV project. There are 6 European partners in the project, which started in March 2011 and is due to be completed by April 2013. The objective of INIS Hydro is to provide a standardized seabed survey specification, and high-resolution seabed mapping data in key geographical areas, sensitive bays and inlets on the coasts of the bordering regions. It will also serve up the freely available results via the web.

EMODNET: European Marine and Observation and Data NETwork. This project, funded by DG Mare aims to develop EU wide thematic marine maps under three different modules. It is currently assembling marine data into interoperable and publicly available data streams for complete maritime basins.

GEO-SEAS: This project funded through the FP7 infrastructure fund, is a Pan-European Infrastructure for Management of Marine and Ocean Geological and Geophysical Data. It will represent a network of interconnected ecological/geophysical data centres. The Geological Survey of Ireland and the Marine Institute of Ireland are participating in this (both INFOMAR joint programme managers).

4.4 National programme report for Germany

Majke Kramer – BfN

The status of habitat mapping in the German North and Baltic Sea is still the same as described in the previous report (habitat maps from a project ended in 2010, based on existing data, which is mainly sediment data from point samples – see National Status Report 2011 for details).

BfN is going to start a comprehensive habitat mapping project in June 2012. The project was originally intended to start in 2011, but was delayed during the procurement procedure. The long-term aim is to map the entire German EEZ for both special and predominant habitat types, combining sedimentology, benthology and GIS modelling techniques. This process is estimated to take 12 years. During the first phase of the project (June 2012 – October 2014), the focus will be the following:

1) Natura 2000 sites in the German EEZ: comprehensive mapping
2) German EEZ outside Natura 2000 sites: mapping of biotopes protected according to German law (and at the same time by OSPAR and HELCOM)

Besides the mapping itself, the project also aims at reviewing and standardizing methods of surveying / sampling, data acquisition and analysis, as well as improving the existing German classification system.

4.5 National programme report for UK

Helen Ellwood – JNCC and James Strong – AFBI

4.5.1 Survey work

4.5.1.1 Special Areas of Conservation

The National Oceanography Centre, Southampton, carried out habitat mapping work in the Rockall Trough, NW Rockall Bank (cSAC), Darwin Mound (cSAC) and Hatton Basin to assess the status of different benthic habitats in relation to human activities,

especially deep-seabed-trawling. The Joint Nature Conservation Committee (JNCC) and Natural England also carried out surveys on the sandbanks within the Inner Dowsing, Race Bank and North Ridge cSAC and Haisborough, Hammond and Winterton cSAC off the east coast of England.

Surveys will also be carried out in 2012–2013 within Stanton Banks, Braemer Pockmarks, Scanner Pockmark and Wyville-Thomson Ridge cSACs to deliver evidence to contribute to the development of conservation advice and monitoring.

4.5.1.2 National MPA projects

The UK Marine and Coastal Access Act 2009 and the Marine (Scotland) Act 2010 require the creation of a UK-wide ecologically coherent and well-managed network of marine protected areas (MPAs) and marine conservation zones (MCZs).

MCZ site verification

For inshore England and offshore England and Wales, JNCC and Natural England have received MCZ recommendations from the dedicated sea user and stakeholder groups. The verification of the worthiness of these sites has required a large amount of recent survey work in order to collect new data (Figure 3). Habitat map production will begin when all the surveys are complete (see: jncc.defra.gov.uk/page-2409).

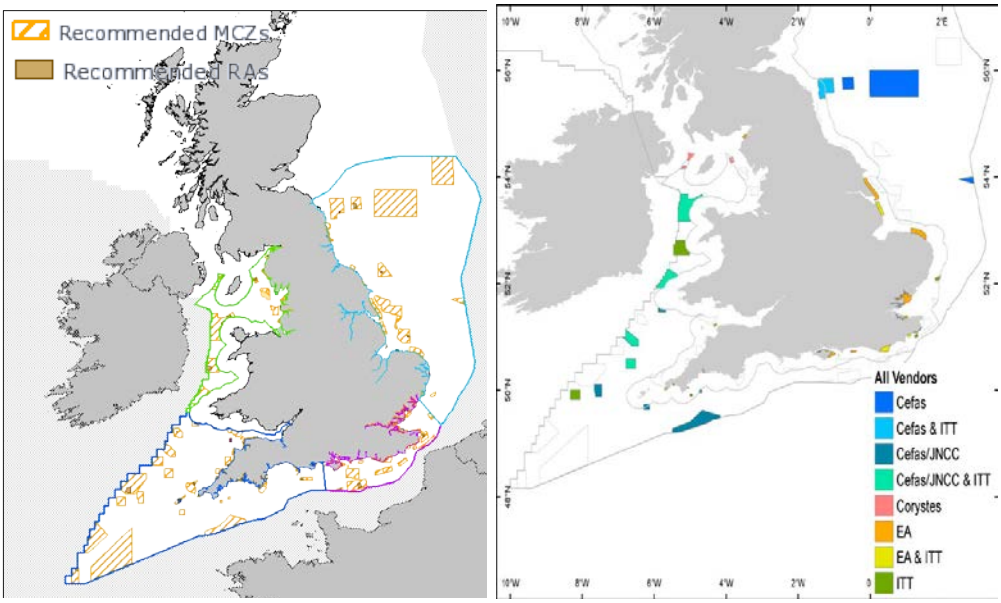


Figure 3. Recommended MCZs (left) and areas surveyed up to March 2012 (right).

Scottish MPA site identification

MPAs will be identified by the statutory conservation advisors for this area, JNCC and Scottish Natural Heritage (SNH). In 2011, surveys were carried out around the Windsock fisheries closure and in the outer Firth of Forth (see: jncc.defra.gov.uk/page-5470).

Welsh MCZs

The Welsh MCZ project is coordinated by the Welsh Government and is currently in the consultation phase. The aim is to have 3–4 highly protected areas. The Countryside Council for Wales (CCW) is currently working on mapping out an additional

area of Modiolus bed off the Llyn peninsular using sidescan sonar (see: wales.gov.uk).

Northern Irish seabed mapping

2011–2012 has seen large areas of multibeam echosounder bathymetry gathered in Northern Ireland under the Agri-Food and Biosciences Institute's (AFBI) INIS Hydro and Essential Fish Habitat mapping projects. These areas have been extensively ground-truthed and broad-scale habitat map production has been started. A Civil Hydrography Programme survey of the Ards Pennisula will also start in 2012 – this information will be available to AFBI under the multibeam data sharing (see Section 4.5.2.2). Other than a small gap between Ardglass and the approaches to Strangford Lough, there is now a continuous band of multibeam bathymetry along the entire coastline of Northern Ireland.

4.5.2 Interpretation

4.5.2.1 MAREMAP

The Marine Environmental Mapping Programme (MAREMAP see: www.maremap.ac.uk) was launched in June 2010 with the aim of improving collaboration between the work of all NERC research centres involved in seabed biological and geological mapping (BGS, NOC and SAMS). There are also currently five associate partners: Cefas, Channel Coastal Observatory, MCA, University of Plymouth and University of Southampton. The programme's work includes habitat and geological mapping and development of innovative technologies and techniques for marine mapping. A project has recently started to investigate the feasibility of utilizing autonomous underwater vehicle (AUV) and glider technology for mapping and monitoring of the UK MPA network – this work is funded by Defra.

4.5.2.2 Making best use of hydrographic multibeam

Multibeam data sharing agreement

The majority of UK government organizations involved with multibeam echosounder data collection have signed up to a Memorandum of Understanding on the free and rapid exchange of multibeam bathymetric survey data between partners. By far the largest contribution to this agreement is the Maritime and Coastguard Agency (MCA)/UK Hydrographic Office (UKHO) who conduct many multibeam surveys within the boundaries of the UK exclusive economic zone.

Interpretation of multibeam data

Following the establishment of the data sharing agreement, a separate agreement was established to run between 2011 and 2012 to fund and undertake the processing and interpretation of MCA/UKHO multibeam backscatter data into substrate and habitat maps. With funding from Marine Scotland and those involved, the following steps have been taken for the sites shown in Figure 5: 1) processing of backscatter data (NOC), 2) interpretation of backscatter data in combination with physical ground-truthing data to produce seabed substrate maps (BGS) and 3) interpretation of backscatter data in combination with seabed substrate maps and biological and physical ground-truthing data to produce seabed habitat maps (SNH – within 12 nm of Scottish coast; JNCC – beyond 12 nm from coast). A similar project to interpret backscatter collected for hydrographic surveys is also anticipated by CCW for inshore Welsh waters.

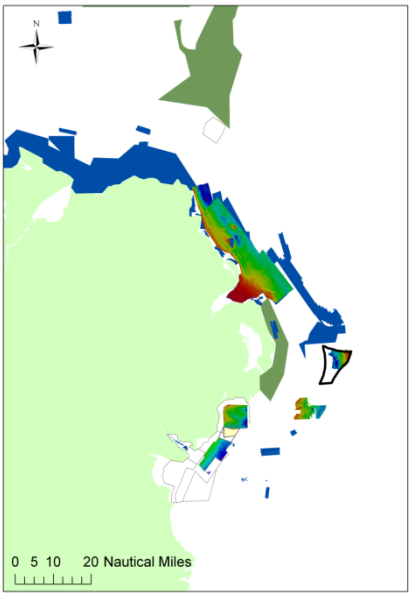


Figure 4. Blue polygons and geotiffs show the accumulation of multibeam data around the coastline of Northern Ireland. The green polygon indicates the areas soon to be completed under the Civil Hydrography Programme.

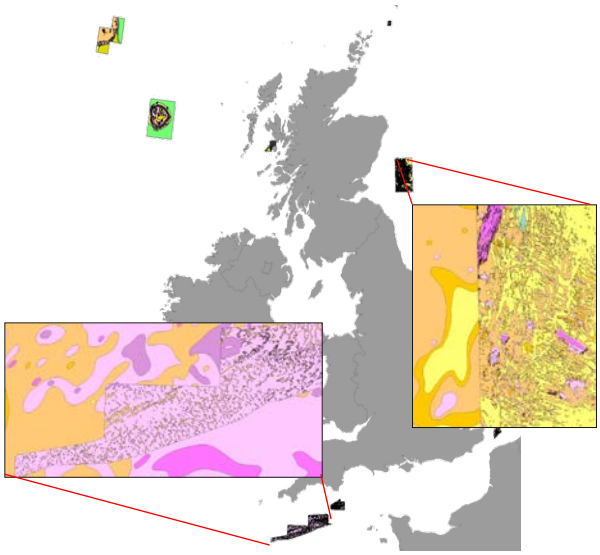


Figure 5. study areas for the agreement on the processing and interpretation of hydrographic multibeam backscatter data. Large-scale maps show two examples of the increase in resolution in seabed substrate maps as a result of detailed multibeam backscatter data.

4.5.3 Northern Ireland map production

AFBI and the University of Ulster have generated habitat maps for proposed Special Areas of Conservation for the Maidens and Skerries respectively. The Department of Agriculture and Rural Development NI are funding AFBI to undertake specific mapping of Essential Fish Habitat locally. The annual AFBI *Nephrops* stock assessment cruise has been modified to allow the collection of multibeam, Sediment Profile Imagery images, *Nephrops* trawls and camera tow data. It is hoped that this overlap in available data will provide insights into bioturbative processes, acoustic soft sediment signatures and potential for seabed integrity indicators in sediment habitats.

Under a service level agreement, the Department of the Environment/ Northern Ireland Environment Agency are funding AFBI to undertake a multibeam echosounder survey of Strangford Lough and provide habitat maps for the area.

4.5.4 Habitats Directive Annex I Sandbanks

A revised estimate of the UK resource of Annex I sandbank habitats is required for reporting under the EC Habitats Directive by September 2012. For larger, topographically distinct sandbanks, such as those found further away from the coast, an analysis of slope and aspect of a digital elevation model of the seabed, in combination with sediment data will be used to delineate the banks (Klein, 2006). For small banks and/or low resolution data, the known distribution of biological communities associated with Annex I sandbanks – such as *Zostera* and maerl beds – will be used to identify the location and extent of Annex I sandbanks primarily defined by their biological communities.

4.5.5 Habitat map compilation

The JNCC continues to compile UK habitat data according to various classifications, as required and publish online (see Table 1).

Table 1. Summary of compiled UK seabed habitats datasets.

Classification	Last update	Next update	Online resource
EUNIS	v3 - June 2010	v4 – June 2012	www.searchMESH.net/webGIS
Annex I reefs	v6 – Jan. 2011	v7 – Sept. 2012	jncc.defra.gov.uk/page-5201
Annex I sandbanks	2008	September 2012	
Annex I mudflats	-	September 2012	
OSPAR	May 2011	February 2012	jncc.defra.gov.uk/page-1583

5 Habitat modelling / Accuracy and confidence – ToR c)

5.1 Confidence in habitat maps – introduction

Helen Ellwood – JNCC

The report for WGMHM 2008 (Section 6.2) provided a useful summary about accuracy and confidence in habitat mapping including:

1) Why assess accuracy and confidence?
2) Definitions: error, uncertainty, confidence, accuracy, validation, error propagation
3) Error propagation
4) Methods to estimate and visualize error/confidence
5) The MESH confidence assessment tool

Often when we talk about confidence in habitat maps, it is a general term reflecting the suitability of a map for its purpose. The way of assessing confidence for a habitat map depends on the way it was created. A somewhat artificial division of types of habitat maps can be made between those based on local survey information (referred to here as "survey maps") and those based on the overlay of full–coverage physical data layers, such as EUSeaMap (referred to here as "modelled maps"). Although it must be understood that all habitat maps may be considered to be models to some degree.

For surveys maps, the MESH confidence assessment tool (MESH, 2008) provides a tool for a user to produce a confidence score for a habitat map with a simple, multi–criteria scoring approach. Section 5.2 describes the results and recommendations of a recent review of this tool, which was first introduced to WGMHM in 2007 and commented on by the group in 2008.

Modelled maps include continuous models of environmental variables, sometimes based on satellite data, and therefore confidence in these maps cannot be assessed using the MESH confidence assessment tool. However, other methods can be used, which include an element of probability. Section 5.3 gives a summary of confidence assessment methods for modelled maps: the recently completed EUSeaMap and UKSeaMap 2010, and the ongoing Mesh Atlantic project.

5.2 Review of the MESH Confidence Assessment tool

Helen Ellwood – JNCC

The MESH definition of confidence refers to it as a subjective assessment of the reliability of a map against its purpose. The MESH confidence assessment tool is a simple, multi-criteria approach that can be used by map-users to create a score indicating the level of confidence in the mapping techniques.

The WGMHM 2007 first reviewed the MESH confidence assessment tool 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".

5.2.1 Confidence assessment method

In the current system, 15 individual criteria are divided into three groups: remote sensing, ground-truthing and data interpretation. Each component is scored between 0 and 3 and multiplied by a weighting factor. Within each group, the sum of the weighted scores is divided by the sum of the highest possible scores. The confidence scores for each group are then averaged to give the overall confidence score for the map.

The online version of the tool can be found at www.searchmesh.net/confidence. Here can be found explanations of all the criteria used in the assessment.

5.2.2 Review of method

JNCC has recently conducted a review of the MESH confidence assessment tool, which was based on an independent review by Marine Ecological Surveys Ltd in 2011 (MESL, 2011). The review took place in order to identify areas for improvement in light of experience in using the tool in practice since 2008.

5.2.3 Overview of recommendations

Recommendations are divided into 1) Guidance (the guidance provided for MESH confidence assessments), 2) Scoring (the way in which parameters are scored or weighted) and 3) Structure (how individual scores are combined).

Guidance

Guidance has been improved in places to ensure consistent scoring across different scorers. Some of the suggested guidance updates would alter previously assigned scores, should they be adopted. For example, 'not appropriate' *Remote Interpretation* technique would score 0 rather than 1 out of 3.

Scoring

A change is recommended to the scoring process to produce two different final confidence scores: a score for physical habitat maps (i.e. EUNIS level 2, 3 or 4) and a score for biotope maps that require biological information for best results. The separate scores would be produced primarily by varying the weightings assigned to various criteria. The benefit of this is that when only a physical habitat map, e.g. EUNIS level 3 that does not refer to biology, is required for some purpose, a map would not be penalized for lacking biological information, as with the current system. This addresses current problems with the classification system in that a particular biological community that is associated with particular physical conditions in the EUNIS hierarchy is not always specific to those conditions. Therefore, if a level 5 habitat is summarized to level 3, it might not reflect the actual physical conditions at that site.

Another scoring recommendation is the development of an additional criterion: '*Translation'*. Ambiguities and subjective judgement can introduce a lower when translating a map from the original survey classification into EUNIS. Therefore this new criterion would score the compatibility between the original and translated habitat classifications.

Structure

The current method for combining the individual criteria is simple and straightforward and the remote sensing, ground-truthing and interpretation categories each has

an equal influence on the final score. While this can be considered appropriate, there is also a problem that where there are fewer criteria within a group (e.g. interpretation - 4) than within another group (e.g. ground-truthing - 6), individual weighted criteria of the former group have a larger influence on the final score than in the latter group. Changing weights would not help as weight values are only relative to other weight values in a group.

The proposed solution is to sum all weighted scores before being divided by the maximum possible weighted score instead of doing this for each category and averaging. Group scores may still be calculated to indicate the areas of strength and/or weakness in a study, but they would not be used as an intermediate step in the calculation of the final score.

5.2.4 Conclusion

The recommendations were presented to the working group and members were asked to comment on a report detailing these proposals, which was distributed after the meeting. If you would like to also comment on the proposals before August 2012, please contact info@searchmesh.net.

It is likely that the changes will be adopted by JNCC in 2012; however, the wider publication and branding of the revised method requires further discussion.

5.3 Confidence assessment methods for modelled habitat maps

5.3.1 Recent projects

Helen Ellwood – JNCC

5.3.1.1 Summary of EUSeaMap and UKSeaMap methods

The EUSeaMap and UKSeaMap 2010 projects produced physical habitat maps by overlaying several full-coverage data layers and matching combinations of physical attributes to habitat types in the EUNIS classification scheme (Cameron and Askew, 2011; McBreen *et al*., 2011a). Confidence layers were produced for all input data layers and combined to show the cumulative effects of the uncertainty in all layers on the final habitat map.

However, due to the different data types and sources, a common approach to assessing confidence for all the input layers was not possible. Three different approaches were used in EUSeaMap and UKSeaMap 2010 to assess confidence in the input layers, which are described below and in Table 2:

1) Confidence in the membership of a class. This is close to the idea of probability, and is controlled by:
   a) Uncertainty in the data, e.g. derived from comparing model outputs for a single variable to *in situ* data
   b) Uncertainty in the threshold values that define the boundaries between classes
2) Confidence in the databased on quality of the source data, including an assessment of survey techniques and interpretation methods.

Ideally an assessment of confidence in an input data layer would be based on a combination of 1a and 1b. A multiplication of the contributing confidence values would provide a simple indication of the confidence in the final habitat classes. However, due to limitations described below, the assessment of the data layers varied between project and data type (see Table 2).

Table 2. Summary of confidence assessment types used in two habitat modelling projects. See text above for the meanings of 1a, 1b and 2.

	EUSeaMap	UKSeaMap 2010
Energy due to waves	1b	1a and 1b
Energy due to currents	1b	1a
Light attenuation coefficient	1b	1a
Depth	1b and 2	1a
Substrate	2	2

1a: confidence in class membership based on uncertainty in the data

It can be a difficult or impossible task to produce a reliable uncertainty layer to accompany a model covering a large area such as a national EEZ or an entire sea basin. This is because there is usually a lack of *in situ* data to validate the model, e.g. a digital elevation model (DEM) or energy of the water at the seabed. For the EUSeaMap project, it was deemed unfeasible to try to produce such layers for any of the input models. For the UKSeaMap 2010 project, which had a smaller scale, these uncertainty layers were produced using as much information as was available but assumptions were sometimes required to make this approach possible. For example, the UKSeaMap 2010 bathymetry layer was composed of a 30m DEM produced by SeaZone, and the coarser General Bathymetric Chart of the Oceans (GEBCO) data elsewhere. The assumption was made that the SeaZone DEM was always correct, and for these areas the uncertainty in a 250x250m UKSeaMap cell was derived from the variance of the contributing cells in the 30x30m DEM. For GEBCO areas, the uncertainty was assessed by using the SeaZone DEM as a validation dataset where the two overlapped (McBreen *et al*., 2011b).

1b: confidence in the class membership based on uncertainty in the class boundaries

The cut-off value of a variable used to define the boundary between two classes should be based on an assessment of the correlation between the variable and the occurrence of a reference species or habitat. One of the clearest relationships is between the proportion of light at the seabed (based on light attenuation and depth) and the presence of kelp habitat on rock, which can be used to define the lower boundary of the infralittoral (or photic) zone. However, a lack of biological reference data can mean the value of the variable used as the cut-off (e.g. the proportion of light at the seabed) is uncertain. Furthermore, other variable, such as energy, do not always have a clear reference species or habitat to help define the boundary although there might be a general understanding of how the variable affects the habitat type.

Because EUSeaMap was unable to assess the uncertainty in the data for the entire study areas, it attempted to at least assess the uncertainty in the class boundaries. For some variables, statistical analysis used to define the "fuzzy" boundary; however, for others, an arbitrary proportion of the boundary value, e.g. +/- 10% was used due to a lack of time and/or data.

2: qualitative assessment of source data

The seabed substrate data for both UK- and EUSeaMap differs to the others, as this is a pre-classified layer that is not the result of a single variable. Rather, there are two stages of classification. First, grains are classified by size into mud, sand or gravel. Second, the relative proportions of each grain size class are classified into sediment types: mud and sandy mud, sand and muddy sand, coarse sediment and mixed sediment.

Once samples are classified the first time, a continuous model may be produced and subsequently classified as per the second classification (see page 43 of WGMHM 2011 for an example). However, this was not available for either UK- or EUSeaMap. Instead, pre-classified layers were used, which had boundaries that were often manually drawn, sometime using ground-type information from acoustic data, where available. Rock polygons were spliced into the sediment map where samples and sometimes acoustic data had revealed the presence of rock at or near the seabed.

Although the boundaries between sediment types could be tested against species or habitat occurrence, the uncertainty in the boundaries could not be mapped in the same way because of the pre-classification. Therefore a more qualitative confidence assessment was used, which was based on the MESH confidence assessment tool with the removal of the criteria related to biology, and for UKSeaMap, sample density and seabed heterogeneity criteria were also included (McBreen *et al*., 2011c). This produced a more blocky confidence layer where sections that had used the same survey and interpretation techniques, with the same sample density and seabed heterogeneity had the same confidence score.

For EUSeaMap, an indication of the relative quality of the bathymetry data were created by scoring three features of DEMs that are thought to account for most of their quality: resolution, vintage and data origin. Each was assigned a score between 1 and 3 and the scores were summed to give an overall total. This also produced a rather blocky confidence layer with blocks of data originating in the same survey or survey series receiving the same score.

5.3.1.2 Combining scores

UKSeaMap 2010

A layer showing confidence in the final classified habitat map was produced by multiplying the confidence scores of all the input data layers where they contributed to the final classification (Table 3).

Table 3. Contributing input layers for groups of habitats. A tick below the name of an input layer indicates its usage in predicting the habitats in a particular group and its confidence score was therefore used to calculate the values for the final confidence layer.

Habitat group	Biological Zone	Tidal energy	Wave energy	Substrate
Infralittoral and circalittoral rock	✓	✓	✓	✓
Deep circalittoral rock	✓	✓		✓
Deep-sea rock (below 200 metres)	✓			✓
Sediment	✓			✓

This multiplication of a mixture of confidence methods mean the scores in the final confidence layer lack some scientific meaning; however, it is most useful as an indica-

tion of the relative confidence one can have in different parts of the map (McBreen *et al.*, 2011a).

EUSeaMap

The two methods (1b and 2) used to produce confidence layers associated with each input data layers were considered to be too different to be able to combine in a meaningful way. Therefore only the layers showing confidence in the class membership (1b) were combined with each other (by multiplication). This layer then shows the combined effect of uncertainty in the biological zone and energy classification, but not substrate type.

It is hoped that more sophisticated methods to assessing confidence in modelled habitat maps will be developed in phase 2 of the EMODnet habitats project.

5.3.2 Mesh Atlantic

Jacques Populus – Ifremer

The MeshAtlantic project is currently gathering confidence data for the layers used for modelling the broad scale EUNIS map (introduced in ToR a). It was felt that confidence rating as already developed in the EUSeaMap project was deemed appropriate and that the project could not afford to seek more sophisticated methods.

The idea was to score both substrate and bathymetry layers. Although leaving aside the assessment of the energy layer, it is thought that the former represent quite a high part of the variance of the modelled map.

As described above, the current EUSeaMap substrate and bathymetry confidence assessments score whole areas considered as homogeneous block of data, giving a blocky result with crisp boundaries and no transition between them. However, although an assessment based on pixel values would result in a more spatially detailed confidence, it is not sure if managers would prefer such an outlook.

Substrate confidence was scored using the same approach as EUSeaMap, as described above. The criteria and the relative weights given to each are shown in Table 4.

Table 4. Criteria and weights used in the modified MESH confidence assessment used to assess confidence in substrate maps.

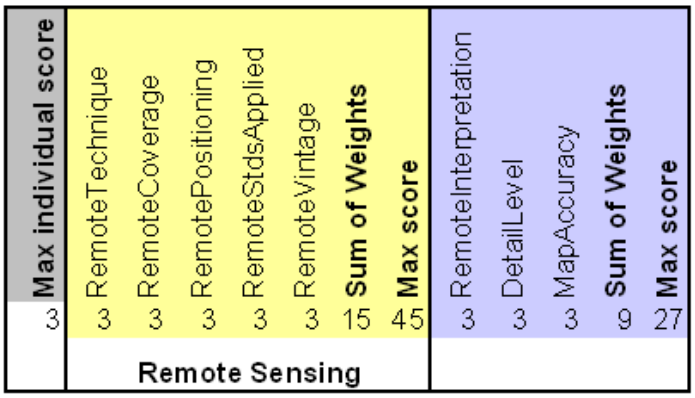
Max individual score	RemoteTechnique	RemoteCoverage	RemotePositioning	RemoteStdsApplied	RemoteVintage	**Sum of Weights**	**Max score**	PGTTechnique	GTPositioning	GTDensity	GTStdsApplied	GTVintage	**Sum of Weights**	**Max score**	GTInterpretation	RemoteInterpretation	DetailLevel	MapAccuracy	**Sum of Weights**	**Max score**
3	3	3	3	3	3	15	45	2	3	3	3	3	14	42	3	3	3	3	12	36
	Remote Sensing							Ground truth							**Interpretation**					

As the Emodnet hydrography lot has not yet come up with an updated method for assessing confidence, bathymetry confidence was built by using the same three criteria as EUSeaMap: the type of sounding, the sounding density (or resolution) and the

vintage. The overall confidence was obtained by simply averaging the two scores with equal weights.

It is however believed that using three criteria is not thorough enough and that the Mesh method could be further adapted to fit the very nature of bathymetric data. Referring to the above table it could be a case of a) scoring the remote sensing section (which can probably be left as it is), b) adapting the interpretation section to account for methodological steps needed to go from the bathymetry survey to the production of a depth DEM (e.g. tide reduction, interpolation, error computation, etc.), c) removing the ground-truth section as obviously bathymetry measurements do not lend themselves to ground-truthing.

Table 5. Suggested criteria and weights for a modified MESH confidence assessment for bathymetry data.



Max individual score	RemoteTechnique	RemoteCoverage	RemotePositioning	RemoteStdsApplied	RemoteVintage	Sum of Weights	Max score	RemoteInterpretation	DetailLevel	MapAccuracy	Sum of Weights	Max score
3	3	3	3	3	3	15	45	3	3	3	9	27
	Remote Sensing											

5.4 References

Cameron, A., and Askew, N. (eds.). 2011. EUSeaMap – Preparatory Action for development and assessment of a European broad-scale seabed habitat map final report. Available at http://jncc.defra.gov.uk/euseamap

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McBreen, F., Askew, N., Cameron, A., Connor, D., Ellwood, H., and Carter, A. 2011a. UKSeaMap 2010: Predictive mapping of seabed habitats in UK waters. JNCC Report, No. 446. Available at http://jncc.defra.gov.uk/ukseamap

McBreen, F., Askew, N., and Cameron, A. 2011b. UKSeaMap 2010 Technical Report 1: Bathymetry. Available at http://jncc.defra.gov.uk/ukseamap

McBreen, F., Askew, N., and Cameron, A. 2011c. UKSeaMap 2010 Technical Report 3: Substrate. Available at http://jncc.defra.gov.uk/ukseamap

MESH (Mapping European Seabed Habitats) 2008. MESH Confidence Assessment. Online information and tool available at www.searchmesh.net/Default.aspx?page=1635

6 Uses of habitat mapping for management – ToR d)

6.1 HELCOM work for habitat classification

Dieter Boedeker – BfN

In the scope of compiling a Red List of marine and coastal biotopes HELCOM developed a biotope classification system in 1998, which is currently being updated.

The first HELCOM classification system was published in 1998 (HELSINKI COMMISSION 1998: Red List of marine and coastal biotopes and biotope complexes of the Baltic Sea, Belt Sea and Kattegat, Baltic Sea Environment Proceedings 75, 115 pp, see http://www.helcom.fi/stc/files/Publications/Proceedings/bsep75.pdf). It was a hierarchical system based on physiographic parameters (depth zones, topographic features, substrate).

It has been realized that on the one hand this first classification system did not fit into the EUNIS system, and on the other hand a biologically meaningful EUNIS classification of specifically Baltic Sea biotopes / habitats needed to be developed. Therefore, an update of the classification system is required within the Baltic Sea Action Plan (BSAP).

HELCOM RED LIST (http://www.helcom.fi/projects/on_going/en_GB/RedLists/), established in 2008, is therefore developing a new classification scheme. Up to now, five levels have been defined: (1) marine area, (2) vertical zones, (3) vegetation, (4) substrate, (5) community. Currently HELCOM RED LIST is working on level 6 (dominant species). The classification system is going to be completed in 2013.

Exposure and salinity are not present in the system per se as they are considered being reflected in substrate and benthic communities, respectively. The inclusion of sea ice in the system is under discussion. Vegetation was included on a high level since it can easily be detected by various techniques. The system does not include a "mixed substrate" class: it was decided that such a class was rather confusing, and could be avoided by good definitions of the individual substrate classes.

WGMHM appreciated the simplicity of the system and the fact that, besides fitting into the EUNIS system, it includes detailed biological information on the community and species level. The group also noted that the system would probably work well for the Baltic. However, when extending the system to other seas, the fact of "marine area" being level 1 would probably cause redundancy in habitats, if similar habitats occurred in different marine areas. WGMHM discussed that – at least in some marine areas – sediment stability rather than substrate grain size might be important for determining communities, and the two parameters are not necessarily correlated (e.g. Norway). Furthermore, the group discussed the consequences of changes in vegetation cover, which however occur only on large temporal scales in the Baltic due to comparatively calm conditions.

6.2 Monitoring and Evaluation of Spatially Managed Areas (MESMA)

Lene Buhl-Mortensen – IMR

The EU FP7 project MESMA (http://www.mesma.org/) focuses on marine spatial planning and aims to produce integrated management tools (concepts, models and

guidelines) for Monitoring, Evaluation and implementation of Spatially Managed marine Areas, based on European collaboration.

MESMA is expected to supply innovative methods and integrated strategies for governments, local authorities, stakeholders, and other managerial bodies for planning and decision-making at different local, national, and European scales, for sustainable development of European seas.

At the heart of the MESMA project is the MESMA framework. This framework explores in a logical way how the management initiatives in a certain area were established, so that they can be evaluated and monitored. In cases where no management plans are available, following this framework leads to recommendations for future plans.

An important part of the framework for spatially managing of marine areas is to provide geo-referenced information of human activities the resulting pressures and ecosystem components. This will rely on mapping and quality of background data.

These are central topics for WGMHM.

Annex 1: List of Participants to WGMHM Meeting Isle of Vilm, Germany, 22–25 May 2012

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Annex 2: WGMHM 2012 terms of reference

The **Working Group on Marine Habitat Mapping** (WGMHM), chaired by Pål Buhl Mortensen*, Norway, will meet on Isle of Vilm, Germany, 22–25 May 2012 to:

International programmes – ToR a)

a) Report on progress in international mapping programmes (including OSPAR and HELCOM Conventions, Emodnet, EC and EEA initiatives, CHARM, Prehab, Sesma and Mesh-Atlantic projects);

National programmes (National Status Reports) – ToR b)

b) Present and review national habitat mapping activity during the preceding year, providing National Status Report updates according to the standard spreadsheet reporting format and in geographic display in the ICES webGIS and focusing on particular issues of relevance to the rest of the meeting;

Habitat modelling / Accuracy and confidence – ToR c)

c) Evaluate recent advances in marine habitat modelling techniques and address the spatial distribution of errors. Make final review of collaborative report or paper on habitat modelling;

Uses of habitat mapping for management – ToR d)

d) Review practise about the use of habitat maps, and more specifically "Mapping for the MSFD and marine spatial planning";

e) Review and report on policy drivers relating to the management of seabed habitat (in the ICES area) and define scales for describing the distribution and types of habitat that would be needed to support these drivers. Review and report on existing mapping exercises and, if necessary, propose and initiate a process for describing habitat in the relevant categories at the relevant scale.

WGMHM will report by 20 June 2012 (via SSGSUE) for the attention of SCICOM and ACOM.

Annex 3: WGMHM 2012 agenda

Progress in international mapping programmes – ToR a)

- Emodnet, EC and EEA initiatives (JPO)
- Mesh-Atlantic (JPO)
- Mesma (PBM)
- OSPAR-related projects (HEL)
- HELCOM (DBO)

National programmes (National Status Reports) – ToR b)

- National status report : short presentation (10' to 15' for each country – De, N, NL, UK, F, E) by national delegates

Habitat modelling/Accuracy – ToR c)

- Mesh Atlantic, map confidence assessment (JPO)
- Mesh Confidence assessment (HEL)
- Uncertainty evaluation in connection with value setting in Norway (PBM)
- Status of the paper on species distribution modelling (JPO)

Habitat mapping for management – ToR d)

- A framework for managing seabed habitats in near shore Special Areas of Conservation (FMcG)

Other issues

- Venue for next year's meeting
- Next year's TORs

Annex 4: WGMHM terms of reference for the next meeting

The **Working Group on Marine Habitat Mapping** (WGMHM), chaired by Pål Buhl Mortensen, Norway, will meet at ICES Headquarters, Copenhagen Denmark, 21–24 May 2013 to:

International programmes – ToR a)

a) Report on progress in international mapping programmes (including OSPAR and HELCOM Conventions, Emodnet, EC and EEA initiatives, CHARM, and Mesh-Atlantic projects);

National programmes (National Status Reports) – ToR b)

b) Present and review important results from national habitat mapping during the preceding year, as well as new ongoing and planned projects focusing on particular issues of relevance to the rest of the meeting. Provide National Status Report updates in geographic display in the ICES webGIS;

Habitat mapping techniques and modelling – ToR c)

c) Evaluate recent advances in marine habitat mapping and modelling techniques, including fieldwork methodology, and data analysis and interpretation;

Habitat mapping relating to management – ToR d)

d) Review practise about the use of habitat maps, for example Mapping for the MSFD, marine spatial planning, and management of MPAs;

Habitat classification – ToR e)

e) Review of existing habitat classification systems and identify commonalities and differences.

WGMHM will report by 21 June 2013 (via SSGSUE) for the attention of SCICOM and ACOM.

Supporting Information

Priority	This Group coordinates the review of habitat classification and mapping activities in the ICES area and promotes standardization of approaches and techniques to the extent possible.
Scientific justification	The working group provides an important forum to discuss international and national seabed mapping programmes, along with their relevance to Regional conventions and European directives and more specifically among them the MSFD. The MSFD required better knowledge of the seabed, both from a biodiversity but also an integrity point of view. WGMHM examines techniques with a capacity to address these issues, whether for direct mapping or through modelling. Habitat suitability modelling is a key emerging technique as it allows addressing large areas of the seabed using field data and environmental parameters or their proxies, limiting the need for survey data. Mapping physical habitats is also a promising approcah. The compilation of National status reports remains an important tool to show progress in knowledge of our seabed. This extends to interpreted and modelled maps as well as substrat maps. ToR d: This ToR is of paramount importance in view of the many developments

	and impacts occurring in the coastal, shelf and even deeper zones and because of the MSFD requirements where a link is sought between the ecology and the pressures. However linking science and usages remains a difficult task and hopefully some members will be keen to address this at 2013 meeting. ToR e: The diversity of habitat classification schemes and systems has increased over time. WGMHM regard this ToR to be important for better assessing the relevance of different classification systems and communicating between habitat mapping projects.
Participants	The Group is normally attended by some 15–20 members and guests. Representatives from Member Countries with experience in habitat mapping and classification.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to advisory committees	ACOM.
Linkages to other committees or groups	BEWG, WGEXT, WGDEC, WGMPCZM
Linkages to other organizations	OSPAR, HELCOM, EEA