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

21–24 April 2009

National Institute of Aquatic Resources,
Charlottenlund Castle,
Copenhagen, Denmark

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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 convened in Copenhagen, Denmark from 21–24 April and was hosted by Kerstin Geitner from the Technical University of Denmark, National Institute of Aquatic Resources (DTU Aqua). The meeting was chaired by Jacques Populus (Ifremer, France) and was attended by 17 delegates from 11 countries.

Keypoints from the meeting

Although somewhat smaller international programmes are underway in Europe than in the past years, the importance of marine habitat mapping is being underpinned at European level by a) the upcoming MSFD (Marine Strategy Framework Directive) and b) the delivery in 2008 by Member States of the outlines of their Natura 2000 extension to sea. These, along with a strong push towards the creation of MPA (Marine Protected Areas) in both the coastal zone and the deeper waters, are prompting the community towards the delivery of more habitat maps. As the territories increase in size and not all countries can follow the Irish or Norwegian examples blended approaches of detailed surveys and interpretation and modelling techniques are in particular focus. The group also called for developments to Eunis adapted to the way data are collected (namely with the advent of remote sensing) and to the way information has to be rendered according to specific users' needs. The importance of applying quality standards to better inform map users was also recalled.

International programmes

A few international programmes will be dealing with habitat mapping in 2009. This is the case for parts of Charm 3 (UK-France) extended to the whole Channel, for CoralFish (deep sea corals in relation with fisheries) and for Prehab (habitat modelling and pressure of human activities in the Baltic Sea). A project called EuSeaMap is currently underway under JNCC lead to provide global models of several European marine basins. It is part of the Emodnet initiative launched by DG/MARE and it connects with other lots due to deliver several types of marine data sets over the next two years. A follow-up to Mesh (Mesh-Atlantic) applying to the Interreg Atlantic Area Programme will be submitted in June.

Reporting on national programmes

WGMHM has continued to review countries' mapping endeavours which are found in various forms, from national programmes to more local projects. This forum is very important for members to keep mutually informed of their respective developments. In order for the group to report on mapping progress, the National Status Reports have been requested from the 11 countries present. Following repeated past recommendations, it has been decided to organise NSRs slightly differently and, whilst continuing to report comprehensively in spreadsheet form, to visually demonstrate progress in habitat mapping by creating a webGIS with map outlines and associated metadata. Adequate tools will be developed by the ICES data management team and implementation is planned by the end of 2009. It is also planned to liaise with other expert groups that may have similar needs.

Protocols and standards for habitat mapping

The crucial importance of map confidence assessment was once again emphasised by the group. The group discussed the assessment of modelled maps for which fewer efforts have been made in past studies than for detailed maps. The relevance of working towards a spatial confidence throughout the final habitat map was also stressed, rather than delivering a single overall score (as had been produced by Mesh). The emphasis was therefore placed on assessing the reliability of the source data layers that are commonly used in modelling (bathymetry, substratum and physical drivers) and how these can be combined. The group agreed on using the various fora to remind data providers of the importance of associating accuracy and confidence scores to their data at all times. The group will work on producing a position paper on this topic.

Habitat modelling

A number of modelling studies were presented, with proves a continued interest for this type of indirect approach. Most modelling examples were applied to single species/habitats. These studies call for an improvement in source data layers resolution and quality. After the Mesh and Balance first initiative in broad-scale modelling, a second series of project are going to develop this approach with focus on Eunis and will report later.

Use of habitat mapping in a management context

The group discussed a table sorting out various types of marine human activities versus the range of scales of habitat maps and whether specific types of maps could serve specific needs. Participants are invited to contribute this matrix with relevant comments and cases. When some progress is made, these cases will be handed over to the ICZM working group for cross-fertilization.

1 Opening of the meeting

The meeting was hosted by Kerstin Geitner from DTU Aqua in Charlottenlund Castle off Copenhagen city. Excellent facilities in a beautiful green, environment were provided by Kerstin.

The meeting was attended by 17 delegates in total, some of them partially. The list of participants is given in Annex 1.

Apologies were received from Ulf Bergstrom, Neil Golding, Mike Robertson, Roger Coggan, Matt Service, Pål Buhl Mortensen, ElsVerfaillie, Wouter Willems, Fernando Tempera, Jan Ekebom, Peter Lawton, Brian Todd, Sytze Van Heteren, Jan Van Dalfsen, Grete Dinesen, and Johnny Reker.

2 Adoption of the agenda

The Terms of Reference for the meeting were reviewed and are given in Annex 2. The draft agenda was modified and the final agenda adopted by the group. The Agenda is in Annex 3.

3 Appointment of rapporteurs

Rapporteurs were appointed for each ToR, namely:

ToR a (International programmes): Fergal McGrath

ToR b (International programmes - Eunis): Bregje Van Wesenbeeck

ToR b: (National programmes): Natalie Coltman

Tor c (Habitat modelling): Göran Sundblad

ToR d (Ground-truthing strategies): Dieter Boedeker

ToR e (Accuracy and confidence): Kerstin Geitner

ToR g (Use of maps): Dieter Boedeker

No rapporteur was assigned to ToR f as this was not supported by any document or presentation.

4 Progress in international mapping programmes

4.1 EUSeaMap

Natalie Coltman (UK) provided a briefing on the EUSeaMap project

In March 2009 a seabed mapping project started which will create broad-scale seabed habitat maps for European waters. The project objective is to provide broad-scale maps of seabed habitats, using common functional mapping methods, for the Baltic Sea, North Sea, Celtic Sea and Western Mediterranean, and to determine what further steps are required to improve their usefulness and coverage. The primary driver for the contract is the requirement to carry out the Initial Assessments in 2012 for the Marine Strategy Framework Directive. In order to do this, habitat maps should be consistent and have full coverage as possible. The project, EUSeaMap, is a service contract from the European Commission Directorate General-Maritime Affairs and Fisheries (DG-MARE). The project has a budget of €800,000 and will run until December 2010. The project consortium consists of 7 partners: BLST (Denmark), DHI (Denmark), IEO (Spain), Ifremer (France), ISPRA (Italy), JNCC (UK) and SEPA (Sweden). JNCC is leading this consortium.

The Commission has also let contracts which are preparatory actions for EMODNET: the European Marine Observation and Data Network. EMODNET has 4 lots to develop consistent layers for different data types: hydrographic, geological, biological and chemical. Strong links will be developed between EUSeaMap and these lots, particularly hydrographic and geological consortia which will provide key input layers to predicting habitats.

4.2 CHARM

Jacques Populus (IFREMER) provided an update on the third phase of the CHARM project (Channel integrated Approach for marine Resource Management). CHARM 3 is expected to be funded through the Interreg IVA stream of funding (€11.3M).

Interreg IIIA CHARM 1 & 2 were based on a multidisciplinary approach, with an innovative approach of ecosystem modelling. One of the key results was an Eastern Channel habitat atlas for marine resource management. This atlas is first of all an assessment of available and usable data for this approach. It presents a descriptive analysis of the environment of the Dover Strait and its resources benthic assemblages, marine fish species: larvae, juvenile and adult. Also presented are the methods used to analyse these data and to map the suitable habitat for 16 marine fish species.

CHARM 3 is a follow-on project with the specific aim of widening the ecosystemic approach and expanding to the whole Channel. There are three strands of work comprising 17 actions:

1) Collection, standardisation and cartography of:
- Physical, environmental, biological, usages
- Phyto and zoo plankton, inventory of taxons, space and time variability of primary production
- Ichtyoplancton
- Benthic invertebrates, engineering species, sensitive habitats
- Classification of marine habitats
- Commercial fisheries data (landings, efforts, fishermen communities)
- Legislation
- Integration of information through modelling:
- Mapping and modelling habitats
- Economic context (dynamics of fisheries communities and viability of fisheries, diversification, general economic context)
- Climate change : change in composition of benthic communities
- Change in distribution of fish species and communities
- Top predators
- Functional approaches (trophic network)
- Consequences of human disturbance on stock of *Solea solea*
- Functional approach to benthic ecosystems
- Spatial planning of the Eastern Channel

2) Data dissemination : interactive atlas

4.3 CoralFISH

Jacques Populus (IFREMER) provided and update on CoralFISH which is an FP7 project concerned with ecosystem based management of corals, fish and fisheries in the deep waters of Europe and beyond. The project started in mid-2008 and has an expected duration of 48 months. It has a total project value of €11.4m with an EU Grant-Aid portion of €6.99m.

CoralFish brings together a unique consortium of 16 partners, including deep-sea fisheries biologists, ecosystem researchers/modellers, economists and a fishing industry SME, who will collaborate to collect data from key European marine eco-regions. CoralFISH will:

1) develop essential methodologies and indicators for baseline and subsequent monitoring of closed areas;
2) incorporated fish into coral ecosystem models to better understand coral fish carrying capacity;
3) evaluate the distribution of deepwater bottom fishing effort to identify areas of potential interaction and impact upon coral habitats;
4) use genetic fingerprinting to assess the potential erosion of genetic fitness of corals due to long term exposure to fishing impacts;
5) construct bio-economic models to assess management effects on corals and fisheries to provide policy options, and;
6) produce as a key output, habitat suitability maps both regionally and for OSPAR Area V to identify areas likely to contain vulnerable habitat. The latter will provide the EU with the tools to address the issues raised by the UNGA resolution.

In 2006 UNO assembly resolution (61/105) relative to worldwide fisheries management stated that there was a need to measure the impact of deep sea trawling, to identify and map deep sea ecosystems and to establish no take zones (unless strict management measures were enacted to prevent degradation).

The concept for this project came about through the identification of a major lack in knowledge by two current FP6 projects. Both the FP6 DG Fisheries STREP 'Marine Protected areas as a tool for ecosystem conservation and fisheries management' (PROTECT) and the DG Research Integrated Project 'Hotspot Ecosystem Research on the Margins of European Seas' (HERMES) have highlighted the paucity of information concerning the interaction between fish and cold-water coral habitats. A better understanding of the relationship between fish and deep-sea habitats is essential for the evaluation of the impact of marine protected areas on fisheries. The marine ecoregions identified by ICES (2004) will likely form the basis for regional cooperation among Member States in the implementation of the European Marine Strategy, the main environmental pillar of any future European Maritime Policy.

4.4 HERMES

Hermes is an integrated research project designed to gain new insights into the biodiversity, structure, function and dynamics of ecosystems along Europe's deep-ocean

margin. It lasted for 4 years and is now complete. It was supported by €15.5M from FP6. More information can be found at http://www.eu-hermes.net.

The HERMES consortium comprised 45 partners including 9 small companies, from 15 European countries. The partners included small and large institutions and both universities and government laboratories. HERMES study sites extend from the Arctic to the Black Sea and include biodiversity hotspots such as cold seeps, cold-water coral mounds and reefs, canyons and anoxic environments, and communities found on open slopes. These important systems require urgent study because of their possible biological fragility, unique genetic resources, global relevance to carbon cycling and susceptibility to global change and human impact.

4.5 HERMIONE

4.5.1 Project objectives

The HERMIONE project sets out to investigate ecosystems at critical sites on Europe's deep-ocean margin. Even these remote areas are being affected by man, either through the indirect effects of climate change or directly through exploitation of deep-sea resources. HERMIONE will investigate the distribution of ecosystems of varying size on the deep-sea floor and define the environmental tolerances that maintain ecosystems e.g. temperature, and predict what will happen as climate changes or as man impacts them in other ways. HERMIONE will look at the functioning of these ecosystems, which is dependent on biodiversity, and estimate the possible consequences of biodiversity loss. Finally, the project will engage with stakeholders and policy-makers and provide them with the scientific knowledge to support deep-sea governance aimed at the sustainable management of resources and the conservation of ecosystems.

4.5.2 Methodology

The HERMIONE project will study a range of hotspot ecosystems – open slopes, cold and hot seeps (where fluids and methane escape at the seabed), canyons, cold-water corals and seamounts. Strong connections to policy makers will ensure that the science is focused on the most relevant issues and that the results are used in plans for the sustainable use of the oceans. The HERMIONE workplan includes a significant field and sampling programme based around more than 1000 days of shiptime aboard Europe's research vessel fleet and with extensive use of remotely operated vehicles. Study sites encompass the key ecosystem hotspots and include; the Arctic because of its importance in monitoring climate change; Nordic margin with abundant cold-water corals, extensive hydrocarbon exploration and the Hakon Mosby mud volcano natural laboratory; Celtic margin with a mid latitude canyon, cold water corals and the long term Porcupine Abyssal Plain monitoring site; Portuguese margin with the highly diverse Nazare and Setubal Canyons: seamounts in the Atlantic and W. Mediterranean as important biodiversity hotspots potentially under threat; mid Atlantic Ridge site to link cold seep to hot seep chemosynthetic studies; Mediterranean cold water cascading sites in the Gulf of Lions and outflows of the Adriatic and Aegean Seas. The HERMIONE sampling programme will start in spring 2009, ensuring maximum time for data collection through the project, and will continue through to Year 3. The focus will shift mid-way through the project towards more laboratory work, but the continuing field programme will allow additional or complementary data to be collected as the project evolves.

4.6 OSPAR Habitat Mapping Programme

Natalie Coltman (UK) outlined the OSPAR programme and its progress to date. The OSPAR Commission adopted an initial list of threatened and/or declining species and habitats in 2003, extending the list in 2004 and 2007 to include 16 habitats. For these habitats, JNCC coordinates a habitat mapping programme to collate existing habitat data in order to identify appropriate conservation measures. Point data are collated for each contracting party by a lead organisation in that country, and submitted to JNCC on a yearly cycle (by 31 July) in a specified Data Exchange Format. This programme has some difficulties with data management because contracting parties do not refresh their datasets regularly, and often send subsets of data. There are no data for the two most recent habitats added to this list (2007), Coral gardens and *Cymodocea* meadows.

There are a total of sixteen habitats on the *Initial OSPAR List*:

- Littoral chalk communities
- Intertidal *Mytilus edulis* beds on mixed and sandy sediments
- Intertidal mudflats
- *Zostera* beds
- *Cymodocea* meadows
- *Sabellaria spinulosa* reefs
- *Modiolus modiolus* horse mussel beds
- *Ostrea edulis* beds
- Maerl beds
- Seapens and burrowing megafauna communities
- Deep-sea sponge aggregations
- Coral gardens
- *Lophelia pertusa* reefs
- Carbonate mounds
- Oceanic ridges with hydrothermal vents/fields
- Seamounts

4.7 A regional habitat assessment process for the OSPAR Convention

As a contribution to the OSPAR Quality Status Report, which is due to be published in 2010, a new broad-scale assessment process has been developed and trialled. The process aims to provide an assessment of the status of habitat types and species groups (e.g. cetaceans, fish) at the scale of the OSPAR Regions (e.g. North Sea, Celtic Seas), but can be applied at any desired scale. It leads to a status assessment for each habitat type or species group, according to defined criteria, with status defined as Good, Moderate or Poor. The criteria and threshold values used were based on those used for assessing Favourable Conservation Status under the Habitats Directive. The

process and methodology are fully described in Connor (2009)[1] and Robinson *et al*. (2009)[2].

Developing assessment processes at this scale has been partly driven by the requirement to determine Good Environmental Status at the scale of the MSFD subregions (i.e. at the scale of the Greater North Sea or Celtic Seas). The OSPAR trial has consequently provided valuable learning to feed into the development of appropriate assessment techniques for application in the MSFD.

In order to trial the assessment process, an expert workshop was convened in Utrecht from 9-13 February 2009 (report to be published by OSPAR to support the QSR). The assessments for habitat types used habitat distribution maps, and maps of the distribution of human activities and their pressures to support a structured assessment of each habitat type in each Region against a set of 22 pressures (ranging from climate change, to eutrophication, removal of target species and habitat damage). The trial successfully delivered assessments of four very broad habitat types and four species groups for the OSPAR area, and revealed a number of areas where the methodology needs to be further developed. Key outcomes included the need to undertake assessments at finer scales, both of habitat types and regions.

4.8 JIBS

Fergal McGrath (INFOMAR) provided a briefing on the status of the Joint Irish Bathymetric Survey Project (JIBS). JIBS commenced in April 2007 and was completed by August 2008. This project was lead by the UK's Maritime and Coastguard Agency (MCA) with the Marine Institute of Ireland as project partner. Funding was through the European INTERREG IIIA programme and was co-ordinated by Northern Ireland's Department of the Environment (Environment and Heritage Service). The area surveyed was the 3 nm coastal strip from Malin Head to Melmore Head. The survey was conducted to IHO Order 1 standard. The R.V. Celtic Voyager spent two (2) month surveying an area between Inishowen Head and Melmore Head in 2007/2008. In the Republic of Ireland, approximately 420KM^2 of seabed was surveyed using MBES (EM1002 / EM3002). 43 sediment samples (grabs) were acquired in this area. These data have verified by the UKHO for inclusion on updated admiralty charts for the area.

More information is available at:
http://www.marine.ie/home/services/surveys/seabed/JIBS.html. The data acquired may be viewed at http://gsigis1.dcmnronline.ie/imf/imf.jsp?site=JIBS. The data may be downloaded at https://jetstream.gsi.ie/jibs/index.html.

The JIBS project has provided a framework for north/south cooperation, via the steering group and stakeholders meetings.

[1] Connor, D.W. 2009. Assessing the state of the marine environment. A Regional assessment process for the OSPAR Quality Status Report 2010. Joint Nature Conservation Committee, Peterborough.

[2] Robinson, L.A. Karman, C., Rogers, S., and Frid, C.L.J. 2009. Methodology for assessing the status of species and habitats at the OSPAR Region scale for the OSPAR Quality Status Report 2010 . (Contract No: C-08-0007-0085 for the Joint Nature Conservation Committee). University of Liverpool, Liverpool, Centre for the Environment, Fisheries and Aquaculture Science, Lowestoft and IMARES, IJmuiden.

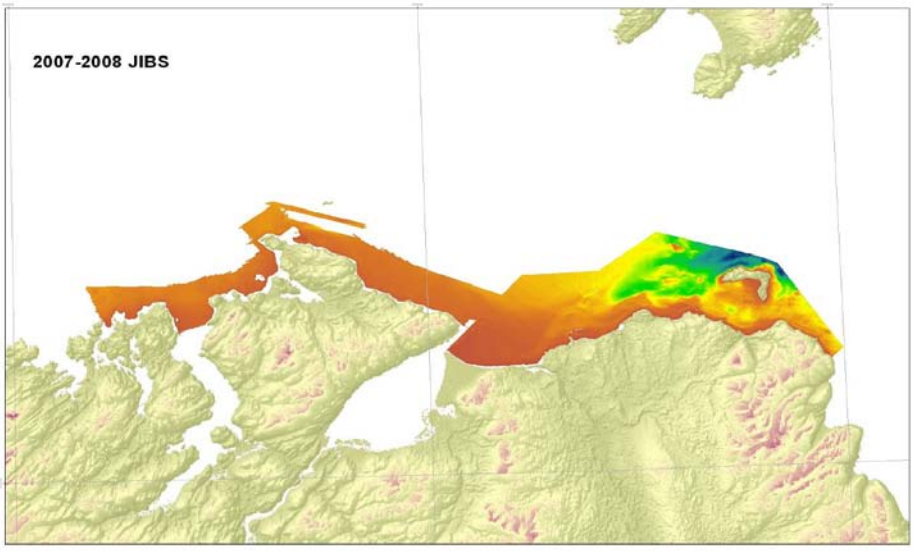

Figure 4.8: Combined JIBS MBES coverage from Marine Institute and Maritime Coastguard Agency acquisition programmes.

4.9 MESMA

Jacques Populus (France) received an update from Jan van Dalfsen (IMARES) via e-mail on the MESMA (Monitoring and Evaluation of Spatially Managed Areas) project.

The project will be funded under 7th EU Framework Program as a large-scale integrating project. MESMA has 18 partners from 12 EU countries. At present negotiations are ongoing with the EU.

MESMA focuses on marine spatial planning and aims to produce integrated management tools (concepts, models and guidelines) for monitoring, evaluation and implementation of Spatially Managed Areas (SMAs). The project results will support integrated management plans for designated or proposed sites with assessment methods based on European collaboration.

The major challenge is to combine an optimized use with a sustained ecosystem of high quality, taking into account ecological and economic differences. By studying and comparing different national situations and solutions from a selected number of sites throughout Europe and by determining common features and differences, including the socio-economic settings and requirements, an integrated toolbox that can be applied throughout Europe will be made available.

MESMA will 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. This will also comprise an easy accessible information system to gain support from politicians, stakeholders and the public in general for difficult (inter)national decisions that will be needed for sustainable use and protection of this vulnerable area. This data system, containing information on the distribution of marine habitats and species, economic values and benefits and human uses and its effects will also be an interface between science, policy and decision makers.

The tools, concepts and guidelines developed in the project will help to develop standardized, scientifically-sound and acceptable methods for an integrated management and assessment of SMAs. The project as a whole will support the spatial

component of the management of resources in the marine environment. The principle aims of MESMA are to:

1) provide an inventory of state-of-the-art spatial management approaches, strategies and processes world-wide for the marine environment, leading to the distillation of key issues, opportunities, threats, gaps, drivers and developments in science and policy.

2) collect and integrate information concerning the distribution and quality of seabed habitats, the health status of species and ecosystems, geological structures and anthropogenic activities in an integrated geographic information system and knowledge base for both the surface and the subsurface.

3) develop a generic framework for monitoring and evaluation of Spatially Managed Areas (SMAs) which comprises guidelines for:

i) the selection of goals, objectives and indicators of progress,

ii) the monitoring and evaluation, and

iii) the feedback process to deliver an adaptive management of multiple objectives of multiple components, taking into account interactions between ecological, economical and societal factors.

4) demonstrate the applicability of the framework through case studies in which different scenarios and strategic options for spatial management are tested.

5) develop a set of tools that can be used:

(i) in support of an evaluation of the effectiveness of SMA from the perspective of ecosystem-based management and in the context of climate change,

(ii) to reduce or resolve conflict between different users,

(iii) to combine information on and predict the response of indicators such as, but not limited to, the presence of key species, biodiversity, representativeness, degree of fragmentation and connectivity, sediment and water quality against changes in drivers such as (multiple) human uses and geophysical conditions (climate change, geohazards).

6) organize a platform for discussion, in order to generate input from all relevant parties (stakeholders) to this process, substantiating the analysis and generating support to both the process and the outcome.

7) disseminate the results of the project through stakeholder workshops, (scientific)publications, leaflets and a website.

The project will support the formalization and implementation of EC policy. The project contributes to the design and implementation of the Common Fisheries Policy, the Thematic Strategy for Marine Protection and the recently endorsed Marine Strategy Framework Directive which aims to achieve good environmental status of the EU's marine waters by 2021 and to protect the resource base upon which marine-related economic and social activities depend. The proposed MESMA project will provide a firm basis for the implementation of the Marine Strategy Directive and related policies.

4.10 HELCOM

Jacques Populus (IFREMER) received and update via e-mail on the current activities of Helcom.

HELCOM's activities concerning habitat mapping are considered in the BIO report which was presented to the HELCOM Commission meeting in March and approved for printing. The draft report contains reference to habitat mapping and modelling in Section 3.2.2 and in Annex IV. Habitat mapping is included in the Baltic Sea Action Plan but there is no specific HELCOM project on habitat mapping.

HELCOM relies on national activities and other ongoing projects. The next forum for review of progress will be at the HELCOM HABITAT meeting in May.

4.11 European Policy Developments with Habitat Mapping Relevance

David Connor (UK) provided an overview of recent developments at the European Commission and OSPAR Convention levels which have relevance to marine habitat mapping and their uses.

4.11.1 EMODNET

A European Marine Observation and Data Network (EMODNET) is being developed by the European Commission's DG Maritime Affairs and Fisheries (DG MARE). This new initiative aims to draw together marine data sets for European regional seas, and to increase access to marine observation data in relation to the needs of the Marine Strategy Framework Directive 2008/56/EC (MSFD) and the development, in the context of the Shared Environment Information System (SEIS) and its Water theme (Water Information System for Europe, WISE, cf. www.water.europa.eu) which will also be extended to cover data and information on the marine environment in relation to the implementation of the MSFD (**WISE-Marine**; reporting & sharing of information).

As initial developments for EMODNET, DG-MARE has let five contracts to develop initial data layers for certain regions of European waters. The contracts cover the following topics:

- Hydrography
- Geology
- Chemistry
- Biology
- Seabed habitats (see EUSeaMap section).

There is a consultation to seek views on the future direction of EMODNET at http://ec.europa.eu/maritimeaffairs/consultation_emodnet_en.html. This will help formulate the following phases in development, which are expected to include a compilation of studies across European waters using multibeam acoustic survey.

4.11.2 European Atlas of the Seas

As part of the EC Maritime Policy developments (the 2007 'Blue Book'), DG-MARE are developing an on-line Atlas of the Seas. This is expected to draw upon the datasets being developed by EMODNET, as well as other topics, to develop an educational tool. It is due for release by the end of 2009, with further development in 2010.

4.11.3 Marine Strategy Framework Directive (MSFD)

The Marine Strategy Framework Directive was adopted in June 2008. As a new environmental policy instrument which covers all waters of EC Member States (out to 200nm EEZ limits and beyond into any areas claimed as extended Continental Shelf Areas up to 350nm), it is expected to become a major policy driver for environmental protection in the coming years. The Directive requires an Initial Assessment of Mem-

ber States waters to be prepared by 2012, covering physical, chemical and biological characteristics, as well as a wide range of pressures from human activities. There are requirements to describe the range of habitats and their associated communities, as well as specific needs to present maps of protected habitats (such as those listed in Annex I of the Habitats Directive and on the OSPAR and HELCOM threatened lists) and for particular areas. The Directive requires Member States to achieve Good Environmental Status (GES) by 2020, according to a set of eleven GES 'descriptors' listed in the annex I of the document. Descriptors 1 (biodiversity), 4 (food webs) and 6 (sea floor integrity) have most relevance to habitat mapping.

WGMHM discussed the development of guidance on the Descriptors by ICES/JRC Expert Groups and recognised the potential difficulty in adequately distinguishing the remits of D1 and D6.

4.12 EUNIS- Classification Updates

4.12.1 Developments in the EEA's EUNIS scheme

David Connor (UK) reported on developments in the EEA's EUNIS scheme. The European Environment Agency (EEA) is responsible for developing the pan-European EUNIS habitat classification (http://eunis.eea.eu.int/habitats.jsp).

EUNIS is a comprehensive classification system for all habitats and this generality brings about difficulties in refining and structuring the system. Improvements of EUNIS on all levels, is constantly required. In 2007 a new version of EUNIS was launched. This new version contained several changes compared to previous versions:

- 116 new habitats – mostly types that are applicable to the Black Sea area
- 68 codename changes
- 3 habitats deleted

JNCC have produced a correlation table, comparing and linking different habitat classification schemes. This table will be available at the JNCC website somewhere in May/June.

Other developments that are going on in the UK and relate to EUNIS are:

- Offshore analysis of benthic data for coarse and mixed sediment.
- Deep sea sediment mapping using different acoustic datasets. Also a map of landscape types (high EUNIS level) is produced for the same area. A PhD student from the University in Plymouth will follow-up on these developments into more detail.

Outside the UK other EUNIS related developments are happening, mostly in the Baltic Sea. Currently, EUNIS is not applicable to this area. So, workshops were held in 2007 and 2008, to propose restructuring of hard substrata habitats and include different salinity zones.

Other, more general restructuring efforts include adding of new categories. A category for cultivated systems is added, such as salt pans, and oyster and mussel cultures. Another category is added for non-oxygen systems.

There might be a need to include more specific systems. For now, the Baltic is considered a separate system, based on salinity regime. In the Baltic, a workshop in March 2008, hosted by the Swedish Environmental Protection Agency in Stockholm, devel-

oped initial proposals for restructuring the current EUNIS classification to better accommodate the main physical drivers for the region (salinity, substratum, depth, exposure), and examined the outputs of analyses of benthic data from Sweden, Finland, Lithuania, Latvia and Estonia.

These proposals were further developed during 2008 in order to finalise a set of habitat types within a suitable classification framework for the Baltic region. This would allow Baltic to be integrated into modified classification system.

However, the Mediterranean and Atlantic are part of the same classification scheme. Showing a map of bottom temperatures illustrates clear differences between the Mediterranean and the Atlantic. This might be an argument to reconsider inclusion of new, separate Mediterranean habitat types.

In general more work needs to be done to optimize the EUNIS system. New projects to use and validate and possibly change EUNIS are necessary. However, momentarily there are little means to realize that.

Summarizing prospects for progress:

- Validation of upper-levels EUNIS
- Develop proper mechanism, useable at European level, to distinguish between sensible new propositions for habitat types, or deviations of an existing type
- Produce EUC map for Baltic and Mediterranean

A probable project that could benefit EUNIS developments is the hopefully upcoming MESH Atlantic project.

The use of EUNIS seemed to be growing, but there remained difficulties in applying the classification for three main reasons:

- Local variations in habitats were not always easily interpreted into EUNIS types
- Parts of the ICES area were poorly covered by the EUNIS scheme (arctic waters, southern Europe, deep sea)
- The higher level arrangement of EUNIS types did not always lend itself to practical mapping (e.g. surveyors can't assess wave exposure categories in the field).

WGMHM recommended establishment of a mechanism at EU level to facilitate discussion and integration of newly defined habitats and by extension – harmonised classifications/maps. Considerable further work is needed to harmonise habitat classification schemes across the ICES area, to facilitate aggregation of data and maps across countries. There exists a constant requirement to review classification types in different levels. Projects like EUSeamap will provide opportunities to define the classification types over a larger European area. WGMHM considers that the EA should be encouraged to advancing EUNIS.

WGMHM was reminded that a format for submitting changes to EUNIS (Pro forma) is already established. This can be found at http://www.jncc.gov.uk/page-3365.

4.12.2 Classification of benthic marine habitats: current status and mapping proposals for coastal habitats in Brittany

Ifremer (France) is trying to offer decision makers a more practical solution for mapping Natura 2000, while keeping a link with Eunis. Furthermore, the EUNIS classifi-

cation does not always take into account habitat mapping using remote sensing. Units that are easily visible on remote sensing imagery are low in the EUNIS hierarchy, implying that they should actually be identified by abiotic conditions, such as exposure and sediment type. However, sediment might not be visible as biological components are covering it.

The following difficulties are recognized with the different systems:

- Mapping boundaries
- Lack of distinction on the level of estuarine habitats in Habitat Directive
- New and biogenic habitats are not included in OSPAR methodology
- Hard to find uniformity between EUNIS/Natura 2000/Ospar habitats

Specific difficulties arise with EUNIS:

- Higher levels are theoretically constructed
- Hierarchy of levels is not designed for operational mapping at different scales
- Some habitats are low in hierarchy, but can be directly identified using remote sensing
- Translation and cultural problems

Suggestions:

- Trade-off between EUNIS and Habitat Directive
- Recognizing the value of coverage by flora/fauna
- Grouping habitats that are otherwise scattered in EUNIS
- Putting forward priority/particular habitats
- Abandoning the notion of exposure *per se*
- Submitting new habitats (estuarine seaweeds)
- Taking into account habitat changes and invasive species
- Adopt three hierarchical levels and use EUNIS to go into greater detail

Emphasis is put on defining habitats that are easily visible using remote sensing, without going into the EUNIS systematics. However, there should be a relation to EUNIS. Plus, particular attention should be given to species that modify their habitats, such as seagrasses and oysters.

There is some discussion on giving more priority to biological elements or not. In general the original rationale behind EUNIS, that abiotics are more leading on higher levels and biology is only considered on lower levels, is considered reasonable. It is argued that 1/ some biological elements can occur over a range of different environmental conditions and 2/ that under the same environmental background conditions composition of the biological community is variable.

For France several habitats seem to be missing in EUNIS, such as rock fields that are recognized in the Habitat Directive, but not in EUNIS, limestone communities and specific rocky habitats in south Bay ofBiscay. Furthermore, there is some agreement that translating Natura 2000 habitats to EUNIS systematics is hard. Doing this the level of detail is rather coarse.

5 National Programmes (National Status Reports)

Present National Status Report updates according to the standard reporting format by evaluating national mapping activities during the previous year.

(**ToR b**)

WGMHM discussed the National Status Reports based on presentations from national representatives in the Working Group. The compilation of the National Status Reports in spreadsheet form is available from ICES sharepoint at: http://groupnet.ices.dk/WGMHM2009/default.aspx. For those not having access to this sharepoint it can be obtained by writing to jpopulus@ifremer.fr.

5.1 France

Jacques Populus (Ifremer) presented seabed mapping programmes for France.

5.1.1 Seabed sediments

The so-called "G series" from SHOM has progressed in 2008 (2 maps). These follow the usual 1:50,000 nautical chart series outlines. They now cover almost two thirds of the western coasts of France. Along with the recent Ifremer achievements (in the frame of the Rebent habitat network and other initiatives of the Department of geology), more than 80% of the coastal zone are now covered. Full coverage is expected by 2012.

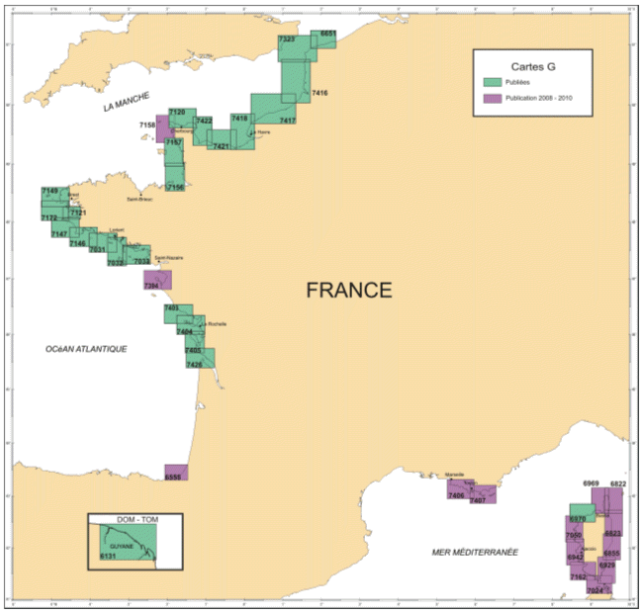

Figure 5.1.1: Extension of substratum "cartes G" maps in France, green published, violet planned by end 2010.

5.1.2 Habitat maps

Historic maps

The background task of collating historic maps has continued at Ifremer. These maps are being digitised, quality checked, translated to the EUNIS classification and their metadata captured. Two syntheses were also produced by assembling EUNIS maps on large chunks of territory. There is now an almost complete coverage of French coasts with medium scale (roughly from 1:100,000 to 1:300,000) maps, either in their

authors' original classification but also in EUNIS for a number of them. Five new maps were incorporated in 2008. There is still scope to make available more historical maps such as local sediment and vegetation maps.

Recent maps

Recent maps are being made in the frame of the Rebent habitat network. In 2008 four new maps were published on the Rebent interactive mapping site for the regions of Trégor, Baie de Concarneau, Douarnenez and Vilaine. This does not take into account Natura 2000 mapping productions, which are complementary to the above.

Natura 2000 maps

Three Natura 2000 maps (from a total of 18) produced by consultants in Brittany under the aegis of Diren Bretagne (the regional environmental authority) have been quality checked by Ifremer before they were stored on a specific website being currently designed.

Atlas of seagrass beds

The update of the 1997 atlas of seagrass beds in Britanny was updated and both a paper and web versions were delivered in 2008. This update was made possible by the availability of a completed coverage of orthophotographs, the interpretation of which was complemented by field truth. The quality status of a number of seagrass beds units is also reported in the atlas.

All the above mentioned maps are for consultation at : www.rebent.org

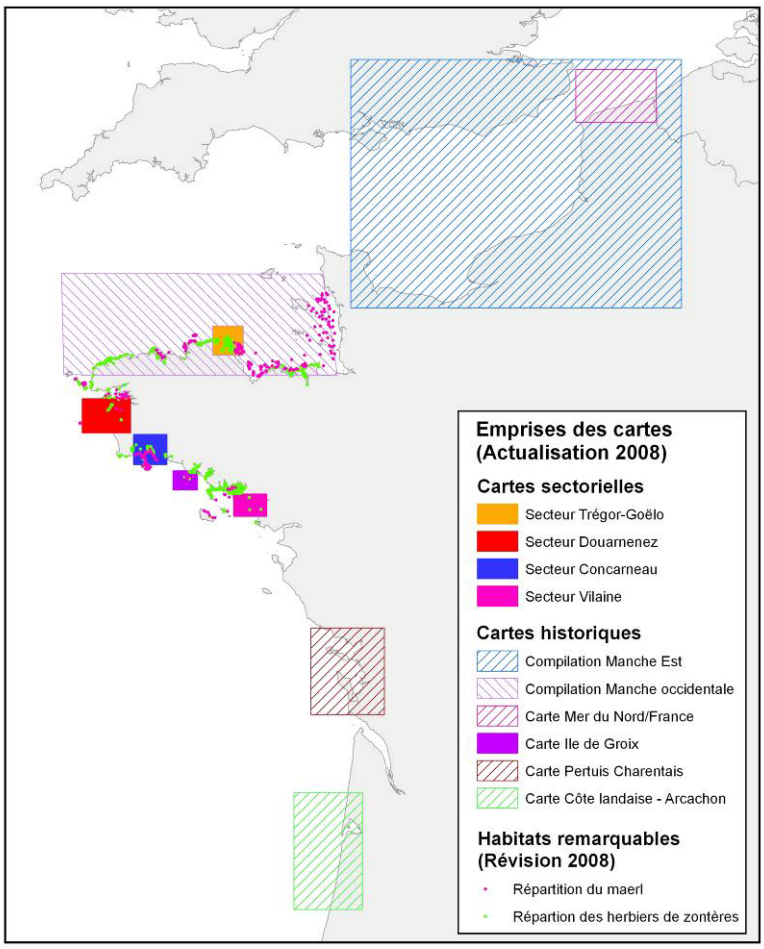

Figure 5.1.2: Historical and recent maps published on the web in 2008.

5.2 Germany

Dieter Boedker (BfN) presented the NSR for Germany. There are no changes to the habitat mapping situation in Germany since the 2008 report to this group.

Further perspective was given about the lack of national coordination in Germany. For example, BfN activities focus on nature conservation interest features, especially Habitats Directive Annex I types, as well as HELCOM and OSPAR priority habitats. Other institutes in Germany concentrate on sediment mapping. Sediment maps at 1:500,000 scales exist for German waters, and Federal Maritime and Hydrographic Agency (BSH) is continuing a national programme of more detailed sediment distribution mapping. To date, these activities have not been connected. Several agencies have attempted to secure funding for a coordinated mapping programme, but have not yet been successful. German states are responsible for mapping Habitats Directive Annex I types out to 12nm: common standards were developed prior to this mapping work. The focus is on sandbanks and reefs as these are the only ones known to occur in German waters (reported 2 years ago to this group). Effort is now shifting to the development of monitoring strategies in N2K sites.

5.3 The Netherlands

Bregje van Wesenbeeck (Deltares) updated the group about the status of marine habitat mapping work in the Netherlands.

Although many monitoring activities are going on in the Netherlands, in 2008 and 2009 no/limited habitat surveying/mapping activities were planned. In 2010 mapping activities will probably start up under the national programme "Building with Nature" and under the EU-project MESMA.

In 2008 several specific surveys were done in relation to sand nourishments in the coastal zone, which is a protected area. Surveying was accompanied by an extensive monitoring program to collect biological and sediment data. To asses effects of nourishing samples and mapping are performed before and after nourishing.

Further, a specific survey was executed by IMARES to look for habitat type 1180: Submarine structures made by leaking gases. Surveying this specific habitat will probably be continued in the future. Another survey was performed at the Borkemse Stenen on the Duitse Plat.

Monitoring and mapping information of multiple years was visualized in a book, called the "Noordzee Atlas". Maps can be viewed on http://www.noordzeeatlas.nl/. Note that maps should be viewed with care, as sometimes areas where no data is available are characterized as zero measurements and methods of interpolation are not always obvious. The atlas is supposed to be updated.

5.4 Sweden

Göran Sundblad and Martin Isæus

Last year, Sweden's national status report (NSR) provided information on the mapping and modelling oriented EU Interreg IIIB project BALANCE (2005-2007). Outputs from the successful project has since spurred several regional, as well as national, authorities to continuously invest in mapping and modelling large parts of Sweden's coastal areas. The overall aims of these projects are often to identify and map areas of interest to nature conservation, information that is to be used in marine spatial planning and management.

In 2008 a governmental commission concerning an improvement of knowledge about the seafloor was given Swedish Environmental Protection Agency. The commission especially focused on the use of habitat modelling as a mapping tool. Data for modelling was to be provided by digitalizing old depth measurements by Swedish Maritime Administration, and conversion of marine geology maps to surface sediment maps was to be provided by the Swedish Geological Survey. Lead by the Swedish Environmental Protection Agency a project aimed at modelling the distribution of bladderwrack (*Fucus vesiculosus*) was performed on a national scale, as well as a number of benthic organisms in three pilot areas in the Baltic Sea. The modelling was performed by AquaBiota Water Research. Results show that the quality of spatial data, e.g. bathymetry, is too low for successful modelling on a national scale. In smaller pilot areas, where bathymetry of higher quality was available, the modelling was successful and a number of biological layers for marine spatial management were provided.

Habitat and distribution models at off -shore banks are currently being used as a spatial tool in planning for conservation values, and site investigations for the potential establishment of wind power plants. These models include the distribution of cod, turbot and flounder in parts of ICES areas 25, 26, 27 and 28-2, in Baltic proper. Benthic habitats are presently being modelled at a number of banks along the Swedish coast. This modelling effort will continue during 2009.

As decided by the Swedish government, 6 marine reserves (no-take areas) will be established by 2010, 3 on the west coast and 3 on the east coast of Sweden. In order to

provide supportive information for the establishment and necessary spatial planning, the distribution of several fish species in some of the suggested reserve areas has been undertaken.

A research project on development of monitoring methods for both terrestrial and shallow marine habitats using LIDAR was funded by Swedish EPA. The project, called EMMA, continues until 2012, and involves a large consortium of researchers. Results from the project will likely be communicated to the WGMHM in future meetings.

5.5 Finland

Essi Keskinen reported on the status of Finland's marine habitat mapping work.

The Finnish Inventory Programme for the Underwater Marine Environment (VELMU) is a national mapping programme covering the whole coast of Finland which will end in 2014.

Finland has started Life+ funded marine habitat project "Inventories and planning for the marine Natura 2000 network in Finland" (FINMARINET). The project was launched in 2009 and will end in 2012, with a budget of €3.4 million. It will carry out inventories of the marine habitat types of the EU Habitats Directive Annex I in Finnish territorial waters and the Finnish exclusive economic zone (EEZ) (Figure 5.5.1). The Finnish EEZ was established recently (2004), after the designation of the Natura 2000 network, and only a few preliminary surveys of underwater habitat types have been conducted in these Natura 2000 areas. This project will assess the major marine Natura 2000 sites including adjacent areas potentially valuable for the extension of the Natura 2000 network. The main objective is to produce cartographic images (thematic maps of the habitats and key species, spatial assessments) to underpin decision making regarding the Annex I marine habitat types listed in the Habitats Directive.

All project beneficiaries work together within VELMU at present. Data, information and knowledge for the marine Natura 2000 network will be provided by FINMARINET. Special attention is paid to the information production process from collection of field data, modeling of habitats, quality assessments and coherence analysis, and to raising stakeholder awareness. Through the project, the Habitats Directive Annex I marine habitats of the outer parts of the Finnish territorial waters and the EEZ will be assessed. This makes it possible to decide on joining parts of the EEZ to the Natura 2000 network. Around 77% of the budget will be used in the Natura 2000 areas and 23% in the EEZ areas. These figures include field work as well as corresponding modeling and map production.

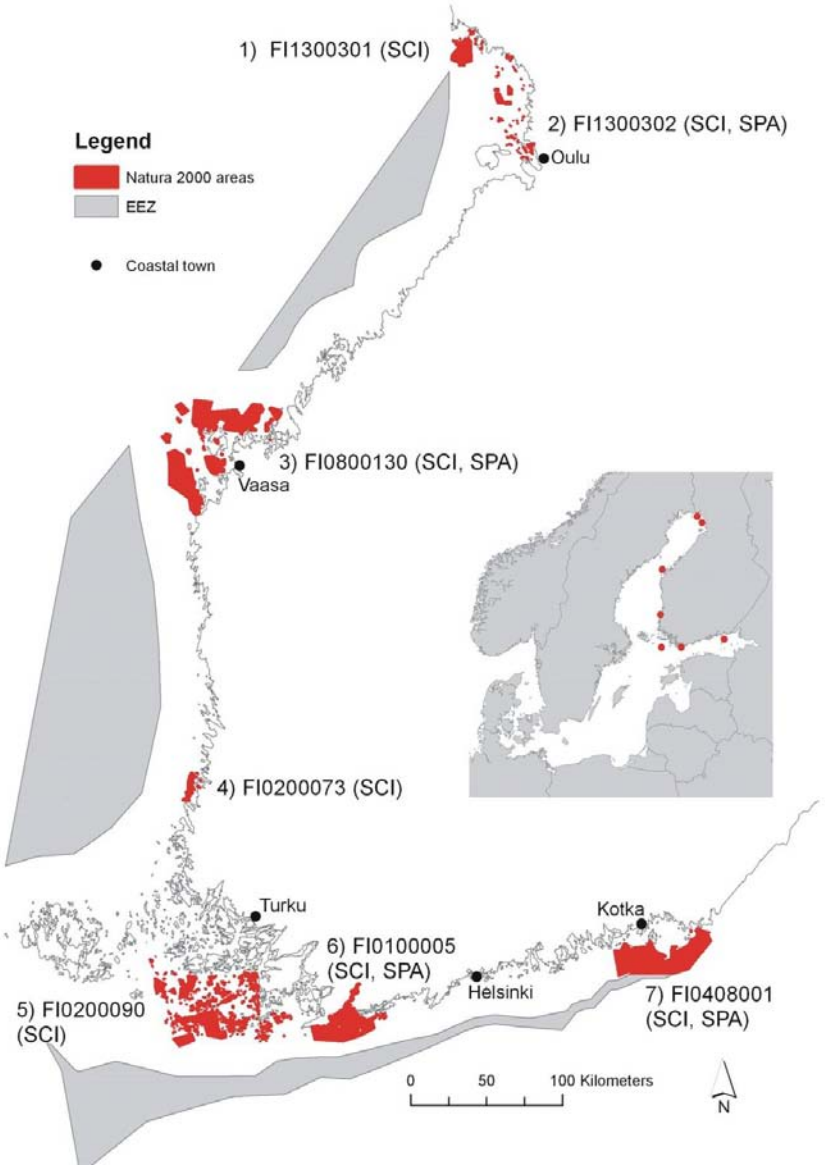

Figure 5.5.1: FINMARINET project will conduct habitat mapping over the next four years in these seven Natura 2000 areas starting with the 2009 field season.

Finland began a national effort to map its marine habitats and biodiversity, The Finnish Marine Underwater Nature Inventory Programme (VELMU), in 2002. The timeframe was set to be 12 years, and currently the inventory is conceived to finish in 2014. VELMU is a cooperation programme involving seven government Ministries. The practical work will be carried out by government institutions, universities and other parties.

The Geological Survey of Finland (GTK) has a national programme on mapping marine geology. GTK participates also on VELMU –programme and FINMARINET-project. Participation in VELMU pilot projects (e.g. VALKO) has facilitated more detailed surveys that are not included in the marine geological mapping programme. During the year 2009 geological surveys will be conducted in the Gulf of Finland.

The Natural Heritage Services (Metsähallitus) has a duty to develop management plans for Natura 2000 areas and national parks, and are in the process of collecting information on marine nature in the government-owned marine areas (Figure 5.5.2). Their

needs and the needs of VELMU match up very well, and they are a key player in the inventory of state waters down to 25 m depth. Natural Heritage Services will continue the inventories in the 7 Natura 2000 areas which were designated in the FINMARINET project (Figure 5.5.1).

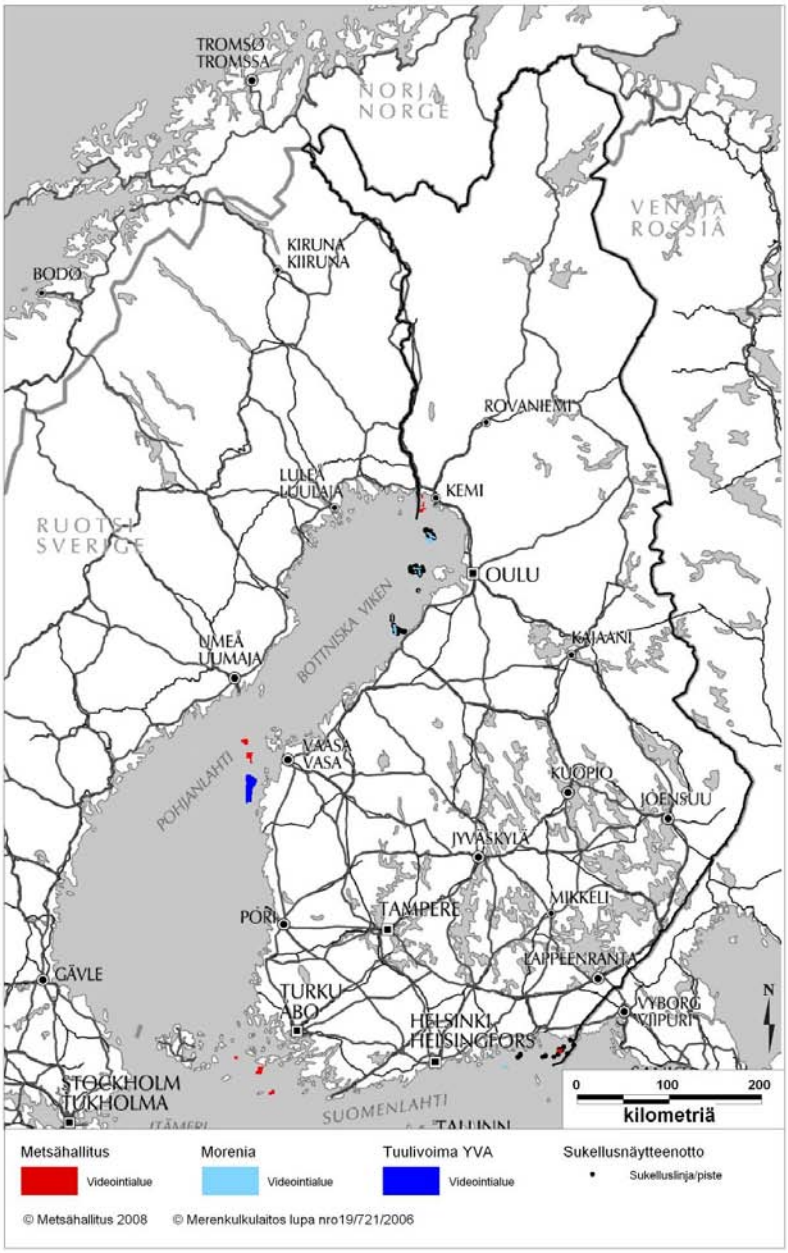

Figure 5.5.2: The Natural Heritage Services has so far done habitat mapping in the areas shown in the map. Red indicates drop video habitat mapping for the Natural Heritage Services' own management uses and for the VELMU dataset, light blue indicates areas that were covered by drop video for the purposes of marine aggregate Environmental Impact Assessments, dark blue indicates drop video areas for off shore wind power Environmental Impact Assessments and the black dots are scuba dive points.

The Game and Fisheries Research Institute largely takes care of the inventory of fish breeding grounds, with input from universities. Main part of the fish in the northern Baltic Sea spawn in the coastal area, but still the coastal reproduction areas of fish are to a large extent unknown. Fish production, however, depends strongly on the success of the reproductive stage. The project "Coastal Reproduction Areas of Fish" by

the Finnish Game and Fisheries Research Institute forms part of the national VELMU program and aims at fulfilling this gap in information by (1) defining critical environmental conditions that limit the coastal reproduction areas of fish, (2) mapping the reproduction areas and (3) developing cost-effective field survey and mapping methods. The reproduction areas of several freshwater and marine fish species are studied in surveys conducted over a range of habitat types along the Finnish coastline, in the northern Baltic Sea. Field surveys and sampling stratification are planned based on clues from remote sensing. Field sampling of early life stages of fish are performed using diverse, species-specific methods and a variety of environmental variables are also measured. Predictive distribution modelling is then used to link the occurrence of early life stages of fish to continuous maps of environmental predictors in GIS. The probability maps are validated in separate areas, and models are revised as necessary. The end products are probability maps of distribution of the fish reproduction habitats. The results facilitate coastal zone management, habitat protection and are a prerequisite for setting marine protected areas or other local fishing restrictions. The results also enable assessing the environmental change effects on fishes more efficiently. All data that the Game and Fisheries Research Institute will collect will also go to VELMU dataset (Figure 5.5.3).

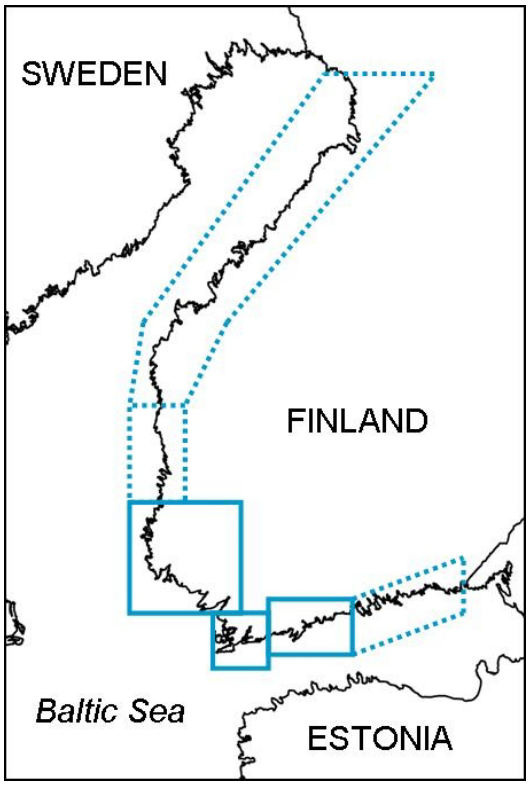

Figure 5.5.3: The Game and Fisheries Research Institute has been mapping fish spawning areas in the areas boxed with blue and will continue mapping in the blue dotted areas during the field seasons of 2009 and 2010.

The Finnish Environment Institute (SYKE) is the holder of many national environmental databanks, e.g. on water quality, bottom fauna and endangered species, and will be responsible for developing the data management in VELMU. They also have a specialised GIS department and will lead the map production effort. SYKE is the

leading partner of the FINMARINET project and participates on several other international and national projects.

In addition to the government institutes many other players are involved in the national VELMU work and habitat mapping through research projects, including many universities, the Regional Environment Centres and consultants. Many other government institutes, such as the Maritime Administration, local and regional administrative bodies and NGOs participate in the Stakeholder Group.

5.6 Norway

Lene Buhl-Mortensen (IMR) presented an overview of the work that has been undertaken under the MAREANO seabed mapping programme in the southern Barents Sea. MAREANO (**Ma**rine **AREA**database for **NO**rwegian coast and sea areas) is a multidisciplinary mapping programme, focusing on offshore areas in the southern Barents Sea in a first phase (–2010). It is a collaborative venture between three main partners: the Institute for Marine Research (IMR), Geological Survey of Norway (NGU) and the Norwegian Hydrographic Service, coordinated by IMR. MAREANO was initiated to address the lack of knowledge about the seabed, natural resources and pollutants which is required for informed, sustainable management.

The project is financed through an inter-ministerial financial collaboration between the ministry of the Environment, Fisheries and Coastal Affairs and Trade and Industry, with a yearly budget of around 5 million Euro. The first phase of the MAREANO mapping began in 2005 and will deliver results for a revision of the Barents Sea management plan in spring 2010. The plan is that mapping will be continued in the Barents Sea after 2010 and in addition mapping will start in the Norwegian Sea. The mapping programme includes acquisition of multibeam bathymetry and backscatter data together with a comprehensive, integrated biological and geological sampling programme. Equipment used includes underwater video (CAMPOD), box corer, grab, epibenthic-sled, and beam trawl. Multicore samples are also taken for assessments of organic and inorganic contaminants in the sediment, and some shallow seismic data are also acquired.

Mapping outputs from the project include bathymetric data, geological maps (morphology, hard and soft seabed, sediment grain size distribution, sedimentary environment (erosion & deposition areas), and genesis), biological maps (including biodiversity and faunal distribution, i.e. species abundance and biomass), benthic habitat maps, and environmental geochemistry maps (contaminants). All results from MAREANO are integrated in the web portal, www.mareano.no. Other relevant datasets are also made available via this web portal by the project partners.

The MAREANO (phase 1) area covers 162 000 km^2, and mapping has been prioritised in key areas (Eggakanten, Troms II and Nordland VII) within the MAREANO area, including areas of interest for commercial exploitation. Biological and geological sampling during 2007-2008 was conducted in Troms II and Nordland VII. Multibeam data acquisition continued in Nordland VII during 2007 out to the 1000 m depth contour. During 2007 a decision was taken by government to extend the MAREANO area beyond the 1000 m contour in Nordland VII and Troms II. The maximum depth in these sectors is 2700 m. This area was sampled during two research cruises in 2008.

IMR and NGU cooperate to perform the habitat mapping following biological analysis of the video and sample data at IMR. Tromsøflaket is currently being used as a case-study area to develop suitable habitat modelling methods and products from MAREANO. Multivariate statistical methods are being used to relate bottom envi-

ronment (including multiscale physical descriptors of the seabed derived from multibeam data) and fauna distribution in order to find objective criteria for definition of habitats and biotopes. Through the use of assisted GIS analyses biotopes/habitats are predicted in new areas. For future MAREANO cruises an important task will be to ground truth predicted occurrences of bottom fauna/biotopes based on observed relationships and to test the reliability of these predictions in the wider MAREANO area.

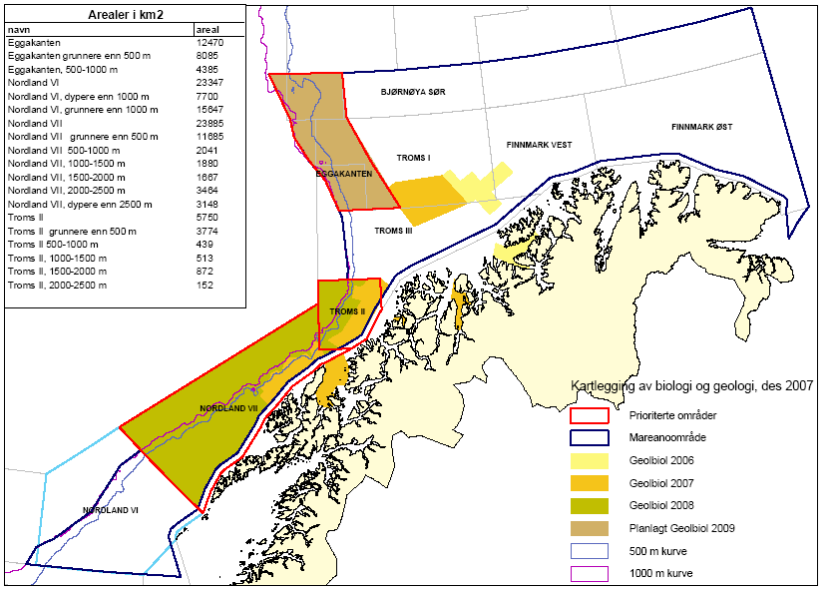

Figure 5.6: Mareano planned coverage.

There are also a number of other seabeds mapping projects in Norway, mostly in the coastal zone. IMR, NGU and NIVA (Norwegian Institute for Water Research) are currently involved in several applied mapping projects. These include the national programme on mapping and monitoring of biological diversity and marine nature types, under which occurrences of priority nature types (ice marginal deposits, carbonate sand, kelp forests, seagrass meadows, etc.) are predicted and validated. Further details of various projects are listed in the summary table in the Appendix.

5.7 United Kingdom

Natalie Coltman (JNCC) provided an update on the status of habitat mapping in the UK. The update covered survey work carried out in 2008-2009, new habitat mapping initiatives (not necessarily survey), data interpretation projects and future surveys.

The programme of offshore SAC surveys has continued, with surveys this year of of Dogger Bank, of submarine structures in the mid-Irish sea, and of Solan Bank, off the north coast of Scotland (Figure 5.7.1)

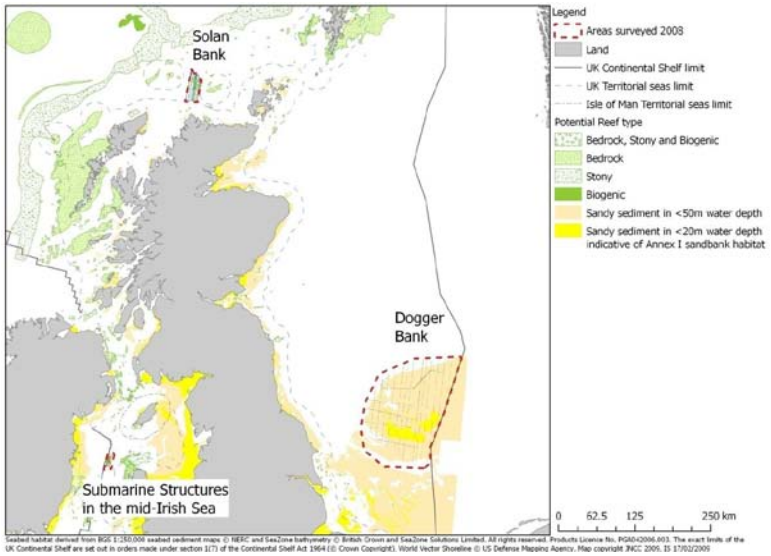

Figure 5.7.1: JNCC Offshore survey 2008–2009.

Since 2007 (not previously reported), Natural England have carried out extensive mapping work English territorial waters to identify Habitats Directive Annex I habitats away from the coast, specifically reefs and sandbanks.

The fisheries agencies have conducted a variety of habitat mapping surveys. Cefas have worked as a contractor to JNCC and Natural England for mapping Annex I habitats, have carried out Regional Environmental Characterisations for the aggregate industry, and have worked with the nuclear energy industry. AFBI have continued work on the internal project "Sensitivity of Benthic Habitats in NW Irish Sea and Malin Shelf", with reference to their sensitivity to key pressures such as: fishing, aquaculture, run-off, aggregate extraction and other offshore development such as wind farms. This was reported to WGMHM in 2008. Recent survey work has also focussed on inshore aquaculture activities and offshore areas adjacent to *Nephrops* fishing grounds. FRS have focussed habitat mapping survey effort on wet renewables in areas in North Scotland, such as Pentland Firth and Duncansby Head.

Recently there have been some important moves in the UK which are relevant to this group but which are not new survey work. For example, Charting Progress 2 (part of the UK Marine Monitoring and Assessment Strategy) provides an assessment of the state of the UK's marine environment, and includes a summary of the areas of the UK for which various types of bathymetric data are available. The compilation includes work done by the MESH project, but also reached a wide range of industry data providers and as such is a very useful resource for those conducting marine habitat mapping (Figure 5.7.2).

A Seabed Mapping Working Group has been set up to assess the requirement for, and feasibility of, a UK-wide seabed survey. The group is chaired by British Geological Survey and is expected to report in June/July 2009 as part of the UK Marine Monitoring and Assessment Strategy evidence group for 'Healthy and Biologically Diverse Seas'. A Memorandum of Agreement has been established between a range of government agencies to allow the sharing of multibeam data collected since 2003, free of charge. The usefulness of such an agreement was exemplified in planning the JNCC Solan Bank survey, where high resolution multibeam data was made available from the Maritime and Coastguard Agency. This allowed side-scan sonar transects to be targeted to areas of interest.

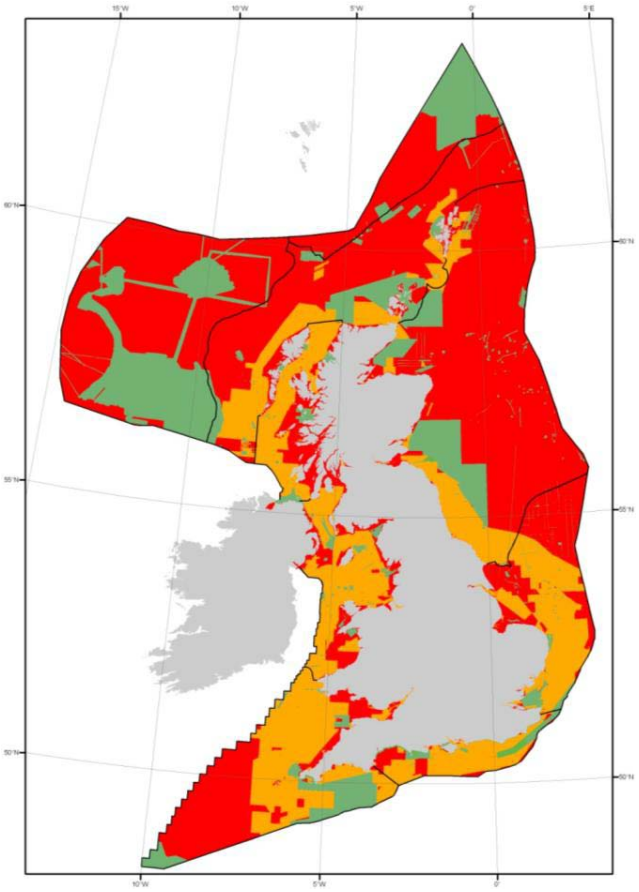

Figure 5.7.2: Charting progress 2.

5.8 Denmark

Kerstin Geitner presented the national status report for Denmark. Several institutes from Denmark will be involved in the EUSeaMap project. Kerstin presented a task that the Technical University of Denmark, Institute for Aquatic Resources (DTU Aqua) is performing. It concerns the Environmental Impact Assessment (EIA)-consequences of fisheries in Natura 2000 areas. There exists a Danish Executive order from the Ministry of the Environment (no. 408 from 1 May 2007). This order is requesting every fishery that takes place in a Natura 2000 area to be evaluated in regards to what impact the fishery would have concerning the factors that are forming the basis for the designation of the area as a protected site. This evaluation is based on a fishery plan that the fishermen prepare themselves on how the fishery is planned to take place during the following year in a given area. This fishery plan is evaluated by DTU Aqua. The evaluation is then given to the Danish Directorate of Fisheries where an assessment of the impact on the environment is done and it is decided if the fishermen are adjudged the permission to carry out their fishery according to the fishing plan. As there are many Natura 2000 sites, and there are still being appointed more sites in the Danish EEZ, and fisheries are taking place in many of them, there is a lot of work connected with this task. Some of the evaluation work is carried out using GIS, thus needing input data for example for bathymetry and mussels. The habitat maps that are available for the Natura 2000 sites are of fluctuating quality, thus making the evaluation in some of the Natura 2000 areas difficult. The GIS evaluation is also useful to determine possible conflict areas geographically and calculate the area affected.

5.9 Belgium

In the framework of the Belgian Science Policy programme QUEST4D (Quantification of Erosion/Sedimentation patterns to Trace the Natural from the Anthropogenically-induced Sediment dynamics, http://www.vliz.be/projects/quest4D/), areas were mapped using multibeam and/or side-scan sonar (2007–2008). Related to habitat mapping, the Vlakte van de Raan area is targeted. A multibeam reconnaissance survey was carried out along both the northern and southern edge of this area. In addition, an area is mapped in detail where high densities of the polychaete /Owenia fusiformis/ prevail. These colonies tend to stabilise the seabed; as such time-series are recorded at representative locations. In 2009, MUMM will map the spatial distribution of the typical habitat of /Ensis directus/, the most important invasive species on the Belgian part of the North Sea.

Seabed maps on the median grain-size, morphology and gravel distribution on the Belgian part of the North Sea were published in 2007, in report form and as GIS shapefiles (DVD GIS@SEA). Multibeam bathymetry and backscatter maps are available for the Sierra Ventana region, area south of the Hinder Banks, Goote Bank and Buiten Ratel (Van Lancker *et al*., 2007).

Verfaillie *et al*. investigated spatial distribution models of various seabed parameters and mapped habitat preferences of the main macrobenthic communities of the Belgian part of the North Sea. Marine landscapes were modelled and ecologically validated.

Both habitat suitability modeling (HSM) and remote sensing are techniques that can be used for marine habitat mapping (MHM).

The use of HSM within MHM was demonstrated at the level of macrobenthic community structure (Degraer *et al*., 2008a) and at the species level (Willems *et al*., 2008). In both papers, the application of the HSM provided fine-scale (resolution: 250x250m) and full coverage (habitat suitability) maps of the Belgian part of North Sea (BPNS). Habitat suitability should here be considered the chance of encountering a community or species or, in other words, the maps could be interpreted as predicted distribution maps. Both papers advocate the use of habitat suitability maps within a marine management framework, macrobenthic communities providing a comfortable and useful level of detail for communication and thus management (Degraer *et al*., 2008a) and the tube-building polychaete Lanice conchilega being the hotspot of marine diversity and density in mobile sediments in the BPNS, when occurring in dense aggregations (Rabaut *et al*., 2008). These dense aggregations (sometimes called "reefs", because of their particular physical and biological properties, Rabaut *et al*., 2009) were further investigated with remote sensing (Degraer *et al*., 2008b). This exercise showed that, using very high resolution (400–450 kHz) side scan sonar imagery, it is possible to detailed sense and thus map these small-scale (elevation: up to 12 cm; up to 15m²) and patchy (coverage: ± 10%) benthic biotope. Remote sensing hence opens the possibilities for future mapping of this ecologically important biotope, which was impossible using point samples, as derived from for instance Van Veen grabs;

In the frame of the Belgian fund for sand extraction, Norro *et al*. have been working in calibration of acoustic classes used for habitat mapping over given region of the Belgian continental shelf. In 2008, two cruises have been organised and samples (video footage and direct measurements of sand thikness) have been taken on the Buitenratle zone (Figure 1). The objective was to validate the class 3 featuring high BS values.

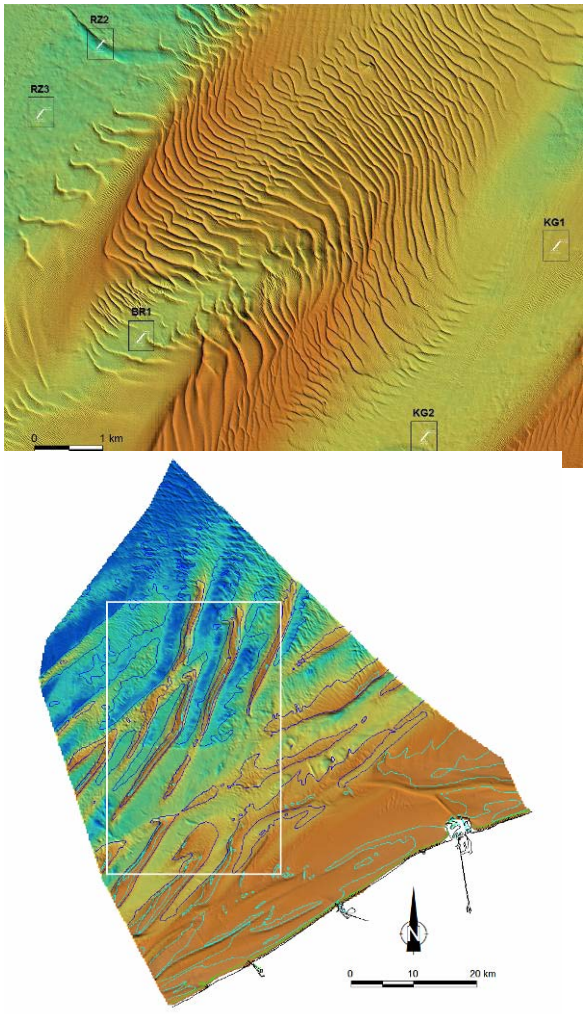

Figure 5.9: Buitenratle zone on the Belgian continental shelf.

An updated version of the report, Degrendele *et al*., has been produced. (Degrendele *et al*. 2009).

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Verfaillie, E., Du Four, I., Van Meirvenne, M., and Van Lancker, V. 2009. Geostatistical modelling of sedimentological parameters using multi-scale terrain variables: application along the Belgian Part of the North Sea./ International Journal of Geographical Information Science, 23(2), 135–150.

Verfaillie, E., Degraer, S., Schelfaut, K., Willems, W., and Van Lancker, V. In press. A protocol for classifying ecologically relevant marine zones. Estuarine, Coastal and Shelf Science.

Verfaillie, E. 2008. Development and validation of spatial distribution models of marine habitats in support of an ecological valuation of the seafloor. Universiteit Gent (Renard Centre of Marine Geology/Section Marine Biology). Institute for the promotion of science and technology in Flanders. Unpublished PhD, 207 p.

Van Lancker, V., Du Four, I., Verfaillie, E., Deleu, S., Schelfaut, K., Fettweis, M., Van den Eynde, D., Francken, F., Monbaliu, J., Giardino, A., Portilla, J., Lanckneus, J., Moerkerke, G., and Degraer, S. 2007. Management, research and budgetting of aggregates in shelf seas related to end-users (Marebasse). Brussel (B), Belgian Science Policy (D/2007/1191/49), 139 pp. + DVD GIS@SEA <mailto:GIS@SEA> + Habitat Signature Catalogue (order at: http://www.belspo.be/belspo/fedra/proj.asp?l=en&COD=EV/18).

Willems, W., Goethals, P., Van den Eynde, D., Van Hoey, G., Van Lancker, V., Verfaillie, E., Vincx, M., and Degraer, S. 2008. Where is the worm? Predicting the spatial distribution of the tube-building polychaete Lanice conchilega (Pallas, 1766). Ecological Modelling, 212: 74–79. doi: 10.1016/j.ecolmodel.2007.10.017.

5.10 Spain

5.10.1 International programmes

Habitat mapping in the Hendaye and Txingudi bays

This habitat mapping programme has been co-funded by the Regional Governments of Aquitania and Basque Governments in the period 2006 to 2008. The partnership was composed by Ifremer, AZTI-Tecnalia, Laphy and IMA. Main of the projects was the biological characterisation of the Basque continental shelf; for that, Txingudi bay was established as training site (Figure 5.10.1.1). The specific objectives were: (i) habitat classification and mapping using integrated methodologies; MBES, LiDAR, grab sampling, video, diving and (ii) the analysis of the EUNIS applicability (adaptation of the description-species, new habitats, etc.).

Figure 5.10.1.1: Study area.

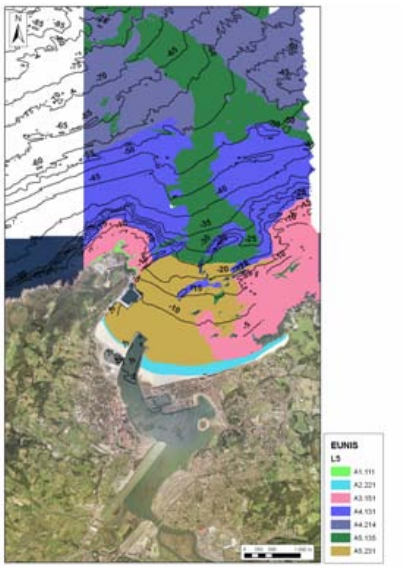

Figure 5.10.1.2: Classified habitat map.

Main results of the project includes final habitat map at different EUNIS classification up to level 5 (Figure 5.10.1.2) and the description of the habitats including the characteristics species of the study area and that there were not included in the EUNIS habitat descriptions. Moreover, characteristic habitats not included in EUNIS were found. This project resulted in a publication by G. Chust, I. Galparsoro, Á. Borja, J. Franco, A. Uriarte, 2008. Coastal and estuarine habitat mapping, using LIDAR height and intensity and multi-spectral imagery. Estuarine, Coastal and Shelf Science (78) 633–643.

5.10.2 National programmes

Information about Spanish habitat and mapping programmes information was submitted by Jose Luis Sanz from the Spanish Oceanographic Institute (IEO).

5.10.2.1 ESPACE Project.

This Project was conducted between 2002-2007 by Instituto Español de Oceanografía and the Secretaría General de Pesca Marítima. Surveyed area includes North continental shelf of Alboran Sea between Malaga and Murcia Community continental shelf between 10–130 m water depths (Figure 5.10.2.1).

The main objective of the programme was to produce base cartographic information for nature conservation, fisheries and other activities management such as pipelines installation.

The techniques used include swath bathymetry, backscatter, seismic, ground truthing with grab samples and underwater photo and video.

Final results were in GIS format and paper maps were edited at 1/50000 and 1/100.000 scales.

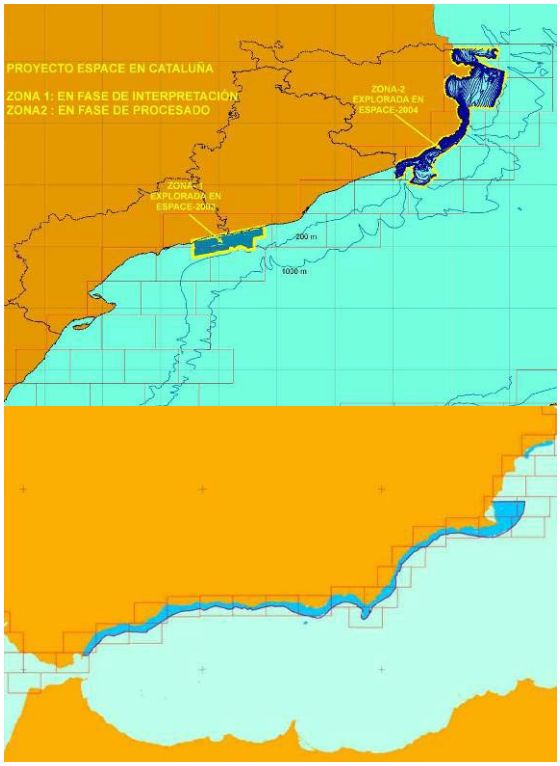

Figure 5.10.2.1: ESPACE Project coverage in the Catalonian (left) and Andalucian (right) continental shelves.

5.10.2.2 CARPEMA Project

This Project was conducted by Instituto Español de Oceanografía - Secretaría General de Pesca Marítima during 2002 and 2007. Surveyed area was North of Alboran Sea between Málaga and Almeria between 120–2,000 m water depth. Gathered data include: seismic profiles, swath bathymetric data and sediment data.

5.10.2.3 ZEE Española

This project was conducted by Instituto Español de Oceanografía - Instituto Hidrográfico de la Marina in 1999. The objective is the systematic survey of the geological composition of the seafloor within the Spanish marine territory and Exclusive Economic Zone (EEZ). Fieldwork was conducted during 1995–1998 in the Balearic Islands continental margin, from 2000 to 2003 on the Canary Islands continental shelf and since 2005 northwest Iberian margin is being surveyed.

Swath bathymetry, backscatter, seismic, marine gravimeter, marine magnetometer techniques are being used.

5.10.2.4 Marine ecocartographies

It was conducted by the Dirección General de Costas in 2002. Surveyed areas were the continental shelves of Canary Islands, Málaga, Alicante and Valencia in the range of depths between 0 to 100 m water depth. Main objective of the project was to map of geological, hydrographic, and any biological characteristics of Spanish continental shelf and littoral zone, for environmental, management and planning purposes. Paper maps were produced at 1:25,000 and 1:50,000 scale.

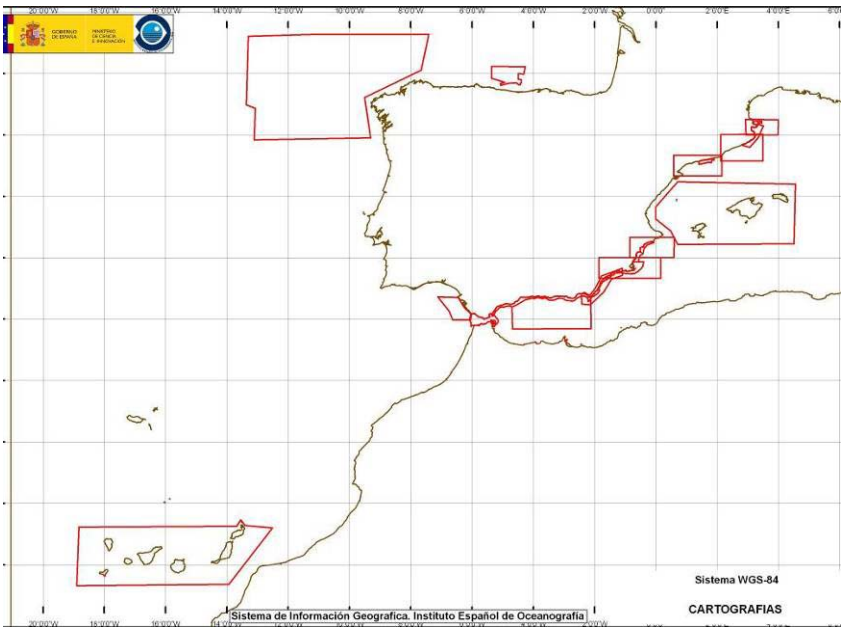

Figure 5.10.2.4: Location of the main cartographic programmes surveys.

5.10.3 Regional programmes

5.10.3.1 Habitat mapping and seafloor characterisation of the Basque continental shelf

This project is funded by the Department of Environment and Regional Planning of the Basque Government. It started in 2005 and will finish in 2009. The main objective is: to generate seafloor cartography, defining and delimitating marine habitats, and identifying the main species associated to each habitat type, within the continental shelf. And the specific objectives:

- obtain high resolution bathymetric data;
- characterise different seabed types (including geologic and geomorphologic features);
- determine habitat distribution pattern, in relation to environmental factors;
- produce habitat maps (intertidal and subtidal zones);
- classify habitats (European Natural Information System (EUNIS)); and
- identify and locate habitats of Community Interest.

The study area includes all the continental shelf in the range from supralittoral up to 100 m water depth and an integrated approach is being performed (Figure 5.10.3.1). For intertidal and very shallow water aerial images interpretation has been performed together with LiDAR and BathyLiDAR data analysis. For sublittoral area, MBES survey were carried out and finished in 2008. In 2004 a Marine Observatory was established in 2004 were grab samples are being collated for sediment, benthos and pollutants in sediments. Up to now, more than 4,400 sediment grab samples data are available in GIS standarised format.

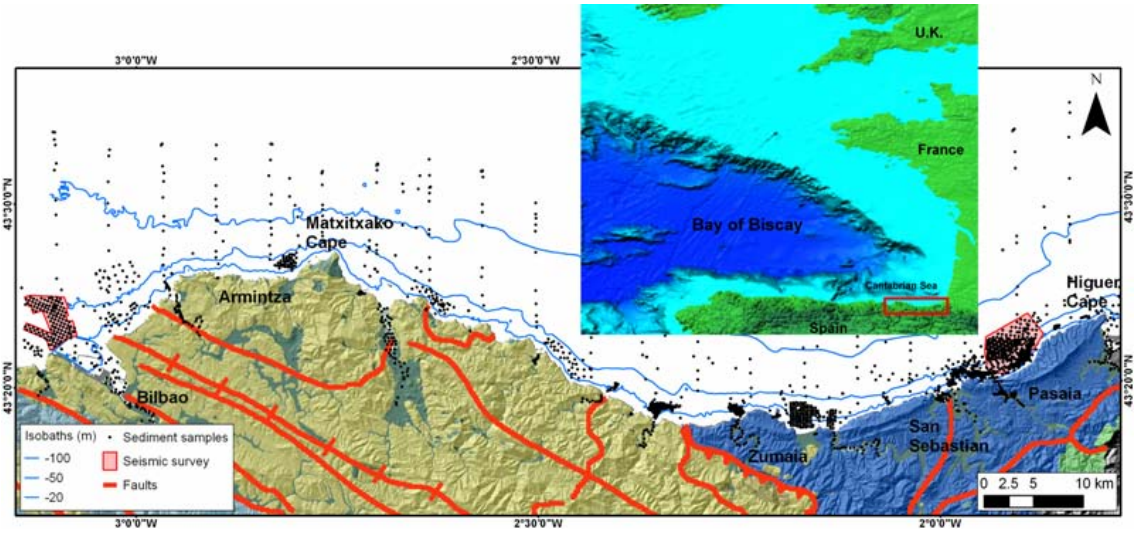

Figure 5.10.3.1: Study area within the Bay of Biscay.

At the moment, 1 m DEM has been produced together with derived topographic product such as slope, aspect, etc. Apart from that, wave energy spatial distribution has been calculated by means of hydrodynamic modelisation.

During 2009 groundtruthing will be performed with grab samples for sediments and benthic data acquisition.

5.11 Ireland

Fergal McGrath (INFOMAR Programme) presented an overview of the work currently being undertaken in Ireland

5.11.1 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.

INFOMAR is a joint venture between the Marine Institute and the Geological Survey of Ireland. The programme was allocated a budget of €4m per annum between 2006–2008 (www.infomar.ie). In 2008 the project was government approved for a further 5 years (subject to annual reviews) to the value of €3.4m per annum. 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. The mapping programme includes acquisition of multibeam bathymetry and backscatter data together with a comprehensive geological sampling programme. Equipment used includes EM3002, EM1002, EA400, Hull Mounted Pinger, GeoSpark 200, underwater video, ROV, box corer, 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.

5.11.2 INFOMAR Activities

In 2008, Eight (8) priority bays and two (2) priority areas were partially surveyed. In total c. 2,190 Km² of seabed area was surveyed and 119 sediment samples acquired (Grab). MBES (EM3002) data were acquired using the Celtic Voyager in four (4) priority bays and two (2) priority areas. LiDAR data were acquired in six (6) priority bays.

NAME	ACQUISITION	AREA KM2	GRAB SAMPLES
Donegal Bay (May 2008) Sligo Bay	MBES	688	-
Cork Harbour Approaches (July 2008) South Priority Area	MBES	411	22
Dublin Bay Approaches (Dec. 2008) South East Priority Area	MBES	282	97
Tralee Bay (April 2008) Galway Bay (North limits / Aran Islands) Blacksod Bay Donegal Bay Sligo Bay Lough Foyle	LIDAR	810	-

Small areas around the Aran Islands and Galway Bay were also infilled with MBES.

5.11.3 Habitat maps

INFOMAR are working closely with Quester Tangent Corporation in evolving their automated classification system (QTC Clams). Testing is ongoing. MBES classification point data are gridded and categorically interpolated using QTC Clams. Unsupervised classification is used to cluster pixels on the basis of spectral / statistics similarity, without any user-defined training classes. The clusters are then assigned labels using groundtruthing (samples/video).

Seabed classification charts (with a classification foot print is 10mx10m) have been produced for Galway Bay, Mulroy Bay, Waterford Area and Offshore Dublin. These maps are medium scale (from 1:50,000 to 1:200,000).

It is planned to develop a level of habitat map as part of the INFOMAR suite of products.

5.11.4 Other Programme Activities

JIBS: The Joint Irish Bathymetric Survey Project (JIBS) commenced in April 2007 and was completed by August 2008. This project was lead by the UK's Maritime and Coastguard Agency (MCA) with the Marine Institute of Ireland as project partner. Funding was through the European INTERREG IIIA programme and was co-ordinated by Northern Ireland's Department of the Environment (Environment and Heritage Service). The area surveyed was the 3 nm coastal strip from Malin Head to Melmore Head. The survey was conducted to IHO Order 1 standard. The R.V. Celtic Voyager spent two (2) month surveying an area between Inishowen Head and Melmore Head in 2007/2008. In the Republic of Ireland, approximately 400KM² of seabed was surveyed using MBES (EM1002 / EM3002). 43 sediment samples (Grab0) were acquired in this area. These data have verified by the UKHO for inclusion on updated admiralty charts for the area.

More information is available at:

http://www.marine.ie/home/services/surveys/seabed/JIBS.html. The data acquired may be viewed at http://gsigis1.dcmnronline.ie/imf/imf.jsp?site=JIBS. The data may be downloaded at https://jetstream.gsi.ie/jibs/index.html.

OCEAN ENERGY: An Ocean Energy Development Unit has been established part of Sustainable Energy Ireland (SEI). The first stage will include the development of a grid-connected wave energy test site near Belmullet, Co. Mayo. A multibeam survey of a prospective wave-buoy ocean energy site off Mace Head, (Galway) was undertaken in 2008 by INFOMAR onboard the R.V. Celtic Voyager. A full sized test bed is due to be launched in Q4 2009.

SMARTBAY: A wireless network is to be set up in Galway Bay comprising three buoys measuring water quality and oceanographic parameters. Phase 2 will involve the setting up of a test and demonstration facility for sensor testing. It is hoped that this will be in place by mid-to-late 2009. Phase 3 will see a functioning cabled observatory by 2010.

NPWS: Intertidal zone / shallow water surveys for habitat mapping have been carried out at several SACs by the National Parks and Wildlife Service and its contractors. Several commercial surveys have also been carried out around the country. These include Doonbeg (Clare) EIA, Diver Transects in Blacksod Bay (Mayo), Mulroy Bay and Rutland Island (Donegal) and Sound.

BIM: The Irish Fisheries Board carried out three seed mussel area surveys in 2008. Three small areas off the coast of Wexford and Waterford were surveyed using Roxswath but no sampling was undertaken.

5.12 NSR way forward:

The group discussed the future of this ToR, including a potential webGIS to be hosted by ICES, based on the paper presented in Annex 4. It was agreed that there are 2 purposes of ToR b: updating group members and ICES, and collating habitat mapping status information in a single place for the ICES area.

In response to the first purpose of this ToR, the group recommends using a consistent structure for the National Status Reporting (presentations as well as summary text). This structure is:

- National Programmes (e.g. MAREANO, INFOMAR)
- Other mapping activities (including habitat mapping *sensu stricto*, sediment mapping, bathymetric mapping and habitat modelling)
- Summary of habitat mapping status

Members of the group should endeavour to fit their updates to this structure. Not all members will have national programmes to report. The summary of habitat mapping status should refer to the previous two sections. Group members were also reminded that updates about monitoring work are not required as this is dealt with in other groups.

Secondly, the NSR tables are currently devalued with the inclusion of very variable scale information (programmes, projects, surveys) which results in tables which do not present a coherent or complete picture, and furthermore are not easily accessible. At the same time, ICES (represented by Hans Mose-Jensen) have already developed web mapping capability and are keen for ICES working groups to be able to make use of this facility where possible. ICES now have ArcGIS licences and have experience developing online mapping applications such as FishMap, an online atlas of

North Sea fish, which was built in partnership with RIVO and Cefas: http://www.ices.dk/marineworld/ices-fishmap.asp. ICES have built a test version of their own mapper, containing ICES reference layers (e.g. ICES areas), other reference layers (e.g. EEZ borders, GEBCO) and Working Group products (e.g. cold-water coral distribution maps from WG DEEP). This WG MHM would contribute to this last category of data.

The proposed solution is to make outlines of habitat mapping areas available online, linked to simple metadata. This would create a useful resource covering the ICES area, both for use by this group, by ICES, and by the habitat mapping community more widely. It was agreed that the group will **not** collate outlines for areas where data exist but have not been interpreted into a seabed map. In this context, seabed maps are understood to be maps divided into areas where a particular seabed type has been identified, whether the type includes biological information or physical information only. This can include maps created by 'traditional' techniques such as combining remote-sensing and ground-truthing data, as well as maps created from modelling.

Categorising of maps was discussed in this context, to agree whether different types of maps should be coloured in different ways, such as EUNIS/non-EUNIS, or modelled/non-modelled. It was agreed that a distinction between modelled and non-modelled was essential. Other information about the maps would be included in the metadata, and possibly used at a later point to symbolise the maps.

NOTA: The 2009 National Status spreadsheet (Compiled NSR 2009.xls) is available on the sharepoint.

6 Mapping strategies and survey techniques

Evaluate recent advances in marine habitat modelling techniques

(**ToR c**)

Summarised below are several presentations evaluating recent advances in marine habitat modelling techniques. The presentations include a range of techniques that have been used to describe and map the distribution of lobster, oyster and algae, as well as threatened and/or declining habitats and biotopes. Common features such as issues of scale and confidence were discussed, as well as possibilities and limitations of habitat modelling. All presentations included suggestions and plans on how to move forward, highlighting the increased usage of habitat modelling techniques for meeting international agreements (OSPAR, HELCOM, EU MSFD).

6.1 Assessment of the discrimination potential of bathymetric LIDAR and multispectral imagery for intertidal and subtidal habitats

This presentation was given by Ibon Galparsoro (Marine Research Division, AZTI-Tecnalia; Spain).

The first presentation provided an assessment of the contribution of bathymetric LIDAR and the Near Infra-Red (NIR) band compared to using only the visible images (RGB) bands for supervised habitat classification and mapping. The study was undertaken in Urdaibai estuary (North-eastern Spain), and depth ranged from the supralittoral to 20 m water depth. LIDAR data acquisition and ground truth sampling was performed at the same day in June 2008. A supervised image classification methodology was carried out. For each identified habitat, band signature was extracted

and maximum likelihood (ML) was applied, to assess individually and jointly the gains in the classification accuracy when adding the neo-channels (DEM, slope, aspect and shaded relief together with RGB and NIR bands), to the reference datasets. Combinations of different bands and predictor variables for all habitat classes were tested to quantify how the classification was improved. The final classified habitat map (Figure 6.1), resulted in a 90% overall accuracy (kappa of 0.88).

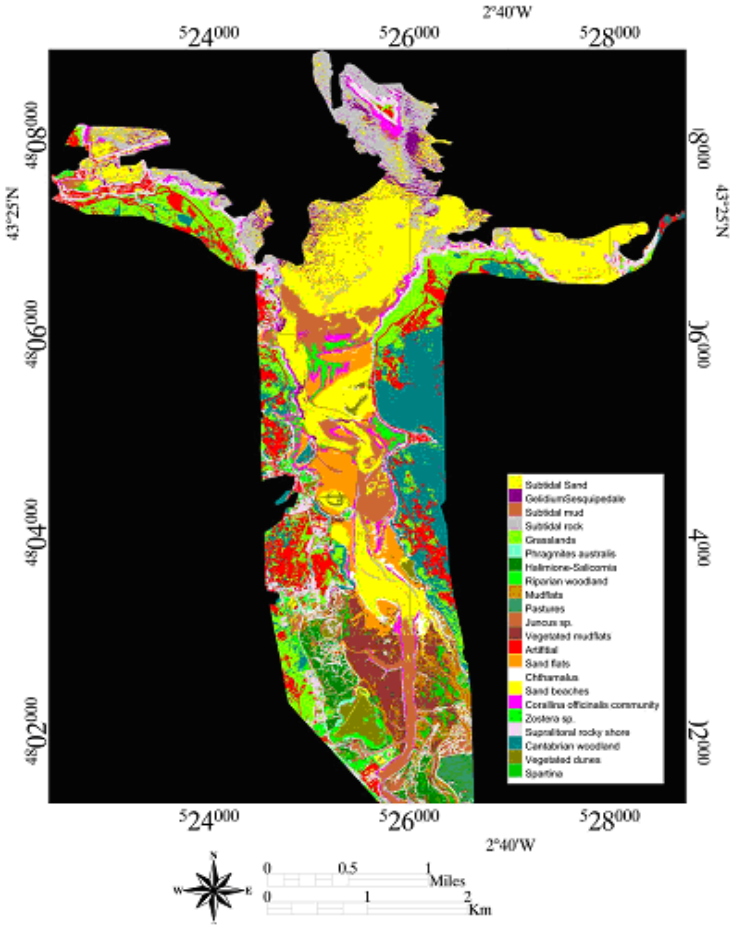

Figure 6.1: Habitat map of the Urdaibai estuary.

6.2 Predicting suitable habitat for the European lobster (Homarus gammarus), on the Basque continental shelf (Bay of Biscay), using Ecological-Niche Factor Analysis.

The second presentation by Ibon Galparsoro aimed at determining seafloor features that drive the distribution of lobster and map the potential distribution. For lobster presence data acquisition, commercial fisheries data, i.e. lobster pot lines, were used. In total, 17 lines (650 metres long) with 60 pots on each were deployed over night. 1m horizontal resolution DEM produced from MBES data and derived topographic variables i.e. slope, aspect, curvature, rugosity and benthic position index (broad and fine scale), were used as predictor variables. In addition, distance to rocky substrate and average wave flux over the seafloor was included. Average wave flux was modelled

using SMC software[3], resulting in a 20 metres horizontal wave energy distribution grid.

Habitat suitability calculations were made with the ENFA approach implemented in the free software Biomapper[4], which uses presence only data. The ENFA computes suitability functions by comparing the species distribution in the eco-geographical variables (EGV) space, with that of the whole set of cells. Two criteria for habitat preference are provided, i.e. Marginality (M) and Specialisation (S). Marginality is the ecological distance between species optimum and mean habitat (global) value. Specialisation is the ratio of the standard deviation of the global distribution and the species standard deviation. In order to find an appropriate scale for modelling lobster distribution the predictor variables derived in three different grid resolutions: 3x3, 9x9 and 27x27, as well as multiscale.

In total 92 lobsters were caught, average 5.3 per pot line. Bathymetric profiles for the lines were used to describe lobster presence, which was often on sandy bottoms close to rocky substrates. The fact that this was based on fishermen catch data spurred some discussion. The fishermen had probably targeted specific areas, which could have lead to a slight bias towards sandy bottoms, due to the risk of losing the fishing gear in rocky habitats.

Results from the scale analyses indicated that the finest scale (3x3 which corresponds to 15m x 15m spatial scale) performed the best with regards to marginality (0.983) and specialisation (2.418). Main drivers of lobster distribution were, in order of importance, the distance to rock, broad-scale BPI, slope, medium to high energy wave flux and depth.

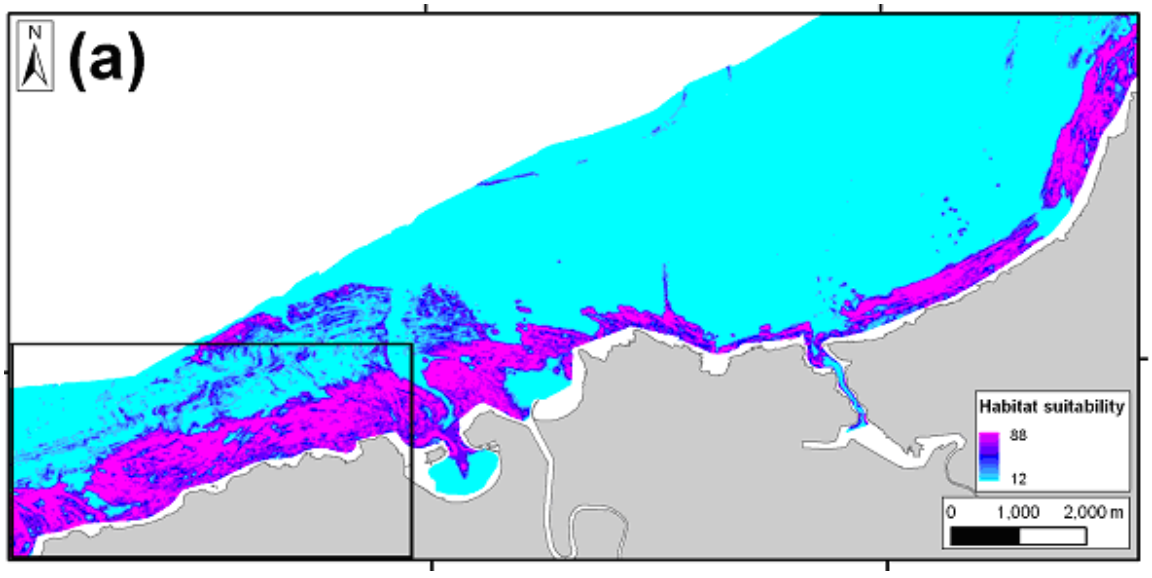

Figure 6.2. Habitat Suitability for European lobster in the study area.

[3] González, M., Medina, R., Gonzalez-Ondina, J., Osorio, A., Mendez, F. J., Garcia, E. 2007. An integrated coastal modelling system for analyzing beach processes and beach restoration projects, SMC. Comp. Geosc., 33 (7): 916–931.

[4] Hirzel, A., Hausser, J., Chessel, D., Perrin, N. 2002. Ecological-Niche Factor Analysis: How to compute Habitat-suitability maps without absence data. Ecology, 83 (7): 2027–2036.

Interestingly, new areas currently not used by fishermen were predicted as suitable for lobster habitats. Future work involves validating model performance and examining these areas. In addition, a test using random (fishery independent) surveys should also be planned.

This study has recently been published[5].

6.3 Scales in marine mapping and modelling: opportunities and limitations

This talk was given by Martin Isæus from Sweden. A background on the approach to spatial modelling and prediction was provided. In general, the presented work followed the description given in the WGMHM 2008 report (Chapter 5.4 Habitat modelling techniques). In short, the distribution of an organism is statistically related to environmental predictor variables, and the potential distribution is then predicted in a GIS based on spatial layers of the environmental variables. The presentation put emphasis on uncertainties, e.g. related to the potential introduction of error due to a low quality of the GIS predictor variables. Model performance is often based on cross validation, and the accuracy of the predicted distribution should best be evaluated using independent data. The area under the curve value (AUC) obtained from receiver operating characteristics plots are often used as a measure of both model and predictive performance[6]. A scale for determining suitable performance thresholds based on AUC was suggested; >0.9 excellent, 0.8–0.9 good, 0.7–0.8 intermediate and 0.5-0.7 poor, where intermediate can be acceptable depending on the purpose of the study.

Focus then switched to issues of scale and a national model of Bladder wrack (*Fucus vesiculosus*) probability of occurrence for the whole Swedish coast was presented. The explanatory model was excellent (AUC 0.90), while an external validation of the prediction resulted in poor performance (AUC 0.54). This discrepancy was due to the quality of the predictor variables. Especially bathymetry was highlighted as being of poor quality, and a comparison between field measured samples and grid values illustrated this (R^2 0.33). The question is then; how do we improve model performance using the data available? Three tests were presented (a-c);

a) Regional models based on subsets of the data showed a slight improvement compared to the national model, but still predictions were classified as poor (AUC 0.60).

b) Another issue potentially influencing the results were areas with restricted depth information. These areas have restricted access to depth information and only contain the class "6-200 m". However, excluding the classified areas gave only a marginal increase in predictive performance (AUC 0.62), which was not deemed enough.

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[5] Galparsoro, I., Borja, Á., Bald, J., Liria, P., Chust, G. 2009. Predicting suitable habitat for the European lobster (*Homarus gammarus*), on the Basque continental shelf (Bay of Biscay), using Ecological-Niche Factor Analysis. Ecological Modelling., 220(4): 556–567.

[6] e.g. Fielding, A. H., Bell, J. F. 1997. A review of methods for the assessment of prediction errors in conservation presence/absence models. Environmental Conservation, 24: 38–49.

c) Improving the resolution of the bathymetry to 25 metres. Due to computer constraints this was done in four subareas. In one subarea, Bothnian Sea, the prediction was intermediate (AUC 0.76), while the others were still classified as poor.

Another example on large scale modelling was given from the project MopoDeco funded by the Nordic Council of Ministers. The aims of the project was to model habitat forming species (mussels, Bladder wrack and eelgrass) for the entire Baltic Sea, results which may form an integral part of spatial planning and management. The results from modelling of Bladder wrack using data layers available for the entire Baltic Sea also showed severe shortcomings in environmental predictor layer quality. Generally the bathymetry of the Finnish coast over-estimated the amount of shallow depths, which resulted in an over-prediction of Bladder wrack presence. Also on the Swedish coast over-prediction was apparent in areas with restricted depth data (6-200 m). An obvious error was also visible in the Curonian lagoon, where Bladder wrack was predicted to occur. In reality the lagoon has more or less fresh water, but the salinity layer showed the same (high) psu as outside the lagoon. These types of uncertainties and errors in the predictor layers used for predicting species distributions may have severe consequences for accuracy and confidence in the results. An accuracy map was produced to visualize the confidence problems.

The conclusion from these two large scale studies was that available environmental layers had not sufficient quality for large scale predictive modelling. However, since the explanatory model was excellent, based on AUC-criteria, new predictions may be performed if better environmental layers (especially bathymetry) are provided by national authorities in the future.

In three smaller pilot areas situated in the north, central and southern east coast of Sweden, high quality environmental layers were available and predictive modelling (as above) showed mainly good or excellent validation results. The scale of these prediction maps were estimated to correspond to the level of detail to 1:50 000.

What scales are needed in maps to be useful for different management tasks? Table 6.3 suggests the scale that corresponds to different survey techniques as well as examples on modelling of waves and surface sediments.

Table 6.3: Scales corresponding to a subset of survey techniques and modelling of wavesand surface sediments.

Scale	1:2 000 000 - 1:500 000	1:300 000 – 1:100 000	1:50 000 - 1:25 000	1:10 000 - 1:5 000
Bathymetry from nautical charts	x	x		
Bathymetry from digitized old measurements	x	x	x	
Bathymetry from multi-beam	x	x	x	x
Marine geology, regional quality	x			
Marine geology, detailed quality	x	x		
Interpreted back-scatter	x	x	x	x
Interpreted side scan sonar			x	x
Sediment modeling based on multi-beam bathymetry		x	x	x
Wave exposure (SWM)	x	x	x	

Predictive modelling, national scale	x		
Marine landscapes (BALANCE)	x		
Predictive modelling, pilot areas			x

By using this table and the one given in section 8 below, managers and authorities are provided guidance in understanding which survey or modelling efforts that are needed to fulfil certain management tasks.

A conclusion from the Swedish examples is that the predictive modelling presented from more detailed scale pilot areas generally contain layers of sufficient quality to fulfil a number of management tasks in Sweden, e.g. planning for the establishment of wind parks and MPAs. At the national level the quality of the environmental layers limits the use of predictive modelling as a tool for providing layers for management. The next step in Sweden is to start modelling at a county level based on environmental high quality layers.

6.4 HABITAT: A spatial analysis tool for ecological (and risk) assessment

HABITAT was presented by Bregje van Wesenbeeck from The Netherlands as a (free) spatial tool for ecological assessments to make predictions by analyzing availability and quality of habitats. Several levels may be modelled, i.e. species, groups of species as well as an ecotope level. The tool is used to support the development of water management plans in accordance with the water framework-, bird- and habitat directives.

The modelling software is called PcRaster and input consists of i) abiotic maps, modelled or measured and interpolated, and ii) response curves, often obtained from literature sources. As an introduction to the software three examples were presented.

The first example dealt with Japanese oyster occurrence in the Oosterschelde estuary. Oyster response on depth and bottom shear stress was determined by comparing oyster occurrence in the field, with maps of these abiotic conditions. Obtained response curves were then used to determine potential new oyster habitat in the Oosterschelde. This revealed that currently not all potential oyster habitats in the study area were occupied.

The second example dealt with the modelled distribution of potential habitats of eelgrass in the Wadden Sea. Results indicated that there were several places suitable for eelgrass persistence. This was then compared to a dynamic model of eelgrass seed dispersal from a nearby estuary, showing that few potential habitats were likely to be colonised by seed from a natural source.

Uncertainty in biological data feeding into the models can include; i) overlooked key variables and ii) imprecise response curves. Abiotic variables also contain several uncertainties, e.g. they are derived from modelling efforts, and especially for the ecotope classification the splitting value may contain a high degree of subjectivity.

Currently, work on validation of Dutch Salt Water Ecotope System is conducted, using data from a benthic monitoring program, which is expected to give increased experience on these issues.

6.5 Draft maps on marine landscapes and biotopes in the German North Sea and Baltic Sea

Dieter Boedeker (Germany) presented (very) new draft maps on marine landscapes and biotopes in the German North Sea and Baltic Sea produced for BfN by BioConsult Schuchardt & Scholle GbR. The biotope maps are based on the BfN biotope classification given with the German Red List of Biotopes[7]. Biotope maps are needed to identify the location and distribution of threatened and/or declining biotopes and habitat types. The marine landscapes maps were produced in order to fulfil international obligations arising from OSPAR, HELCOM and the EU Marine Strategy Framework Directive.

The maps were compiled by using existing data from different sources, hence, parts of the map contain more detailed data, while other parts are less precise. Several variables have been used in the classification, e.g. distance to coast, tidal range, depth, sediment, salinity, geomorphology, currents, oxygen, temperature, etc, and also some biota such as blue mussel beds in the Baltic Sea and eelgrass-beds in the Wadden Sea. The landscape maps also include all natural habitat types according to Annex I of the Habitats Directive and all Water Bodies as demanded by the Water Framework Directives.

In the future the focus will be to improve mapping biotopes, rather than mapping landscapes, i.e. including more biota in the mapping efforts and not only basing the classification on physical variables such as substrate distribution.

Final results and the maps will be made available at: www.habitatmare.de.

6.6 Recent progress in kelp modelling around Brittany, France

WGMHM Chair, Jacques Populus (France), presented recent progress on kelp modelling around Brittany, France, a work which was also described in last year's National Status Report. Kelp is both an economically and ecologically important component of the coastal system and mapping kelp habitats will provide significant input to the establishment of marine parks in France. Within the next four years 10 marine parks (MPAs) are planned to be established and the work is led by a newly established agency. Results from the presented study (described below) will feed into detailed studies that are planned to be undertaken at one of these areas (the Ushant-Molène archipelago).

The modelling approach in the presented study was similar to previous presentations, with the distribution of kelp being related to environmental variables. Echo-integration from acoustics provided percentage coverage in 200m squares, which relates well to the resolution of the predictor layers. Explanatory variables were derived from a DTM and included slope, benthic position index (BPI) and rugosity. Hydrological predictor variables derived from satellite included summer SST, the attenuation coefficient (kPAR), chlorophyll a, with the addition of bed stress. Two restrictive binary variables were used, substrate (rocks) and photic depth. Predictor variables in the final model were bathymetry, temperature, chl a, bed stress and low

[7] Riecken, U., Finck, P., Raths, U., Schröder, E., Ssymank, A. 2006. Rote Liste der gefährdeten Biotoptypen Deutschlands. Zweite fortgeschriebene Fassung. 318 Seiten.

BPI (Figure 6.6). Model evaluation was based on cross-validation, which resulted in between 60 and 90% concordance for all study sites.

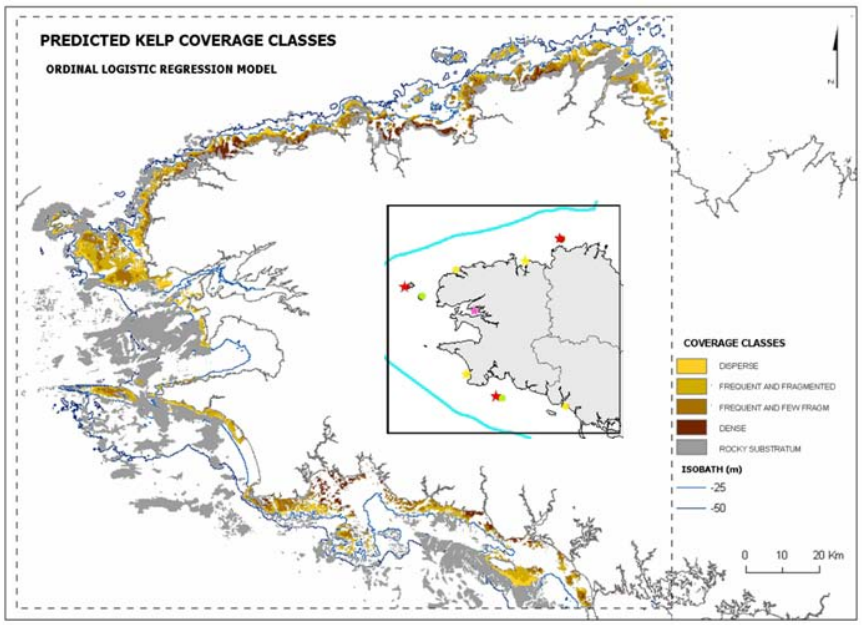


Figure 6.6: Predicted kelp coverage classes in the study area.

Results showed that robust predictive maps can be produced at regional levels. However, some improvements were suggested, i) a better depth layer would be expected to increase efficiency when collecting field data, ii) refinement of the rocky substrate layer by including LIDAR and interferometry, as well as the oceanographic proxies (kPAR, BPI, bed stress) would be expected to lead to a better overall model and more precise predictions. Expected outputs from future detailed studies are occurrence and biomass estimates of kelp within the marine park.

Evaluate ground-truth sampling strategies and validation for remote-sensing data and modelling predictions in the production of habitat maps. Develop recommendations for operational guidelines.

(**ToR d**)

The meeting discussed matters related to ground truthing particularly after habitat modelling presentations, but not as an agenda item itself.

It was not questioned that ground truthing is needed for all means of remote sensing and acoustic surveying. Depending on the water depth different methods are appropriate.

Scuba divers can only operate in shallow waters, and diving is very time and cost consuming, but remains in some cases the most reliable method for the verification of video and/or sidescan sonar tracks. Video tracks themselves are predominantly used in shallow waters too. With this method one can roughly address sediment types and macrophyte vegetation and epifaunal species as well as lebendspuren of some endofaunal species. A standardized and intersubjectively verified method for the multivariate assessment of videos is needed, but has not been developed so far.

Different methods of grab sampling for endofaunal and sediment type surveys are very well developed and standardized. The same is due for dredging to survey

epibenthic communities. The deeper the survey area becomes the more costly this method is.

The meeting did not discuss ground truthing in depth, it is notable that for example in Norway there are trends to show on each map all points or tracks where ground truthing was performed; otherwise it must be assumed that no ground truthing had been taken place. The Norwegian Mareano project below gives a field data collection strategy. Other countries may of course have other standards adapted to the extend and depth of their marine area.

6.7 Multibeam retrodiffused signal calibration using video images and in-situ measurements of sand thickness

Alain Norro (MUMM, Belgium) gave a talk on multibeam retrodiffused signal calibration using video images and *in-situ* measurements of sand thickness. The study area of the project was determined by historical data from the end of the 18th century. The maps from that time show benthic richness. In the past the investigated area was very rich in oyster beds, now there are no oysters found in this area any more (the "Hinderbank zone").

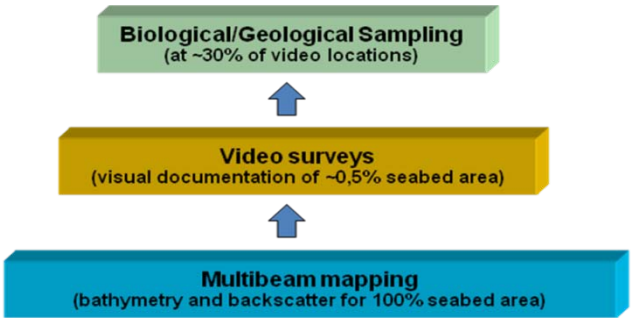
There were used different techniques in this project for mapping the seabed habitats. The first technique was a Mutibeam echosounder, Kongsberg Tryton software was used to treat BS signal and a supervised classification methodology was used; there was a need for calibration of these data, which was carried out using scuba-operated video and *in situ* measurements. The field work was started in 2005.

The conclusions of the study were that marine habitat mapping can be achieved using acoustic signature retro diffused by various seabed. The ground- truth issue calls for precise positioning since precise maps are available. Interdisciplinary experiment presented aims to validate BS acoustic signal with *in-situ* sand thickness measurements. A new instrument is used since last year (an EM 3002). That instrument is working at 300 kHz. Further conclusions and perspectives of the project were that on one of the classes defined (class 3); bioturbation was responsible for the high BS shown. Since EM1002 was working at 95 kHz, the signal penetration can explain partially that high BS since sand thickness on the zone is less than 50 cm and Ypres clay is present bellow the sand. All test zones will be sampled again with the new instrument next year.

6.8 The MAREANO concept of ground-truthing

Depending on the topographical variability the density of stations needed for ground truthing will differ. In the high relief area presently mapped the number of video transects is 10–15/1000 km^2 and sampling stations are between 3–5/1000 km^2. The mapping steps are:

1) Multibeam mapping of 100% of the survey area > topography
2) Interpreting multibeam backscatter > indicating sediment softness
3) Information from 1 and 2 are user to position sampling stations
4) Video documentation (0.5% of the surveyed seabed) and sampling of sediment and fauna (ca. 30% of video tracks i.e. 3–5 sampling stations/1000 km^2 and dredges/epibenthic sledges) > sediment-, biodiversity and "naturtype" habitat maps



3. Sampling
Sampling stations for ground-truthing of biology and geology 3–5 st / 1000 km^2

2. Selecting
Selecting transects for video documentation (10 - 15/ 1000 km^2)
700-1000 m long covering 1000 -1500 m2 each .

1. Multibeam
Multibeam mapping covering total areas ½-1 year before mapping biology and geology

7 Protocols and standards for habitat mapping

Report on current methodology for the assessment of accuracy and confidence in habitat maps through the assessment of selected habitats and their associated reports/metadata by considering both the final maps and the survey design.

(**ToR e**)

7.1 Confidence assessment of modelled maps

Natalie Coltman (JNCC, UK) showed a few slides on the issue of assessing confidence in broad-scale habitat models to give an input to a discussion. Different issues that would influence the confidence of the map were discussed with the example of bathymetric data, light penetration and substrate.

It was clear that for each data set, there is a whole range of possible errors and error types and magnitudes would highly depend on each type of data source. The different sources of error will have different implications and will need different methods to minimize them. It was put forward that in the UK there will be a system called WORF online very shortly, which could be used to improve the bathymetric data set. There is also a project going on there that is a part of a government contract with the purpose of developing a system for assessing the confidence of broad scale classification maps (available as "Assessing_Confidence_Feb2009"_on ICES sharepoint at http://groupnet.ices.dk/WGMHM2009/default.aspx. The system is supposed to be able to estimate confidence on any sort of layer. It is designed to be generic in order to be able to deal with layers that may come up in the future. For the combining of the assessments, the error will be calculated by computing the product of the assessment of the probability for the biological zone, the sediment type and the energy level. In this case, the 3 variables are weighted evenly which might not be what is desired.

Other approaches were also shortly discussed, based on a document in Annex 5. There was also a question whether other mapping issues like for example bathymetry mapping are faced with the same issues to create a confidence map. The general response was that the habitat mapping case is different from the way confidence is assessed in other cases, so the same techniques that are used in other scientific fields cannot be applied here. Generally all disciplines seem to be very poor in producing

confidence maps, and as they are needed as input to habitat mapping, confidence assessment of the latter will be very difficult.

There was a general agreement that mapping confidence is a very important issue, but that there are no easy solutions and shortcuts on that issue. The prerequisite for making confidence maps for habitat maps will always have to be confidence maps for the maps that were used to generate the habitat maps. Thus the confidence level will be different between different areas of the map.

The time scale issue of sampling across an area was also brought up, meaning that when you are sampling over a big area, some parameters will be so dynamic that you cannot really use the different observations, which were taken at different times, to produce a map over the whole area. For some kinds of information, sampling density is also an important issue to consider when estimating confidence and there are suggestions that sample locations always appear on a habitat map as an overlay to habitat polygons.

This group wants to remind people working in this scientific field never to forget the confidence issue when producing and using maps. There is an example of map confidence assessment in the finish archipelago from the BALANCE project. The report is in English and can be accessed from the BALANCE website at http://balance-eu.org/xpdf/balance-interim-report-no-31.pdf.

8 Uses of maps in a management context and relevance in understanding ecosystems

Evaluate the range and style of habitat maps, including issues of scale and thematic content in relation to broad types of applications (e.g. spatial planning, protected area designation, local developments). Recommended standard approaches with regard to the main areas of habitat map application.

(**ToR g**)

8.1 The Prehab project

Mats Lindegarth, from the University of Gothenburg, gave a presentation of PREHAB (Spatial PREdiction of benthic HABitats in the Baltic Sea: incorporating anthropogenic pressures and economic evaluation), a one M€ project which started in January 2009. The project is funded by BONUS, which is an EU 6 Framework Programme ERA- NET project. PREHAB partners are institutions from Sweden, (2 partners) Finland (3 partners) and Lithuania (1 partner). It focuses on developing methods for regional spatial planning in Baltic coastal areas and includes development of methods for:

1) empirical modelling and mapping of habitats using natural and anthropogenic processes,

2) monetary valuation of economic and ecological goods and services in a geographic context,

3) integration of ecological modelling and economic valuation into scenarios for planning with focus on important policy documents (e.g. the Baltic Sea Action Plan).

The project is organised in four main workpackages of which spatial prediction and modelling constitutes≈50% of the total budget. The generality of modelling a p-proaches, predictive power of predictors and use-fullness of response variables, will

be evaluated in 2–3 regional areas in the Baltic (Archipelago Sea, Lithuania and Kattegat). Predictive power of proxies for coastal development and eutrophication will be assessed and used to illustrate the use of a limited number of future scenarios. The project will be completed at the end of 2011.

8.2 Discussion of range of map scales and types against uses

A presentation due to be given by Johnny Reker on marine spatial management and linking multiple pressures was cancelled at short notice. The group was invited to discuss a table sorting out various types of marine human activities versus the range of scales of habitat maps and see whether specific types of maps could serve specific needs.

It was noted that although habitat maps are mostly used by planners and policy makers at higher level in conjunction with other types of maps, they could also be used by corporations (such as e.g. aggregate extraction firms).

Displaying scales in ranges was found more or less relevant by the participants according to their backgrounds and views. Some found it more appropriate to deal with notions such as local, national or regional (basins) scales than to encapsulate scales in numbers. These ranges of scales, currently centred around 1/10000, 1/500000, 1/2000000 and 1/1M and coarser are however encountered in Natura 2000 guidelines for the former two and in the EUSeaMap for the latter, which makes them relevant for discussion.

It was insisted on the fact that comprehensive mapping is foreseeable at local scale (surveys) or at very coarse scale (global models) but that at intermediate scales none of these methods were effective and would require huger resources.

The participants are invited to read the Guidelines for the establishment of the Natura 2000 network in the marine environment. Application of the Habitats and Birds Directives available at
http://ec.europa.eu/environment/nature/natura2000/marine/index_en.htm

Table 8.2: Marine activities versus scales.

SCALE 1/	5 000 TO 10 000	25 000 TO 50 000	100 000 TO 300 000	500 000 TO 2 M
Detailed study (harbour, sewerage, cable)	Site study (development)	Scoping map		
Coastal MPA designation and management		Current management map	Regional scoping	National/European scoping
Higher sea MPA designation and management			Current management map	National & regional scoping
Renewable energy (cable, generator)	Site study (development)	Site study (ecology impact)	Regional assessment	
Aggregate/dredging		Site study (licensing)	Regional assessment	
Fisheries (ecosystem)	Impact assessment			Resource assessment
Aquaculture siting	Farm siting	Suitability assessment	Farm siting (ecological impact)	

The meeting discussed two tabular matrixes (one of them shown above) containing several human uses and activities on the one side and on the other side scales and EUNIS levels, respectively. Both matrixes include more or less similar specifications of activities according to different scales/EUNIS levels. Participants were of the opinion that such matrixes are very useful tools for all actors and spatial planners in the marine environment. Dieter Boedeker (Germany) agreed to combine both tables. It was agreed that with the table no information should be given on confidence and resolution related to different scales/EUNIS levels, because this would cause more questions than additional information.

8.3 Request from WGICZM for consideration by WGMHM

The meeting discussed a request from the ICES WGICZM on several items related to the mapping of human uses. WGMHM is also looking at Marine Spatial Planning because habitat maps are a fundamental component to take into account in decision making. However the group felt that such a request should be more specified in relation to regions, scales etc. and agreed to inform the ICZM group that our group during the last years has worked on standards and protocols for habitat mapping, GIS use and metadata handling, which was a huge task in itself, for which a lot more work is needed within the group. WGMHM's achievements can be consulted in the group's yearly reports available from ICES. Valuable information thereof can be found in the "Mesh Guide on habitat mapping" which contains a lot of details on ways to handle geographic information in its chapter 6. Should the request by WGICZM be made more specific and more in line with current WGMHM work ToRs, common activities could be foreseen (e.g. a mini-workshop - Mallorca 2010?). The answers made to WGICZM can be consulted in Annex 6.

9 Recommendations and actions for use by ICES secretariat

9.1 Recommendations and actions for use by ICES secretariat

These can be consulted in Annex 7 as per ICES recommended template. Some recommendations imply actions to be taken by working group members and in this case their deadlines are indicated. After submission of the report, the ICES Secretariat will follow up on the recommendations, especially when it is felt they impinge on proposed Terms of Reference to other ICES Expert Group Chairs.

9.2 Locations and dates for future meetings

Following a recent disengagement of our Canadian colleagues, the Halifax venue initially planned for 2010 has to be abandoned and put off to 2011. A suggestion is made to hold WGMHM 2010 in Corsica, following an invitation of Ifremer. Dates are chosen the same as this year, e.g. 20–23 April. The anticipated location is the Stareso Marine Research Centre located ten kilometres away from Calvi, which will be confirmed as soon as possible. It is also planned to encourage Canadian colleagues to resubmit an offer to host the 2011 meeting.

9.3 Terms of reference for 2010 meeting

The Terms of Reference for 2010 meeting are given in Annex 8

9.4 Adoption of the report

The draft report and its annexes were discussed by the working group before closing the meeting. The documents were circulated to all participants for final edits.

9.5 Close of the meeting

The Chair, Jacques Populus, thanked Kerstin Geitner and her institution DTU Aqua for having received the group at the beautiful Charlottenlund castle. Thanks to the warm Danish hospitality, the awesome weather during the whole meeting period and the extremely valuable contributions of all participants, this was a very productive and enjoyable meeting.

Annex 1: List of participants

NAME	ADDRESS	EMAIL
Jacques Populus	Ifremer – France	jpopulus@ifremer.fr
David Connor (22-24/4)	JNCC - UK	david.connor@jncc.gov.uk
Natalie Coltman	JNCC - UK	Natalie.coltman@jncc.gov.uk
Alain Norro	MUMM - Belgium	A.norro@mumm.ac.be
Fergal Mac Grath	MI - Ireland	Fergal.McGrath@marine.ie
Essi Keskinen	Natural Heritage Services - Finland	essi.keskinen@metsa.fi
Anu Kaskela	Geological Survey of Finland	anu.kaskela@gtk.fi
Kerstin Geitner	Technical University of Denmark, Institute for Aquatic Resources (DTU Aqua)	kjg@aqua.dtu.dk
Dieter Boedeker (21-23/4)	German Federal Agency for Nature Conservation	dieter.boedeker@bfn-vilm.de
Bregje Van Wesenbeeck	Deltares - NL	Bregje.vanWesenbeeck@deltares.nl
Göran Sundblad	Swedish Board of Fisheries	Goran.sundblad@fiskeriverket.se
Martin Isaeus (21-23/4)	AquaBiota Water Research – Sweden	martin.isaeus@aquabiota.se
Cecilia Lindblad (21-23/4)	SEPA - Sweden	cecilia.lindblad@naturvardsverket.se
Ibon Galparsoro	AZTI - Spain	igalparsoro@pas.azti.es
Hans Mose Jensen (21/4)	ICES - Denmark	hans.jensen@ices.dk
Mats Lindegath (24/4)	U. Goteborg - Sweden	mats.lindegarth@marecol.gu.se
Lene Buhl Mortensen (21-23/4)	IMR - Norway	lenebu@imr.no

Annex 2: WGMHM terms of reference for the 2009 meeting

2008/2/MHC07 The **Working Group on Marine Habitat Mapping** [WGMHM] (Chair: J. Populus, France) will meet in Copenhagen, Denmark (at The National Institute of Aquatic Resources, Charlottenlund Castle) from 21 to 24 April 2009 to:

International programmes

a) report on progress in international mapping programmes (including OSPAR & HELCOM Conventions, EC & EEA initiatives, HERMES, CHARM, PLANOR, JIBS)

National programmes (National Status Reports)

b) present and review national habitat mapping activity during the preceding year, providing National Status Report updates according to the standard reporting format, an overview map, and focusing on particular issues of relevance to the rest of the meeting.

Mapping strategies and survey techniques

c) evaluate recent advances in marine habitat modelling techniques.

d) evaluate ground-truth sampling strategies and validation for remote-sensed data and modelling predictions in the production of habitat maps. Develop recommendations for operational guidelines.

Protocols and standards for habitat mapping

e) report on current methodology for the assessment of accuracy and confidence in habitat maps, through the assessment of selected habitat maps and their associated reports/metadata, considering both the final maps and the survey design. Develop guidelines for standard presentation of results to the end user.

f) review the testing of the MESH survey metadata standards (and use of the associated Access database application) and make recommendations for improvements if required. Explore the traceability of survey data in metadata for habitat maps.

Uses of habitat mapping for management

g) evaluate the range and style of habitat maps, including issues of map scale and thematic content, in relation to broad types of applications (e.g. spatial planning, protected area design, local development). Recommend standard approaches with regard to the main areas of habitat map application.

h) provide guidance on formats and metadata of human-activities data, usful indices for which will be communicated to WGMHM by WGICZM prior to 21 April 2009, to facilitate contiguous mapping of these activities in coastal waters.

WGMHM will report by 25 May 2009 for the attention of SciCom as well as 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	Action Plan nos.: 1.4.1, 1.4.2, 1.4, 1.4.3. The WG provides an important forum to present and discuss the progress of multinational programmes, in particular, within the Regional Conventions (OSPAR and HELCOM), the EU and its funding instruments (Interreg and FP7 programmes) and the EEA. The strategies, standards and issues addressed by each programme need to be assessed to facilitate sharing of best practice, sharing of difficulties and to work towards integration of resultant maps if feasible. The compilation of National Status Reports is required to keep abreast of current activities and bring attention to new initiatives, developing techniques and data availability. Marine habitat modelling is a growing area of research, with multiple approaches and techniques. WGMHM should share and develop best practice in this field. In recent years there have been considerable advances in the use of remote acoustic techniques for marine mapping. There is a need to examine how well these techniques are validated through ground-truth sampling and to provide suitable guidance. Similarly, maps developed through modelling need validation and associated guidance on this is necessary.Assessment and presentation of issues about accuracy and confidence is marine habitat mapping, to better inform end users of potential limitations in the maps, is at an early stage in development. This is a significant new area in which WGMHM members can contribute to developing new approaches.
	Sound data management is important in the archiving and distribution of data sets and in interpreting the data to make maps and assess their confidence. WGMHM members have agreed to test a standard developed by MESH and to report back. Habitat maps can be presented in a variety of ways and levels of detail, depending on their purpose. Examination of presentation techniques linked to end-user requirements could help improve the outputs.
Participants	Representatives from Member Countries with experience in habitat mapping and classification. Participation of the Baltic countries and from USA and Canada is particularly sought. The participation of members of BEWG, WGEXT, WGECO, WGDEC, WGFAST would be helpful in developing appropriate linkages to other areas of ICES work.
Linkage to Advisory Committee	ACOM
Linkages to other Committees or groups	BEWG and SGNSBP, WGEXT, WGECO, WGDEC, WGFAST and SGASC, SGEH (Baltic Committee), WGICZM
Linkages to other organizations	OSPAR, HELCOM, EEA

Annex 3: Agenda

21 April
10h00

Opening of the meeting

Terms of Reference

Adoption of the Agenda

Appointment of Rapporteurs

International programmes

ToR a: review report on progress in international mapping programmes (including OSPAR & HELCOM Conventions, EC & EEA initiatives, HERMES, CHARM, PLANOR, JIBS)

- Briefing on EU DG/MARE project EUSeaMap of global mapping of European seas. Natalie Coltman, JNCC.
- Briefing CoralFISH & CHARM projects (Jacques Populus)
- Update on habitat mapping under the aegis of the HELCOM Convention (TBC)
- An overview of priority habitat data and BA4 assessment (Natalie Coltman, JNCC)
- Some conclusions on the Interreg UK/Ireland JIBS (Fergal Mac Grath)
- Briefing on EU and EEA mapping and habitat classification perspectives
- (David Connor)
- Recent proposals for improving habitat classification in the littoral zone
- (Jacques Populus)

National programmes (National Status Reports)

ToR b: present and review national habitat mapping activity during the preceding year, providing National Status Report updates according to the standard reporting format, an overview map, and focusing on particular issues of relevance to the rest of the meeting (presentations strictly limited to a 15 minute overview per country; posters are encouraged for supplementary information; national status reports to be circulated prior to the meeting; outline map of study areas in shape-file GIS format)

- France (Jacques Populus, Ifremer)
- Germany (Dieter Bödeker, BfN)
- The Netherlands (Bregje van Wesenbeeck, Deltares)
- Sweden (Martin Isaeus, Aquabiota)
- Finland (Essi Keskinen and Anu Kaskela, Metsähallitus)
- Norway (Lene Buhl-Mortensen; MAREANO mapping programme)
- United Kingdom (Natalie Coltman, JNCC)
- Denmark (Kerstin Geitner, DTU Aqua)
- Belgium (Alain Norro, MUMM)
- Spain (Ibon Galparsoro, AZTI)
- Ireland (Fergal Mac Grath, Marine Institute)
- The NSR webGIS – The way forward (Jacques Populus, Ifremer and Hans Mose-Jensen, ICES). Specifications, data types, software developments, timeline. Discussion based on Mesh webGIS example.

22 April
09h00

Mapping strategies and survey techniques

ToR c: Evaluate recent advances in marine habitat modelling techniques.

- Mapping suitability of lobster habitat with biomapper (Ibon Galparsoro)
- Habitat classification of BathyLIDAR data with spectral signatures (Ibon Galparsoro)
- Evaluation of recent advances in marine habitat modelling techniques (Martin Isaeus)
- Estimating and verifying Japanese oyster occurence in the Oosterschelde estuary (Bregje van Wesenbeeck)
- Progress on kelp modelling (Jacques Populus)

ToR d: evaluate ground-truth sampling strategies and validation for remote-sensed data and modelling predictions in the production of habitat maps. Develop recommendations for operational guidelines.

- Multibeam retrodiffused signal calibration using video images and in-situ measurements of sand thickness (Alain Norro)
- Mareano ground truthing strategy (Lene Buhl Mortensen)
- Protocols and standards for habitat mapping

ToR e: Report on current methodology for the assessment of accuracy and confidence in habitat maps, through the assessment of selected habitat maps and their associated reports/metadata, considering both the final maps and the survey design. Develop guidelines for standard presentation of results to the end user.

- Confidence assessment of modelled maps. An overview of work carried out in the UK (Natalie Coltman)
- WG to discuss confidence in modelled maps
- Briefing on EU and EEA mapping and habitat classification perspectives
- (David Connor)
- Recent proposals for improving habitat classification in the littoral zone
- (Jacques Populus)

23 April
09h00

ToR f: review the testing of the MESH survey metadata standards (and use of the associated Access database application) and make recommendations for improvements if required. Explore the traceability of survey data in metadata for habitat maps.

Uses of habitat mapping in a management context (human activities; implementation of Directives and Conventions) and its relevance in understanding ecosystems

ToR g: Evaluate the range and style of habitat maps, including issues of map scale and thematic content, in relation to broad types of applications (e.g. spatial planning, protected area design, local development). Recommend standard approaches with regard to the main areas of habitat map application

- Introduction to the Prehab project (Mats Lindegarth)
- WG to discuss contribution to MSFD GES and marine spatial planning.
- WG to discuss request from WGICZM

24 April 09h00	
	Recommendations and Actions
	ToRs for 2010 meeting
	Editing the report
	Adoption of the Report
13h00	**Close of Meeting**

Annex 4: NSR report in a webGIS

Background

WGMHM 2007 recommended that in recognition of the growing volume of information (metadata) being produced from mapping programmes, including that collated by WGMHM in its National Status Reports, better use of these metadata (i.e. the NSR spreadsheets) is required by collating the annual reports and making these more widely available via a web portal.

WGMHM 2008 recognised that NSR information remains hidden within the WG reports rather than being widely available (e.g. via a web portal) and secondly, that the reports do not build, year on year, into a compiled catalogue of mapping studies.

NSRs are currently in the form of Excel spreadsheets filled in by WGMHM country representatives with data collated on maps, studies, cruises, samples etc., which results in a great variety and of types and presentations of data. The capture template (Annex 1) has recently been updated to better reflect the real content of the data sets but it is rather freely adapted by the users and would need more guidance (e.g. scrolling lists).

The experience of the Mesh webGIS

The mesh webGIS has successfully developed a web map server based on the WMS technology that allow displaying a wide variety of habitat mapping related data i.e. points, images, maps and survey outlines. The webGIS allows the user to display maps in an image mode, to zoom and pan, to identify point/polygon content, to access metadata of these data sets. Maps can be viewed in two modes: either their real content (polygons or pixels) or simply their outlines. The current coverage of maps can be seen at a glance, however the geographic coverage is limited to the Interreg north-west area of European seas.

In the course of the Mesh project, data were transferred to JNCC, the webGIS administrator, using a data exchange format (DEF, Annex 1) for efficient data sharing. There are no DEF for raster data files. The DEF relates to fields in the attribute table of data files. The DEF has four variants, each reflecting a different data theme, for example Study area DEF, Original habitat DEF.

A metadata catalogue describing these studies was also produced. The metadata was populated using MS Excel template spreadsheets, which were imported into a central MS Access database. All the 25-metadata fields make up a metadata record for a seabed habitat mapping study. (for more details about DEF, see http://www.searchmesh.net/default.aspx?page=1919). For more details about metadata spreadsheet and guidance, see http://www.searchmesh.net/Default.aspx?page=1567).

The system of coordinates had been chosen as spherical coordinates and WGS84 datum, which seemed a suitable choice for all partners in the area, although this choice made the webGIS look stretched. The Esri shapefile format was the standard chosen for geographic data exchange and download.

Anticipated developments at ICES

Data type

Following a critical review of the Mesh webGIS and considering the limited resources within WGMHM and ICES headquarters in general, the following considerations are proposed:

- data types should be limited to maps. Intermediate data (imagery, DTMs) are not in the scope of this webGIS, however links to repositories are possible through the metadata
- maps types selected here should be in close relation to seabed habitats, i.e. either full habitat maps (resulting from interpretation and/or models), substratum maps or sediment maps.
- even though maps all result from a combined process of interpretation and modelling, there is currently a distinction between "interpreted maps" resulting from surveys (usually more local) and maps resulting from models (even though it is supported primarily by survey data) which usually are more global. Single habitat maps are still another category. Showing the outline of such maps along with other "holistic maps" can be misleading to the user. More discussions are required to categorise maps according to their type, the way they were generated and the feasibility of displaying them together or separately.
- map scales vary from very global (e.g. the Mesh Eunis modelled map covering the whole Interreg NW area) to very local (a few tens of km²) and it may not be suitable to condition display with scale.
- polygons will not be displayed on the webGIS, which is only concerned with map outlines. Map content is available from map custodians referenced in the metadata.

Backdrop data

Backdrop data are deemed to remain as simple as possible for the purpose of properly locating habitat maps within the ICES perimeter. Beside an appropriate coastline, coarse bathymetry and the ICES areas may be of interest for some users. It is also feasible to display the EEZ and territorial boundaries. However for the sake of clarity it is suggested to offer a possibility to toggle them on and off. The resolution of the backdrop data must be in relation with the zoom capability, which itself depends on the smaller map size to be displayed. Following the Mesh experience it is recommended to use a coastline at scale no less than 1/300000. For more global display, a coastline on scale 1/1million such as Gebco's is suitable.

Metadata

At first, a metadata format has been prepared by Ifremer, using MS Excel spreadsheet. It very much reflects the content of the former NSR Excel spreadsheet (Annex 2) and the MESH metadata standard, which means few adjustments have to be made. The metadata structure is shown in Annex 3. The proposed structure is compliant with the core elements required to identify a dataset with the ISO 19115.

GeoNetwork opensource is a standards based, Free and Open Source catalog application to manage spatially referenced resources through the web. It provides

powerful metadata editing and search functions as well as an embedded interactive web map viewer. See details about Geonetwork on http://www.fao.org/geonetwork/srv/fr/main.home and http://geonetwork-opensource.org/.

WebGIS display

The webGIS could be mostly similar to Mesh's with some simplifications, which are suggested below and need discussion.

- No distinction with map classification type would be made in the display. It is deemed more important to know that at a given location a map does exist regardless of the classification it used. For those interested the classification type will appear in the metadata anyway. The same holds true for substratum maps.
- Distinction between map types is not so much the fact that some come from surveys and others from models (or both), but rather whether the map is "holistic" (a habitat are present at any location) or showing a single habitat (e.g. a maerl map).
- In order to avoid misleading users with global maps having a wide coverage but poor level of detail, probably a couple of cut offs in the level of zoom should be implemented and this should also be discussed : a) detailed maps (better than 1/50000), global maps (not better than 1/1M) and medium resolution in-between.
- the colour scheme could be chosen in compliance with e.g. the Mesh or Ospar GIS. Shapefiles of map outlines should remain slightly hatched or coloured, hence allowing visibility of underlying backdrop data.

Implementing the webGIS

Implementing the webGIS requires the following elements:

- a web server such as Apache/Tomcat, to host the Geonetwork application,
- a DBMS such as Oracle or PostgreSQL, to host metadata
- a web map server OGC compliant, such as Mapserver,
- a web mapping client e.g. OpenLayers or Cartoweb
- developments could be necessary to adapt the Geonetwork capture environment as well as to produce a users' manual.

Annex 5: Data exchange format (DEF)

FIELD NAME	FID	SHAPE	POLYGON	GUI	ORIG_GUI	DATASET	VERSION
Data type (length)	Number	Text (8)	Long integer (Precision 8)	Text (8)	Text (8)	Text (50)	Text (50)
Description	Feature ID. Internally generated identification number for each polygon (not visible if .dbf file is opened using MS Excel)	Internally generated text, indicating whether the feature is a polygon, point or line (not visible if .dbf file is opened using MS Excel). This will be 'POLYGON' in the study area DEF	Identification number for each polygon which must be manually created as ascending integers 1,2,3… Do not use the value 0. This label for each polygon is necessary to identify the original polygon because the FID field may change during the processing of datasets	Globally Unique Identifier (GUI) of the study area dataset - i.e. the GUI for the study area shapefile. Consists of 2 letter country code (which corresponds to ISO 3166-1) plus 6 digits. This field will be identical in all records of the shapefile, and is used during the processing of datasets.	The Globally Unique Identifier (GUI) of the study which the outline delimits, in the form of a 2 letter country code (which corresponds to ISO 3166-1) plus 6 digits. Each ORIG_GUI must correspond to a record in the metadata catalog.	The information identifying the general theme of the resource : HABITAT SPECIES SUBSTRAT MARINE LANDSCAPE BATHYMETRY ……..	The classification system used and publication date of this classification if possible. For example : LOCAL NATIONAL EUNIS_VERSION_2004 OSPAR_HAB_2004 FOLK ……. If no classification system is known, enter "UNKNOWN" in this field If the dataset does not contain a classification, enter "NA" in this field
Examples	0	POLYGON	1	FR100000	FR000005	SPECIES	LOCAL
	1	POLYGON	2	FR100000	FR000007	SPECIES	LOCAL

NSR spreadsheet template

Country code	Programme or project title	Date - start	Date - end	Organisation(s) undertaking survey	Geographical coverage (country, region)*	ICES rectangle	Depth range surveyed	Purpose of study/targeted end-users	Summary abstract for study	Survey techniques used	Datasets generated	Habitat classification scheme used	Outputs	Contact name & Organisation	Study area polygon ID
Give code of country reporting the study (not country studied if different)			Enter future date if programme not yet completed		**North-west Europe (MESH) regions:** Northern North Sea Southern North Sea Eastern Channel Western Channel Bay of Biscay Celtic Sea Atlantic South West Approaches Irish Continental Shelf Irish Sea Minches & West Scotland Scottish Continental Shelf Faroe-Shet	Use either ICES system e.g. 31F3 or Area IVc block 29 (example is from Belgium)	<0m (intertidal) 0-20m 20-50m 50-100m 100-200m 200-500m 500-1000m 1000-2000m >2000m	Area management & planning (e.g. SEA) Environmental quality assessment (monitoring) Nature conservation Navigation (inc. dredging) Research Aggregate industry Cables & piplines Coastal development Fisheries Oil & gas industry Renewable energy		**Remote sensing (aerial)** Aerial photography Airbourne digital imagery (CASI/ATM) Lidar Satellite imagery **Remote sensing (in water)** Single beam echo sounder AGDS Multibeam echo sounder Side-scan sonar Interferometric sonar Sub-bottom profiling 3-D seismic	e.g. Bathymetry Physical seabed characteristics Biological samples Photographic images Habitat map	Local (within project) National (state which) EUNIS Other Not relevant (no habitat map)	Give report reference(s), web sites etc	Contact for programme or project	If supplying GIS shape file, give polygon ID code(s) for study area(s)

Proposed metadata template

Required	Required	Required	Optional	Optional	Required	Optional	Optional	Required	Required	Required	Required
Country code	Resource title	Information date	Resource point of contact	Geographical coverage (country, region)	Resource language	Datasets generated	Scale of final map	Summary abstract for study	Distribution format information	Date - start	Date - end
Give code of country reporting the study (not country studied if different) Code of country corre-sponds to ISO 3166-1 (2 letters)	The title of the resource(s) is the name by which it is commonly known.	Reference date and event used to describe the resource (creation or publication or revision) Format reference date : mm/yyyy or yyyy	Organisation(s) or person(s) which have a responsibility face to face of the resource : Name(s) of the responsible(s) person(s) : surname, given name, job title; Responsible(s) organisation(s) name(s): full organisation name (acronyms may be included in parenthesis for clarity); Address(es) of the responsible(s): the most practical means to contact (mailing address,	North-west Europe (MESH) regions: Northern North Sea; Southern North Sea; Eastern Channel; Western Channel; Bay of Biscay; Celtic Sea; Atlantic South West Approaches; Irish Continental Shelf; Irish Sea; Minches & West Scotland; Scottish Continental Shelf; Faroe-Shetland Channel; Rockall Trough &	Language(s) used within the resource Codes for the representation of names of languages correspond to ISO 639-1 (2 letters)	The general theme of the resource: Habitat Species Substrat Marine landscape Bathymetry Biological samples ..... The 'Habitats' theme should be used for benthic data which have been assigned to habitat categories; 'Species' refers to datasets describing the distribution of a single taxon; 'Substrat' refers to datasets describing seabed sediment; 'Marine landscape' refers to datasets describing	The scale of the final map, e.g. 250000.	Brief narrative summary of the content of the resource(s)	Name of the resource transfer format(s) (for example : TIFF, ZIP, SHP …) and the version of the format (date, number …)	Time period covered by the content of the resource : Date start (dd/mm/yyyy or mm/yyyy or yyyy)	Time period covered by the content of the resource : Date end (dd/mm/yyyy or mm/yyyy or yyyy) Enter future date if programme not yet completed

	electronic mailbox, telephone numbers ...)	Bank; Atlantic North West Approaches; Other areas: Give Country & area	marine environment based on geophysical parameters (sediment characteristics, morphology, hydrodynamics); 'Bathymetry' refers to datasets showing floor relief or terrain as contour lines, and may additionally provide surface navigational information;

Required **Depth range surveyed**	Optional Data type	Optional Spatial reference system	Optional Reference	Optional Purpose of study / targeted end-users	Optional Survey techniques used	Optional Classification scheme used	Optional Point of contact for distribution
<0m (intertidal) 0–20m 20–50m 50–100m 100–200m 200–500m 500–1000m 1000–2000m >2000m	The format of the dataset. Select one from: Database or spreadsheet GIS vector polygon GIS vector point GIS vector polyline GIS raster Acoustic image Paper map Other – for example reports, or electronic maps which are not GIS files Unknown	The spatial reference system of the dataset, e.g. WGS 1984 (LatLong), WGS84 (UTM zone 31N), OSGB (EN), OSGB (LL) Give as much information as possible. Note that the MESH Data Exchange Formats specifies WGS 1984 Lat Long as the datum and coordinate system to be used for exchange of electronic data within the MESH project. The Spatial reference system field should refer to the datum and coordinates of the original dataset before any conversion.	A full citation for a report produced based on the resource (published or unpublished) e.g. author(s), publication date, full title & publishing details; The more precise as possible **web site where is the map** (not only the home page of the site), for example: "http://www.ifremer.fr/rebent_carto/viewer.htm?MS=28" "http://www.searchmesh.net/default.aspx?page=1516&Action=DYNAMIC&MapName=D:/websites/mapping/MapserverService/Map/MESHexternal.map&MapLayersToShow=World;CountrySeas&MapLayersSelectable=CountrySeas" The more precise as possible **web site where is the report** (not only the home page of the site), for example: http://www.forumskagerrak.com/download/744/x/WP6%20pop%20web.**pdf**	The purpose for which the study was conducted. Select one or more from: Area management & planning (e.g. SEA); Environmental quality assessment (monitoring); Nature conservation; Navigation (inc. dredging); Research; Aggregate industry; Cables & piplines; Coastal development; Fisheries; Oil & gas industry; Renewable energy	The survey technique(s) employed to collect the data used to create the resource(s). Select one or more survey technique(s) from the list (sub-headings only, do not use the bold headings in this field): **- Acoustic techniques :** Multibeam echo sounder; Single beam echo sounder; Side scan sonar; Interferometric sonar; AGDS; Multibeam ground discrimination; 3D seismic imagery; Sub bottom profiling **- Benthic sampling techniques :** Grabs; Cores; Trawls; Dredges **- Sediment analysis :** Particle size analysis; Geotechnical measurements **- Video and imaging techniques :** Towed video; Diver video; ROV; Drop camera; Sediment profile imagery **- Remote sensing techniques :** Aerial photography; Airborne digital imagery; Satellite imagery; LIDAR **- Direct observation techniques :** Diver survey; Intertidal survey **- Other :** Model; Other	The classification scheme used to describe the seabed in this resource: Local (within project) National (state which) EUNIS OSPAR Natura 2000 Greene Folk Wentworth Other (be more precise) Unknown	Responsible organisation or individual from whom the resource may be obtained: **Name of the responsible person** : surname, given name, job title; **Responsible organisation name** : full organisation name (acronyms may be included in parenthesis for clarity); **Address of the responsible party** : the most practical means to contact the distributor (mailing address, electronic mailbox, telephone numbers ...)

Annex 6: Confidence assessment for modelled maps

(J. Populus, Ifremer)

Modelled maps are basically issued from the following source layers:

- Bathymetry
- Substratum
- A few physical drivers (light, temperature, bedstress, etc.)

The former two usually are "historic" data, which means they have not been collected in a bespoke way to make habitat maps but were collected for other purposes and are readily available as proxies. Being historic data not collected by modern remote sensing techniques, they mostly happen to be of lesser density (the case for depth data) and only qualified at certain locations (the case for substratum samples). The latter physical drivers mostly come from models with limited amount of field data assimilation, hence they are seldom assessed in terms of confidence.

Most generally these data suffer from a lack of metadata (e.g. historic sediment maps) and quite often the content of their source field samples is not available any more. Therefore it may be difficult to assess the quality of these maps, as was the case in Mesh where the confidence score of some historic maps remained low for lack of knowledge. Obviously spatial assessment (as opposed to a global score for a map) is even more difficult in that case. The only parameter that easily lends itself to a comprehensive estimation of quality is bathymetry in the form of a DTM, since computing the error on interpolations of such a physical quantity is an easy task when building the DTM.

Two tracks are being suggested to carry out confidence assessment.

a) The first one is to try and assess the reliability of source data and build some kind of weighted sum of the quality scores of the individual source layers. In spite of the difficulty raised above, this could probably be done using experts' advice. An assessment of historic substratum maps could follow the rules set up by Mesh for habitat map with minor adjustments. Physical data coming from models could be assessed by looking at the quality of the underlying bathymetry and the amount of field data assimilated to them. This would remain by all means extremely approximate. The weighted sum could reflect the relative importance of each layer as viewed by the benthos experts.

   This method could yield a spatial vision of quality, even though it would remain coarse.

b) Another potential way is by statistically compare the outputs of the model to some recent detailed maps. This could be achieved in several ways, either by selecting polygons or samples. As reference data need to be as reliable as possible, it would probably be best to choose recent field habitat samples used in the construction of some recent maps. It would be a case of selecting a wide variety of samples illustrating the whole scope of broad bottom types, depth zones and energy regimes. These samples could be summarised to the same Eunis level as the co-located model outputs

(mostly level 3) and a point-in-polygon GIS processing function would yield a contingency matrix.

It is quite difficult to foresee the result of such an assessment. There are a bunch reasons why these two sets of data would depart from each other. This departure lies not only with the modelled data but also with the way recent samples are identified and attributed to Eunis classes. While depth zones from field work reflect the faunistic or floristic assemblages, seabed energy is more difficult to estimate for the simple reason that it is not measured while sampling. This needs to be trialled.

Assessing confidence in modelled maps could probably be a blend of the two methods. A first step could be to first split a wider geographic area (region or basin) into consistent sub-areas in terms of source data quality. This can be illustrated in the Mediterranean by zones where the original depth data is either GEBCO or a recent 500m cell size DTM or more local higher resolution data. Within such sub-areas the statistical approach, based on a selection of samples randomly chosen in a few recent habitat maps could provide a more local confidence estimate.

Annex 7: Liaison with WGICZM

Context

Following a request from Tom Noji, former Head of ICES Marine Habitat Committee the group was requested to provide guidance on formats and metadata of human activities data, useful indices for which will be communicated to WGMHM by WGICZM prior to 21 April 2009, to facilitate contiguous mapping of these activities in coastal waters.

Request from WGICZM meeting, March 2009

WGMHM has made a request for input from WGICZM with regard to Marine Spatial Planning (MSP). After some discussions in the group it was decided that a list of questions/issues to be addressed by WGMHM was proposed:

1) The working group recommends that data translation and visualisation summarisation approaches be investigated.
   i. In addition to habitat mapping, these should include other significant ecosystem components such as spawning/nursery grounds, migration routes and key mating/feeding grounds that are vulnerable to human activities.
   ii. In addition, it would also include mapping of the intensity of human activities taking into account social, cultural and economical components.
   iii. The maps should illustrate the connectivity and coherence between land/sea interactions as it relates to rivers, coast and sea.

2) The working group recommends the development of geo-spatial/temporal analysis tools that combine ecological and socio-economic modelling and assessment, taking into consideration existing relevant legislations, indicators and management action thresholds.

3) The working group recommends the development of geo-spatial visualisation tools for interactive policy scenarios.

Tentative answer from WGMHM

These data on spawning/feeding grounds are within the remit of ICES fisheries working groups. However WGMHM could contribute to providing guidance on how to finalise them in GIS format to make them available to the community. Perhaps this type of data is in the scope of the forthcoming ICES webGIS. We can further investigate on this. Note that one specific issue may be the temporal aspect of these data

Mapping the intensity of human activities is of course central to ICZM and spatial planning. Again the key question is how to deal with temporal aspects, of paramount importance in the fisheries sector both resource-wise and effort-wise. WGMHM has no particular capacity on dealing with the temporal aspects of mapping.

Estuarine habitats and land/sea interactions are not central to WGMHM (being of lesser biodiversity interest) and besides no estuarine habitats are being monitored in the frame of the Water Framework Directive.

These two items are intermingled. First of all we would have to bring all relevant data in homogeneous formats, whether they be on several servers. Habitat mapping, mostly under the pressure of the Mesh project, underwent the process of homogenis-

ing maps in the Eunis classification, however such endeavours remain rare and the process needs to be expanded to European seas.

Annex 8: Recommendations

RECOMMENDATION	FOR FOLLOW UP BY:
1. ToR b: To give more visibility to NSRs, the group agreed on continuing filling in NSRs in spreadsheet form as a way of mutually and externally informing the community on a yearly basis of current ongoing habitat mapping activities. However for better visibility activities should be categorised in three types.	Action: ALL Deadline : next meeting in 2010
It was also decided to collaborate with ICES in setting up a webGIS. The webGIS is to be of general use for ICES working groups, with regards to WGMHM it will be used to show habitat maps. A timeline was agreed with ICES with the aim of having the webGIS running for the end of 2009. The deadline for providing habitat map outlines as shapefiles was set at October 2009.	Action: JNCC and Ifremer to review and circulate metadata template to group members, to include a field to distinguish mapped from modelled data. Deadline: Jul. 2009
	Action: ALL to send outlines of habitat maps to ICES, by Sept. 2009, in the following format: ESRI™ Shapefile, Lat Long coordinates with WGS84 datum, Single attribute: [ID] which links to metadata spreadsheet. Text format, 8 characters. ISO country code plus 6 digits, e.g. GB000001
In collaboration with the ICES data management unit it is planned to liaise with other expert groups that may have similar needs	ICES: To make a prototype site available by Dec. 2009 for comment by WGMHM in time for final release at end March Action: J. Populus and H. Mose Jensen. Deadline: October 2009
2. ToR e: It was recommended that the EuSeaMap project (DG/MARE) under JNCC guidance exerts a strong push on other strands of the Emodnet preparatory actions so that confidence data is provided along with data sets. EuSeaMap will keep WGMHM informed of their current progress a few months before the 2010 meeting.	Action: JNCC and Ifemer (N. Coltman and J. Populus) Deadline: February 2010
Participants should be constantly aware of the necessity of requesting quality assurance and confidence data for source layers or proxies they are using in their interpretation and/or modelling procedures. Specific efforts made on this point should be reported at 2010 meeting. The report drafted in the UK by APB Mer report on "Assessing the confidence of broad scale classification maps" is going to be disseminated to all participants. It can be obtained by writing from: jpopulus@ifremer.fr	Action for the ICES secretariat: inform relevant group Chairs
It was suggested to try and produce a position paper on accuracy and confidence that could be reviewed at the next meeting.	Action : J. Populus to prepare draft and circulate (Dec. 2009)

3. ToR g: The group was invited to discuss a table sorting out various types of marine human activities versus the range of scales of habitat maps and see whether specific types of maps could serve specific needs. Participants are invited to contribute this matrix with relevant comments and cases.	Action: WGMHM members to report to Johnny Reker by November 2009.

Annex 9: WGMHM Terms of Reference for 2010 meeting

The **Working Group on Marine Habitat Mapping** [WGMHM] (Chair: Jacques Populus, France) will meet in Calvi, France (at the Stareso Marine Station) from 20 to 24 April 2010 to:

International programmes

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

National programmes (National Status Reports)

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

Modelling

c) Evaluate recent advances in marine habitat modelling techniques

Protocols and standards for habitat mapping

d) Report on advances on survey strategy and data collection and develop guidelines for data collection by completing the list of recommended operating guidelines (ROGs) produced by Mesh (with particular emphasis on, but not limited to grabs, sonar interferometry, PSA etc.)

e) Report on progress in post processing and interpreting data (e.g. Sonarscope)

Accuracy and confidence

f) Review methods for accuracy and confidence assessment on both modelled maps and interpreted maps and initiate production of written guidelines.

Uses of habitat mapping for management

g) Review practise about the use of habitat maps in different countries for various purposes.

WGMHM will report by end of May 2010 for the attention of SCICOM as well as 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	Action Plan nos.: 1.4.1, 1.4.2, 1.4, 1.4.3. The WG provides an important forum to present and discuss the progress of multinational programmes, in particular, within the Regional Conventions (OSPAR and HELCOM), the EU and its funding instruments (Interreg and FP7 programmes) and the EEA. The strategies, standards and issues addressed by each programme need to be assessed to facilitate sharing of best practice, sharing of difficulties and to work towards integration of resultant maps if feasible. The compilation of National Status Reports is required to keep abreast of current activities and bring attention to new initiatives, developing techniques and data availability. It enables the group to keep record of current progress in mapping coverage in Europe and gives visibility to the wider community. Marine habitat modelling is a growing area of research, with multiple approaches and techniques. WGMHM should share and develop best practice in this field. In recent years there have been considerable advances in the use of remote acoustic techniques for marine mapping. There is a need to examine how well these techniques are validated through ground-truth sampling and to provide suitable guidance. Similarly, maps developed through modelling need validation and associated guidance. Issues about accuracy and confidence is marine habitat mapping, to better inform end users of potential limitations in the maps, is coming of age and need to be synthetised and reported. Habitat maps can be presented in a variety of ways and levels of detail, depending on their purpose. Examination of presentation techniques linked to end-user requirements could help improve the outputs in the framework of marine spatial planning.
Participants	Representatives from Member Countries with experience in habitat mapping and classification. Participation of the Baltic countries and from USA and Canada is particularly sought. The participation of members of BEWG, WGEXT, WGECO, WGDEC, WGFAST and WGICZM would be helpful in developing appropriate linkages to other areas of ICES work.
Linkage to Advisory Committee	ACOM
Linkages to other Committees or groups	BEWG and SGNSBP, WGEXT, WGECO, WGDEC, WGFAST and SGASC, SGEH (Baltic Committee), WGICZM
Linkages to other organizations	OSPAR, HELCOM, EEA