

REPORT OF THE
Working Group on Marine Habitat Mapping (WGMHM)

**Sandy Hook, USA
1–4 April 2003**

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International Council for the Exploration of the Sea
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1 OPENING OF MEETING

The Working Group on Marine Habitat Mapping (WGMHM) convened in Sandy Hook, New Jersey, USA from 1–4 April 2003 at the NOAA National Marine Fisheries Service James J. Howard Marine Sciences Laboratory. The participants at the meeting were welcomed by Thomas Noji, on behalf of NOAA, the host of the meeting.

The meeting was attended by 19 people, from Canada, Germany, Ireland, Spain, the UK and the USA (Annex 1), each providing a brief introduction of themselves. Apologies were received from John Alvsvåg (Norway), Eugene Andrulowicz (Poland), Dieter Boedeker (Germany), Chris Cogan (Germany), Jan van Dalftsen (The Netherlands), Cynthia Davies (UK), Steven Freeman (UK), Anthony Grehan (Ireland), Brigitte Guillaumont (France), Stig Helmig (Denmark), Dick de Jong (Netherlands), Dorian Moss (UK), Sergej Olenin (Lithuania), Mike Robertson (UK) and David Scruton (Canada).

As new Chair, David Connor looked forward to a productive meeting, and the opportunities offered by its location in the US for increased contribution from Canadian and US members. The outgoing chair, Eric Jagtman, was unable to attend, but sent his good wishes for a successful meeting.

Thomas Noji, assisted by Catherine Noonan, Danielle Dowds and Donna Johnson, provided guidance on the local organisation of the meeting and ensured the meeting ran effectively.

1.1 Appointment of Rapporteurs

The task of preparing the report of the meeting was shared amongst participants as follows: Craig Brown (item 3), Dave Limpenny (item 4), Roger Coggan (item 5), Brian Todd (item 6), Francis O’Beirn (item 7), Matt Service (item 8), Megan Tyrrell and David Connor (item 9) and Heye Rumohr (item 10), with additional contributions from individuals who made presentations.

1.2 Terms of Reference

The Terms of Reference for the meeting were noted and are given in Annex 2. The Agenda and this report were specifically structured to address each item on the ToR.

2 ADOPTION OF AGENDA

The previously distributed draft Agenda for the meeting was discussed, adding items relating to the status of development of a Baltic habitat classification, progress with the North Sea Benthos Project (SGNSBP) and several additional national status reports. The adopted Agenda is given in Annex 3.

3 PRESENTATION AND REVIEW OF NATIONAL STATUS REPORTS ON HABITAT MAPPING AND CLASSIFICATION ACTIVITIES ACCORDING TO THE STANDARD REPORTING FORMAT (TOR A)

WGMHM discussed the National Status Reports after brief introductions from national representatives in the Working Group. Annex 4 provides a compilation of the National Status Reports submitted to the meeting, according to the standard format agreed at the 2002 WGMHM meeting.

3.1 Canada

Paul Boudreau presented an overview of habitat mapping activities in Canada.

A selection of two recently developed offshore major projects was outlined which cover a number of geographical regions. The Canadian Department of Fisheries and Oceans are undertaking a multi-year study of benthic habitat preferences for groundfish. An Integrated Ocean Management policy within Natural Resources Canada is changing the focus of habitat survey work towards an integrated approach incorporating all aspects of the marine environment. Details of the individual projects are presented in Section 6. The primary driver for the mapping work is fisheries and oceans management.

Smaller-scale projects are also under way in Canada. Shallower water surveys (0–30 m depth) are more problematic due to technological limitations.

Canada's national mapping programme, SEAMAP, is still in a proposal stage.

3.2 United States

Thomas Noji introduced the review of mapping activities in the United States.

Ongoing and planned surveys to produce high resolution maps that characterize benthic habitats of the U.S. Continental Shelf and slope are being conducted. These maps should include surficial geology and bathymetry. These maps are important for identifying and describing essential fish habitat and habitat areas of particular concern, for linking species to habitat type, and for analysis and extrapolation of effects of fishing on benthic habitats to areas over which fisheries are managed. In the 1980s, the U.S. Geological Survey and NOAA worked together to accomplish the first coarse survey of the outer portion of the newly designated Exclusive Economic Zone of the U.S. These surveys of the seabed, however, did not cover shallower waters of the upper slope and Continental Shelf, where the bulk of U.S. fisheries exist. Today, the need persists for coordinated, systematic surveys characterizing and mapping seabed habitat for most of the U.S. Continental Shelf and slope. Numerous regional mapping projects exist. An example of one planned, large-scale survey is the Gulf of Maine Ocean Mapping Initiative (GOMMI: www.sh.nefsc.noaa.gov/gommi), which is being coordinated by the Gulf of Maine Council for the Marine Environment, with input from the Geological Survey of Canada, Department of Fisheries and Oceans Canada, U.S. Geological Survey, the U.S. National Marine Fisheries Service, state agencies and universities.

Paul Boudreau added that the U.S. National Academy of Science has convened a Committee on National Needs for Coastal Mapping and Charting (<http://www4.nas.edu/weber.nsf/5c50571a75df494485256a95007a091e/14a706f5533e435985256b56006acf75?OpenDocument>). The study is supported with funds from NOAA and the USGS. The Committee has met over the past 12 months in various locations throughout the U.S. Committee members have heard from data gatherers, map makers, data managers and coastal and marine managers to review the existing status of coastal mapping and charting and to put together recommendations for a national approach to future work. Recommendations will try to address data collection in both shallow and deep waters, data management, habitat mapping and provision of information to users. An interim report has been produced and is available on the Internet. The final report is expected to be released by the end of 2003.

Annex 5 provides an overview of habitat mapping activities in the U.S.

3.3 Spain

Ibon Galparsoro presented the National Status Report for Spain.

There are two principal studies on the Atlantic coast of Spain. The most ambitious study, being carried out by the Spanish Oceanographic Institute, is named ESPACE. It started in 1994 and is projected to be finished in 2014. The entire Spanish continental shelf between 0 m and 170 m is going to be studied with acoustic (multibeam) techniques and high resolution seismic tracks. Bathymetry, backscattering, and seismic data are going to be integrated with other existing data sets into a marine GIS. A series of three types of maps in 1:50,000 map scale are going to be produced, each aimed at different public purposes: bathymetry and seabed characteristics, seabed uses and digital terrain models.

At a regional scale, the project FONDOS is being carried out on the Basque Country continental shelf. This study aims to produce sedimentological maps and principal habitat maps with special focus at the traditional fishing sites. The study covers the area between 0 m and 100 m depth. Acoustic techniques are going to be used, such as AGDS RoxAnn and side-scan sonar. Furthermore, grab sampling and seabed images are going to be used for calibration and ground-truthing purposes.

Other studies have been carried out in the Cantabrian Sea (Bay of Biscay) with acoustic techniques, principally for fishing sites, seafloor characterisation and artificial reefs monitoring.

3.4 Germany

Heye Rumohr outlined studies being undertaken in Germany, indicating that mapping activities are generally at low profile in Germany. Nevertheless a few projects could be reported on. There are no ongoing fishery-related mapping projects. The bulk of mapping exercises is funded by the Federal Agency for Nature Conservation (BfN).

North Sea: a study was completed which recorded and evaluated important habitats in the German part of the German Bight (report in German), to aid implementation of the EC Habitats Directive. The study provided an updated sediment map that took special note of stone reefs and old glacial cliff edges that are considered to be of special biological value.

The ICES Study Group on North Sea Benthos Project (SGNSBP), at their meeting in Yerseke 2003, produced their first tentative distribution maps and community clusters based on TWINSPAN analysis of the 2000 benthos sampling exercise. Inshore mapping activities were not reported.

Baltic: there are a few mapping projects under way by the BfN, which have the same goal of defining ecologically important areas for the EC Habitats Directive. Results and products are still awaited. Also here inshore projects were not reported.

3.5 United Kingdom

Craig Brown had compiled the report for the UK.

The UK has no national mapping strategy at present. However, to date there have been a large number of seabed habitat mapping initiatives in UK coastal waters covering relatively small geographical areas and which aimed to address a range of issues.

Out of the mapping projects listed in the National Status Report, about 130 relate to mapping programmes commissioned by the statutory nature conservation agencies. These were mostly undertaken in Special Areas of Conservation (SACs) to help implement the EC Habitats Directive or in other regions of nature conservation interest. These studies have been conducted by a variety of contracting survey teams, using a wide range of mapping techniques and with limited coordination and standardisation between surveys. The Joint Nature Conservation Committee has recently compiled a comprehensive database of these studies, with a view to assessing issues about compatibility of the results of the studies and to collate the maps into a single GIS.

Other mapping initiatives carried out by the Scottish Association for Marine Sciences (SAMS), the Centre for Environment, Fisheries and Aquaculture Science (CEFAS), the Department for Agriculture and Rural Development in Northern Ireland (DARD) and the University of Cardiff have been primarily conducted under a number of research and development-orientated projects.

3.6 Ireland

A review of mapping programmes in Ireland was given by Francis O'Beirn.

Mapping activity during 2002 was primarily driven by three goals: 1) the continuation of the National Seabed Mapping Programme, 2) nature conservation objectives and 3) fishery resource assessment.

As part of the National Mapping Programme, mapping of Zone 3 (200 m isobath to EEZ boundary) was completed in 2002. In 2002, ground-truthing was carried out at approximately 74 stations within Zone 3. Ground-truthing consisted of either box cores and video imaging throughout the entire area. The sites were selected on the basis of distinguishing features, e.g., mounds, ridges, scouring, as revealed by the original acoustic survey. In 2002, mapping of Zone 2 (50 m–200 m isobaths) continued with a large swath of Donegal Bay completed. The data generated were similar to those of the Zone 3 and consisted of bathymetry, backscatter, shallow seismic profiles, isopach maps and magnetics.

Acoustic surveys were carried out at three candidate Special Areas of Conservation (SAC). These surveys consisted of AGDS accompanied by ground-truthing consisting of video, grab and diver observations. The information will be presented in the form of bathymetric, habitat and life-form maps which will feed into the development of the management plan for each SAC.

A video survey was carried out to assess stocks of the prawn *Nephrops* on the Irish west coast and an acoustic survey was carried out on the north coast for brown crab habitat.

A desk study was commissioned by the Marine Institute to develop a strategy for mapping the inshore area (0–50 m isobath). The primary objectives of the study were to:

- Identify existing Irish inshore mapping programmes and relevant digital mapping data holdings;

- Identify national (including statutory) inshore mapping needs for resource assessment and development;
- Evaluate current inshore resource mapping techniques;
- Identify international case histories and “best-practice”;
- Undertake cost-benefit analysis of mapping techniques;
- Recommend a prioritised and costed mapping strategy.

Preliminary outputs from the study indicate that statutory requirements (SOLAS Convention and Civil Liabilities Act) would require the production of accurate bathymetric maps for ports, harbours and shipping routes.

3.7 Other countries

David Connor presented information on behalf of Lithuania, The Netherlands and Norway, which are listed in Annex 4. The report from Norway is given in Annex 6.

3.8 General discussion

WGMHM discussed aspects of the technical issues relating to the habitat mapping programmes which had been presented. It was evident that many different systems are used in mapping projects and for a wide variety of reasons. The decision on which system is chosen for a particular survey often comes down to the availability of the system, the familiarity of the project surveyors with the techniques available, and the cost. How different systems compare in terms of reliability and accuracy of output appears rarely to be assessed, and the most appropriate techniques to meet the aims of the study are not necessarily selected. There was agreement amongst WGMHM that the client commissioning surveys often has a poor understanding of the systems available for mapping seabed habitats and their appropriateness to the purpose of the mapping study. There is a need to better educate the client to improve the decision-making process when selecting survey approaches.

It was observed that countries that have a national mapping strategy are further ahead in terms of their overall understanding of their offshore habitats than countries which have no such strategy. The lack of such a national approach leads to piecemeal mapping projects that are usually inconsistent in their approaches, ultimately leading to poor compatibility of the resultant information, overlap in projects and redundancy. The drivers pushing forward nationwide mapping programmes vary between countries: in the U.S. a primary driver for mapping is fisheries and the requirement to identify Essential Fish Habitat, whilst in Ireland the driver is the identification of potential mineral resources, nature conservation and fisheries management. National mapping programmes have also assisted in coordinating inshore mapping effort. In the UK there is a difficulty establishing a national approach to seabed mapping due to the large number of agencies involved, both as mapping practitioners and as end users – hence with multiple drivers it becomes more difficult to focus on a single strategy. This causes major problems in establishing coordination and inter-collaboration. A business case is required to be put to the key stakeholders to convince them of the benefits of a national mapping programme. In countries with national programmes, this has been achieved through the focused vision and drive of certain individuals leading to the making of a convincing case to establish a major national programme.

WGMHM discussed data access, issues of data ownership, availability of data and cost of data sets. The consensus of the group was that the data should be widely available and affordable so that as many end users as possible have access to the data. It can then be reused for other purposes and ultimately reduce long-term costs (the “collect once, use many times” approach). In Canada the North American Data Model (NADM) is used to manage data sets collected in mapping programmes. Existing data sets are reformatted to fit into this data model, and all new data will be entered into NADM. This allows all data collected to be available over the web. In the UK a similar system exists for biological data (the National Biodiversity Network), but does not extend to acoustic data. There is a need to encourage access to data from industry, such as that generated during Environmental Impact Assessments (EIAs).

WGMHM also discussed data management issues relating to ground-truthing data sets (video, stills photographs, biological samples). In Canada initiatives have been set up to maintain ground-truthing data. WGMHM agreed that it is necessary to establish good data management procedures at an organisational level to address this issue. It was agreed that data must be well-managed and archived, preferably at a national level. The JNCC initiative in the UK to archive metadata held by a number of agencies was put forward as an example of such an initiative. The importance of good management and archiving of data, particularly management of metadata, was stressed by WGMHM.

4 REVIEW THE HABITAT MAPS FOR THE SOUTHERN NORTH SEA AND THE INTERNATIONAL WADDEN SEA (TOR C)

4.1 Progress on benthic and pelagic habitat work in the Netherlands

Dick de Jong provided a brief report to the meeting outlining progress on this issue, and including an overview of work within Dutch waters on both benthic and pelagic habitat classification systems (Annex 7). He had previously demonstrated to WGMHM the simple GIS application *Habimap*, which presented habitat mapping information for the southern North Sea and the Wadden Sea, and highlighted a series of data compatibility issues that hampered integration of data across organisations and countries. Due to funding shortages, there had unfortunately been no further progress since last year's WGMHM on the production of a southern North Sea habitat map.

4.2 Report on the ICES Study Group on North Sea Benthos Project (SGNSBP)

Heye Rumohr presented a report on the North Sea Benthos Project: Planning, management and objectives.

The objectives of the project are:

- To revisit 1986 stations;
- Augment results from the two surveys with other data sets;
- Establish a database in Flanders for this data which will be widely available to others;
- Resolve problems of comparability.

Outputs of the work will be:

- To determine benthic patterns;
- Compare 2000 survey with 1986 survey;
- Report to ICES;
- Provide a strategic evaluation of this collaborative exercise.

This project represents a comprehensive study that was originally carried out in 1986 and repeated in 2000 covering the entire North Sea. The 1986 study was carried out on a regular grid, but the 2000 study was carried out on a national basis and the sampling strategy was directed by each participating institute. The group will analyse data to determine community structure and provide spatial analysis. It will include sediment analysis for grain size, organics and other contaminants. It will describe benthic communities in 2000 and compare these with those described in 1986. Where appropriate this project aims to integrate other data sets that exist for the North Sea. Sediment data will be used both from this project and from others to help link the benthos to the substrata. It will provide material for future quality status and impact assessments. It will provide a classification of North Sea habitats. The timescale for analysis and reporting is in the order of two to three years. Early results should be available in spring 2004.

It was noted that the Primer analytical software application was not fully capable of handling the volume of data produced within NSBP, although other packages were available and capable. This limitation was of interest to other group members and it was noted that simple modifications to the package could be undertaken to enable analysis of much larger data sets.

SGNSBP were encouraged to compare classifications of benthic communities arising from their data with others already available for parts of the North Sea (e.g., German, Dutch and Belgian shelf maps) and with the EUNIS and new UK classification, so that issues of consistency in biological interpretation could be identified.

WGMHM considered the project valuable from a habitat mapping perspective and felt that the results should be made available as early as possible to contribute to the development of a North Sea map (see Sections 6.7 and 12).

5 REVIEW THE APPLICATION OF EUNIS CLASSIFICATION TO EXISTING MARINE HABITAT MAPS (TOR B)

In introducing the topic, the Chair reminded the meeting that WGMHM had previously reviewed several habitat classification systems and selected EUNIS as that which had appeared most appropriate for wider application within ICES. WGMHM had, however, recognised the need for considerable further testing and development of the EUNIS

system and set aside this part of the agenda for relevant reports. There were four presentations, two from Spain and one each from the UK and Germany, a written submission from the Netherlands and a report on the U.S. ARC classification.

5.1 Applicability of EUNIS classification to seabed habitat maps of the Basque coast

Ibon Galpasoro spoke on the applicability of the EUNIS classification to marine habitat maps of the inner continental shelf areas of the Abrut coast (Spanish Basque region) out to 50 m depth. This is an exposed coast with large tidal ranges (4.4 metres) where kelps and fucoids are naturally rare or absent, so red seaweeds predominate. In general, the EUNIS system had been applicable at levels 2 and 3, though three specific problems had been encountered. Firstly, as Spanish charts do not indicate a low-water mark, there was difficulty distinguishing littoral areas from sublittoral areas (EUNIS Level 2, categories A2 and A3). Secondly, it had been difficult to apply the EUNIS exposure categories (e.g., moderately or highly exposed) due to a lack of relevant definitions of these exposure terms. Thirdly, classification under A4 (sublittoral sediments) required data on grain size, which was not available on existing maps for the region. It was noted that similar difficulties had not been experienced when delineating this region of coast according to the Annex I categories of the EC Habitats Directive (e.g., reefs, sandbanks), due to the much broader definition of the Habitats Directive categories. It was concluded that the EUNIS system could only reliably be applied at level 2 or 3 using existing data on the Basque coast (northern Spain), and though accurate, the resulting habitat map would be imprecise. To map at lower levels in the EUNIS system required additional collection of biological and seafloor data.

5.2 Applicability of EUNIS classification to pelagic habitats of the Bay of Biscay

Yolanda Sagarminaga reported on work addressing the classification of habitats in the epi-pelagic waters of the Bay of Biscay. This had been approached through spatio-temporal studies of different populations at four trophic layers (phytoplankton, zooplankton, small pelagic fish and their predators). Preliminary results, based exclusively on phytoplankton studies, indicate a potential classification based on mean chlorophyll-*a* (Chl-*a*) values derived from SEAWIFS data. Both seasonal and annual variability characterise these data so any classification system must incorporate some temporal notation. Riverine delivery of freshwater to the epi-pelagic has a significant influence on Chl-*a* distribution and is itself temporally variable. Such influences would best be dealt with by applying threshold values to delineate habitat categories (e.g., >35 psu). EUNIS currently makes use of gradients in defining pelagic habitats (e.g., thermoclines, haloclines) but these need further categorisation in terms of their periodicity (ephemeral, seasonal, permanent) in order to define distinct (exclusive) classification criteria. Finally, it was recognised that any map of pelagic habitats would require considerable amounts of real data (in all four dimensions) and it was suggested that reliable numerical models may provide a practical alternative to real data.

Yolanda Sagarminaga also introduced the submission from Dick de Jong (The Netherlands; Annex 7) on pelagic habitat classification for Dutch marine waters. There was general consensus that the EUNIS system required significant development before it could be usefully applied to pelagic habitats at the regional level, and that the approach adopted by Spain in addressing this matter was highly productive and should be pursued further. A better understanding of pelagic ecosystems was required before their habitats could be adequately classified and mapped.

5.3 Revision of the marine habitat classification for Britain and Ireland

David Connor outlined the recently completed revision of the marine benthic classification for Britain and Ireland (originally published as the BioMar classification in 1997). This classification was the culmination of the JNCC's Marine Nature Conservation Review programme tasked with describing the variety (rather than the extent) of coastal (intertidal and nearshore subtidal) marine habitats. The original BioMar classification had been adopted to populate levels 4 and 5 of the EUNIS system. It has been revised over the past 3 years in the light of greater understanding of what is required to classify north European seabed habitats and the availability of new data. The classification is now drawn from multivariate analysis of some 30,000 benthic samples from the coasts of Britain and Ireland, incorporating both species and physical data, and can populate the EUNIS classification as far as level 6. The revised classification places a greater emphasis on energy status for rocky habitats (e.g., high, moderate, or low energy environments) and follows the EUNIS divisions at level 3 for sediment habitats. The revised classification will be launched in April 2003 and made accessible on the Internet at www.jncc.gov.uk/MarineHabitatClassification. Being primarily a coastal classification, its limitations are recognised and there is a need for complementary data to address classification of habitats specific to offshore waters, particularly from surveys that target both benthic infauna and epifauna. It was emphasised that the analysis of large data sets led to a detailed and more robust classification using a bottom-up approach. This ensured that there could be greater confidence in the higher level units which are more physically defined and would allow for better predictive mapping where information on only the physical character was available. Consistency in the classification of the lower level units (levels 4 and 5) was important for mapping purposes because these units could be aggregated in various ways to suit different purposes. The strict use of the EUNIS hierarchy was

not always appropriate and mapping in modern GIS allowed easy aggregation of finer units (e.g., into broader EUNIS types, for Habitats Directive types or for fish habitat).

It was noted in general discussion that the EUNIS classification system pays little attention to temporal changes in habitats and that such consideration is important in any mapping context. Recent developments have done much to address the initial inadequacies of the classification. David Connor advised that increased use and understanding of classification enabled it to develop from a descriptive tool to one that increasingly accounted for ecosystem function. Further development is still required but should not unduly divert ICES away from efforts to encourage, promote and support active mapping initiatives. The best opportunity for further evolution of the classification would appear to be from experience gained when applying it.

5.4 Status of development of a classification scheme for the Baltic

Following recommendations at the 2002 WGMHM, a specific meeting to address the development of a classification scheme for the Baltic had been organised by the European Environment Agency (EEA) in October 2002. Several WGMHM members attended, together with Baltic specialists. The meeting addressed the needs for a Baltic classification and discussed various approaches to classification of the Baltic Sea ecosystem in the context of the EUNIS classification (paper by Heye Rumohr, discussion of the BioMar approach). It was recognised that further development would best be achieved through a dedicated project and that ICES WGMHM would be asked to contribute advice to any such project. The EEA were currently considering funding options.

Heye Rumohr presented his paper on Baltic Sea ecosystems (Annex 8) and previous attempts to produce classifications of it. There was discussion about how directly the benthic communities in the Baltic reflected its salinity regime. It was concluded that overall there was a good correlation and that any classification would need to place a strong emphasis on the salinity regime in the Baltic. Salinity was a stronger driving force than substratum and exposure, as used for the Atlantic classification in EUNIS. It was noted that the relatively stable salinities of the Baltic led to markedly different communities compared with the highly fluctuating salinities of estuaries, and that the Baltic was a dynamic environment that presented additional challenges in developing a satisfactory classification scheme.

5.5 The Aquatic Restoration and Conservation (ARC) classification for the USA

John Manderson reported on a workshop in March 2003, held in Charleston, South Carolina concerning the ARC classification. The workshop discussed issues relating to classification philosophy (descriptive classification versus functional classification), the importance of dynamics and the need to link benthic and pelagic systems. The ARC was a nested classification, but ranges of spatial scale were not explicitly defined at each level. The ARC classification appears to be still in preliminary stages of development; levels 1 and 2 are relatively well developed.

5.6 General discussion

Hierarchical classifications

It was recognised that different classifications adopt different hierarchies; this often reflected the differing driving forces in the area being classified (e.g., salinity in the Baltic, energy/substratum type in the Atlantic). The hierarchical structure adopted (for example in EUNIS) often caused most disagreement amongst practitioners and scientists (compared to the component habitats at the lower end of the system) because of varying views on the relative importance of driving factors and because different end uses demanded different aggregations in the hierarchy.

Use of strict hierarchies was therefore not advocated and indeed, with modern GIS, was not necessary. Rather, flexible hierarchies may work better. However hierarchies had certain benefits. They aggregated similar habitats into broader units, useful for management purposes and for less technical users. They enable fine detail habitats to be placed in context within broader units that had functional relevance (e.g., the wide ranging species or larval supply habitats relevant to a seagrass bed).

There is a need to examine transitional (continuous) classification techniques as used by landscape ecologists, as current approaches (i.e., strictly defined habitat categories) do not always cater well for the marine environment in which most changes in habitat are gradual rather than sharp (the definition of classification units puts artificial boundaries on continuums).

6 DISCUSS U.S., CANADIAN AND EUROPEAN MAPPING APPROACHES AND ASSESS THEIR RELEVANCE TO EACH OTHER (TOR G)

A series of papers were presented which contributed to the discussion on variations in approach to habitat mapping.

6.1 Benthic habitat classification scheme as it applies to waters of the northeastern USA and maritime Canada

Page Valentine, Brian Todd and Vladimir Kostylev presented this paper. A geocentric, bottom-up approach to benthic habitat mapping has been developed for waters of the north-eastern USA and maritime Canada. The classification scheme is based on describing the physical and biogenic attributes of the sea floor combined with observations of the benthic organisms. Four levels are used including class, subclass, category and attribute. Benthic habitat is defined as a combination of the sea floor topography, surficial geology and biology, modified by natural and human disturbance. The classification scheme has been built by recognizing the strengths and limitations of other classification schemes including EUNIS (2001), Allee *et al.* (2000) and Greene *et al.* (1999). The elements of the chronological development of a benthic habitat map are sea floor imagery, ground-truth (video, photographs, sampling), database (video, photographs, analyses), GIS and map publication. The scheme will be published in 2003 by the American Fisheries Society. It would be available on a website, allowing other researchers to use the system or modify it to reflect their particular mapping application.

In discussion it was noted that the scheme had already been applied to the Canadian part of Georges Bank. As a comprehensive set of descriptive categories for seabed habitats, it was recognised that the scheme could be used as a template for other geographical areas. From the very large number of possible combinations of habitat categories, it had been found in practice to yield about 40 distinct habitat types for the initial study area. Whilst the classification scheme could be applied elsewhere, it was recognised that only a proportion of the habitats so far recognised were likely to occur in adjacent stretches of coast.

It was noted that the distribution and recovery terms in this classification scheme have a value in time series habitat investigations in which environmental change is studied through time. The scheme is also scaleable in that it could be used for fine-scale habitat mapping (i.e., a small area) to continental shelf-wide mapping. Whilst it represents a multidisciplinary approach to mapping, the scheme can be applied without full geophysical coverage, but the final map product is cruder than with geophysical coverage.

6.2 The Georges Bank geoscience mapping program and its ramifications for habitat mapping

Brian Todd presented work of the Geological Survey of Canada. Georges Bank is a 33,700 km² bank forming the seaward boundary of the Gulf of Maine. Jurisdiction of Georges Bank is shared by the United States and Canada. Informed management of marine resources and the mitigation of seabed use conflict require an understanding of the benthic habitats on Georges Bank. In 1999 and 2000, the Canadian Hydrographic Service in partnership with Clearwater Fine Foods Inc, systematically collected multibeam sonar data on the 7900 km² Canadian sector of the bank down to the 200 m isobath at a cost of \$1.5 million US. Both before and after the multibeam surveys, ground-truth data were collected on a number of scientific expeditions. These data encompass geophysical, geological and biological sampling. The mapping project has completed three maps: sun-illuminated topography, backscatter strength and surficial sediment. The benthic habitat map is in production and will be completed by the fall of 2003.

Extensive sand wave fields dominate the shallowest portion of Georges Bank. Trough to peak heights are commonly greater than 10 m and wavelengths are 400 m to 500 m. The sand waves overlie a gravel lag surface, which is often exposed in the troughs between sand waves. The bedforms are perpendicular to current flow and provide insight into the regional flow pattern. Areas on Georges Bank not covered by sand are a gravel lag surface. Video and photographic imaging of the sand and gravel substrates was guided by the geophysical information, enabling the characterization of benthic habitats.

6.3 Benthic habitat mapping - linking biology and geology

Vladimir Kostylev described the benthic mapping element of the Geological Survey of Canada's mapping programme. The programme is carried out in a number of geographical areas and employs a variety of sampling and analysis techniques depending on the tasks. Habitat mapping in the Gulf of Maine is strongly influenced by the availability of high-resolution bathymetric and backscatter maps obtained with multibeam echosounder. This information allows for excellent classification of substrate texture and morphology, which is subsequently linked to the information on benthic megafauna collected from underwater video and photography, and ground-truthed by grab sampling. An example of this approach is habitat mapping on Browns Bank (Kostylev *et al.*, 2001). A joint Department of Fisheries and Oceans and

Natural Resources Canada programme is aimed at mapping benthic habitats and communities on the Scotian Shelf, and is based largely on the existing knowledge of grain size distribution of benthic sediment, grab and trawl samples, archive photographic information and ancillary information on oceanography of the region. This approach is mainly based on modelling and interpolating properties of physical habitat and ground-truthing the classification by the analysis of distribution of benthic fauna. A modelling approach based on distinguishing benign/adverse and disturbed/undisturbed areas on the shelf which allows predicting life history traits and community types was commended, as it provided a sound link between benthic communities and seabed physical types. Such an approach was also employed in the Beaufort Sea habitat mapping programme, where active disturbance, such as iceberg scouring, was shown to produce distinct effects on benthic diversity.

Kostylev, V.E., Todd, B.J., Fader, G.B.J., Courtney, R.C., Cameron, G.D.M., and Pickrill, R.A. 2001. Benthic habitat mapping on the Scotian Shelf based on multibeam bathymetry, surficial geology and sea floor photographs. *Marine Ecology Progress Series*, 219: 121–137.

In discussion, the use of a modelling approach (the benign/active model to benthic communities) was commended, as it provided a sound link between benthic communities and seabed physical types.

6.4 Mapping of *Lophelia* reefs and artificial reef studies

A presentation was given by Craig Brown covering ongoing habitat mapping initiatives at the Scottish Association for Marine Science (SAMS). Two projects were outlined:

The Loch Linnhe Artificial Reef Project (2001 onwards): Mapping techniques are being utilised to monitor and measure seabed habitats as the artificial reef modules are constructed. A combination of acoustic (side-scan sonar, RoxAnn), biological and sedimentological (grab, video and diver surveys) and hydrographic (ADCP, current meter deployments) survey techniques have been used to build a comprehensive picture of the seabed environment. These data will form a baseline against which future measurements/surveys can be compared to assess the environmental impact of the reef. Further details of the project can be found at <http://www.sams.ac.uk>. The site in Loch Linnhe was selected for logistical reasons, based on geography, fishing pressures, substrate type and hydrographic regime.

In discussion it was clarified that areas of hard substrate near the artificial reefs were also being surveyed to enable comparison of the composition of benthic communities on natural rock with those developing on the artificial reef.

Mapping Inshore Coral Habitats (MINCH) project: This new project, funded by the Scottish Executive and Scottish Natural Heritage, will commence later in 2003. The project is a collaboration between SAMS, the Department of Agriculture and Rural Development for Northern Ireland (DARD), the British Geological Survey (BGS) and Topaz Environmental and Marine Ltd (TEAM).

The aim of the survey is to locate and map topographical highs on the seabed which may be associated with cold-water coral habitats. Multibeam sonar will be used to produce a baseline bathymetric map. Further surveys will then be conducted using side-scan sonar and underwater drop-down video to accurately map coral distributions.

A number of sites will be surveyed in the Minch, west coast of Scotland in water depths between 100–250 m depth, covering areas in the region of 4 miles². The survey will be carried out in July 2003 during a 14-day cruise using the DARD vessel RV “Lough Foyle”. Results will be published in early 2004. Further details of the project can be found at <http://www.sams.ac.uk>.

6.5 The role of seabed mapping techniques in environmental monitoring and management

Roger Coggan described a joint CEFAS, British Geological Survey and Envision Mapping (formerly SeaMap Research Group of the University of Newcastle) project centred on use of habitat mapping in a management context. The project is addressing the mapping of seabed habitats in mobile substrates subject to three types of anthropogenic disturbance, namely dredged material disposal, aggregate extraction and demersal fishing. It aims to trial and integrate multiple methodologies and data sets appropriate to seabed mapping at various spatial scales. Study sites have been selected in coastal waters of England and Wales. The general approach to mapping a site has been to identify acoustically distinct areas of the seabed (usually from simultaneous side-scan sonar and AGDS surveys) and then to determine their physical and biological properties through ground-truth sampling (using grabs, video methods and small beam trawls). Sediments are described generally (e.g., sand veneers over gravel) and specifically (by particle size analysis), and the biotic communities of the distinct areas (both epifauna and infauna) are described and compared, by standard multivariate techniques. The efficacy of survey methods and the utility of data sets are evaluated over a range of spatial

scales from metres to hundreds of kilometres. Geologists provide a specialist interpretation of side-scan sonar mosaic images, including a detailed description of seabed facies over the study areas. The pool of physical, biological, and geological information forms the basis for seabed characterisation, which can be further augmented by chemical and hydrographic data.

Steps are being taken to enhance the visualisation of such pools of information, both to give a better holistic appreciation of a study site and to make the interpretation more accessible to a wider audience. By way of example, an animated virtual “fly-through” over a study site was demonstrated, incorporating side-scan sonar and AGDS images draped over a 3D bathymetry, with photographic still images posted at points of interest. The next stage will be to incorporate fine-scale data, such as information on biological communities, and broad-scale data, such as from fisheries surveys. The scope for linkage between surveys conducted at different spatial scales is being investigated.

Habitat mapping in areas of anthropogenic disturbance was seen to have three major roles:

- facilitating regulatory bodies, industries and third parties to make more informed decisions;
- enhancing temporal monitoring of impacts and post-impact seabed recovery;
- experience and examples lead to better predictive modelling in future.

The use of AGDS as well as side-scan sonar was questioned; it was stated that AGDS is a complementary system to side-scan sonar and is used routinely for mapping sediment veneers that side-scan sonar alone cannot discriminate. The study provided an excellent example of the application of mapping techniques in a monitoring and management context.

6.6 Use of habitat mapping techniques in the assessment of anthropogenic impacts at relinquished aggregate extraction sites

Dave Limpenny described a four-year CEFAS study (now in its final year) aimed at assessing the impacts of aggregate extraction at relinquished sites around the UK. Sites have been chosen to represent a range of factors including varying dredging practices, geographical location, differing intervals since cessation of dredging and levels of impact. Sites in the southern North Sea and the English Channel were chosen for temporal study. The study has utilised a number of habitat mapping techniques to monitor the scale and spatial extent of any impact and also to assess the longevity of physical and biological disturbance. Positional information supplied from shipboard monitoring systems mounted on all aggregate dredgers since 1993 has provided data on the scale and precise location of dredging effort at all UK licensed sites. This information, along with high-quality side-scan sonar mosaics, enabled the placing of treatment sites at locations of high and low impact and at reference sites away from the influence of any impact. Biological sampling at these locations between 2000 and 2002 showed that there appeared to be a link between an impoverished faunal community and the last period of high intensity dredging carried out at the site (1995). There also appeared to be a higher level of variability in the particulate nature of substrata within the area of high dredging intensity. Techniques such as single-line bathymetry, digital video and stills photography and acoustic ground discrimination systems (QTC) have helped to further define the nature of the impact both spatially and temporally. Findings suggest that assumptions of relatively speedy physical and biological recovery at gravely sites may need to be revised and that in some situations physical and biological effects can still be detected some 9 years after cessation of dredging.

It was noted that on Georges Bank, Canada, recolonisation of epifauna on disturbed gravel takes 2–3 years, whilst on the Scotian Shelf after dredging, clams recolonise an area even when the dredging marks are still clearly visible on the side-scan sonar records. It was concluded that the time required for full recovery could be different for physical and biological perspectives and that measures of biological recovery needed to be carefully expressed to ensure valid comparison between areas and habitats.

6.7 General discussion

Issues arising from the comparison of approaches used in different countries and the example studies presented:

- there are a wide variety of scientific and managerial reasons for benthic habitat mapping; this variety is considered healthy for the advancement of this style of mapping;
- the scale of habitat mapping is variable;
- an integrated approach to habitat mapping works, no matter what the scale of mapping;
- remotely sensed geophysical information, followed by ground-truthing techniques, is a robust and successful survey philosophy;

- an emphasis on the collection of visual ground-truthing data (video, photography, divers) from the sea floor is considered important as it provides more accurate information on the nature of the seabed (physical and biological) compared to traditional remote sampling techniques (e.g., grabs);
- the spectrum of survey costs is recognized (e.g., multibeam sonar data are expensive compared to other acoustic techniques);
- for “selling” the concept and practice of marine habitat mapping (to managers, governments, NGOs, public), good presentation is vital and this is where the geocentric 3D approach demonstrates its applicability, especially in the ease of visualization;
- in contrast, it is challenging to sell EUNIS-based products, until they are visualised in consistently presented maps;
- the ability to build a visual database (i.e., a georeferenced, GIS-based display), and to zoom, in or out to different levels of data and of detail, is key to scientific advancement of marine habitat mapping;
- in this manner, scale is completely flexible;
- the GIS approach to habitat mapping provides (almost) limitless capability to study factors involved in defining habitats, including physical and chemical oceanographic data;
- boundaries developed in a habitat map must be ecologically significant;
- biology should not blindly follow isolines, and habitat mapping based on isolines is discouraged.

Challenges:

- benthic habitat mapping of the ICES area will result in the recognition of significant data gaps;
- the North Sea would be a useful (and more realistic) region to initiate broad-scale mapping because it is smaller, previous investigations have been done, and it is politically attractive because its waters are shared between nations;
- it is recognized that different areas of the North Sea floor have different levels of data richness and it would be valuable to identify areas that are poorly sampled;
- data sources for the North Sea include benthic habitat classifications for German waters (Heye Rumohr), Netherlands waters (Dick de Jong) and the UK BioMar classification (David Connor);
- the ultimate challenge of this Working Group is to provide a benthic habitat mapping template for users;
- inherent in this template are data (and metadata) standards compatible with best practices worldwide; whilst the techniques and strategies adopted in current mapping programmes have a good deal in common, there remain significant differences in data interpretation and presentation that need to be addressed to facilitate future mapping.

7 REVIEW THE OUTCOME OF THE OSPAR WORKSHOP FOR THE DEVELOPMENT OF A NORTH SEA BROAD-SCALE MAP (TOR D)

David Connor briefed the group on the proceedings of a workshop held at Stansted, UK in October 2002. The workshop was convened to assess the feasibility of establishing habitat maps for the OSPAR area and to recommend a strategy to carry out any such mapping projects. A document was produced that outlined a mapping strategy for the OSPAR area, which was presented to the OSPAR Biodiversity Committee (BDC) in Dublin in January 2003 (Annex 9). The strategy was received with enthusiasm by the BDC; the UK was asked to initiate the proposals, although it was recognised that resource commitments from OSPAR countries might be limited. The premise underlying the strategy, in the short term, is to produce two types of habitat maps; 1) a point distribution (geo-referenced) map of specific habitats of particular conservation interest, e.g., *Lophelia* coral reefs, seagrass beds, for the entire OSPAR area, and 2) a holistic habitat map of the North Sea, to include a compilation of all data relevant to the North Sea area, the goal of which is to identify the spatial extent of various habitats. The North Sea was selected on the basis that considerable research has been carried out there and that coverage was substantial. This strategy was preferred over the development of a habitat map of the entire OSPAR area in that it could be presented as a pilot-type project that could be used as a tool to target or justify future resource requests (from OSPAR, EU funding mechanisms – FP6 or INTERREG) to map a wider part of the OSPAR area. Comments from the group were solicited.

The document was warmly received by WGMHM and was considered to be a very clear mechanism for implementing a mapping programme at an international scale. Also, it was considered a logical stepwise approach that was scientifically justified. The driver (e.g., political, economic) underlying this initiative was questioned and it was felt that this needed to be more clearly defined to justify the implementation of any study for both political and general public interests.

WGMHM wished to actively contribute to the OSPAR mapping initiatives and felt it could do this in two main ways:

- Provision of expertise and advice on mapping techniques and the development of guidelines. This relates to discussions under Section 9.
- Practical development of a North Sea map. Ideas were developed on how this could be achieved and proposals for intersessional activity and work within next year's WGMHM defined (see Section 12).

It was recalled that the group had previously requested Dick de Jong to generate a map of the southern North Sea (the HabiMap project). Problems inherent in this process had been identified, not the least of which was that maps from individual countries did not line up when amalgamated. So the lessons learned from this exercise should be acknowledged and taken on board for any future mapping effort. It was felt that the previous exercise suffered from a lack of resources and that any new mapping activity should have a transboundary component to it.

8 ASSESS PROGRESS ON SETTING UP A HABITAT MAPPING DATA EXCHANGE PLATFORM (TOR F)

There was general discussion as to the exact nature of the proposed data exchange platform, including possible relationships to other metadata initiatives and databases. It was recalled that WGMHM 2002 had considered the establishment of national internet-based fora for mapping activities to be a useful stepping stone in helping to achieve improved data exchange. It was concluded that there were two main issues:

- 1) The identification of suitable data sets for associated information (e.g., bathymetry, salinity) that could be accessed to help in developing habitat maps.
- 2) The identification of habitat mapping studies, experts and organisations, which could yield suitable habitat mapping data to contribute to broader or other mapping studies.

Craig Brown advised the group of a questionnaire issued by UK CEFAS in 2002 which aimed to identify parties interested/involved in habitat mapping. This had had only a limited (about 20) response. The aim of placing the results on the internet as the starting point for a web-based discussion group had not been achieved.

The National Status Report (Annex 4) was recognised as a starting point for identifying those organisations involved in mapping and using particular techniques. The possibility of finding a suitable host, including ICES, for such a list should be investigated.

The European sediment database EUMARSIN (<http://www.eu-seased.net>) was cited as an excellent example of data available through the Internet. The development of a similar database for habitat mapping data would be desirable but would need specific funding to achieve it.

Thomas Noji proposed that ICES should request national delegates to identify relevant data sets which should also cover hydrographic and oceanographic data as well as sediment databases.

Regarding data quality, it was recognised that the usability of data sets depended very much on the purpose for their use rather than their inherent quality. As such, all data should carry an appropriate quality flag which fully describes the method for its collection and the standard to which it was collected. It was up to the end user then to determine whether a particular data set was of sufficient standard for the intended purpose.

David Connor presented the JNCC Marine Recorder database application for the storage of benthic sample data. The application has a data structure (the NBN data model) in common with other biodiversity databases in the UK. It allows data to be collated locally and submitted to a central national database or readily transferred between users. From the national database, the data are made accessible over the internet (www.seachnbn.net and www.jncc.gov.uk/mermaid). The application has been developed to accommodate a wide range of benthic sample data, and has various functionalities under further development to enable data export to GIS and statistical packages. The application is freely available from www.jncc.gov.uk/marinerecorder. It has been developed to provide a consistent database structure for housing benthic data and is being made freely available to:

- encourage greater use of common data standards for benthic surveys;
- facilitate rapid exchange of data between organisations;
- encourage sharing of data and contribution of data sets to the UK's national biodiversity databases.

WGMHM members were asked to test/review the Marine Recorder application and assess its suitability as a data exchange platform for wider use.

9 REVIEW THE PROGRESS IN THE INTERSESSIONAL WORKSHOPS ON STANDARDISING TECHNIQUES FOR HABITAT MAPPING, TO INCLUDE MEMBERS OF WGEXT AND BEWG AND NATIONAL AGENCIES (TOR H)

9.1 Workshop proposal for use of RoxAnn as a mapping tool

Annex 10 provides an overview of the proposed workshop to be held in the UK in September 2003. The workshop is intended to allow practitioners to intercalibrate their use of RoxAnn in a field situation and to compare their approaches to interpretation of the data. A final session will present results to end-users and commissioning organisations, with the hope that the capabilities and limitations of the technique can be better understood by those who commission its use.

WGMHM was fully supportive of the proposed workshop, as it believed it was very important to thoroughly test and validate each technique used for seabed mapping. After discussion, it was felt that the additional inclusion of testing QTC methods during the workshop was not feasible in the available time and that QTC methods should be addressed at another time. There should also be testing between techniques to draw out their differences (benefits, drawbacks) in a variety of situations.

9.2 Outline requirements for standards and protocols for habitat mapping

WGMHM recognised that a key role for the group was to draw upon expertise in the habitat mapping process so that such expertise could be shared and where necessary improved. Whilst there existed protocols and guidelines for various aspects of habitat mapping, these were often restricted to particular institutes and operated only at a national level. Further there was a strong need to draw these together in an overview document that encompassed the whole process of mapping from initial data collection through to final map presentation. There are numerous mapping studies being initiated and often they have to develop their own procedures, taking considerable resources and relearning. The availability of guidelines would help reduce unnecessary effort by newcomers to the field and help ensure greater compatibility of the data and resulting maps.

To this end WGMHM started to develop a document that would outline the stages in the mapping process, the key elements to be considered at each stage and to identify where there were existing guidelines and standards that could be followed. It was envisaged that this document should be further developed by WGMHM, with contributions from WGEXT, BEWG and WGFAST as appropriate, and that key aspects that currently lacked guidelines should be addressed in future work of the group.

There was limited time available to work on this topic during the meeting, but the products so far are given in Annex 11.

It was noted that cooperation between WGMHM, BEWG and WGEXT in this area of techniques had been raised at the 2002 Marine Habitat Committee Meeting but that there had been no further moves in this direction. In view of the preliminary state of the document given in Annex 11 and the need to better define the aspects that would need further development, it was considered that such cooperation between the working groups should be sought when the priorities were better defined.

10 CONSIDER OPPORTUNITIES FOR SUBSIDIARY GROUPS OF THE FISHERIES TECHNOLOGY COMMITTEE TO PROVIDE PRODUCTS AND SUPPORT (TOR I)

WGMHM discussed the terms of reference of the newly established Study Group on Acoustic Seabed Classification (SGASC) that will meet in Bergen in June 2003. There was a query regarding potential overlap of remits of this group and WGMHM. After discussion of the details of the proposed agenda, the extent of possible overlap appeared to be reduced. To our knowledge, the group will primarily discuss technological terms of widely distributed RoxAnn and QTC technology and means for their verification. It was pointed out that multibeam and other swathe systems are much more powerful in terms of mapping coverage and WG members advised that the wide use of AGDS systems is often driven by their availability and budgets rather than by their scientific merits. Nevertheless WGMHM was positive about the outcome of the forthcoming meeting and hoped that the results will back up the activities of WGMHM in terms of technology and ground-truthing. WGMHM is interested in the comparability of AGDS with present multibeam technology and the repeatability of the single-beam AGDS techniques.

WGMHM is interested in and willing to review the report of the SGASC intersessionally and report its views to the Marine Habitat Committee in October 2003.

11 ANY OTHER BUSINESS

David Connor reminded participants that they should register their membership of WGMHM with the ICES Secretariat through their national delegates, as membership of ICES working groups is currently being updated.

12 RECOMMENDATIONS AND ACTIONS

WGMHM discussed its future direction and considered that it could achieve more as a group if its efforts were focused through a particular mapping project, which would both result in a useful end product and help highlight issues (e.g., data compatibility) that needed further attention. The group therefore agreed that a significant portion of the next meeting should be devoted to such an activity. In view of the relative richness of available data and the multi-national nature of the area, the North Sea was chosen as a suitable area for which to develop a habitat map. Intersessional work would be undertaken to gather the necessary data sets into a GIS so that the next meeting could be as productive as possible. There was discussion as to the computer facilities needed to undertake such work during the meeting; it was concluded that GIS capability on laptops would be adequate as it was anticipated that all necessary data sets would have been compiled beforehand. Taking this approach into account, the offer from Brigitte Guillaumont to host the meeting at IFREMER in Brest, France was gratefully received.

The following intersessional work would be undertaken:

- David Connor to investigate availability of suitable data sources within ICES and the EEA.
- Brian Todd to develop a plan for activities necessary to prepare a North Sea map during next year's meeting.
- All members to identify suitable data sets and provide in GIS format.
- David Connor to investigate availability of GIS facilities to house incoming data sets.

The following recommendations for Terms of Reference for the 2004 meeting were agreed:

The **Working Group on Marine Habitat Mapping** [WGMHM] (Chair: D. Connor, UK) will meet in Brest, France from 30 March–2 April 2004 to:

- a) actively present, discuss, consider and work towards a generic benthic/pelagic habitat mapping framework for the North Sea, and to produce a prototype habitat map of the North Sea that could be useful for the interpretation of the North Sea Benthos Project;
- b) present and review National Status Reports on habitat mapping according to the standard reporting format;
- c) review existing pelagic habitat classification systems and assess their relationship to benthic habitat classifications;
- d) review the application of habitat maps in a management context;
- e) further progress the development of guidelines for habitat mapping;
- f) review progress on intercalibration and quality control of mapping techniques, including the proposed workshop on AGDS (RoxAnn) techniques.

13 ADOPTION OF THE REPORT

The draft report and list of annexes was discussed by the working group before the close of the meeting and adopted.

14 CLOSE OF MEETING

The Chair thanked Tom Noji and the NOAA staff for hosting the meeting and for providing such excellent facilities with which to have a productive meeting.

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ANNEX 2: TERMS OF REFERENCE FOR 2003 WGMHM

2E06 **The Working Group on Marine Habitat Mapping** [WGMHM] (Chair: D. Connor, UK) will meet in Sandy Hook, USA from 1–4 April 2003 to:

- a) present and review National Status Reports on habitat mapping and classification activities according to the standard reporting format;
- b) review the application of EUNIS classification to existing marine habitat maps;
- c) review the habitat maps for the southern North Sea and the international Wadden Sea;
- d) review the outcome of the OSPAR workshop for the development of a North Sea broadscale map;
- e) discuss progress in setting up classification for the Baltic Sea area [HELCOM 2003];
- f) assess progress on setting up a habitat mapping data exchange platform;
- g) discuss U.S., Canadian and European mapping approaches and assess their relevance to each other;
- h) review the progress in the intersessional workshops on standardising techniques for habitat mapping, to include members of WGEXT and BEWG and national agencies;
- i) consider opportunities for subsidiary groups of the Fisheries Technology Committee to provide products and support.

WGMHM will report by 22 April 2003 for the attention of the Marine Habitat and Fisheries Technology Committees and ACE.

Supporting Information:

Priority	This group coordinates the review of habitat classification and mapping activities in the ICES area and promotes standardization to the extent possible.
Scientific justification	<p>WGMHM has contributed to the development of the EUNIS classification system. The group acknowledges that it has achieved a good consensus on the structure to EUNIS level 4 and much of level 5. Further development is important and should be monitored by reviewing national status reports.</p> <p>The perceived shortfalls in the system are in the Baltic and Mediterranean. HELCOM has requested ICES to include the Baltic Sea in its work on marine habitat classification and mapping. The Working Group has noted that this request requires that relevant experts from Baltic Sea countries are nominated to WGMHM, since the group is lacking in specific knowledge to resolve these issues otherwise, and in the more detailed aspects for the Northeast Atlantic. As a first step WGMHM has proposed an action plan, for which progress will be reviewed.</p> <p>Mapping is important to allow for further testing and development of the classification framework thus far. Mapping will contribute to developing methods for standardisation of existing data and to agreement upon comparable standards for map production. Acoustic techniques are still under development and applying them to habitat mapping still requires testing. The mapping initiatives as proposed here will act as a pilot study for broad-scale collaborative mapping efforts, which in the future can be applied to the whole of the ICES area.</p> <p>Setting up a platform for data exchange will support the production of international, broad-scale habitat maps by informing potential users about the existence and character of data collected, and facilitating the exchange of data.</p>

	<p>Mapping projects in U.S. and Canadian waters can provide valuable insights for work in enclosed/estuarine sea areas (e.g., the Baltic Sea) and vice versa. For this reason, the meeting location has been chosen to enhance participation from the U.S. and Canada. In the near future, the Working Group will meet in the Baltic area in order to facilitate progress with e).</p> <p>Intersessional workshops will provide a better work basis for WGMHM and will access additional expertise from WGEXT and BEWG members as well as from national agencies.</p>
Relation to Strategic Plan	Scientific Objective 1e.
Resource requirements	
Participants	Representatives from Member Countries with experience in habitat mapping and classification. TOR e) requires participation from Baltic countries.
Secretariat facilities	
Financial:	
Linkage to Advisory Committee	ACE
Linkages to other Committees or groups	Discuss need for joint meeting with BEWG and WGEXT; Baltic Committee
Linkages to other organisations	OSPAR, HELCOM, EEA
Cost share	ICES 90 %, HELCOM 10%

ANNEX 3: AGENDA FOR THE MEETING

Tuesday 1 April

1. Opening of meeting
 - 1.1 Local organisation
 - 1.2 Appointment of Rapporteurs
 - 1.3 Terms of Reference

2. Adoption of Agenda

3. Presentation and review National Status Reports on habitat mapping and classification activities according to the standard reporting format (TOR a)
 - 3.1 Canada (Paul Boudreau)
 - 3.2 US (Tom Noji)
 - 3.3 Spain (Ibon Galparsoro)
 - 3.4 UK (Craig Brown, David Connor)
 - 3.5 Germany (Heye Rumohr, report submitted by Dieter Boedeker)
 - 3.6 Ireland (Francis O'Beirn)
 - 3.7 Lithuania (report submitted by Serjei Olenin)
 - 3.8 Netherlands (report submitted by Jan van Dalssen)
 - 3.9 Norway (report submitted by John Alsvåg)

4. Review the habitat maps for the southern North Sea and the international Wadden Sea (TOR c)
 - 4.1 Progress on benthic and pelagic habitat work in the Netherlands (paper submitted by Dick de Jong, RIKZ)
 - 4.2 Progress on the North Sea Benthos Project (Heye Rumohr, University of Kiel)

Wednesday 2 April

5. Review the application of EUNIS classification to existing marine habitat maps (TOR b)
 - 5.1 Applicability of EUNIS classification to marine habitat maps of the Basque littoral (Ibon Galparsoro, AZTI)
 - 5.2 Applicability of EUNIS classification to pelagic habitats of the Bay of Biscay (Yolanda Sagarminaga, AZTI)
 - 5.3 Revision of the marine habitat classification for Britain and Ireland (David Connor, JNCC)

6. Discuss U.S., Canadian and European mapping approaches and assess their relevance to each other (TOR g)
 - 6.1 Benthic habitat classification scheme as it applies to waters of the north-eastern USA and maritime Canada (Page Valentine, US Geological Survey)
 - 6.2 The Georges Bank geoscience mapping programme, its results, and its ramifications for habitat classification (Brian Todd, Geological Survey of Canada Atlantic)
 - 6.3 Benthic habitat mapping on Georges Bank mapping (Vladimir Kostylev, Geological Survey of Canada Atlantic)
 - 6.4 Mapping of *Lophelia* reef (Craig Brown, SAMS)
 - 6.5 The role of habitat mapping techniques at areas of anthropogenic disturbance (Roger Coggan, CEFAS)
 - 6.6 Assessment of the rehabilitation of the seabed following aggregate extraction (Dave Limpenny, CEFAS)

7. Review the outcome of the OSPAR workshop for the development of a North Sea broad-scale map (TOR d)
- 7.1 Outcomes of the OSPAR workshop on marine habitat mapping of the North Sea and OSPAR area, held at Stansted, October 2002 and the OSPAR Biodiversity Committee in Dublin, January 2003 (David Connor, JNCC)

Thursday 3 April

8. Assess progress on setting up a habitat mapping data exchange platform (TOR f)
9. Review the progress in the intersessional workshops on standardising techniques for habitat mapping, to include members of WGEXT and BEWG and national agencies (TOR h)
- 9.1 Workshop proposal for use of RoxAnn as a mapping tool (Craig Brown, SAMS)
- 9.2 Outline requirements for standards and protocols for habitat mapping – all to come prepared with information on existing standards used (at national or international level); please consider all stages in the mapping process from field collection, through data storage, data interpretation, GIS and presentation of results (Action all)
10. Consider opportunities for subsidiary groups of the Fisheries Technology Committee to provide products and support (TOR i)
11. Any other business
12. Recommendations and actions

Friday 4 April

13. Adoption of the report
14. Close of meeting

ANNEX 4: NATIONAL STATUS REPORTS

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
Canada									
Department of Fisheries and Oceans Bedford Institute of Oceanography (Dr Donald Gordon)	Six 10 × 10 km boxes on the Scotian Shelf off eastern Canada (Emerald, Western and Sable Island Banks)	Spatial utilization of benthic habitat by demersal fish	2001–2005 Results will be released when available	Side-scan sonar, QTC seabed classification, DT Biosonics fish assessment, towed (Towcam) and tethered (Campod) video, still photography (both Towcam and Campod), grab sampling and experimental fishing with otter trawl.	Bathymetry Physical habitat (i.e., side-scan, QTC, video, photos and grabs) Benthic communities (i.e., video, photos and grabs) Fish communities (i.e., Biosonics, video, photos and trawl) Stomach contents of fish	Large team effort including scientists from Department of Fisheries and Oceans at both the Bedford Institute of Oceanography (BIO) and the Northwest Atlantic Fisheries Centre. Also scientists from the Natural Resources Canada at BIO. Conducting surveys at the six 10 × 10 km study sites. Depth range about 40–70 m. Sites were selected after analysis of historical groundfish data (32 years). Three sites have the highest probability of encountering juvenile haddock (hot spots) while three sites have the lowest probability of encountering juvenile haddock (cold spots). Selected paired hot and cold spots on each of the three banks. Data are gathered on annual cruises run in September/October after juvenile haddock have settled to the bottom. Different data sets are being compared. Also attempts at data synthesis and extrapolation.	Multiple outputs are expected including maps, reports at scientific meetings, and publications.	No decision yet. Most likely local but done with knowledge of other classification systems. Habitat is being assessed by different tools (i.e., acoustic, imagery, and sampling) and by different team members.	Scientific community, resource managers, offshore industry (e.g., oil and gas, fishing), NGOs, etc.
Geological Survey of Canada (Atlantic), (Dr Brian J. Todd)	Canada, Gulf of Maine	Benthic habitat mapping of the Gulf of Maine	April 1, 2003 to March 31, 2006	Multibeam sonar, seismic reflection profiling, side-scan sonar, sediment coring and grab sampling, video and still photography	ESRI ArcGIS coverage including bathymetry, backscatter, sediment grain size, videography and photography, surficial geology and benthic habitat maps	Banks range from 30 to 100 m, troughs and basins reach 300 m; regional multibeam sonar surveys are followed by groundtruth surveys to obtain both regional samples and samples of particular interest	Digital maps published by the Geological Survey of Canada, Digital Atlas of the Gulf of Maine, scientific publications in peer-reviewed journals	Local classification scheme (i.e., northeastern US and eastern Canadian waters) has been developed by tailoring EUNIS and other schemes	Governments (federal, provincial and state), NGOs, fishing industry, hydrocarbon industry, cable and pipeline industries

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
USA									
Nat. Marine Fisheries Service, NE Fish. Sci. Ctr, (Dr Thomas Noji)	Canada, USA, Gulf of Maine	Benthic habitat mapping of the Gulf of Maine	April 1, 2003 to March 31, 2006	Multibeam sonar, seismic reflection profiling, side-scan sonar, sediment coring and grab sampling, video and still photography	ESRI ArcGIS coverage including bathymetry, backscatter, sediment grain size, videography and photography, surficial geology and benthic habitat maps	Banks range from 30 to 100 m, troughs and basins reach 300 m; regional multibeam sonar surveys are followed by groundtruth surveys to obtain both regional samples and samples of particular interest	Digital maps published by the Geological Survey of Canada, Digital Atlas of the Gulf of Maine, scientific publications in peer-reviewed journals	Local classification scheme (i.e., northeastern US and eastern Canadian waters) has been developed by USGS and GSC	Governments (federal, provincial and state), NGOs, fishing industry, hydrocarbon industry, cable and pipeline industries
Nat. Marine Fisheries Service, Alaska Fish. Sci. Ctr	Bering Sea shelf, Gulf of Alaska, upper slope and shelf habitats of the Aleutian Islands and portions of the Gulf of Alaska.					Distribution, abundance, and life history of deep water corals and sponges vulnerable to gear impacts.			Governments (federal, provincial and state), NGOs, fishing industry, hydrocarbon industry, cable and pipeline industries
Nat. Marine Fisheries Service, NW Fish. Sci. Ctr	Heceta Bank, a 50 km-long, rocky shoal on the outer shelf of central Oregon.					Relationships between ground fish populations and seafloor morphology/texture			Governments (federal, provincial and state), NGOs, fishing industry, hydrocarbon industry, cable and pipeline industries
Nat. Marine Fisheries Service, SW Fish. Sci. Ctr	West Coast, the Cowcod Conservation area off Southern California; Big Creek Ecological Reserve			Laser line scan technology, an electro-optic imaging technique		Effectiveness of the largest and newest Marine Protected Area (MPA)			Governments (federal, provincial and state), NGOs, fishing industry, hydrocarbon industry, cable and pipeline industries
Nat. Marine Fisheries Service, Honolulu Lab	Areas with precious corals (>350 m deep) and black coral (70-150 m deep)					Dependence of fish communities on corals; recovery times from fishing gear related injuries; characterizing and mapping seabed habitat and assessing fishing effects			Governments (federal, provincial and state), NGOs, fishing industry, hydrocarbon industry, cable and pipeline industries

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
Nat. Marine Fisheries Service, SE Fish. Sci. Ctr	Texas coast; Habitat Area of Particular Concern off Florida's Atlantic coast; MPAs along the shelf-slope break off Florida's Gulf coast					Effects of various intensities of shrimp trawling on benthic communities, and recovery of these communities			Governments (federal, provincial and state), NGOs, fishing industry, hydrocarbon industry, cable and pipeline industries
Ireland									
Board Iascaigh Mara (Oliver Tully)	Donegal	Recruitment of brown crab	April-June 2002, reporting 2005	AGDS (RoxAnn) with camera drops	Bathymetry, video footage, acoustic backscatter	Fish habitat classification inside 30 m depth with a view to identifying recruitment and nursery grounds for brown crab	maps	local within project	Crab fishing industry, researchers and fishery managers
Trinity College Dublin (Jim Wilson)	Ireland, Meath	Baldoyle estuary	2002-3	Ground-truth	Habitats. Species, sediments	Intertidal, quality index data	Unpub. Mod. Thesis, TCD	Local	n.a.
Marine Institute (Mick Gillooly); Geological Survey of Ireland (Mick Geoghegan)	Donegal Bay	Irish National Seabed Survey	Survey period - 20 Aug to 20 Oct 2002. Reporting to be completed by end of Feb 2003	Multibeam echosounder; magnetics, single beam echo sounder; sub-bottom profiler; ground-truthing	Bathymetry, backscatter, shallow seismic profiles, isopach maps, magnetics	Part of National Seabed survey using RV Celtic Voyager - from 50 to 200m contour. Actual depth ranges - 6 to 236m.	Charts, interpreted shallow seismics, isopach maps, magnetic maps, bathymetric and backscatter maps.		GSI => academics, utilities, oil industry etc
Marine Institute (Colm Lordan)	Aran, Galway Bay and Slyne Head <i>Nephrops</i> Grounds, ICES Area VIIb.	2002 UWTV Survey on the Aran, Galway Bay and Slyne Head <i>Nephrops</i> Grounds	23 June - 1 July 2002, Preliminary Report Available 17 July 2002, Final Report Pending	Sledge Mounted Under Water TV system, Prawn Fishing Gear and Scanmar Software, Sediment Sampling using Day Grab and Reineck Box-Core, Multibeam Data Collection	Underwater TV Data of <i>Nephrops</i> and <i>Nephrops</i> Burrows and other Shellfish and Benthic organisms, Mutibeam Data, Sediment Data, Biological data from Stations fished, Scanmar Data.	Report available from francis.obeim@marine.ie	Preliminary Report Available 17 July 2002, Final Report Pending, Video Tapes of Tracks available, Reference List from Preliminary Report	National	Irish Fishing Industry, Members of ICES <i>Nephrops</i> Working Group, Marine Institute Fisheries Science Service Staff, Any other interested parties.

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
Duchas, Dept. of Environment and Local Government (Elizabeth Sides); Marine Institute (Francis O'Beirn)	Kenmare River	Marine SACs Broadscale Habitat Mapping	Survey - June 2002 Report - March 2002	AGDS (Echoplus), Video Drop (n=156), Diver (n=18), Day Grab (n=46)	Bathymetric, predictive habitat and biological maps	Generate baseline biotope maps to be used to develop management plans for the SACs.	Report to feed into management plan, GIS	MNCR (epifauna and infauna), Thorsen (infauna)	Conservation Managers, local stakeholders, State Research and Development Agencies
Duchas, Dept. of Environment and Local Government (Elizabeth Sides); Marine Institute (Francis O'Beirn)	Roaringwater Bay	Marine SACs Broadscale Habitat Mapping	Survey - July 2002 Report April 2002	AGDS (Echoplus), Video Drop (113), Diver (n=18), Day Grab (n=46)	Bathymetric, predictive habitat and biological maps	Generate baseline biotope maps to be used to develop management plans for the SACs.	Report to feed into management plan, GIS	MNCR (epifauna and infauna), Thorsen (infauna)	Conservation Managers, local stakeholders, State Research and Development Agencies
Duchas, Dept. of Environment and Local Government (Elizabeth Sides); Marine Institute (Francis O'Beirn)	Clew Bay	Marine SACs Broadscale Habitat Mapping	Survey - August 2002 Report April 2003	AGDS (Echoplus), Video Drop (117), Diver (n=18), Day Grab (n=46)	Bathymetric, predictive habitat and biological maps	Generate baseline biotope maps to be used to develop management plans for the SACs.	Report to feed into management plan, GIS	MNCR (epifauna and infauna), Thorsen (infauna)	Conservation Managers, local stakeholders, State Research and Development Agencies
UK									
Scottish Association for Marine Science, Dunstaffnage Marine Laboratory (Dr Craig Brown)	Loch Linnhe, west coast of Scotland	Loch Linnhe Artificial Reef Project (LLAR)	2001 onwards	Multibeam Side-scan AGDS Video & Still photos Grabs Diver surveys Hydrographic surveys (ADCP and current meters)	Interpreted side-scan sonar mosaics RoxAnn data sets Infaunal data sets Epifaunal data sets Particle size distributions Sediment descriptions Video Stills Bathymetric contour maps Hydrodynamic information	LLAR project - Mapping work associated with monitoring of effects of reef construction on the local marine environment. Depth range of 10-30 m	Work ongoing - project reports will be produced in 2003/2004 and findings will be published in peer-reviewed journals.	EUNIS (part)	UK Gov't Dept's NERC NGO's Industry Scientific community

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
Scottish Association for Marine Science, Dunstaffnage Marine Laboratory (Dr Craig Brown, Dr. Murray Roberts)	West coast of Scotland - sites off Mingulay, south of Rhum, NW Skye and Stanton Bank	MINCH	Work 2003; Reporting 2003/2004	Multibeam Side-scan AGDS Video & Still photos Grabs Diver surveys (LLAR only) Hydrographic surveys (ADCP and current meters)	Interpreted side-scan sonar mosaics RoxAnn data sets Infaunal data sets Epifaunal data sets Particle size distributions Sediment descriptions Video Stills Bathymetric contour maps Hydrodynamic information	MINCH - Demonstration mapping programme investigating the distribution of cold water coral habitats in NW Scottish waters. Mapping will be carried out in water depths of 80–250 m using a suite of techniques.	Work ongoing - project reports will be produced in 2003/2004 and findings will be published in peer-reviewed journals.	EUNIS (part)	UK Gov't Dept's NERC NGO's Industry Scientific community

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
CEFAS (David Limpenny & Alison Hewer) (Partners: British Geological Survey & Newcastle University)	English Channel	Mapping of gravel biotopes and an examination of the factors controlling the distribution, type and diversity of their biological communities. (Project AE0908)	01/04/98 – 31/03/01	Side-scan AGDS Video & Still photos Trawls Dredges Grabs Geo-interpretation	Sampling metadata Bathymetry (line) Georeferenced side-scan Georeferenced AGDS Video records Benthic infauna Benthic epifauna Still Photos Particle size analyses Sediment description	4 sites (some incorporating areas of commercial aggregate extraction) surveyed using side-scan sonar (100 % coverage). Side-scan swathes mosaiced and area divided into acoustic regions based on mosaic. Acoustic regions ground-truthed using above techniques. Statistical analysis (PRIMER – MDS, ANOSIM, SIMPER) used to determine whether the acoustic regions also represented discrete biological communities.	C.J. Brown <i>et al.</i> (submitted). Mapping seabed biotopes using side-scan sonar in regions of heterogeneous substrata. Case study east of the Isle of Wight, English Channel. Underwater Technology. C.J. Brown <i>et al.</i> (Submitted). Mapping seabed biotopes, Hastings Shingle Bank, Eastern English Channel. Part 1: Assessment of the utility of side-scan sonar. Journal of Sea Research R.L. Foster-Smith <i>et al.</i> (Submitted). Mapping seabed biotopes at two spatial scales in the Eastern English Channel. Part 2: Assessment of the utility of two Acoustic Ground Discrimination Systems. Journal of Sea Research J.W.C. James and C.J. Brown (2002) Marine habitats off	EUNIS (part) Folk and Wentworth (sediments) Local (seabed description based on acoustic, physical and biotic information)	UK Gov't Depts OSPAR NGOs Industry Scientific community

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
							<p>Shoreham, eastern English Channel: A geological perspective. British Geological Commissioned Report CR/01/60 C.J. Brown <i>et al.</i> (2002) Small-scale Mapping of Sea-bed Assemblages in the Eastern English Channel Using Side-scan Sonar and Remote Sampling Techniques. Estuarine, Coastal and Shelf Science 54, 263-278 C.J. Brown <i>et al.</i> (2001) Mapping of gravel biotopes . CEFAS Technical Report No.114 R.L. Foster-Smith <i>et al.</i> (2001). Ensuring continuity.... CEFAS Report</p>		

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
CEFAS (Siân Boyd) (Partners: British Geological Survey & Newcastle University)	North Sea, English Channel Irish Sea	Role of seabed mapping techniques in environmental monitoring and management. (Project AE1033)	Start: April 2001 Report: March 2005	Multibeam Side-scan AGDS Video & Still photos Sub-bottom profiler Trawls Dredges Grabs Sediment Profile Imagery Geo-interpretation	Sampling metadata Bathymetry (line & swathe) Georeferenced side-scan Georeferenced AGDS Video records Benthic infauna Benthic epifauna Still Photos Particle size analyses Sediment chemistry Sediment description	Investigating utility and limitations of the various methodologies and the integration of their outputs for surveying and mapping anthropogenic impacts (aggregate extraction, dredge disposal, drag fishing) over various temporal and spatial scales in coastal and shelf waters <100 m deep.	A.J. Hewer <i>et al.</i> (2002) Mapping of gravel biotopes: an integrated approach. ICES CM 2002/ K:01 D.S. Limpenny <i>et al.</i> (2002) The utility of side-scan sonar techniques in the assessment of anthropogenic disturbance at aggregate extraction sites. ICES CM 2002/ K:04 Seabed Habitat Mapping: An Integrated Approach. CEFAS Pamphlet produced by A.J. Hewer and G. Hustwayte (2001)	EUNIS (part) Folk and Wentworth (sediments) Local (seabed description based on acoustic, physical and biotic information)	UK Gov't Depts OSPAR NGOs Industry Scientific community
CEFAS (Sian Boyd) Project (Partners: British Geological Survey and HR Wallingford)	Southern North Sea (Coal Pit & Inner Gabbard), English Channel (Hastings Shingle Bank)	Assessment of the Rehabilitation of the seabed following marine aggregate dredging	3rd Annual report (internal) expected April 2003. Final report April 2004.	Digital chirps side-scan sonar QTC Acoustic Ground Discrimination System Line bathymetry Underwater video Underwater stills Macrofaunal samples Epifaunal samples Groundtruth samples Hydrodynamic data	Interpreted side-scan sonar mosaics QTC data sets Infaunal data sets Epifaunal data sets Particle size distributions Sediment descriptions Digital and analog video Digital and analog stills Bathymetric contour maps Hydrodynamic indices	<u>Research project</u> designed to monitor the rate, degree and <u>processes leading to the</u> physical and biological recovery at relinquished aggregate extraction sites. Sites in water depths of less than 50 m.	Boyd, S.E. <i>et al.</i> (in press). Estuarine, Coastal and Shelf Science. Boyd, S.E. <i>et al.</i> Preliminary observations of the effects of dredging intensity on the recolonisation of dredged sediments (Poster). Boyd, S.E. <i>et al.</i> Assessment of the re-	Local, and generally relate to the physical description of the substrata (i.e., disturbed high impact, disturbed low impact, undisturbed/reference)	Office of the Deputy Prime Minister, DEFRA and The Crown Estate, Conservation Bodies, NGOs Marine aggregate extraction industry Wider scientific community

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
							habilitation of the seabed following marine aggregate extraction (Poster).		
CEFAS (Hubert Rees)	UK coastal waters	Food and Environment Protection Act Monitoring Programme	Continuous	Digital chirps side-scan sonar Sub-bottom profiling QTC/RoxAnn Acoustic Ground Discrimination System Line bathymetry Underwater video Underwater stills Macrofaunal samples Epifaunal samples Groundtruth samples Sediment contaminant analysis Hydrodynamic data	Interpreted side-scan sonar mosaics QTC data sets Infaunal data sets Epifaunal data sets Particle size distributions Sediment descriptions Inorganic and organic contaminant data sets Digital and analog video Digital and analog stills Bathymetric contour maps Hydrodynamic indices	Ongoing commitment to provide advice to UK government to assess the consequences of the disposal of dredged material into the marine environment. Habitat mapping techniques are used widely in this context. Generally in water depths <50 m.	A range of internal reports, some of which are available for wider distribution.	Local.	DEFRA
Dept of Earth Sciences, Cardiff University (Dr NC Mitchell) & School of Biological Sciences, University of Wales, Swansea (Mr A Woolmer).	Wales UK Bristol Channel	Broadscale soft sediment biotope mapping using multibeam sonar data (MSc dissertation)	2002 (Further proposal submitted for work reporting March 2004)	Multibeam sonar, sample assessment	Multibeam sonar, Data sets of tidal sand banks, qualitative biotope maps. Sonar includes one repeat survey.	Shallower than 20 m. Work to date has looked at the habitat of a subtidal bay and nearby sand bank.	Porcupine Meeting. Abstract the only output at present. One unpublished MSc thesis.		Research and commercial aggregate dredging industry.

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
DARD (M Service)	N Ireland/NW Irish Sea/ N Atlantic	NI Inshore Habitat Mapping	May-03	AGDS Side-scan Video Stills Grab Dredge	Physical habitat Biotope Photographic	Broadscale Habitat Maps of N Ireland Sub-littoral to 50 m Targetted offshore areas		EUNIS	Statutory Agencies Fisheries
SNH	Scottish waters	Firth of Tay and Eden estuary, Scotland.	Ground-truthing and satellite imagery - 25 June to 4 July 2002, Intertidal - 10 to 11 and 22 to 26 August 2002, AGDS - Summer 2002				?Author (2001?). Broadscale mapping of habitats in the Firth of Tay and Eden estuary, Scotland. First draft.		
SNH: ERT (Scotland) Ltd	Scottish waters	Isle of May candidate Special Area of Conservation	9 to 22 September, 2002				ERT Scotland Ltd (2002). The Forth Spatial Study: Broad-scale biotope mapping of the Isle of May candidate Special Area of Conservation. Draft Report.		
SNH: Posford Haskoning Ltd	Scottish waters	Firth of Forth	20 October to 23 November 2001				Posford Haskoning (2002). Broadscale intertidal survey of the Firth of Forth. SNH Commissioned Report No: F01AA407.		

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
SNH	Scottish waters	Sound of Barra	April, July and August 2001				Bates (2002). Broad-scale mapping of sublittoral habitats in the Sound of Barra. Final Draft Report. SNH Commissioned Report No: F01AA401B.		
SNH	Scottish waters	Loch Laxford cSAC	11 to 15 November, 2001		Sat IKONOS photography		Posford Haskoning Ltd (2001). Broad-scale intertidal survey, Loch Laxford cSAC, 2001. SNH Commissioned Report No: FA01AA401D.		
SNH: (1) Heriot-Watt University (2) St Andrews University and (3) Edinburgh University	Scottish waters	Loch Laxford cSAC	05/07/01 to 18/07/01				?Author (2001). Sublittoral broadscale mapping, Loch Laxford cSAC. Final Draft Report. SNH Commissioned Report No: F01AA401A		
SNH: (1) Heriot-Watt University (2) St Andrews University and (3) Edinburgh University	Scottish waters	Loch Sunart	25 July to 4 August, 2001				Bate (2002). Broad-scale mapping of sublittoral habitats in Loch Sunart. Final Draft report. SNH Commissioned Report No: F01AA401C		
SNH: Christine Howson	Scottish waters	Sanday cSAC and SPA	29 July to 10 August, 2000				Howson, C (2000) Intertidal survey of Sanday cSAC and SPA. SNH		

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
							Commissioned Report No: F00PA26		
SNH: SeaMap	Scottish waters	Sanday kelp beds	ADGS survey: 30 July to 13 August 1999 and Diver survey: 14 to 17 September 1999				White (2000.) Broadscale sublittoral survey and mapping of seabed biota, Sanday kelp beds. SNH Commissioned Report No: F99PA06		
SNH: SeaMap	Scottish waters	Loch Maddy					Foster-Smith (1999). Trialing of acoutistic ground discrimination sonar (AGDS) and video sledge monitoring techniques in Loch Maddy.		
SNH: Christine Howson & Alastair Davidson	Scottish waters	Loch Maddy cSAC	October 1999				Howson and Davidson (2000). Trials of monitoring techniques using divers and ROV in Loch Maddy cSAC, North Uist.		
SNH: Sedimentry Systems Research Group, SRU University of St Andrews	Scottish waters	Loch Maddy cSAC, North Uist	24 to 25 August, 2000				Sedimentry Systems Research Group (year?). Swath Sounding survey of Loch Maddy cSAC, North Uist Using Submetrix System 2000. A report for SNH.		

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SNH: SeaMap	Scottish waters	Loch of Stenness cSAC	8 to 12 September, 1999				Foster-Smith, R.L. & Howson C.M. (2000). Broadscale survey and mapping of seabed and shore habitats and biota, Loch of Stenness cSAC. SNH Commissioned Report No: F99PA09.		
SNH: IECS	Scottish waters	Solway Firth	1999				?Author (?year). Intertidal Scar Grounds biotope mapping, Solway Firth		
SNH: SeaMap	Scottish waters	Solway Firth	1999				?Author (?year). Marine SAC mapping of subtidal sediments and scars, Solway Firth		
SNH: Dunstaffnage Marine Laboratory	Scottish waters	Loch Creran, Argyll	November 1998 to February 1999				Black K.D., Hughes, D.J., Provost P.G. and Perlira P.M.F. (2000). Broadscale survey and mapping of seabed biota, Loch Creran, Argyll. SNH Commissioned Report No: F98AA408.		
SNH: Colin Munro and Francis Bunker	Scottish waters	Sound of Arisaig	1998				?Author (year?). Sublittoral survey, Sound of Arisaig		

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
SNH: SeaMap	Scottish waters	Firth of Lorn	June, July & December 1996; July & September 1997; June, July & September 1998				Davies J. (1999) Broadscale remote survey and mapping of the sublittoral habitats and their associated biota in the Firth of Lorn. SNH Research, Survey and Monitoring Report No: 157		
SNH: Posford Duvivier Environmental	Scottish waters	Firth of Lorn, Western Scotland	October & November 1997				Posford Duvivier Environment (2000) Broadscale survey and mapping of the shore habitats and biota, Firth of Lorn, Western Scotland. SNH Commissioned Report No: F97PA03.		
SNH/EN: ERT Scotland Ltd	Scottish waters	Sea caves in the Berwickshire and North Northumberland cSAC	10 February to 6 March 1997				ERT (1997). Survey, assessment and mapping of submerged and partly submerged sea caves in the Berwickshire and North Northumberland cSAC. Final report, ERT 97/014/P001		

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SNH: Posford Duvivier Environmental	Scottish waters	St Kilda cSAC	June and July 1997				Posford Duvivier Environment (2000). Broad-scale survey and mapping of the seabed and shore habitats and biota: St Kilda cSAC. Scottish Natural Heritage Commissioned Report No: F97PA01		
SNH: Marine Biological Surveys (Colin Munro) and Sea Sediments (Rob Nunny)	Scottish waters	Dornoch Firth pSAC	28 August to 9 September, 1997				Munro C and Nunny R (2000). Broad-scale survey and mapping of seabed and shore habitats and biota, Dornoch Firth pSAC. Scottish Natural Heritage commissioned report F97PA02		
SNH: Entec	Scottish waters	Vadills cSAC, Shetland	16 to 19 September, 1997				ENTECC (1997). Broad-scale survey and mapping of shore habitats and biota, Vadills cSAC Shetland. Scottish Natural Heritage commissioned report F97PA0		

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
SNH	Scottish waters	Papa Stour, Shetland	Littoral: 10-19 July 1996. Sublittoral caves: 16-17 July 1996 and Sublittoral AGDS: no dates given.				Entec (1997). Broad scale survey and mapping of seabed and shore habitats and biota, Papa Stour Shetland.		
SNH	Scottish waters	Lochs Duich, Alsh and Long	1996				?Author (year?). Broad scale survey and mapping of seabed and shore habitats and biota, Lochs Duich, Alsh and Long. SNH commissioned report No: F97PA05.		
SNH: Christine Howson	Scottish waters	Loch Sunart	1995				?Author (year?). Survey of the shallow sublittoral biotopes, Loch Sunart.		
SNH: Entec	Scottish waters	Busta Voe and Olna Firth, Shetland	1995				Entec (1995). Broad scale habitat mapping of intertidal and sublittoral coastal areas, Busta Voe and Olna Firth, Shetland.		
SNH	Scottish waters	Loch Maddy	1995				?Author (year?). Broad scale habitat mapping of intertidal and subtidal coastal areas, Loch Maddy.		

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
SNH: (Biomar) Newcastle University	Scottish waters	Sound of Arisaig pSAC	1995				Biomar (year?). Mapping of benthic biotopes, Sound of Arisaig pSAC.		
SNH/EN: IECS	Scottish waters	Solway Firth	Intertidal: 20 to 30 September 1994. Subtidal: 23 September to 6 October 1994.				IECS (1995). Broadscale habitat mapping, Solway Firth. SNH Research, Survey and Monitoring Report No: 46		
SNH/EN: ERT	Scottish waters	Loch Laxford and Loch Eriboll	1994				Broadscale biotope mapping survey of the littoral and sublittoral coastal areas, between Loch Laxford and Loch Eriboll, 1994		
SNH: JNCC/DARD (Marenco did subtidal mapping)	Scottish waters	Loch Ryan							
Stena: ERTSL	Scottish waters	Loch Ryan							
SNH: SeaMap	Scottish waters	Rousay Sound, Wyre, Orkney					Rousay Sound, Wyre, Orkney		
CCW	Wales	Phase I Intertidal survey of Wales	11.04.96 to present (current completion target date = 2005.	Aerial photography, ground-truthing	Habitat maps	Intertidal survey of entire coast of Wales to map the distribution of biotopes.	Phase I Intertidal survey GIS biotope maps	MNCR	Conservation managers
CCW	Wales	Severn Estuary			Field maps of biotope distributions		Severn Estuary		

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CCW: SeaMap	Wales	Milford Haven, Pembrokeshire and South Cardigan Bay.			Field maps of biotope distributions		Broadscale remote survey mapping of sublittoral habitats and biota, Milford Haven, Pembrokeshire and South Cardigan Bay.		
SeaMap/BMP	Wales	Milford Haven	1996 to 1998		RoxAnn raw data files				
SeaMap/BMP/ School of Ocean Sciences, UWB/Newcastle Uni/BioMar	Wales	Pembrokeshire coast	1996 to 1998						
Non-Conservation Agency commissioned survey	Wales	St Davids Head to Fishguard	1997 to 1998						
NWNWSFC	Wales	Fishguard and Cardigan Bay	1997						
Nunny/BioMar	Wales	Cardigan Bay to Aberystwyth	1994 to 1995						
CCW (West Area): Longdin and Browning Surveys Ltd	Wales	Pembroke marine cSAC	28 Aug to 14 Sept 2001		Acoustic habitat survey		Habitat and feature distribution in Pembroke marine cSAC: Acoustic habitat survey (Contract No: FC - 73-02-200)		
CCW: North-western & North Wales Sea Fisheries Committee (NWNWSFC)(Lancaster University)	Wales	Welsh cSAC's	May to Oct 1997		Side-scan sonar (SSS) raw data files, RoxAnn		Broadscale mapping methods using RoxAnn in Welsh cSAC's: Pen Llyn		

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
CCW: North-western & North wales Sea Fisheries Committee (NWNWSFC)(Lancaster University)	Wales	Welsh cSAC's: Cardigan Bay	September 1998 to July 1999		RoxAnn raw data files		Broadscale mapping methods using RoxAnn in Welsh cSAC's: Cardigan Bay		
JNCC: NWNWSFC	Wales	Cardigan Bay sublittoral sediment survey	28 January to 14 March 1997		RoxAnn raw data files		Cardigan Bay sublittoral sediment survey		
CCW: North-western & North wales Sea Fisheries Committee (NWNWSFC)(Lancaster University)	Wales	Welsh cSAC's: Sarn Badrig	May 1998.		RoxAnn raw data files (see misc comments column)		Broadscale mapping methods using RoxAnn in Welsh cSAC's: Sarn Badrig		
CCW	Wales	The potential use of airborne remote sensing to identify habitats and biotopes in the Mawddach Estuary			RoxAnn raw data files		The potential use of airborne remote sensing to identify habitats and biotopes in the Mawddach Estuary		
MarineSeen	Wales	Pembroke River					Pembroke River		
MarineSeen	Wales	West of Holyhead breakwater (sewerage treatment)					West of Holyhead breakwater (sewerage treatment)		
MarineSeen	Wales	Rhyl flats (windfarms)					Rhyl flats (windfarms)		
EN: Dove Marine Lab, University of Newcastle	England	Mapping the distribution of benthic biotopes around the Thanet coast	10 to 12 May 1995				Davies (1995). Mapping the distribution of benthic biotopes around the Thanet coast. English Nature Research Report No 154.		

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EN: Seemap	England	Mapping survey of the sublittoral and littoral biotopes of the Berwickshire coast					Foster-Smith, Foster-Smith, Sotheran and Bunker (1996). Mapping survey of the sublittoral and littoral biotopes of the Berwickshire coast. A report to SNH, SNH Survey and Monitoring Report No 60		
EN: Posford Duvivier Environment Ltd	England	Essex estuaries cSAC littoral and sublittoral biotope mapping	Feb-98				Posford (1998). Essex estuaries cSAC littoral and sublittoral biotope mapping and data capture exercise.		
EN: Newcastle University (Bentic Mapping and Assessment Project)	England	Broadscale mapping of Morecambe Bay	16 to 16 August 1996				Sotheran and Walton (1997). Broadscale mapping of Morecambe Bay. English Nature Research Report No: 232		
EN	England	Mapping survey of the eel grass (<i>Zostera marina</i>) beds of the main channel of the Salcombe-Kingsbridge estuary					Mapping survey of the eel grass (<i>Zostera marina</i>) beds of the main channel of the Salcombe-Kingsbridge estuary		
EN: Posford Duvivier Environment Ltd	England	Broadscale mapping of Plymouth Sound and estuaries					Posford Duvivier Environmental (1997). Broad-scale mapping of Plymouth Sound and		

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
							estuaries. English Nature Research Report No: 208.		
EN: Seamap	England	Broadscale mapping of the habitats and biota of the sublittoral seabed of the Wash					Broadscale mapping of the habitats and biota of the sublittoral seabed of the Wash		
EN: Natural History Museum	England	Survey of the chalk cave, cliff, intertidal and subtidal reef biotopes in the Thanet cSAC.	Intertidal - August and September 1997. Subtidal - 1997 (no further information)				Tittley <i>et al</i> (1998). Survey of the chalk cave, cliff, intertidal and subtidal reef biotopes in the Thanet cSAC.		
EN: BKS Surveys Ltd	England	Mapping <i>Zostera</i> beds in SACs by aerial photography, Scilly Isles and Lindisfarne			Scillys survey only		BKS Survey LTD (1998). Mapping <i>Zostera</i> beds in SACs by aerial photography, Scilly Isles and Lindisfarne.		
EN: BKS Surveys Ltd	England	Mapping <i>Zostera</i> beds in SACs by aerial photography, Scilly Isles and Lindisfarne.	17/09/1997		Lindisfarne survey only		BKS Surveys Ltd (1998). Mapping <i>Zostera</i> beds in SACs by aerial photography, Scilly Isles and Lindisfarne.		
EN: Newcastle University (Benthic Mapping and Assessment Project)	England	Broadscale biological mapping of Lundy marine nature reserve with particular reference to	15 to 19 July 1997				Sotheran and Walton (1997). Broadscale biological mapping of Lundy marine nature reserve		

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		reefs					with particular reference to reefs. English Nature Research Report No: 231		
EN: Seemap	England	The Wash, and the Lincolnshire and the north Norfolk coasts	1 to 14 August 1996. 1 to 18 July and 15 to 20 September 1997. 3 to 7 August 1998.				Foster-Smith and Sotheran (1999). Broadscale remote survey and mapping of the sublittoral habitats and biota of the Wash, and the Lincolnshire and the north Norfolk coasts. English Nature Research Report No: 336.		
EN: MarineSeen (Francis Bunker)	England	North Norfolk coast	10 to 16 January 1998				Perrins and Bunker (1998). Biotope survey of the littoral sediments of the north Norfolk coast cSAC. English Nature Research Report No: 285		
EN: Geodata Institute, University of Southampton	England	Solent and south Wight					Geodata (1998). Survey and mapping of the intertidal and subtidal marine cSACs - Solent and south Wight		
EN: Newcastle University	England	Flamborough Head	8 to 12 August 1994				Davies and Sotheran (1995). Mapping of the distribution of the benthic		

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							biotopes at Flamborough Head. English Nature Research Report No: 121		
EN: Seemap	England	Isle of Wight	28 June to 2 July 1994				Sothorn and Foster-Smith (1995). Mapping the distribution of benthic biotopes around the Isle of Wight. English Nature Research Report No: 120.		
EN: University of Newcastle, BioMar Project	England	Falmouth Bay and the lower Fal Ruan estuary	4 to 8 July 1994				Davies and Sothorn (19??). Mapping the distribution of benthic biotopes in Falmouth Bay and the lower Fal Ruan estuary. English Nature Research Report No 119a.		
EN: Ambios Environmental Consultants Ltd (Colin Munro and Rob Nunny)	England	Isles of Scilly	21 Spetember to 22 October 1997				Munro and Nunny (1998). Isles of Scilly subtidal habitat and biotope mapping survey, 1997. English Nature Research Report No: 276		
EN: Hydrosurveys	England	Flamborough Head					Hydrosurveys (2002). Acoustic survey of sublittoral reefs in Flamborough		

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
							Head European Marine Sites.		
EN: Seamap	England	<i>Sabellaria spinulosa</i> in the Wash and north Norfolk cSAC and its approaches	June to November 2000				Foster-Smith and White (2001). <i>Sabellaria spinulosa</i> in the Wash and north Norfolk cSAC and its approaches: mapping techniques and ecological assessment.		
EN/SNH: ERT Scotland Ltd	England	Southernness Point, Solway Firth	22 to 23 September 1999				ERT Ltd (1999). Scar ground monitoring at Southernness Point, Solway Firth.		
EN: MarineSeen	England	Plymouth Sound and estuaries	16 to 22 August and 15 to 19 October 2001				Bunker and Perrins (2001). Broadscale mapping of Plymouth Sound and estuaries European Marine Site.		
EN: Seamap	England	Durham							
EN: Seamap	England	Tees							
EN: Seamap	England	Sussex							
EN: CEFAS	England	Channel							
EN: Seamap	England	Kimmeridge							
EN: Nunny and Munro	England	Great West Bay							

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EN	England	North Northumberland	August to September 1993				Foster-Smith and Davies (199?). Survey of the maritime environment of north Northumberland: an assessment of the conservation interest of the marine biotopes.		
EN: Nunny and Munro	England	An intertidal survey of the biotopes of rocky scars in the Drigg Coast European marine site	28 to 30 July and 12 August 1999				WA Marine and Environment (1999). An intertidal survey of the biotopes of rocky scars in the Drigg Coast European marine site.		
EN: Seemap	England	Flamborough	2002				Howson (in press). Title not known, Flamborough		
EN: Natural History Museum	England	Thanet intertidal survey	15 to 22 September 2001				Tittley and Spinner (2001). Thanet intertidal survey: Assessment of favourable condition of reef and sea-cave features in the Thanet coast cSAC. Draft report.		
EN: EMU Environmental Ltd (SSS and groundtruthing)	England	Acoustic seabed survey techniques for monitoring marine SAC's. A trial of 3 systems in Plymouth Sound.	18 to 26 January 2000				?Author? (19??). Acoustic seabed survey techniques for monitoring marine SAC's. A trial of 3 systems in Plymouth Sound.		

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EN: Analytical and Environmental Services (AES)	England	Survey of the littoral and sublittoral sediments of the River Parrett, Severn Estuary, Somerset					AES (1997). Survey of the littoral and sublittoral sediments of the River Parrett, Severn Estuary, Somerset.		
EN/SNH	England	Intertidal scar ground mapping of the Solway Firth					Intertidal scar ground mapping of the Solway Firth		
EN/SNH: Seemap	England	Solway Firth - marine SAC mapping. Sub-tidal sediments and scars					Solway Firth - marine SAC mapping. Sub-tidal sediments and scars		
EN: Christine Howson	England	Flamborough Head sea-cave survey					Flamborough Head sea-cave survey		
EN/JNCC	England	Flamborough Headland: Sublittoral survey.					Flamborough Headland: Sublittoral survey.		
EN: IECS	England	Survey of the littoral sediments at Lindisfarne NNR and Budle Bay on the Berwickshire and north Northumberland coast					Survey of the littoral sediments at Lindisfarne NNR and Budle Bay on the Berwickshire and north Northumberland coast		
EN: Seemap	England	Broadscale mapping of the reefs of Berwickshire and Northumberland					Broadscale mapping of the reefs of Berwickshire and Northumberland		
EN: Seemap	England	A marine biological survey of Beadnall to Dunstanburgh Castle, Northumberland					A marine biological survey of Beadnall to Dunstanburgh Castle, Northumberland		

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
DARD/EHS (Dr Matt Service)	Northern Ireland	Lough Foyle nearshore subtidal mapping	13/08/1996						
DARD/EHS (Dr Matt Service)	Northern Ireland	North Coast - broad' nearshore subtidal mapping							
DARD/EHS (Dr Matt Service)	Northern Ireland	North Coast - Skerries' nearshore subtidal mapping	23/02/2003						
DARD/EHS (Dr Matt Service)	Northern Ireland	East Antrim Coast' nearshore subtidal mapping	05/10/00; 01/10/02; 27/01/03; 05/02/03; 13/02/02; 11-12/02/03						
DARD/EHS (Dr Matt Service)	Northern Ireland	Larne Lough nearshore subtidal mapping	2000						
DARD/EHS (Dr Matt Service)	Northern Ireland	Belfast Lough nearshore subtidal mapping	18/10/99; 27/10/99; 07/08/00; 08/01/01						
DARD/EHS (Dr Matt Service)	Northern Ireland	Ards Peninsular' nearshore subtidal mapping	23/07/96; 12/02/02; 13/02/03						
DARD/EHS (Dr Matt Service)	Northern Ireland	Strangford Lough' nearshore subtidal mapping	05/08/99; 13/03/00; 11/12/00; 23/07/02; 25/07/02						
DARD/EHS (Dr Matt Service)	Northern Ireland	Strangford entrance to Dundrum Bay' nearshore subtidal mapping	13/02/2003						

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
DARD/EHS (Dr Matt Service)	Northern Ireland	Dundrum Bay' nearshore subtidal mapping	08/08/2000						
DARD/EHS (Dr Matt Service)	Northern Ireland	Annalong & Kilkeel' nearshore subtidal mapping	10/08/00; 11/08/00; 31/05/02; 06/06/02						
DARD/EHS (Dr Matt Service)	Northern Ireland	Carlingford Lough' nearshore subtidal mapping	27/11/00; 30/05/02; 30/05/02; 05/06/02; 26/06/02; 1997						
DARD/EHS (Dr Matt Service)	Northern Ireland	Rathlin Island' nearshore subtidal mapping	28/02/01; 11/06/01; 12/06/01; 06/08/01						
DARD (Dr Matt Service)	Northern Ireland	Northern Ireland east coast scallop grounds, Area V' nearshore subtidal mapping							
DARD (Dr Matt Service)	Northern Ireland	Northern Ireland east coast scallop grounds, Area II' nearshore subtidal mapping							
DARD (Dr Matt Service)	Northern Ireland	Northern Ireland east coast scallop grounds, Area I' nearshore subtidal mapping							
DARD/QUB/KMM (Dr Matt Service)	Loch Ryan	Loch Ryan' nearshore subtidal mapping	17-24/11/00						

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DARD: Dove Marine Lab, University of Newcastle	Northern Ireland	Grid off Carlingford and tracks in Irish Sea	23/02/1999						
DARD/EHS: Seemap	Northern Ireland	Grid off Carlingford Lough	28/07/1999						
DARD: Posford Duvivier Environment Ltd	Irish Sea	Large Irish Sea grids	03/06/2000						
DARD: Newcastle University (Bentic Mapping and Assessment Project)	Irish Sea	Large Irish Sea grid completed using 38kHz	04/06/2000						
DARD	Irish Sea	Irish Sea grid just south of IoM, across Western Irish Sea front	24/07/2000						
DARD: Posford Duvivier Environment Ltd	Irish Sea	Irish Sea grids	04/06/2001						
Belfast Harbour Commissioners : Seemap	Irish Sea	Dredge disposal site off Belfast Lough	07/08/2001						
DARD: BNHM	Irish Sea	Irish Sea grids	19/06/2002						
DARD: BKS Surveys Ltd	Irish Sea	Grid off Carlingford - dredge disposal ground?							
DARD: BKS Surveys Ltd	Irish Sea	Irish Sea and section off Belfast Lough entrance	??/06/98						

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
DARD: Newcastle University (Benthic Mapping and Assessment Project)	Irish Sea	Large grid in Western Irish Sea over Western Irish Sea front	1997						
DARD: Seemap	Irish Sea	Irish Sea off Carlingford and section of Belfast Lough	22/02/99; June 1999; July 1999						
DARD: MarineSeen	Irish Sea	Irish Sea grids from Nephrops cruise	12/08/2002						
EHS: Geodata		Intertidal biotope mapping in Strangford Lough: monitoring and management of a special area of conservation	08/99 - 09/99				Preston J, Portig A & Montgomery I (1999) Intertidal biotope mapping in Strangford Lough: monitoring and management of a special area of conservation.		
EHS: Newcastle University		Intertidal biotope mapping in Strangford Lough: monitoring and management of a special area of conservation.	08/99 - 09/99				Preston J, Portig A and Montgomery I (2000) Intertidal biotope mapping in Strangford Lough: monitoring and management of a special area of conservation.		
EHS: Seemap		Intertidal biotope mapping in Strangford Lough: monitoring and management of an SAC.	08/99 - 09/99				Preston J, Portig A and Montgomery I (2001) Intertidal biotope mapping in Strangford Lough:		

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
							monitoring and management of a special area of conservation.		
Lithuania									
University of Klaipeda (Dr Sergej Olenin)	SE Baltic, Lithuanian coast	Biodiversity study and mapping of marine habitats in the vicinity of the Butinge oil terminal	2003, 2003	UW remote camera, echo-sounder, SCUBA	GIS related biotope descriptions (incl. photo and video), species lists (incl. abundance, biomass)	Depth range: 0–25 m; UW video survey for mapping in a scale 1:10000; SCUBA divers observations and sampling at selected sites; analysis of video materials and biological samples, granulometry	Report (in Lithuanian and English); biotope map, distribution maps of most important species; publication(s) in peer-reviewed journals	National, related to EUNIS(HELCOM)	Ministry of Environment, Oil terminal authorities
Netherlands									
Delft Cluster (Jan van Dalssen)	Dutch Coast	Eco-morphodynamics of the Sea Floor	2003	Multibeam, side-scan, box-corer, frame positioned sensors	hydrodynamics, bathymetry, seabed morphology, sediment and zoobenthic community (species, abundance and biomass) descriptions	3 areas studied (offshore sandwave area at 25–30 m depth; a shoreface connected ridge area at 20–25 m depth; transition area between lower shore face and inner continental shelf at 15–20 m depth) during spring and autumn	Yearly progress reports, in English, publications in pr-journals	National	Marine and coastal management authorities
Germany									
University of Kiel	Mapping of reefs in the North Sea and Baltic Sea					Verification and identification of reef like structures in pre-selected areas using side-scan sonar.			
ARGUMENT	Identification and demarcation of sandbanks in the North Sea and Baltic Sea					Application of computer models for the analysis of bathymetric data.			

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
Alfred-Wegener Institute (AWI), Baltic Sea Research Institute (IOW)	Investigations of benthos and sediment					Mapping of sediment distribution and benthic communities in the North Sea and the Baltic Sea. Investigations of sandbanks and reefs			
Spain									
IEO - Instituto Español de Oceanografía (Spanish Institute of Oceanography) (Jose Luis Sanz)	Spanish continental shelf	ESPACE	1999–2014	Multibeam, Topas, ground sampling, samples from divers	Bathymetry, Backscattering, high resolution seismic data	Study area divided into 167 sheets. Depth range 0–170 m. Integration of the resulting data in a marine GIS for its appropriate management and use for geology, biology and environmental management.	3 map series, map scale 1:50000, UTM projection: Serie A: Bathymetry and seafloor characteristics, Serie B: management, Serie C: digital models and geomorphology	Projected EUNIS	Public domain information: Fishermen, Management, Sportif, etc.
AZTI Fisheries and Food Technological Institute (Adolfo Uriarte)	Basque Country continental shelf	FONDOS	2003	Side Scan Sonar, RoxAnn, grabs, photography	1. Detailed sedimentological cartography, 2. Principal habitat maps, 3. Traditional fishing sites seafloor characterisation.	Depth range: 0–100 m		EUNIS	
Spanish government (Jose Luis Ramirez Caro)	Gipuzkoan shelf (Basque Country, Bay of Biscay)	Marine geophysical study between the French frontier and Ondarroa	1992	Echo-sounder, side-scan sonar, seismic studies 3kHz, uniboom	Bathymetry, geomorphology, sedimentological thickness	Depth range: 0–50 m. Objectives: dredging disposal sites for regeneration and creation of beaches.	1:5000 maps series		
Spanish government (Galo F. Diez Rubio)	Biscay shelf (Basque Country, Bay of Biscay)	Biscay coast geophysical study	1990	Echo-sounder, side-scan sonar, seismic studies 3kHz, uniboom	Bathymetry, geomorphology, sedimentologic thickness	Depth range: 0–50 m. Objectives: dredging disposal sites for regeneration and creation of beaches.	1:5000 maps series		

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
Norway									
Bodø Regional University, Department of Fisheries and Natural Sciences (Stig Skreslet: stig.skreslet@hbo.no)	Norway, ICES code 00-54 Skjerstadvfjorden	Carrying capacity for organic outlet in Skjerstadvfjorden	2002	SBE25 CTD	Physical environment (Temperature, salinity and oxygen)	Collection of data to test a model for estimation of the carrying capacity of organic outlets from fish cages in fjords.	Skreslet, S. 2002. Miljøundersøkelse i Skjerstadvfjorden 1. Resultater av måleprogrammet. HBO-rapport nr. 2/2002. 54 pp. (In Norwegian) Skreslet, S. 2002. Miljøundersøkelse i Skjerstadvfjorden 2. Resultater fra simulering med regnemodell. HBO-rapport nr. 3/2002. 21 pp. (In Norwegian)	Local	Local authority.
Bodø Regional University, Department of Fisheries and Natural Sciences (Stig Skreslet: stig.skreslet@hbo.no)	Norway, ICES code 06, Træna-Myken.	Habitats of <i>Calanus finmarchicus</i> in the Vestfjorden area	2003	Bongo- og VP2-net, acoustic, SBE25 CTD, <i>in situ</i> fluorometry, Plankton nets, acoustics, CTD and <i>in situ</i> fluorometry.		Observations along transects from the coast to the ocean to monitor the spawning biomass of <i>Calanus finmarchicus</i> in view of the physical conditions in the sea.	Skreslet, S. and N.Å. Rød 1986. Advection of <i>Calanus finmarchicus</i> between habitats in Norwegian coastal waters. Pp 375–388 in S. Skreslet (ed.) The role of freshwater outflow in coastal marine ecosystems. NATO ASI Series, Vol G7. Springer-Verlag, Heidelberg.		

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
Bodø Regional University, Department of Fisheries and Natural Sciences (Stig Skreslet: stig.skreslet@hbo.no)	Norway, ICES code 00 Vestfjorden	Habitats of <i>Calanus finmarchicus</i> in the Vestfjorden area	Time series from 1983	Each year, 5 replicated vertical plankton net hauls (0.1 m ²) in February and in October.	Vertical profiles of temperature, salinity and oxygen.	Monitoring of the population of <i>Calanus finmarchicus</i> in relation to climate changes and the recruitment of cod (<i>Gadus morhua</i>).	Skreslet, S. and N.Å. Rod 1986. Advection of <i>Calanus finmarchicus</i> between habitats in Norwegian coastal waters. Pp 375–388 in S. Skreslet (red) The role of freshwater out-flow in coastal marine eco-systems. NATO ASI Series, Vol G7. Springer-Verlag, Heidelberg. Heath, M.R., O.S. Astthorsson, J. Dunn, B. Ellertsen, A. Gislason, E. Gaard, W.S.C. Gurney, A.T. Hind, X. Irigoien, W. Melle, B. Niehoff, K. Olsen, S. Skreslet, and K.S. Tande 2000. Comparative analysis of <i>Calanus finmarchicus</i> demography at locations around the northeast Atlantic. ICES Journal of Marine Science, 57: 1562–1580.		

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
Bodø Regional University, Department of Fisheries and Natural Sciences (Stig Skreslet: stig.skreslet@hbo.no)	The fjords of Nordland county.	Fish species composition at shrimp fisheries areas.	1994	Shrimp trawl.		Fish species composition in relation to topography and environmental parameters.	Pedersen, M., S. Skreslet and T. Thomassen 1979. Slutt-rapport fra rekeundersøkelsen i Salten 1977 og 1978. NDH, Mat/nat fagseksjon, Rapport 1979:11. 51 pp. (In Norwegian) Skreslet, S. 1982. Fiskefauna i forurenset fjord. NDH-Rapport 1982:5. 22 pp. (In Norwegian) Skreslet, S. 1994. Årsvariasjoner i fiskefaunaen på reketrålfelt i Salten. HSN-rapport 1994:5. 38 pp. (In Norwegian) Skreslet, S. 1994. Oppvekst av fisk og reker i gjødslet fjord. HSN-rapport 1994:1. 15 pp. (In Norwegian)	Local	Management
Norwegian Institute for Water Research (NIVA) (Frode Olsgard: frode.olsgard@niva.no & Mats Walday: mats.walday@niva.no)	Southern Norway, especially the Oslo fjord area.	Mapping and monitoring of coastal sublittoral biotopes by remote sensing techniques, NFR project 2003-2004	2004	Acoustic mapping of the seabed with Simrad dual scan echo-sounder and ROV	Hard bottom is documented by diving and/or photo; soft sediments are documented by corer samples.	Overall objective is to explore the possible use of ROV (remotely operated vehicles) and echo-sounder systems in sublittoral biological community investigations, especially of mapping of coastal shallow biotopes and dominant key species distribution.	Only internal reports in Norwegian are available at the moment.	EUNIS habitat classification will be tested on the data sets in the future.	Research, national management and directives from the EC.

Organisation, name of contact person*	Geographical coverage (country, region)*	Project title	Date of work, expected year of reporting*	Techniques used (e.g., acoustics, ground-truthing)*	Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*	Brief description of work (including depth range)	Outputs: Reports, publications, maps, reference lists	Classification used; local (within project), national (state), EUNIS	Targeted end-users
Norwegian Institute for Water Research (NIVA) (Frithjof Moy: frithjof.moy@niva.no)	Norway	Classification of Norwegian water types	2003	Collection and systematisation of existing data	Topography, bathymetry, geology and biology collected by a various techniques	A description of water types according to EC Water Framework Directive	Only internal reports in Norwegian.	According to EC Water Framework Directive	National management
Norwegian Institute for Water Research (NIVA) (Frithjof Moy: frithjof.moy@niva.no)	Southern Norway, Oslo fjord.	Marine shallow water biotopes in the inner Oslo fjord	1996	Diving and inspections from land.	Topography, bathymetry, geology and biology collected by diving.	Methodology for how to map coastal areas in the view of council management.	NIVA-report 3703-97 (In Norwegian)	Local habitat classification with similarities to EUNIS	Coastal councils
Institute of Marine Research (Egil Ona: egil.ona@imr.no)	Norway	ACOUSEC	2003	Multi frequency echo-sounders, sediment samples, epibenthic samplers and grab samples.	Grain-size analysis, species composition (epi- and infauna). Development of a library of acoustic features for a spectrum of sediment types.	System for acoustic seabed classification	Only internal reports	Not decided yet.	Research and management
Institute of Marine Research (Jan Helge Fosså: jan.helge.fossaa@imr.no)	Norway	SUSHIMAP	2004	Echo-sounders, multibeam and multifrequency. Video, grabs, epifauna samplers.	Grain-size analysis, species composition (epi- and infauna).	Survey strategy and methodology for marine habitat mapping	Only internal reports	Not decided yet.	Research and management

ANNEX 5: SEABED MAPPING ACTIVITY IN THE USA

Thomas Noji, James Thomas, National Oceanic and Atmospheric Administration, National Marine Fisheries Service

Marine habitats are important as living space for organisms which constitute biodiversity and support fisheries. These habitats are subject to a number of activities that can influence their quality and quantity. Foremost among these are the fishing and offshore petroleum industries with impacts from trawling, drilling, pipelines, and pollution. Presented here is an overview of seabed mapping activities performed by or with the National Marine Fisheries Service (NMFS), which is part of the National Oceanic and Atmospheric Administration (NOAA).

Ongoing and planned surveys to produce high resolution maps that characterize benthic habitats of the U.S. Continental Shelf and slope are being conducted. These maps should include surficial geology and bathymetry. These maps are important for identifying and describing essential fish habitat and habitat areas of particular concern, for linking species to habitat type, and for analysis and extrapolation of effects of fishing on benthic habitats to areas over which fisheries are managed. In the 1980s, the US Geological Survey and NOAA worked together to accomplish the first coarse survey of the outer portion of the newly designated Exclusive Economic Zone of the U.S. These surveys of the seabed, however, did not cover shallower waters of our upper slope and Continental Shelf, where the bulk of our fisheries exist. Today, even though newer, better and more efficient methods exist and have been used successfully applied over relatively small, isolated areas, the need persists for coordinated, systematic surveys characterizing and mapping seabed habitat for most of the U.S. Continental Shelf and slope.

In 1996, the Alaska Fisheries Science Center (AFSC) initiated a number of seafloor habitat studies directed at assessing habitat characteristics and investigating the impacts of fishing, particularly bottom trawling as well as evaluating acoustic technology for seabed classification. Researchers also began determining the distribution, abundance, and life history of deep water corals and sponges vulnerable to gear impacts. These field studies have focused on specific geographic areas and habitat types: the shallow water soft-bottom areas of the Bering Sea shelf, the deeper soft bottom shelf areas of the Gulf of Alaska, and the hard bottom upper slope and shelf habitats of the Aleutian Islands and portions of the Gulf of Alaska. Laboratory studies have been initiated to determine the habitat preferences of ground fish. Our scientists have been developing a model of fishing impacts that considers fishing intensity and habitat recovery rates.

Researchers at the Northwest Fisheries Science Center, the Pacific Marine Environmental Laboratory of the National Oceanic and Atmospheric Administration (NOAA), Washington State University, and the Southwest Fisheries Science Center are characterizing and quantifying relationships between ground fish populations and seafloor morphology/texture and the factors controlling these relationships for a major fishing area, Heceta Bank, a 50 km-long, rocky shoal on the outer shelf of central Oregon.

Researchers from our Southwest Fisheries Science Center, in collaboration with researchers from the University of California Santa Barbara, Moss Landing Marine Laboratory, California Department of Fish and Game, and NOAA's National Undersea Research Program (NURP) are collecting baseline data to determine the effectiveness of the largest and newest Marine Protected Area (MPA) on the West Coast, the Cowcod Conservation area off Southern California. These researchers, also working in the Big Creek Ecological Reserve off central California, are evaluating the capabilities and effectiveness of laser line scan technology, an electro-optic imaging technique, as a more efficient way to map and show the relationships between organisms and their seabed habitats over relatively large areas (approximately 10m × 4km/hr) at very high spatial resolutions (i.e., mm to cm).

Researchers at our Honolulu Laboratory along with NURP scientists are describing the dependence of fish communities on corals, both precious corals (>350 m deep) and black coral (70–150 m deep) as well as the growth rates of these corals for estimating recovery times from fishing gear related injuries. These researchers also are documenting previously undescribed fish and habitat assemblages on the moderately deep (30–40 m) summits of the Northwest Hawaiian Islands, where the majority of Hawaii's commercial fishing occurs (Parrish and Boland, in review).

NOAA's National Ocean Service is mapping corals in the Northwest Hawaiian Islands as well as in the Florida Keys and around Puerto Rico and the U.S. Virgin Islands. They are conducting ecological studies on the relationships between species and seabed habitats, and together with the U.S. Geological Survey, they are mapping resources within NOAA's Marine Sanctuaries. They also are mapping the seabed with multibeam and side-scan systems, particularly in the shallower areas closer to shore, in connection with safe navigation and nautical charting.

Researchers at the Southeast Fisheries Science Center (SEFSC) are studying the effects of various intensities of shrimp trawling on benthic communities, and recovery of these communities during a seven-month closure each year (December 1–July 1) in an area off the south Texas coast. The information will be applied to management of the shrimp

fishery and potential use of marine reserves. Together with scientists from the U.S. Geological Survey and Florida State University, researchers from the SEFSC also are characterizing and mapping seabed habitat and assessing fishing effects in two protected areas, the coralline Oculina Banks Habitat Area of Particular Concern (HAPC), off Florida's Atlantic coast, and Madison-Swanson and Steamboat Lumps Marine Protected Areas, along the shelf-slope break off Florida's Gulf coast where gag grouper spawn. Of particular interest is the testing of a variety of restoration methods to restore coral at the Oculina Banks HAPC. Finally, in concert with commercial fishers, they are studying the effects of traps on benthic habitat in open fishing areas and adjoining marine reserves of the Florida Keys, Puerto Rico, and U.S. Virgin Islands. The National Ocean Service has a related study in the Florida Keys National Marine Sanctuary looking at the effects of spiny lobster traps on seagrass beds.

Scientists at the Northeast Fisheries Science Center in concert with the U.S. Geological Survey, are characterizing and mapping benthic habitat over portions of Georges Bank. They also are investigating the effects of bottom trawling and the associated recovery rates of scallop yellowtail flounder, cod and haddock habitats on Georges Bank. Similar investigations are underway on tilefish habitat off New Jersey. The tilefish burrows are threatened by bottom trawling. Further, a larger Canadian – U.S. mapping project for the Gulf of Maine is now being planned. The Gulf of Maine Council on the Marine Environment (GOMC), with sponsorship from NOAA, hosted the Gulf of Maine Marine Habitat Characterization and Mapping Workshop in Sebasco Harbor, Maine on October 21–23, 2001. The goal of the workshop was to develop a five-year regional strategy to map and characterize marine habitats in the Gulf of Maine. The overarching recommendation from the workshop was to map the entirety of the Gulf of Maine Basin utilizing consistent technology and mapping strategies. The Gulf of Maine Council for the Marine Environment endorsed the Gulf of Maine Ocean Mapping Initiative (GOMMI) at their December 2001 meeting and agreed to serve as the umbrella organization for this effort. A strategic plan for GOMMI has been written and is now being revised for distribution and comment in the spring of 2003.

ANNEX 6: NATIONAL STATUS REPORT, NORWAY

John Alvsvåg, IMR

Only a few institutions reported back to IMR about projects dealing with habitat mapping. The results are listed in Annex 4.

In Norway there is still a proposal to the government for a large project on the development of a Marine Area database (MAREANO) covering information on geology, sediments, bathymetry, pollution and biology. The area of interest is shown in Figure A6.1.

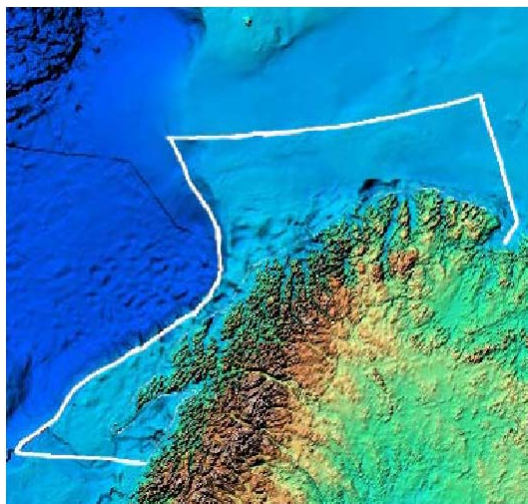
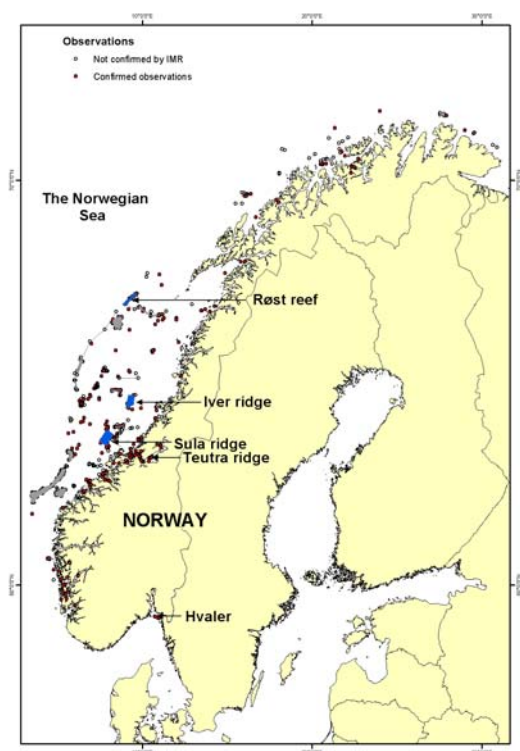


Figure A6.1. The area of the MAREANO project.

Through collection of information from fishermen and oil companies IMR has made an updated map of the distribution of cold-water coral reefs (*Lophelia pertusa*) (Figure A6.2). All these areas with coral reefs have a general protection through fishing regulations which ban any fishing activity which can destroy the reefs.

Figure A6.2. Norwegian coral reef.



Last year IMR discovered a “new” coral reef ten times bigger than the Sula ridge. The extent of the reef was mapped by analysing the acoustic signals, and verified by UW-camera. On 4 January 2003 the Norwegian Minister of Fisheries gave the coral reef special protection against bottom trawling. The location of the reef is shown in Figure A6.3. At the moment there are four areas which have this protection, and a fifth area, also discovered last year, Hvaler, is under consideration.

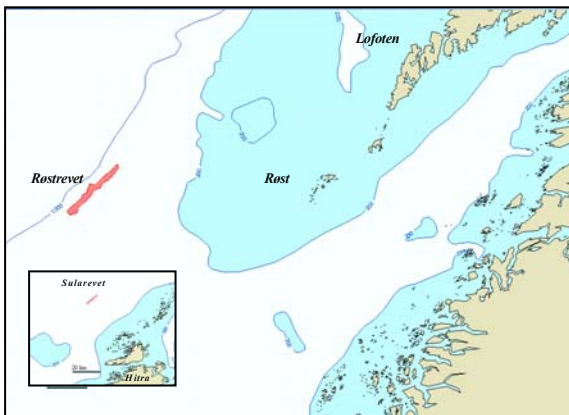


Figure A6.3. The Røst reef.

Norway has also developed a list of areas suggested as Marine protected areas. A total of 36 areas are within the list. These areas are shown in Figure A6.4.

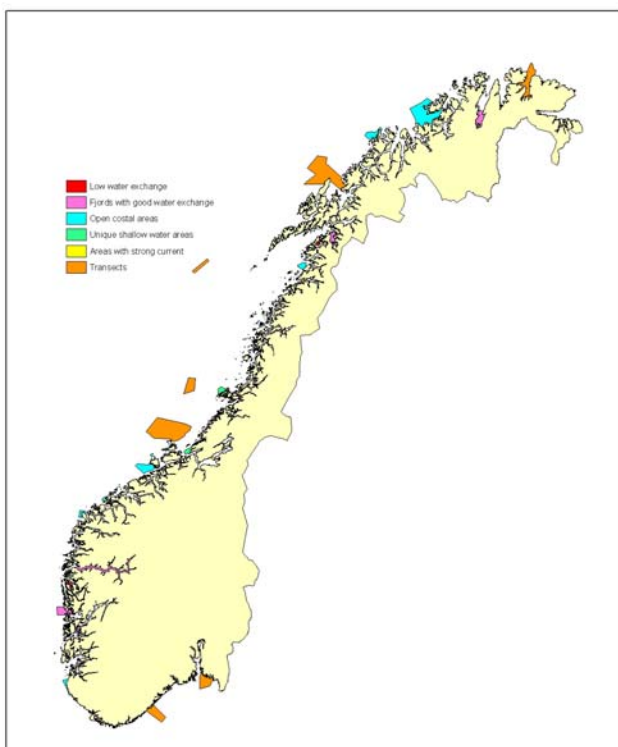


Figure A6.4. Suggested Marine Protected Areas.

In Norway there are a lot of fishing boats which over the last 10–15 years have saved information on geographical position and depth on their navigation systems. IMR have, through an agreement with a company, access to this database. The database will cover an area from The North Sea in south to the fishing grounds north of Spitsbergen. The data do not stand up to navigation quality, but will indeed be useful in the view of habitat mapping. The data are

planned to be ready in 2003. Through a literature study (internationally published and other literature) IMR has made a literature database with 230 records where geographical location, depth and dominating species are recorded.

ANNEX 7: RECENT RESULTS CONCERNING HABITAT CLASSIFICATION AND MAPPING IN THE NETHERLANDS BY THE NATIONAL INSTITUTE FOR COASTAL AND MARINE MANAGEMENT IN 2002

Dick J de Jong, (P.O.Box 8039, 4330 EA Middelburg, The Netherlands. d.j.djong@rikz.rws.minvenw.nl)

Benthic habitat classification

An overall habitat classification system for the Dutch marine and estuarine waters was finished last year, the Dutch Marine Habitat Classification System. It has been described in a draft report. However, due to severe financial problems in the institute no funds are available at this moment to finish and print it and to translate it. It fits in the EUNIS-classification, except that in the coastal waters it uses hydrodynamics instead of soil composition as a parameter for morpho-dynamics. This was done as one of the purposes of the classification is predicting future situations as well as making hindcasts (for determination of reference situations in the past). These have to be done with the help of model calculations and up to now it has been impossible to make adequate soil maps, whereas hydrodynamics are more predictable. Moreover, in the Dutch situation soil composition is often not a good reflection of the hydrodynamic situation due to either very low suspended sediment concentrations or specific local conditions (that may lead to mudflats with a high mud content combined with maximum current velocities up to 1 m/s and more). With regard to salinity both the average salinity (boundaries according to the Venice system) and the annual fluctuations (leading to either stable salinity or fluctuating salinity; fluctuating is defined as a range larger than twice the standard deviation, based on one year of data) are used.

Pelagic habitat classification for the Dutch marine waters

In ICES WGMHM the possibilities for pelagic habitat classifications are discussed, and attempts are made to determine the main parameters to be used to distinguish them. A classification on a high level was proposed, which is not yet useful for actual use.

Last year a first attempt was made to make a concrete pelagic habitat classification for the Dutch marine and estuarine waters. A first proposal was made for the Westerschelde estuary, keeping in mind that it had to be useful for other areas as well. The basic idea for the classification is, as it is also for the benthic habitat classification, the possibility to use it in policy making, e.g., the Water Framework Directive and Environmental Impact Assessments, as well as in predicting future situations after major human activities. Therefore, the parameters to be included should be determining for ecological processes and communities, as well as important and potentially influenced by the works to be carried out or controllable by man.

The major parameters so far used in the classification proposal are salinity (average salinity according to the Venice system, as well as range in fluctuation), residence time (3 classes according to the ICES proposals), turbidity (mixing) and primary production (level and major limiting factor). Primary production is added as this is an important driving force for the aquatic systems, and the level is determining for the level at which the system as a whole may act. Moreover, it is highly affected by human activities. Turbidity is considered important as it may determine the possibilities for e.g., spawning and juvenile growth of fish and shrimp; it is still quite open for further discussion.

At this moment it is only a tentative classification for discussion purposes, to get a more concrete insight in the importance of parameters and to test possible classification boundaries for their ecological relevance and their usefulness for practical use.

Later this year I hope a clearer concept will be obtained on the possibilities of a pelagic habitat classification.

Habitat mapping Southern North Sea

Unfortunately no further progress was made with concern to habitat mapping of the Southern North Sea.

ANNEX 8: CLASSIFICATION OF BALTIC HABITATS

Dr. Heye Rumohr, IfM, Kiel, GER

Introduction

Many attempts have been made to classify the Baltic Sea into different sections, habitats, biogeographic regions and other units.

Purely physical-based classification schemes such as the one by Dietrich (1949) using currents, depths and oceanic provinces will not be followed in this paper. However, the paper by Herrman Wattenberg (1949), published post mortem, on the “Draft of a Natural Division of the Baltic” is still the basis for all geographical terminology within the Baltic area. It follows the basins and natural borders caused by the sills bearing in mind, of course, the hydrographical margins and provinces. It is still in use, even if some detailed regional corrections have been made.



Figure A8.1. Classification of the Baltic Sea into regions after Wattenberg (1949).

Wattenberg grouped the Baltic basins from North to West into the:

- Bothnian Bay
- Bothnian Sea
- Åland Sea and the Skerry Sea (Schärenmeer)
- Gulf of Finland
- Gulf of Riga
- Western and Eastern Gotland Sea (incl. Gdansk Deep)
- Bornholm Sea
- Arkona Sea
- Belt Sea (incl. Mecklenburg and Kiel Bay)
- Kattegat

Later the central parts were grouped into the “Baltic Proper” and the Belt Sea into the “Transition area”. It is obvious that these classifications follow those elements considered most important by the researchers in question. Jürgen Lenz (1977) classified the whole Baltic as a tide-free estuarine system with its characteristic salinity gradient from NE to SW. This is characterized by oblique isopycnics with freshwater on top and more saline water below. However, for faunistic characterisations the master-factor is salinity in combination with oxygen, which generally dictates the presence and types of life in the deeper parts of the Baltic.

Salinity

Salinity was the central factor in the attempt by Remane and Schlieper (1958) to set up a new field of Brackish Water Ecology, although they knew that brackish water is a vague term since it starts where marine species show first physiological reactions to the dilution of their external medium and ends where metabolic reactions of freshwater species can be shown in response to the increase of salinity of their external medium. Based on the Redeke-Vaelikangas System (Figure A8.2) that was especially designed for northern Europe, scientists agreed in 1958 on the so-called **Venetian System of Salinity** which divides the salinity spectrum into several zones and avoids the term “brackish water” due to its ambiguity.

Zone	salinity (‰)
Hypersaline	> 40
Euhaline	40–30
Mixohaline	(40) 30–9.5
Mixoeuhaline	> 30 but < adjacent euhaline sea
(Mixo-)polyhaline	30–18
(Mixo-)mesohaline	18–5
(Mixo-)oligohaline	5–0.5
Limnetic	< 0.5

Regarding the dynamic nature of the system Remane and Schlieper stated: “ In view of the transitional character of the floral and faunal boundaries between zones with saline areas in nature, as well as their regional and local variation, any salinity classification can correspond approximately with the zonation of the flora and fauna. It should also be remembered that reference given even to the best possible system will never give more than the average salinity conditions in a given water...” In those days this system did not cover inland saline waters.

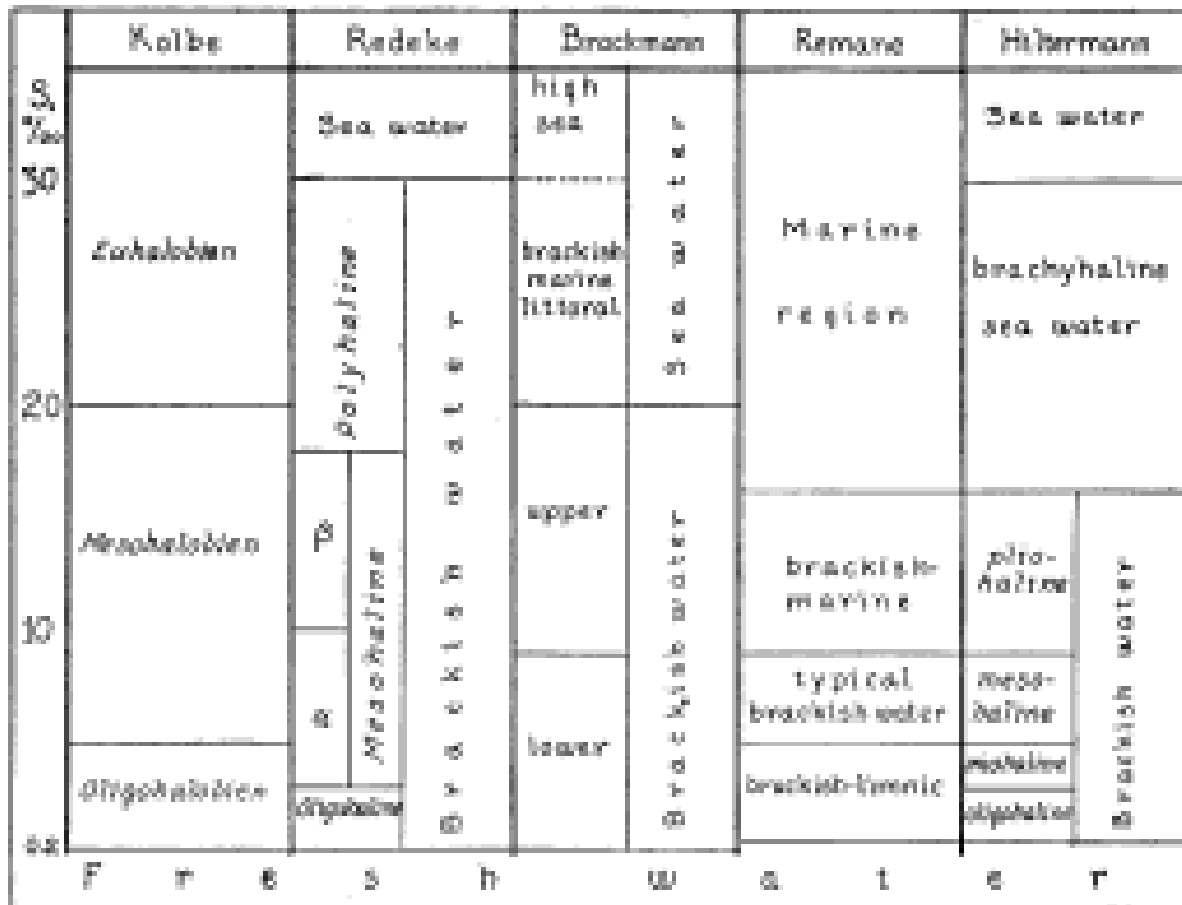


Figure A8.2. Salinity classification after Redeke-Vaelikangas and others in Hedgpeth (1957).

Oxygen

Apart from salinity oxygen is the most important parameter for the distribution of animal life in the Baltic. So too the frequency of hypoxia or even anoxia is an important classification item. It has been published by Finnish authors over many years with stamp-like icons that covered the deeper parts of the Baltic proper, incl. the southern Baltic. These areas with oxygen concentrations in the bottom water under 2 ml/l are assumed to be devoid of macroscopic life. The sediments may remain azoic and anoxic when the near-bottom water becomes oxygenated again. The bottom is, in this case, very often covered with mats of Sulfurbacteria (*Beggiatoa* sp.) which can be monitored with video profiles. Rumohr (1993) tried to combine macrofauna data with sediment-profile photographs (SPI) and results from routine video investigations in a 5-step benthic deterioration model for the southern Baltic. Together with Bonsdorff and T. Pearson (Rumohr *et al.* 1996) this model was refined and its applicability discussed for the whole Baltic. It showed also that the diversity of functional groups was reduced in the W-E gradient.

Macrofauna

Species occurrence mirrors the dramatic salinity gradient from marine to limnetic conditions. Remane condensed this transition from a marine fauna to an increasingly limnetic fauna in his famous diagram (Figure A8.3). Limnetic species are almost gone with 5 ‰ whereas euryhaline species start at zero and increase over the full salinity range. The number of genuine brackish-water species remains, however, small.

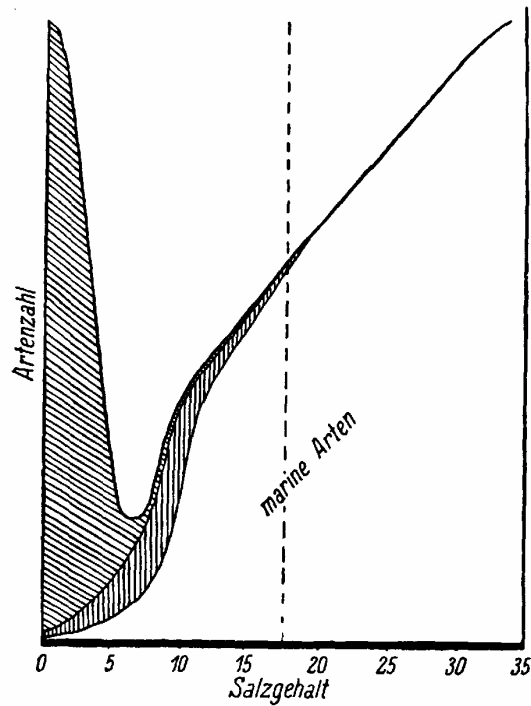


Figure A8.3. Species number in relation to the salinity of the water. White: marine species; vertical shading: genuine brackish water species; oblique shading freshwater species.

A general problem of the Baltic is that most habitats and communities are always in a state of succession after a disturbance and the whole system is in the state of a contemporaneous disequilibrium/flux.

Any attempt at a more rigid classification (e.g., Benthos communities: C.G.J. Petersen, Hagmeier, Demel and Mulicki) is falsified by the natural dynamics and variability of the Baltic System. Gislén criticized the Petersen System as early as in 1936 and preferred a continuum system following the environmental gradients.

The map of benthic communities in Zenkevitch (1963) is still the only benthos map of the whole Baltic Sea (Figure A8.4). It is no longer true but facing the lack of more recent maps it is still much in use. Not only species names but also distribution and diversity of feeding types and other functional groups are important and needed for classification purposes in the Baltic Sea (Bonsdorff and Pearson, 1999, Pearson, 2001).

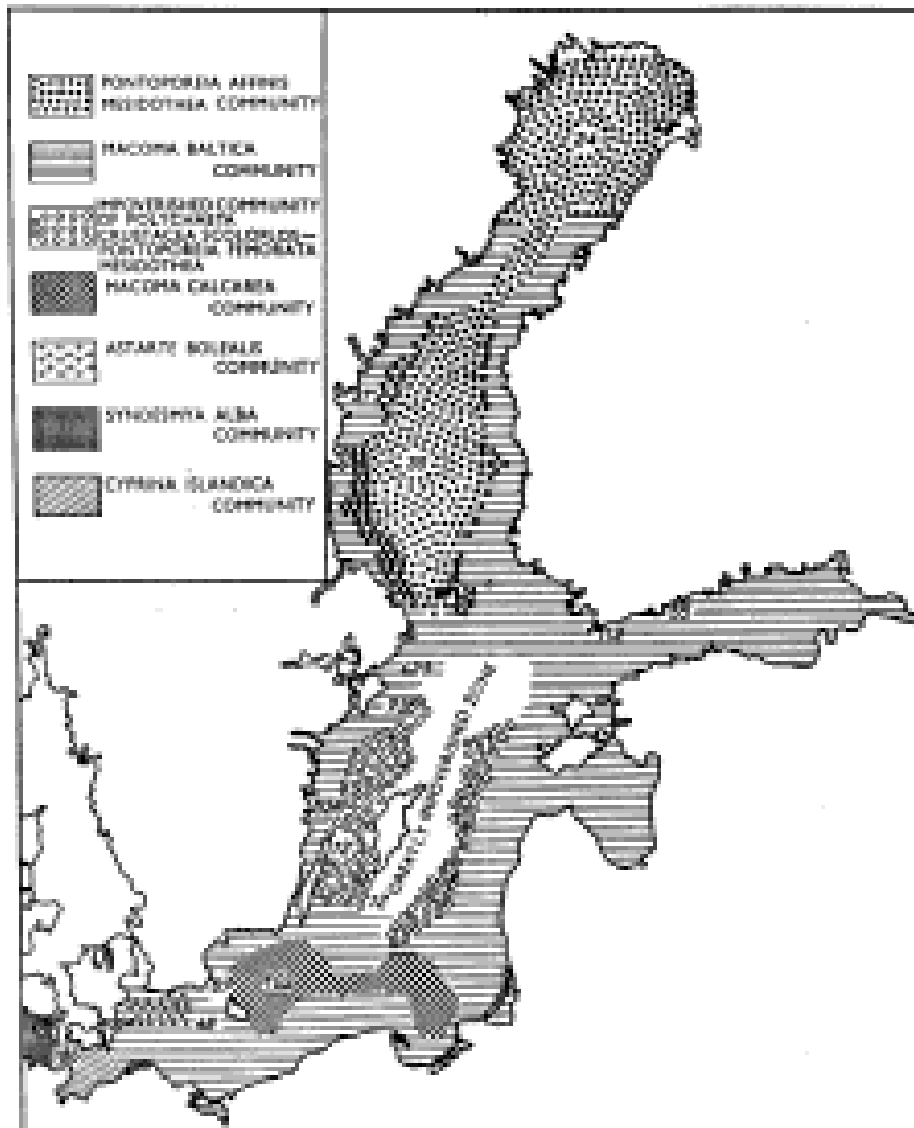


Figure A8.4. Classification of Baltic sea floor according to benthic communities (Zenkevitch, 1963).

Another applied approach is the classification of the Baltic coast line according to its sensitivity towards oil pollution and other disturbances. This classification is a future tool which will help combat oil and pollution. Data concerning macrobenthos and macrophytobenthos are registered on a rather fine scale covering also waterfowl, sea mammals and also spawning grounds of fishes. This classification follows the approach of Gundlach and Hayes (1978). This approach needs, nevertheless, to be adapted to the Baltic Sea following the HELCOM (1998) “Red List of Marine and Coastal Biotopes and Biotope Complexes of the Baltic Sea, Belt Sea and Kattegat”, Baltic Sea Environment Proceedings, No. 75, pp. 1–115.

Ice

Especially in the Northern parts of the Baltic Sea, ice is a structuring force for the littoral fauna and flora and is of highest importance for any classification schemes. Duration of ice cover, frequency of ice disturbances and other ice-related criteria must be taken into account when classifying local, coastal habitats according to the presence of sea ice. Also long-term dynamics of ice appearance and its climatic forcing functions can influence habitat classifications.

Sediments

Baltic sediments show the lowest dynamics compared with other parameters and should be the most conservative classification factor in the Baltic Sea which is nevertheless a very young and still changing and developing system still recovering from the “glacial trauma” (*sensu* Bonsdorff).

Consequences for a Baltic Habitat Classification

The Baltic Sea forms an environmental gradient with changing borders. The Baltic system is dynamic and so are borders at the sea floor. Most habitats and communities especially below the pycnocline are in a permanent state of succession after disturbance and the whole system is in the state of contemporaneous disequilibrium. As a consequence any attempt at a more rigid classification (e.g., Benthos communities) was falsified by the natural dynamics and variability of the Baltic System. We need updated species distribution maps on annual/decadal scale including the new species, the invading species or the “criminal species” as Ramon Margalef recently called them.

Distribution and diversity of feeding types and other functional groups are important and needed (Bonsdorff and Pearson, 1999, Pearson, 2001). Finally, sediments are the most conservative classification factor in the Baltic Sea.

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ANNEX 9: OSPAR BIODIVERSITY COMMITTEE PAPER ON HABITAT MAPPING PROPOSALS

Marine habitat mapping proposals for the North Sea and the OSPAR area

Presented by the United Kingdom

This paper presents proposals, as requested by BDC, on how to proceed with habitat mapping activities.

Background

1. At the OSPAR Biodiversity Committee meeting in 2001 (BDC 2001) progress on marine habitat mapping was addressed. The need for such mapping was recognized by such developments as the work on threatened and declining habitats, the development of EcoQOs and the JAMP. To make further progress in this area, the UK, as lead country on this issue, proposed to host a workshop to assess the feasibility of preparing a GIS-based habitat map for the North Sea and for the whole OSPAR area, and to prepare proposals on how these might be achieved. The issues to be considered would include:

- a. the spatial scales at which the information needs to be assessed and presented, including the need for different scales for different areas and purposes;
- b. the timeframe for development and delivery, including the feasibility of early completion of maps of lower resolution to demonstrate what was feasible and to meet priority needs;
- c. the availability of suitable data relating to bathymetry, seabed geology/morphology, acoustic survey data and benthic infaunal and epibiota sample data.

2. BDC welcomed the proposed workshop to be hosted by the UK, and commended the idea of a two-track approach, initially focussing on the North Sea but also considering the application to the wider OSPAR area of the principles developed.

3. This paper presents proposals, as requested by BDC, on how to proceed with habitat mapping activities.

Mapping workshop at Stansted, 28–30 October 2002

4. The UK hosted a workshop at Stansted, London from 28–30 October 2002 to help develop the habitat mapping proposals requested by BDC. It was attended by 40 delegates representing most coastal Contracting Parties to OSPAR and had the following objectives:

- To assess the feasibility of preparing a multi-layered habitat map for the North Sea, in a GIS (Geographical Information System), that will meet the priority needs of management, biodiversity protection and scientific research. This should include data layers for aspects such as bathymetry, seabed geology, benthic communities and interpreted habitat maps; summary information from such a system should be publicly available via the Internet.
- To assess the feasibility of preparing a GIS-based habitat map for the OSPAR area and to prepare proposals on how it might be achieved.

5. The workshop came to the following key conclusions:

- a. considerable volume of suitable high quality data already exist that could be used to prepare habitat maps for significant parts of the OSPAR area, particularly near shore and shelf areas.
- b. there are substantial reasons to start preparing habitat maps for national purposes as well as recent calls by OSPAR, the North Sea Conference, the EEA and the EC to compile these at international level. Such maps would contribute significantly to spatial and strategic planning requirements, as well as habitat protection and implementation of an ecosystem-based approach to management.
- c. the data required for habitat mapping are currently held in a variety of institutes and in various formats. There is an urgent need to mobilize these data and to establish standards and guidelines for their consistent interpretation and presentation.

- d. preparation of habitat maps for the North Sea and the wider OSPAR area is a potentially large task requiring significant resource input and co-ordination, but could be achieved in a step-wise approach. The issue of resourcing is crucial to the success of this area of OSPAR work and needs to be actively addressed.

6. Proposals on how to prepare habitat maps, both to meet short-term needs and to work towards longer-term goals were formulated during the workshop. These are described in more detail in **Annex 1** of the attached report of the Habitat Mapping Workshop.

Action requested

7. BDC is invited to:
 - a. identify a coordinator(s) to take forward the recommendations identified in section 8 of the report of the Habitat Mapping Workshop;
 - b. consider how best to pursue the recommendations taking into account the potential resource implications for Contracting Parties.

Report of Habitat Mapping Workshop, Stansted, UK, 28-30 October 2002

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Annex 1

Marine habitat mapping proposals for the North Sea and the OSPAR area

Background

The OSPAR Biodiversity Committee (BDC), as part of its work to implement Annex V of the Convention and the Biodiversity Strategy, has identified a need to prepare maps of seabed habitats. This is to meet both specific and immediate needs in relation to the protection of threatened habitats, the development of EcoQOs (Ecological Quality Objectives) and longer-term goals regarding quality status assessments and implementation of an ecosystem-based approach to management of the marine environment. Such habitat mapping is a natural progression of the ongoing work of the Committee to develop a habitat classification system for the OSPAR area, in conjunction with the European Environment Agency (EEA) and ICES.

The 5th North Sea Ministerial Declaration¹ in March 2002 also recognized the importance of a marine habitat classification for the assessment of the conservation status of marine habitats, and specifically encouraged OSPAR and the EEA to start marine habitat mapping of the North Sea by 2003.

In 2000 the Biodiversity Committee² agreed the following overall objectives:

- **Habitat classification:** to develop a classification system for all marine habitats within the OSPAR area, which meets the requirements of OSPAR for habitat protection, mapping and assessment, and which is fully compatible with the EEA's EUNIS classification;
- **Habitat mapping:** to prepare maps of the OSPAR maritime area, showing the spatial distribution and extent of habitats according to a consistent classification system, to meet the needs of OSPAR in the assessment and protection of marine habitats.

In October 2002 OSPAR³ further defined its requirement for habitat classification and mapping as follows:

BT-2 Operational EUNIS classification at the level required for mapping;

Purpose: This classification will be the basis of the GIS-based habitat maps under BM-1

Content: The classification will contain the means whereby the different areas of the OSPAR maritime areas can be allocated to different marine habitat types for the purposes of mapping.

Method: The lead country (UK) will prepare proposals on the basis of a workshop.

BM-1 GIS-based habitat maps for the OSPAR maritime area; these could be improved in further information collection, which could start with a one-off survey;

Purpose: To provide a means of summarising information about species, habitats and human activities in a given area.

Content: The maps will incorporate the available GIS-based information, and will be periodically up-dated as further information becomes available.

Method: The lead country (UK) will make available the framework into which Contracting Parties will enter their GIS-based data. Maps for key habitats will be completed by 2005.

¹ Ministerial Declaration of the fifth international conference on the protection of the North Sea. Bergen, Norway. 20–21 March 2002.

² BDC 00/15/1, Annex 7

³ BASH 02/6/1, Annex 6

The UK, as the lead country for the tasks of habitat classification and mapping, was requested by the Biodiversity Committee in November 2001 to present proposals to its next meeting on how habitat maps for both the North Sea and the wider OSPAR area might be achieved. This paper is presented in fulfillment of that request.

Key objectives of the habitat mapping workshop

To begin to address these issues the UK hosted a workshop at Stansted from 28–30 October 2002 to help develop the habitat mapping proposals requested by BDC. It was attended by 40 delegates representing most coastal Contracting Parties to OSPAR (see Annex 2 for a list of delegates and Annex 3 for the workshop programme). The workshop had the following objectives:

- To assess the feasibility of preparing a multi-layered habitat map for the North Sea, in a GIS (Geographical Information System), that will meet the priority needs of management, biodiversity protection and scientific research. This should include data layers for aspects such as bathymetry, seabed geology, benthic communities and interpreted habitat maps; summary information from such a system should be publicly available via the Internet.
- To assess the feasibility of preparing a GIS-based habitat map for the OSPAR area and to prepare proposals on how it might be achieved.

As the purpose of the workshop was to prepare proposals for habitat mapping, the discussions and conclusions of the workshop are reflected in this paper rather than through a separate report of the workshop.

Importance of seabed habitats to OSPAR

Seabed habitats and the communities of species⁴ that occupy them are a key feature of the marine ecosystem and consequently must play a major role in the ecosystem-based approach to management of the marine environment to which OSPAR and the North Sea Ministerial Conference are committed. However, in spite of the importance of habitats to OSPAR's work, the level of understanding of habitats across the north-east Atlantic is still very poor, and there are no European-level integrated marine habitat reporting or monitoring mechanisms. This discrepancy was reflected by the relatively little attention given in the last OSPAR Quality Status Report (QSR) to habitats compared to issues relating to contaminants, eutrophication, fisheries and human activities.

Holistic descriptions of seabed habitats are needed to improve the management and spatial and strategic planning of the North Sea and the wider OSPAR area. A greater understanding of the distribution, extent and status or quality of habitats will facilitate the protection of threatened and rare habitats and the wiser use of habitats where there are competing demands (e.g., fishing, sand and gravel extraction, wind energy generation).

In particular, OSPAR has recognized the importance of habitats in a number of ways:

- Habitats are one of the 10 issues for which EcoQOs are to be developed.
- BDC is identifying priority habitats in need of protection where they are declining or threatened.
- The development of proposals by BDC on the management of human activities using marine protected areas (MPA) requires detailed knowledge of habitat extent and sensitivity.

Descriptions of seabed habitats are also needed by OSPAR as a more general contribution to improving our understanding of the North Sea ecosystem and the wider OSPAR area. Seabed habitats are an essential component of the ecosystem and our overall understanding of ecosystem function must relate seabed habitats to hydrography, nutrient cycling, plankton changes and the distribution of wide-ranging species (i.e., fish stocks, cetaceans, birds).

Compared with other elements of the marine environment (e.g., hydrography, nutrients, plankton) our knowledge of the distribution and extent of seabed habitats is of variable quality and detail. As a consequence, we are currently unable to provide holistic maps of seabed habitats, even within the North Sea which is one of the well-studied areas. This is largely due to the lack of consistent interpretation of biological data (according to a common habitat classification

⁴ The term habitat is used throughout to encompass both biotic and abiotic elements (alternatively termed a biotope), in a similar manner to its use in the EC Habitats Directive. A habitat can be defined at various scales (e.g., a rocky shore or as a series of zones and features within a rocky shore); the use of a hierarchical system of classification enables definition and use of habitat information at appropriate scales.

system), to the uncoordinated efforts of multiple habitat-mapping projects and to the lack of focus on this aspect of the ecosystem in management requirements.

To resolve these concerns, the following information is required from habitat maps:

- Presentation of habitat distribution at a scale and level of detail which enables appropriate management action to be taken. Such presentation needs to be flexible to address a variety of biodiversity and management issues.
- Current distribution and extent of specific habitats, such as *Lophelia* coral reef, and others on the draft priority list of threatened habitats which may require urgent management action.
- Changes in habitat distribution and extent during the last century, to provide information on habitat quality status, and rate of change in habitat distribution.
- Extent of any protection already afforded to habitats by existing or proposed Marine Protected Areas (MPAs), and the degree to which this provides sufficient protection.
- The range and intensity of human activities that occur in particular habitats, and the degree to which such habitats are affected by those activities.
- Relative importance of particular habitats (i.e., which habitats are rare or of global importance in the OSPAR area) and the implications of this for prioritising management action.
- Habitat mapping information needs to be used in conjunction with other spatial information in a GIS, particularly activities, management and conservation areas, and other environmental data sets.

Feasibility of habitat mapping within the North Sea and the OSPAR area

4.1 Overview

Habitat mapping programmes have become increasingly common over the past 5-10 years, spurred on by both the improvements in technology and the increasing demand for this type of information (see Annex 4 for a list of relevant studies). Whilst the purpose for doing the mapping varies considerably (e.g., industry, conservation, fisheries, planning), the underlying techniques and type of data collected have a great deal in common. The scale of the programmes also varies considerably, from large scale programmes covering the whole EEZ (Ireland, Belgium) to local studies covering individual protected areas (Special Areas of Conservation - SACs).

Significant volumes of information therefore already exist within each country, and there are an increasing number of new initiatives being started to meet local and national needs. Given the volume of data already available or in the process of being collected, it is clear that the preparation of international habitat maps is now feasible. Its compilation in a consistent format will not only help fulfill OSPAR requirements but add considerable value to existing data to enable management decisions at national and local level to be taken using a much sounder information base. To achieve such OSPAR-level maps a series of technical issues must be resolved.

4.2 Technical issues to be addressed

The following issues need to be addressed before OSPAR can make use of existing data sets at national and international levels.

- Data collation – much of the data is not held centrally in national databases, but often with regional or habitat-related experts.
- Data interpretation – different national mapping programmes tend to interpret data in a specific way to suit the objectives of the project, so the resulting habitat maps are ‘study specific’. This limits the opportunities for compiling maps with broad coverage using separate maps from different studies. One of the most urgent priorities is there to ensure that the necessary data standards and sampling protocols are developed to enable this patchwork of separate activities to be brought together into holistic maps.
- Scales of habitat maps – Ideal habitat maps will fulfill a range of purposes, from providing a broad-scale overview of habitat extent throughout the OSPAR area, to very detailed site specific information for the same habitat to advice on measures such as the location of MPAs. It may be necessary to select and use different scales for coastal and offshore regions. The scale at which data are stored and presented is a key issue.

Thus there is an urgent need to develop standards for data collection, storage, interpretation and dissemination, to improve the compatibility of data sets from different sources and to facilitate the exchange or aggregation of data. The expertise gained during these separate mapping studies must be shared to encourage best practice, and to ensure that resultant maps become far more valuable and can much better contribute to national and international needs. International effort is required to establish these standards and OSPAR has an important role in coordinating such activity.

There are also more specific technical issues related to the production of habitat maps for OSPAR regions. It will be necessary to:

- Assess the availability and utility of existing data relating to bathymetry, seabed geology/morphology, acoustic survey data, benthic infaunal and epibiota sample data and image data, before recommending a strategy for the production of North Sea maps, and for undertaking possible new surveys to fill in the gaps between existing but non-adjacent maps.
- Identify how best to prepare habitat maps that fulfill their original purpose and which also test and apply the EEA's EUNIS habitat classification and, if necessary, propose amendments to it.

Finally, it will be necessary to establish a timeframe for development and delivery, including the feasibility of delivering maps of lower resolution and for priority habitats rapidly, to demonstrate capability in this area and to meet priority needs whilst working towards more high quality maps in a longer timeframe.

4.3 Information needed to prepare habitat maps

The following are the key data sets needed to compile habitat maps:

- Bathymetry
- Seabed substratum (sedimentology)
- Acoustic data (e.g., from multi beam, AGDS or Side Scan; or remote image data for intertidal areas)
- Benthic infaunal community data (from grabs and cores)
- Benthic epibiota community data (from trawls, dredges, video, divers, shore surveys).

Various combinations of these data sets can be used to derive habitat maps of varying degrees of confidence:

- The highest level of confidence in habitat type is gained from point-source benthic sampling or direct observation, but spatial coverage is typically very limited and other similarly acquired data are needed to develop habitat maps showing spatial extent.
- High quality habitat maps are derived from acoustic data, as this adds the spatial component, which is ground-truthed with benthic sampling. Bathymetric information is usually collected alongside the acoustic data.
- Lower quality maps can be derived from interpolating bathymetric and seabed substratum data (from geological surveys) with benthic sample data.
- The use of geophysical data sets alone can provide high quality seabed topographic maps; broad-scale biological character can sometimes be inferred but confidence as habitat maps is very low.

In all of the above approaches, increased density of sampling improves the accuracy of the final map.

In addition to seabed substratum type and depth, seabed communities are also influenced by a variety of other factors and the availability of data for the following is often helpful in preparing habitat maps:

- Currents
- Wave exposure
- Salinity
- Temperature
- Turbidity

Types of habitat map

Habitat maps can be categorized into two key types, within which can be recognized various degrees of confidence (levels of certainty/uncertainty) in what is mapped:

5.1 Maps of specific habitats

- a. Specific habitat maps can be made for particular habitats (e.g., estuarine intertidal mudflats) and habitat-forming structural species (e.g., *Lophelia* coral reefs) (see Annex 5 for an example map).
- b. These maps depict the distribution of a specific habitat, and can be displayed as single habitat maps or in combination with other habitats.
- c. The level of detail depicted can vary from point distribution (dot maps showing occurrence of habitat at various resolutions) through to spatial extent (vector polygon maps).
- d. The level of certainty can vary from high (based on actual sampling and position fixing), through moderate (presence of habitat inferred from the presence of key structuring species) to low (probability maps based on known physical requirements of a community, e.g., depth, substratum, temperature).
- e. This type of map is relatively easy to compile from existing data, and is particularly appropriate to meet OSPAR needs for the mapping of threatened habitats across the entire OSPAR area.
- f. For certain habitats, there may be sufficient historical and contemporary data to incorporate temporal changes in habitat extent.

5.2 Holistic habitat maps

- a. Holistic habitat maps are maps that define seabed types over 100% of the area mapped (see Annex 6 for an example map).
- b. In addition to showing distribution, this type of map also depicts the extent of habitats and their spatial arrangement.
- c. As such, they are ultimately much more useful, meeting a greater number of end needs, particularly for management purposes.
- d. Production of this type of map is more resource intensive, but recent advances in technology (particularly acoustic seabed mapping and remote imagery techniques) have led to an escalation in mapping programmes of this type.
- e. Although more data intensive, sufficient data exist for significant proportions of inshore and continental shelf areas of many OSPAR countries, making production of holistic maps a feasible option.
- f. As with single habitat-type maps, the quality of such maps can vary from very high (where good acoustic techniques and adequate ground-truthing give high resolution and high confidence) to low (predictive maps coupling limited seabed sampling with physical seabed characteristics and broad-scale thematic maps based on expert opinion).
- g. Whilst the quality of such maps is highly variable, the extent of available coverage is significant. However these data are currently in highly dispersed sources and need to be collated.
- h. Compilation of existing available maps would provide a first step to preparation of OSPAR-wide holistic maps.
- i. A second key stage would be to establish common interpretation of the maps, coupled with identification of gaps and commissioning of new surveys. Any new survey should be prioritized to those areas where further information is most needed, either to fill gaps in data coverage or to where higher quality maps are needed.

Options for development of maps for specific habitats

6.1 Overview of programme

It is proposed that maps for the priority habitats at the OSPAR-wide scale should be developed to provide simple dot-distribution maps which can be readily compiled from existing data with modest resources and within a short time-frame. Working at this resolution with a few specified habitats appears to be the most realistic way of starting to

develop maps covering the entire OSPAR area. Such maps would be prepared to a scale and format that would have direct relevance to BDC's short-term needs in relation to its priority habitat work.

The data should be drawn from existing national databases, but if possible supplemented with more dispersed data sources (e.g., literature) to provide comprehensive habitat distribution maps and a historical perspective.

6.2 Specification for mapping programme

The following table gives an outline of how mapping of specific habitats, covering the entire OSPAR area, should be approached, giving additional options on what could be undertaken, if additional detail is deemed necessary and resources are made available:

	Proposed (minimum) scope	Additional options
Geographical area to be covered	Whole OSPAR area	
Habitats to be mapped	<p>The proposed OSPAR priority habitat list:</p> <ul style="list-style-type: none"> • Carbonate mounds • Deep sea sponge aggregations • Estuarine intertidal mudflats • Littoral chalk communities • <i>Lophelia pertusa</i> reefs • Oceanic ridges with hydrothermal effects • <i>Ostrea edulis</i> beds • Seamounts • Sublittoral mud with seapens & burrowing megafauna • <i>Zostera beds</i> <p>Guidance on definitions of these habitats will need to be provided (from EUNIS) to ensure consistent interpretation of data.</p>	<p>Add further specified habitats, e.g., others proposed by Contracting Parties (CPs) but not on final Leiden list.</p> <p>Add EUNIS level 3 habitats (e.g., sublittoral mud, littoral sheltered rock). These very coarse-level habitats could be readily mapped at 50km grid square level from available charts/geological maps.</p>
Data collection – resolution/accuracy	The UTM 50 x 50 km grid should be the minimum resolution adopted. This is the EEA's standard European grid for biological data. Collection of data at this scale could be achieved with minimal effort (often just by expert judgment and without accessing specific data).	Many data will be derived from actual samples of the habitat and thus be fully geo-referenced (usually to 100 m accuracy or greater). This resolution will be of much greater value, particularly for inshore habitats, and should be used whenever possible.
Habitat extent & confidence	Point sample data (i.e., single geo-reference in Lat./Long., habitat present but extent unknown). Allow absence data to be collected.	Some data will be available with extent data (polygons in GIS or area km ²) or as predictive maps. It may be possible to develop Bayesian models to predict habitat distribution from physical data where there are insufficient samples.
Time frame for data	Access recent data only (i.e., post 1980), providing date of collection, to show current distribution (the majority of habitat data are from one-off surveys, so even 1980 constitutes 'recent'; some judgment on the resultant maps will be needed in the light of recent pressures that may have altered the habitat distribution). It is anticipated that the easiest access to data will be via major national databases. These may hold more historic data sets and miss more dispersed records from recent surveys.	<p>Ideally a complete historic record should be collated, enabling changes with time to be assessed. However this needs to be balanced against the ease of access to data. Data will be available in:</p> <ul style="list-style-type: none"> • National & local databases • Scientific literature • Grey literature (especially consultants reports) • Experts <p>CPs would need to decide how thorough they</p>

		can be in accessing these sources.
Associated data	Minimum required: date, geo-reference, depth, source plus associated quality/accuracy tags (see Section 6.4). Strictly for the preparation of a map of this type, only limited information is required and the simpler the process, the greater the chances of success. Provided the source of the data is supplied, access to that source can be gained later if necessary.	Additional data fields could be added (related to issues about habitat quality, threats, protection or management measures). However this increases the burden on the data suppliers and may severely compromise the chances of success of this programme.
Data supply format	Simple Access database supplied to CPs to enter data or CPs supply agreed data fields in spreadsheet format from their own databases.	Develop Web-based data entry system to facilitate direct entry from a variety of sources within each CP (avoids collation & co-ordination issues within each CP).
Quality assurance	Habitat definitions, data fields and associated quality tagging to be agreed with CPs prior to data collection phase. Standardised data fields (with error checking) to help minimize data problems. CPs to be responsible for QA prior to submission and to maintain their own national data sets.	
Data collation	Data to be collated at national level and supplied to agreed timetable to coordinator for OSPAR-level collation.	Automated collation from web-based data entry. Data could be added from multiple sources (with minimal national co-ordination).
Data dissemination	Maps of each habitat to be prepared at 50km grid cell scale and supplied in report to BDC by 2005. GIS project showing all data to be made available to CPs. Maps showing 50km, 10km or point sample location of habitats (singly or in combination), depending on scale of map required or detail of available information..	Web-based simple GIS mapping tool providing zoom facility (OSPAR scale down to local) and options for display of single or multiple habitats. Full access to all data.
Reporting	Final distribution maps should be reported to BDC by 2005. These should be accompanied by an assessment of the confidence in the data available and any recommendations for further work.	These reports should be made available via the web site. The reports should be periodically updated, in the light of new information and monitoring processes.

6.3 Proposed programme timetable

A proposed project outline has been drawn up, providing a staged approach to delivery of completed maps for priority habitats by the 2005 deadline. The task descriptions may need to be adjusted to reflect any modification to the specification (e.g., type of data or data transfer mechanism).

Mile-stone	Task description	Responsibility	Timescale
1	Data fields and guidance notes on how to collate and input data agreed	Coordinator & BDC representatives	April 2003
2	Liaise with national experts & institutes to develop network of data compilers	BDC representatives	April 2003
3	Develop data capture software	Coordinator	June 2003
4	Send out data request in a predetermined format with mandatory and additional fields to national experts/institutes	Coordinator via BDC representatives	June 2003
5	Data to be collated from relevant existing databases, data from contemporary (mandatory) and historical (optional) surveys and other additional sources (e.g., literature).	National experts & institutes	April 2004
6	Collate national data sets and supply to coordinator	BDC representatives	May 2004
7	Prepare OSPAR maps of threatened/listed habitats, indicating whether records are recent or historical, and assess overall quality/gaps in data coverage	Coordinator	August 2004
8	Comments on distribution maps and the interpretation of quality/coverage	National experts & institutions	September 2004
9	Draft report completed and circulated to CPs for comment	Coordinator	October 2004
10	Final report submitted to BDC. Final project to include initial point-source distribution charts, polygons (data permitting), written interpretation, data requirements and recommendations for future work	Coordinator	January 2005

6.4 Data fields to be collated

The following proposed fields are considered the minimum necessary to develop habitat maps and provide essential information to determine its quality or source back to its origin if required. Data entry would be streamlined by providing easy to select choices (term lists) whenever possible. Data transfer from existing databases should be encouraged to avoid data entry effort.

- Habitat type (with EUNIS code) (state sample technique used)
- Position (lat/long) (with level of accuracy, e.g., to nearest 100m or 10 km)
- Date (accuracy e.g., specific day, a year, or for historical data, a decade)
- Depth (accuracy, e.g., a specific depth or a depth band)
- Data source (literature reference, unpublished data, database, research vessel/cruise number/cruise station etc.)
- Data input by (person, organization, date)

Further data fields relating to habitat extent, character (species present and their abundance), quality, and management activities could be considered, but as noted above may significantly increase the resource requirements.

Options for preparation of holistic habitat maps

7.1 Overview

Preparation of holistic habitat maps at an international level will require much greater effort compared to that for single habitat maps, as the amount of data required, and the issues about data integration and presentation are considerably more complex. As discussed above, the major task to be achieved is integration of data sets, at least at the final interpretation stage, so that habitat maps from different sources (institutes within different CPs) can be drawn together to present international-level habitat maps.

Because of the overall scale and technical issues that need to be resolved, it will be necessary to follow a staged approach that will bring early results whilst working towards improving the overall quality through more integrated data interpretation and, in the longer term, filling geographical gaps in coverage.

This programme is presented in distinct phases, but careful management could see quality/detailed habitat maps being made available early in the programme and improvements in quality and coverage being achieved at differing rates according to resource availability. With resources for and benefits of mapping likely to be focused at national level, OSPAR should

- encourage the data collation at national level that is needed to provide international-level information
- establish the data standards that will allow inter-operability of the data as it becomes available
- define its requirements for these data to be interpreted/presented to meet OSPAR needs.
- establish a framework in which these data can be collated and aggregated to provide data sets and habitat maps that are easily accessible, preferably by the internet.

Successful implementation of this programme will depend on the level of commitment and resources offered by Contracting Parties. Whilst much can be achieved with existing data, mobilization and standardization of these data will require concerted effort, but also yield significant benefits. Resourcing is critical to the success of this programme and could be achieved through the following:

- Commitment by Contracting Parties to deliver this programme by directing its relevant agencies and institutes to undertake the work as part of their Government-funded programmes.
- Direction of OSPAR funds to support key elements of the programme.
- Seeking EC funding, e.g., from FP6, to build a multi-institute dedicated programme that will provide specific resources to tackle the key technical issues and deliver. Consider supporting the Norwegian-led FP6 'Habitope' proposal. There is a need to influence the EC funding mechanisms to direct resources towards habitat mapping initiatives.

7.2 Phases in proposed programme

The following phases are therefore envisaged:

Phase 1. Collate existing interpreted maps and compile in a GIS. This can be achieved both quickly and with limited resources and will bring existing habitat information held in disparate places together into one application. The GIS product will show maps of different scales, different resolutions and different habitat classifications, drawing information from a variety of techniques. The data compatibility issues identified by this collation process will be resolved in Phase 3, leading to a step-wise improvement in quality. This phase could be achieved in 12-18 months through the supply of existing habitat maps (in digital or paper format) to a coordinator for incorporation in a GIS system.

Phase 2. Compile metadata catalogue. Linked to phase 1 should be a metadata compilation of suitable data sources. National and international metadata catalogues already exist for some types of habitat mapping data (e.g., Euroseismic data sets); these need to be accessed and either added to or brought together. This could be achieved in 2 years.

Phase 3. Establish improved data compatibility and interpretation standards. Through the development of best practice guidance for all stages in the habitat mapping process (field data collection, storage, interpretation and dissemination), develop the necessary procedures and standards that both enable existing data to be interpreted consistently and ensure any new data collected are undertaken to these standards. It should be achieved through:

- habitat mapping experts exchanging best practice and developing best practice guidance for techniques at each stage in the mapping process. ICES could be asked to co-ordinate such work through joint effort of its working groups, especially the Benthos Ecology Working Group (BEWG), the Working Group on Marine Habitat Mapping (WGMHM), the Working Group on the Effects of Extraction of Marine Sediments on the Marine Ecosystem (WGEXT) and the Fisheries Acoustic Science and Technology Working Group (WGFAST).
- specific projects to resolve inter-compatibility issues between data types (e.g., relationship of acoustic to benthic data or sediment type to benthic data). This should examine issues both within data types (e.g., acoustic, benthic) and between types (i.e., relationship of acoustic to benthic).
- Refinement and confirmation of the EUNIS classification system using actual data sets, to ensure EUNIS is fully operational (development of working definitions of each habitat type, and their links to different data types).
- This phase is likely to take 2-4 years, depending on resource input by CPs and ICES, but output from projects here would contribute to phase 4.

Phase 4. Interpretation of existing data to agreed standards. Once data/interpretation standards are established, existing data sets should be reinterpreted to prepare habitat maps to these standards. This phase would need to evaluate the benefits of reinterpreting some existing data sets, as for some it may be deemed more effective to undertake resurvey.

Phase 5. Predictive modeling. Understanding of the relationship of community type with seabed physical type and other characteristics (e.g., currents) (from Phase 3), should facilitate predictive modeling using available geophysical data where limited biological data are currently available. Such modeling must be field tested for accuracy and value compared with undertaking bespoke surveys.

Phase 6. New surveys to fill gaps or improve quality. The requirement for new survey will mostly likely be driven by national needs, but as OSPAR-level maps become available, OSPAR may wish to encourage new surveys to answer particular OSPAR issues regarding specific habitats and to provide information for areas where data are lacking or of poor quality. The guidelines established in phase 3 should be actively promoted to ensure inter-operability of the resultant data and maps.

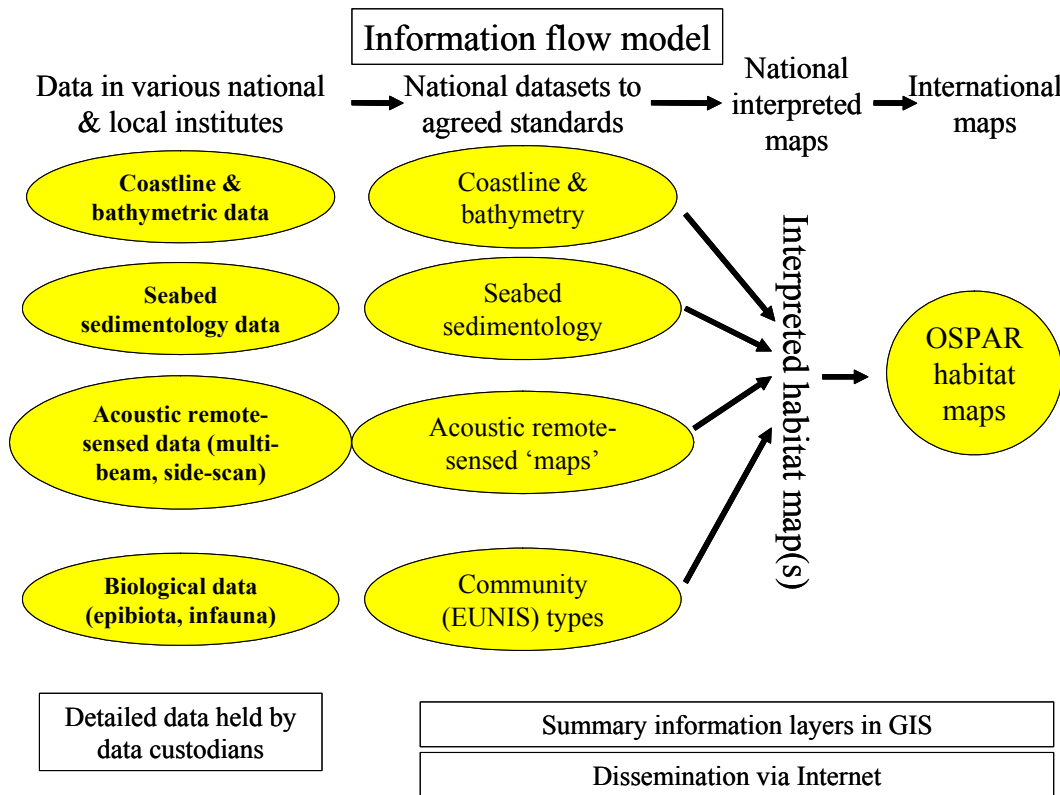
7.3 Programme specification

Holistic habitat maps should be prepared in a GIS format, enabling both flexibility in subsequent data use, the exchange of data and if possible the dissemination of summary information via the Internet (in a system similar to that of Magic – see www.magic.gov.uk).

As habitat maps are an interpretation of various data sets the GIS should hold both the basic data sources (in summary format) and the interpreted maps. This allows much greater flexibility in the end product, especially as there may be a need to interpret the data in different ways to suit different purposes (e.g., a EUNIS interpretation, a fish habitat map and a Habitats Directive habitat map). Once the basic data sets are available and interpreted into EUNIS biotopes, different aggregations of the data can be added rapidly to suit other purposes. Thus the GIS should hold data layers for:

- Coastline
- Bathymetry
- Seabed sedimentology
- Acoustic data
- Benthic data (infauna and epibiota)
- Interpreted data layers:
 - EUNIS habitat map
 - Fish habitat map
 - Habitats Directive habitat map
 - Priority habitats (from the specific habitat mapping programme) - The GIS and data collected for this and the specific habitat programme should be fully inter-compatible.
- Other data sets (e.g., human activities, nutrients, contaminants, etc.) could be added as necessary

A possible flow diagram for data and summary information, from original data sources through to national-level interpretations and finally to compiled OSPAR-level maps, is shown below:



	Proposed scope
Geographical area to be covered	North Sea – a substantial volume of suitable data exist to make this area highly suitable to pilot holistic mapping. Other areas should be added if CPs are keen to contribute mapping information. The framework developed should effectively have no geographical limitations, although it may be sensible to phase the work.
Habitats to be mapped	All habitats within the geographical area, providing 100% cover. Guidance on definitions of these habitats will need to be developed (from EUNIS) (see proposals about phasing of work with regard to unifying types from different data sources).
Data collection – resolution/accuracy	Map at the resolution supported by the available data – poorer data may only allow discrimination to a higher habitat type (equivalent to EUNIS level 2/3), whilst high quality data should allow discrimination to biotope level (EUNIS level 4/5). The display of the data should be flexible enough to cope with such differences in resolution. Habitats should be discriminated at a scale suitable to the area mapped. It is likely to be coarser for offshore areas (1:100,000 - 1:200,000 or greater) and finer for inshore areas (1:25,000-1:50,000).
Confidence in habitats mapped	This will vary according to the data available. The highest quality data sets should be used whenever possible, supplemented by data of lower quality or lesser suitability to provide greater coverage. A confidence attribute should be assigned to all data, enabling judgment of how

	the data should/should not be used. Given that some geographical areas will lack high quality data for some time, it is best to apply a confidence rating, rather than set some quality threshold for the data. As the data will have multiple end uses at multiple scales, the same data may be acceptable for one purpose but not for another.
Data supply and accreditation	Copyright and data ownership to remain with originators of the data or data compilers as appropriate. Summary data made available via the internet should be fully accredited to the data supplier. All contributors should establish any necessary data access requirements (e.g., licenses) with the data suppliers.

Recommendations

Whilst there remains considerable uncertainty as to the level of resources Contracting Parties may wish to contribute to the development of more comprehensive holistic habitat maps, and a likelihood that CPs will move forward at different rates, there are some simple and cost-effective tasks which can be undertaken now to start the process of habitat mapping.

The following steps are therefore recommended:

- a. Start both mapping programmes, to achieve short-term goals for priority habitats whilst building capacity to develop holistic maps over the longer time-frame.
- b. For specific habitat mapping, adopt the basic project specification (see section 6.2) but encourage collation of data at the point sample resolution (rather than at 50km square resolution); build a dynamic web-based data entry and dissemination tool [need to check resource requirements]. [Need to check resource requirements and identify a coordinator].
- c. For holistic habitat mapping, develop compiled maps in GIS from existing sources (see section 7.2 phase 1). [Need to identify a coordinator].
- d. Begin to compile a metadata catalogue of data suitable for habitat mapping (see section 7.2 phase 2).
- e. Develop guidelines and standards for each stage in the mapping process (data collection, storage, interpretation and dissemination) (see section 7.2 phase 3). ICES should be asked to take a lead on this.
- f. Explore with other European institutions, especially the EC (including INSPIRE), EEA, ETC/NPB and ICES which data standards, reporting mechanisms and data management processes need to be taken into account and establish possible roles these organizations might play.
- g. The UK reports to BDC 2004 on progress made on the above.

Annex 2 List of participants at the OSPAR habitat mapping workshop, Stansted, 28–30 October 2002

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Annex 3 Programme for OSPAR habitat mapping workshop

OSPAR Workshop on Marine Habitat Mapping

LONDON STANSTED, 28–30 OCTOBER 2002

Workshop programme

Monday 28 October

- From 1230 Lunch
- 1400 Welcome
- 1405 **1 Introduction and background to the workshop (David Connor, JNCC, UK)**
- 1.1. OSPAR Biodiversity Committee requirements
 - 1.2. North Sea Conference Bergen Ministerial Declaration
 - 1.3. Objectives for the workshop
 - 1.4. EEA perspective, including habitat mapping needs and relevant programmes (Dorian Moss, ETC/NCB, Paris for EEA)
- 1430 **2 OSPAR's needs for habitat mapping – short and long-term requirements**
- 2.1. Threatened/priority habitats (David Connor, JNCC, UK)
 - 2.2. Ecological Quality Objectives (EcoQOs) and status assessment including Quality Status Reports (QSRs) (Stuart Rogers, CEFAS, UK)
 - 2.3. Management of human activities and habitat sensitivity, including dredging/dumping, constructions, fisheries, oil & gas (Chris Vivian, CEFAS, UK)
 - 2.4. Defining needs/uses for (international scale) habitat mapping – plenary discussion session
- 1545 Coffee
- 1615 **3. Types of habitat map – different maps for different purposes**
- 3.1. Demonstration of different types and scales of habitat map (Stuart Rogers, CEFAS, UK)
 - 3.2. Defining types/scales of map that will meet end-user requirements – plenary discussion session
- 1700 **4. Using existing data – current mapping initiatives and their inter-compatibility**
- 4.1. Broad-scale mapping programmes (15 mins each):
 - 4.1.1. Overview of the Irish National Seabed Survey (Eibhlin Doyle, Geological Survey of Ireland)
 - 4.1.2. Southern North Sea and Wadden Sea - data compatibility issues and experiences from *HabiMap* (Dick de Jong, RIKZ, Netherlands)
 - 4.1.3. Bay of Biscay mapping programme (Ibon Galparsoro, AZTI, Spain)
 - 4.1.4. Norway – the *Mareano* programme (Terje Thorsnes, Geological Survey, Norway)
 - 4.1.5. Mapping the Belgian coast (Vera van Lancker, University of Gent, Belgium)
 - 4.2. Other relevant studies (10 mins each):
 - 4.2.1. *BEAST* – habitat mapping for EIAs (Jan van Dalssen, TNO, Netherlands)

- 4.2.2. *DigBath250* and *DigSB250* – UK digital seabed bathymetry and geology (Ceri James, BGS, UK)

2000 **Workshop dinner at Hilton London Stansted**

Tuesday 29 October

0900 **5. The role of GIS in habitat mapping and spatial management**

- 5.1. Demonstration of an internet-based mapping system – *Magic* (Ruth Matthews, Defra, UK)
5.2. Defining options for presenting/delivering habitat information – plenary discussion session

1000 **6. Key conclusions from previous plenary discussions and introduction to working groups**

1030 [Coffee]

1100 **7. Opportunities for and obstacles to progress**

- 7.1 Working group sessions in Specialist groups:
- Geophysical information (geology, bathymetry)
 - Acoustic seabed survey
 - Benthic ecology
 - Data management

Issues for each group to tackle:

Where are the major sources of data (add to pre-prepared lists)

What parts of OSPAR area have adequate coverage?

What are the data compatibility issues?

How useful are the data for different types of mapping (refer back to previous options)?

What standards are used/available for data interpretation and how widely are these applied?

Are there ongoing national programmes that can contribute?

What priority issues need to be addressed (e.g., inter-calibration, survey and data standards, interpretational issues)

1230 [Lunch]

1330 7.2. Specialist groups – report back to plenary

1430 **8. Development of options for habitat mapping**

Working group sessions [may need to adjust depending on outcome of Monday pm discussion)

- 8.1. OSPAR-level mapping – specific habitats (threatened)
8.2. OSPAR-level mapping – broad scale/thematic maps
8.3. North Sea mapping – detailed mapping

Each group to outline:

Key end uses

Critical steps in preparing such a map

Options for data collation, interpretation and dissemination

Data management – options for co-ordination at national and international level

What could be achieved in 2, 5, 10 year time frames (scale of resources)?

[Coffee]

1700 8.4. Report back in plenary from 3 working groups

1930 **Dinner at Hilton London Stansted** (*costs to be covered by delegates*)

Wednesday 30 October

0900 **9. Finalisation of proposals for habitat mapping**

9.1. Further sessions in working groups as necessary

1030 [Coffee]

1100 9.2. Presentations from three working groups (plenary session)

9.3. Final discussions on proposals/options (plenary session)

1230 **10. What happens next?**

10.1. Preparation of paper for BDC, including comments from delegates

1300 **Close of workshop**

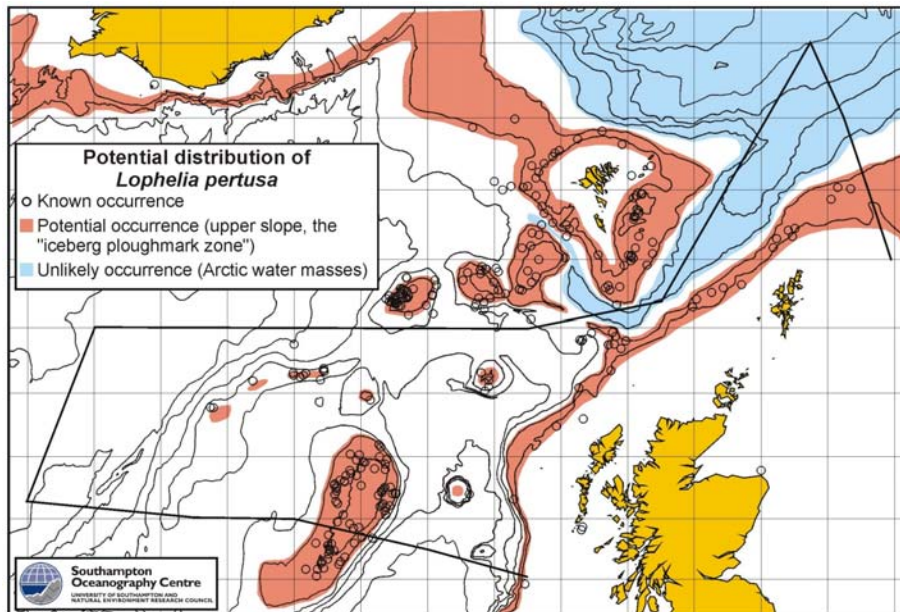
Annex 4 Initial list of significant habitat mapping programmes within the OSPAR area

This list could be expanded – PLEASE ADD FURTHER STUDIES

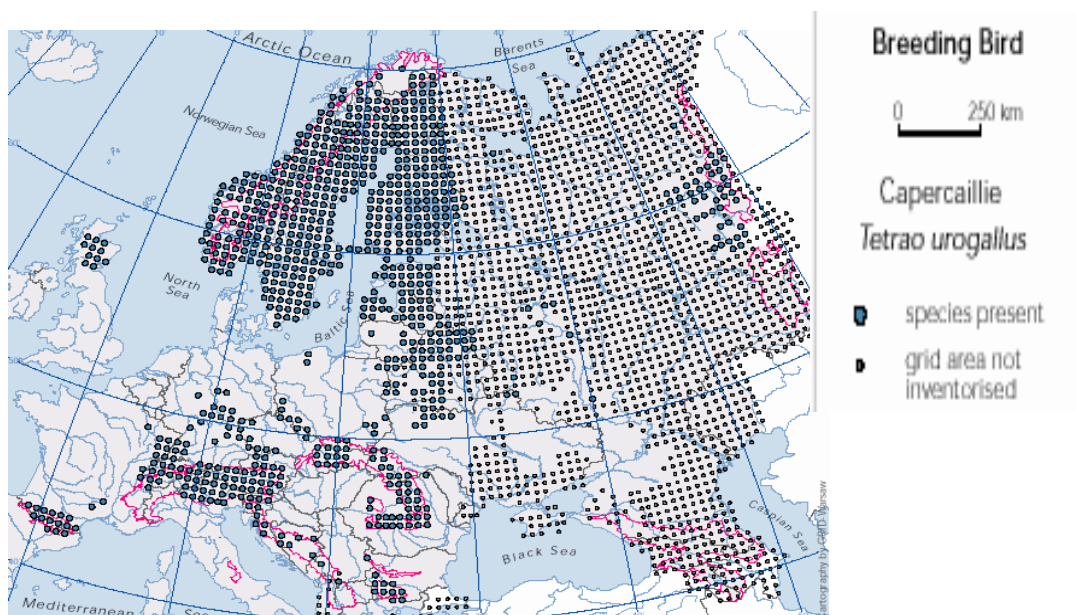
Country	Organisation	Geographical area	Methods
Belgium	University of Gent	Belgian continental shelf	Side-scan
France	Ifremer	Coastal SACs	Aerial photography, LIDAR, benthic sampling
GB	CEFAS	English Channel	AGDS; Side-scan; Benthic sampling
GB	CCW/SNH/EN/JNCC	UK cSACs in coastal areas	AGDS; Side-scan; Benthic sampling
Ireland	GSI	Irish continental shelf	Multibeam, bathymetry, sub-bottom profiler; benthic samples and photographs
Ireland	Duchas/Marine Institute	Irish cSACs in coastal waters	AGDS; Benthic Sampling; Scuba.
Netherlands	RIKZ	Southern North Sea (Habimap) & Waddensea	Benthic data with sediments in GIS
Northern Ireland	EHS/DARDNI	Northern Ireland coastal area	AGDS; Side-scan; Benthic sampling
Norway	NGU/IMR/Statkart	Norwegian Shelf	Multibeam bathymetry/backscatter/ROV
Scotland	SAMS	Lynn of Lorne	AGDS; Side-scan; Benthic sampling; scuba
Scotland	FRS	Minch/Sea of Hebrides	AGDS, Video
Spain	AZTI	Bay of Biscay coastal waters	AGDS
Portugal	DOP-UAz/ISR-IST/IGM	Selected SACs in the Azores	Bathymetry, sub-bottom profiler, SCUBA (divers and video/photographic assessments), benthic samples, GIS

Annex 5 Examples of maps for a single habitat type

Point sample distribution map, coupled with predictive distribution map for *Lophelia* cold-water coral (Southampton Oceanography Centre, UK)

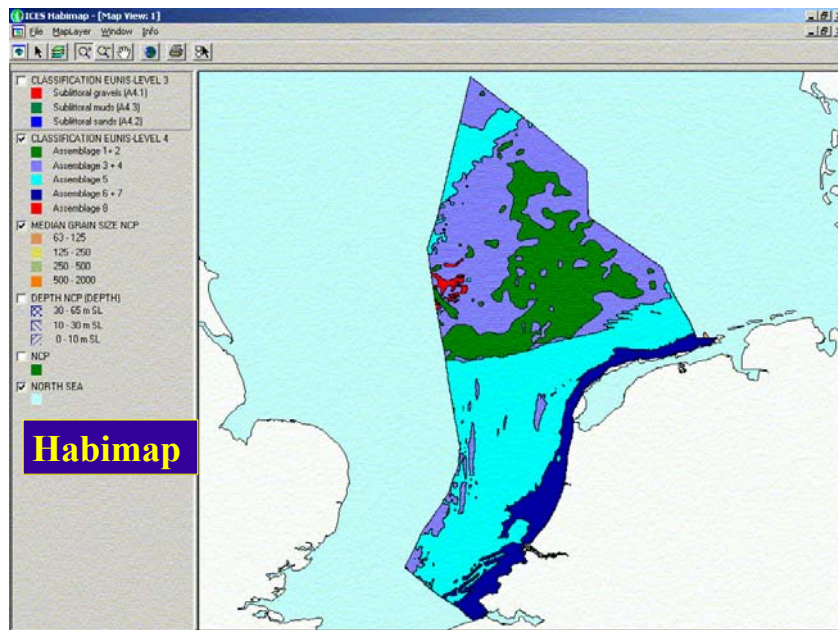


Example dot distribution map using UTM 50x50 km grid (example shown is for a species, but the grid is also used for terrestrial habitats) (EEA's European Topic Centre for Nature Protection & Biodiversity).

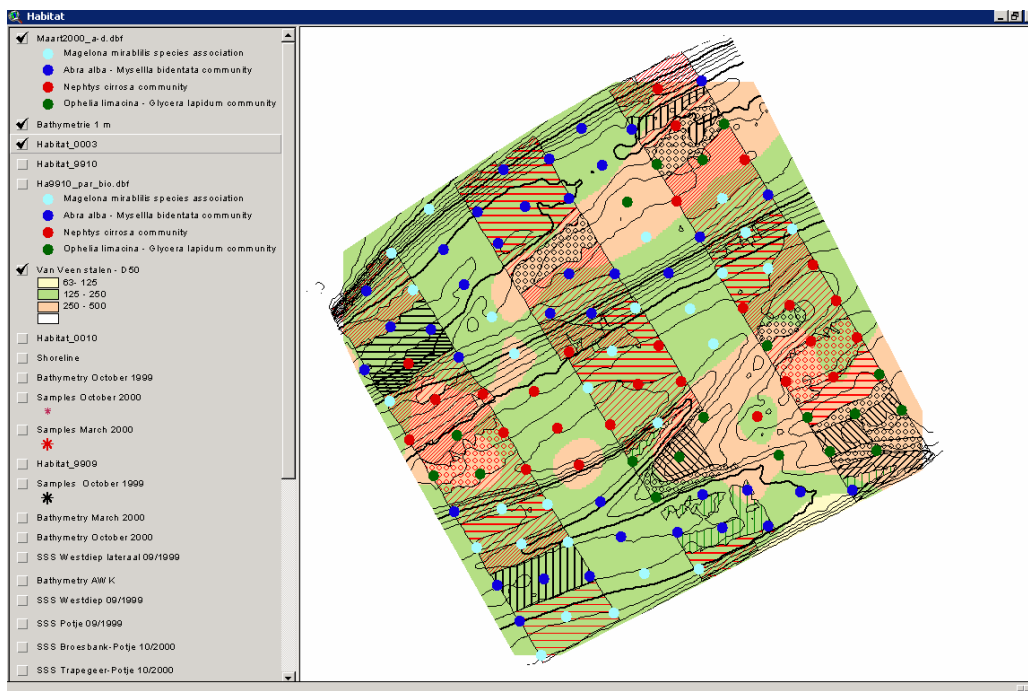


Annex 6 Examples of holistic type habitat maps

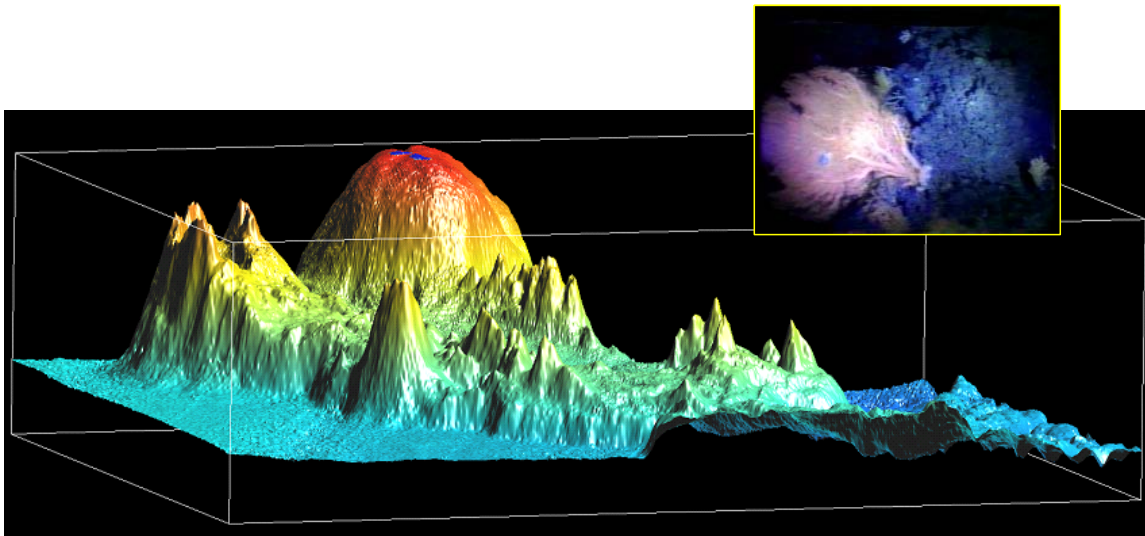
Example 1: Habitat distribution map for Dutch continental shelf in GIS (Habimap) (RIKZ, The Netherlands)



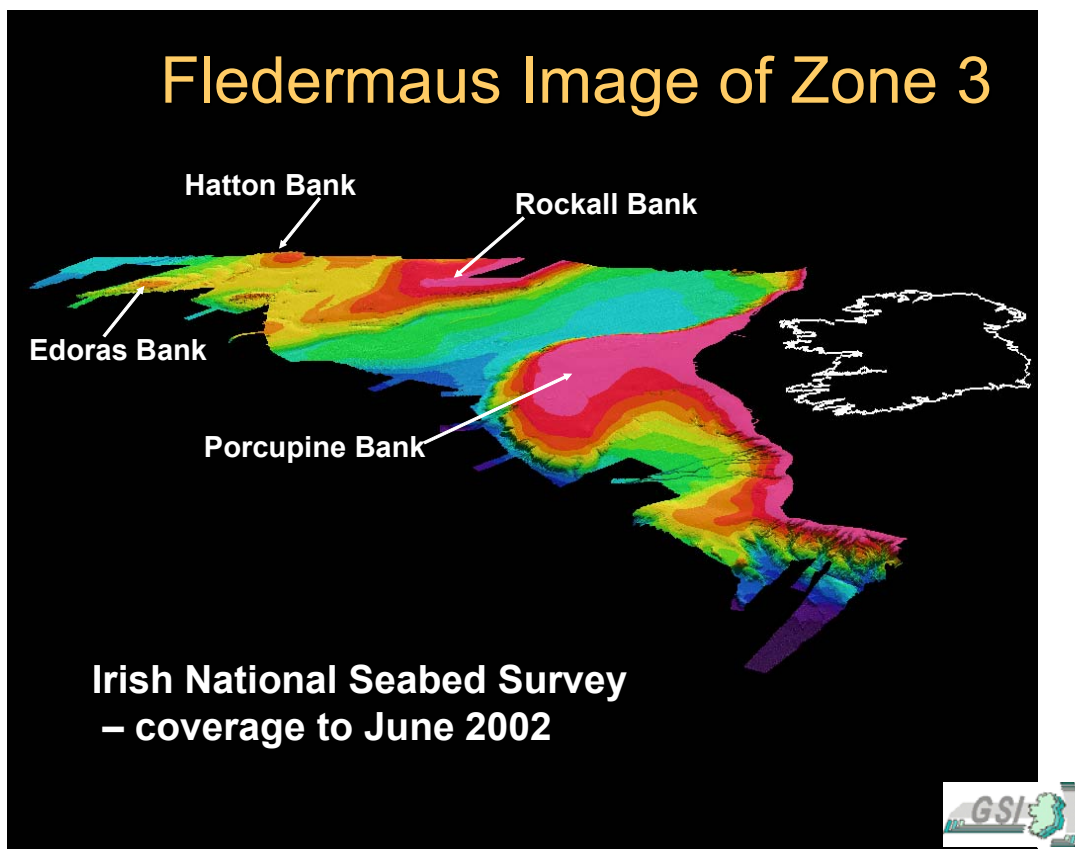
Example 2: Compiled maps from acoustic, benthic & sedimentology data (University of Gent, Belgium)



Example 3: Geophysical map from multi-beam data (Geological Survey of Norway)



Example 4: Geophysical maps from multi-beam acoustic data (Geological Survey of Ireland)



ANNEX 10: PROPOSAL FOR A WORKSHOP ON AGDS

DRAFT PROPOSAL

Workshop to assess the accuracy of AGDS as a tool for mapping seabed biotopes (in SACs)

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The Purpose:

An increasing number of research/contract groups are undertaking broad-scale seabed mapping activities at various sites around the UK coastline, often with little knowledge of experience that exists amongst other groups. This proposal is for funding to hold a practical workshop that would bring together UK research/contract groups who use the acoustic ground discrimination system (AGDS), RoxAnn, for the production of biotope maps. The workshop would compare and contrast mapping methodology and ultimately biotope maps produced by each group over the same area of seabed using the same research vessel. This would fully evaluate the utility of the acoustic system in question for the production of such maps, improve communication between UK groups working in this field, and lead to the production of guidelines/recommendations on best practise for the production of full-coverage seabed biotope maps using AGDS. The final day of the workshop would be opened up to all interested parties within the UK, in particular non-technical managers/advisors involved in the implementation and end use of such biotope maps, to present the findings from the workshop and outline benefits, problems and limitations associated with biotope maps produced using this approach.

Background:

Marine benthic habitats are under threat from a wide range of anthropogenic activities (e.g., fishing impacts, construction activities, oil and gas exploitation, dredged material disposal, aggregate extraction). Recent developments in seabed mapping techniques, driven by continuous improvements in acoustic systems (e.g., side-scan sonar, multibeam sonar, acoustic ground discrimination systems), offer the potential to radically alter approaches to monitoring and mapping this component of the marine ecosystem. Such an approach provides a means to conduct cost-effective, wide-scale reconnaissance surveys, which may serve a number of important purposes. For example, they may be employed in identifying seabed (or sub-seabed) features of conservation or resource interest, as an exploratory tool to facilitate the generation of effective site-specific sampling designs, or in the determination of representative reference sites against which changes at impacted locations may be compared in long-term monitoring programmes. In recent years the application of acoustic mapping methodology (in particular the use of acoustic ground discrimination systems – AGDS), used in conjunction with ground-truth sampling, has become common practise in monitoring and mapping seabed habitats at a number of Special Areas of Conservation (SACs) around the UK coastline (e.g., Davies, 1999; Foster-Smith and Sotheran, 1999; Foster-Smith *et al.*, 1999, 199b, 2000; Service, 1998; Service and Magorrian, 1997). Whilst this approach offers advantages over more traditional style benthic grab surveys, the accuracy of the spatial distribution maps produced from such surveys has at time been questioned.

The proposal:

The proposed workshop will aim to critically evaluate the use of the Acoustic Ground Discrimination System, RoxAnn, for use in mapping seabed biotopes. In recent years this acoustic system has been heavily used in the production of spatial distribution maps of seabed habitats and benthic communities in coastal SACs and other regions of scientific or conservation interest (Brown *et al.*, 2001, 2002; Davies, 1999; Foster-Smith *et al.*, 1999, 2000, 2001; Pinn *et al.*, 1998; Robertson and Pinn, 1999; Service, 1998; Service and Magorrian, 1997). However, issues such as data quality, repeatability of survey, and predictive capability of the system have come into question.

A small test site on the west coast of Scotland within close proximity to DML encompassing a wide range of benthic habitats will be chosen as the study site (probably within the Firth of Lorn SAC). The workshop will invite a number of research/survey teams working with the AGDS RoxAnn to apply their own mapping methodology over this study area.

Each team will be encouraged to use their own RoxAnn systems during a 1–2 day data collection workshop at sea. Issues such as survey design, system set up and data quality assessment will be addressed. A common ground-truthing data set (underwater video data) will also be collected from within the test site during this time, and issues relating to the selection of ground-truthing station will be discussed.

The common-ground-truthing data set will then be used by each team to process the RoxAnn data sets back at the laboratory during a 2-day data-processing workshop. Workshop sessions will be run covering various aspects of data handling, quality assessment and data processing to establish methods of best practice. Spatial coverage maps will be produced from each of the RoxAnn data sets and the accuracy and predictive capability of each map will then be tested against an external ground-truthing data set collected prior to the workshop by SAMS/DARD. A minimum of 3 different RoxAnn data sets will be collected and processed during the workshop (weather permitting) to assess aspects such as between-system variability, survey design and data quality. A workshop report will be produced stating recommended best practices for mapping marine benthic habitats using the AGDS RoxAnn based on the out-put of the various RoxAnn surveys.

The final day of the workshop will be opened up to all interested parties within the UK; the focus will be to present the findings of the workshop to non-specialist environmental managers/advisors involved in the implementation and end use of biotope maps. Issues relating to accuracy, predictive capability and system limitations will be discussed to provide a better understanding of this mapping approach to non-specialists using the out-puts from such surveys.

Research Objectives:

- To compare the reliability of the AGDS RoxAnn, for the production of full spatial coverage maps of seabed habitats and biotopes. This will be achieved by comparing the out-put from a number of different RoxAnn systems over the same area of seabed;
- To compare and evaluate different approaches to seabed mapping between different research teams within the UK, with the aim of identifying and standardising best practice;
- To assess the predictive capability of biotope maps produced using RoxAnn through the collection and application of an external ground-truthing data set;
- To report on the significance of the findings for the management and monitoring of SACs;
- To provide a better understanding to non-specialist environmental managers/advisors of the techniques and data processing methodology involved in the production of full-spatial coverage biotope maps produced using the AGDS RoxAnn, and to high-light potential benefits/limitations of biotope maps produced in this way.

Workshop Timetable (early September 2003):

Day	Target	Work involved
Pre-workshop (2 days)	Collection of contingency RoxAnn data set (in case of bad weather), side-scan sonar data and external ground-truth data	1–2 days of survey on RV “Seol Mara”. Surveys with RoxAnn (contingency data set), side-scan sonar and collection of external validation underwater video footage (DARD/SAMS)
Sunday pm	Mobilisation of RV “Calanus” with survey gear	
Monday 9–10am	Introduction to workshop. Discussion of structure of workshop.	
Monday/Tuesday	Sea-going workshop. Data collection.	RoxAnn surveys over the study site using at least 3 different RoxAnn systems and various survey strategies. Collection of a common ground-truthing data set using underwater video (and grab).
Wednesday/Thursday	Data processing and report preparation	Each group works up data sets and produces a habitat/biotope map. Validation of maps using external ground-truth data. Collective sessions on data quality assessment, post-processing and map validation to be run (Envision Mapping). Production of project report and recommendations/conclusions.
Friday	Open session to non-technical environmental managers (JNCC/SNH/EN/CCW/EHI/DEFRA etc.)	Findings from the workshop presented to generic practitioners and environmental managers

Benefits:

It is expected that for a modest level of funding the utility of RoxAnn as tool to map seabed habitats would be fully evaluated. Standardising methodology for the analysis of AGDS data through inter-group discussion/collaboration would be of benefit to the wider scientific community involved in habitat mapping studies by establishing protocols for interpretation of AGDS data. Dissemination of information regarding the benefits and limitations of biotope maps produced in this way to environmental managers who use the out-puts from such surveys, but who may not have a clear understanding of how the maps are produced, and the limitations associated with the techniques employed.

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ANNEX 11: HABITAT MAPPING PRELIMINARY PROTOCOLS AND STANDARDS

Introduction

The creation of the ICES Working Group on Marine Habitat Mapping is a testament to the international concern that coastal and ocean environments worldwide are coming under increasing pressure from resource development. Mapping of these environments is the critical first step leading to an increased understanding and improved environmental management. However, WGMHM recognizes that the practice of habitat mapping means different things to different people (e.g., Greene *et al.*, 1999, Allee *et al.*, 2000), and that the available mapping resources (both equipment and personnel) vary widely. Therefore, it is the goal of the WGMHM to assist in developing protocols and guidelines for the best practice of habitat mapping based on information gleaned from mappers worldwide. Some approaches have been published in the scientific literature, while others have not.

The concept of integrated resource management, developed for the terrestrial environment, has been successfully adopted in marine systems through integrated coastal zone management. On land, characterizing elements of the environment is relatively simple through mapping and remote sensing techniques. In marine environments, conventional remote sensing can only be used in the littoral zone; visualizing the sea floor in deep water with the same spatial coverage and resolution has not been possible. With the collapse of offshore fisheries and competition among industries for use of the seabed, many maritime countries are recognizing that much higher resolution data are needed for sustainable management of offshore resources.

Until recently, sea floor mapping reliability and accuracy were restricted by the available technology. For example, echo-sounders, side-scan sonars and seismic systems provided information from relatively narrow swaths of the sea floor. Interpreted maps of bathymetry and sediment type were produced by extrapolating between tracks. Commonly, ground-truth information was only available for a very small percentage of the total area mapped. For more than 30 years these techniques provided the fundamental knowledge of the continental shelves.

The last decade has witnessed the development of new technologies to map the sea floor. Multibeam sonar surveying enables us to construct detailed images of the sea floor. These sonar systems operate by ensonifying a narrow strip of sea floor across the survey ship's track and detecting the bottom echo. We measure the seabed elevation (soundings) and amplitude of the backscattered acoustic signal. Precise navigation using GPS ensures the positional accuracy of the measurements. Sophisticated computer programs process the data and display the sea floor with colours showing different water depths. The amplitude of the backscatter return from sea floor materials enhances geological interpretation. Because backscatter is a complex response to a suite of acoustical parameters, backscatter is interpreted in conjunction with other geophysical data (seismic reflection and side-scan sonar sonograms) and geological samples of sea floor materials.

Developments in multibeam mapping technology, in concert with traditional survey techniques, now provide the capability to discriminate objects on the sea floor 0.5 to 10 metres in size, depending upon water depth. In this Annex, an example from the Canadian Atlantic continental margin demonstrates the application of high-resolution sea floor mapping techniques to develop data bases and maps; these maps provide fundamental information for the sustainable management of offshore resources. It is hoped that this discussion can serve as the nucleus for the development of a WGMHM document, with future input from other ICES groups (e.g., WGEXT, BEWG and WGFAST).

Benthic habitat mapping

Browns Bank on the Scotian Shelf (Figure 1) supports a multimillion dollar scallop fishery, as well as lobster and groundfish fisheries. In the late 1990s, government and industry recognized that a better understanding of scallop habitat could improve stock assessment and management. To this end, Clearwater Fine Foods Incorporated (CFFI) co-sponsored a multidisciplinary study of Browns Bank with the Canadian Hydrographic Service (CHS) and the Geological Survey of Canada (GSC). Multibeam surveys were first completed, the backscatter signal processed and maps of sea floor morphology and backscatter strength were produced (Figure 2). Preliminary interpretations from these maps were used to plan geological and benthic habitat ground-truth surveys and produce maps of surface sediment cover and benthic habitat (Todd *et al.*, 1999). Coupling high-resolution mapping of the physical environment with associated mapping of the distribution of benthic species enabled relationships between the substrate and benthic community to be developed (Kostylev *et al.*, 2001), and most importantly key scallop habitat areas were mapped (Kostylev *et al.*, 2003). Following the success of the demonstration project on Browns Bank, CFFI outfitted a scallop dragger with a multibeam sonar system and has completed other surveys on the Scotian Shelf.

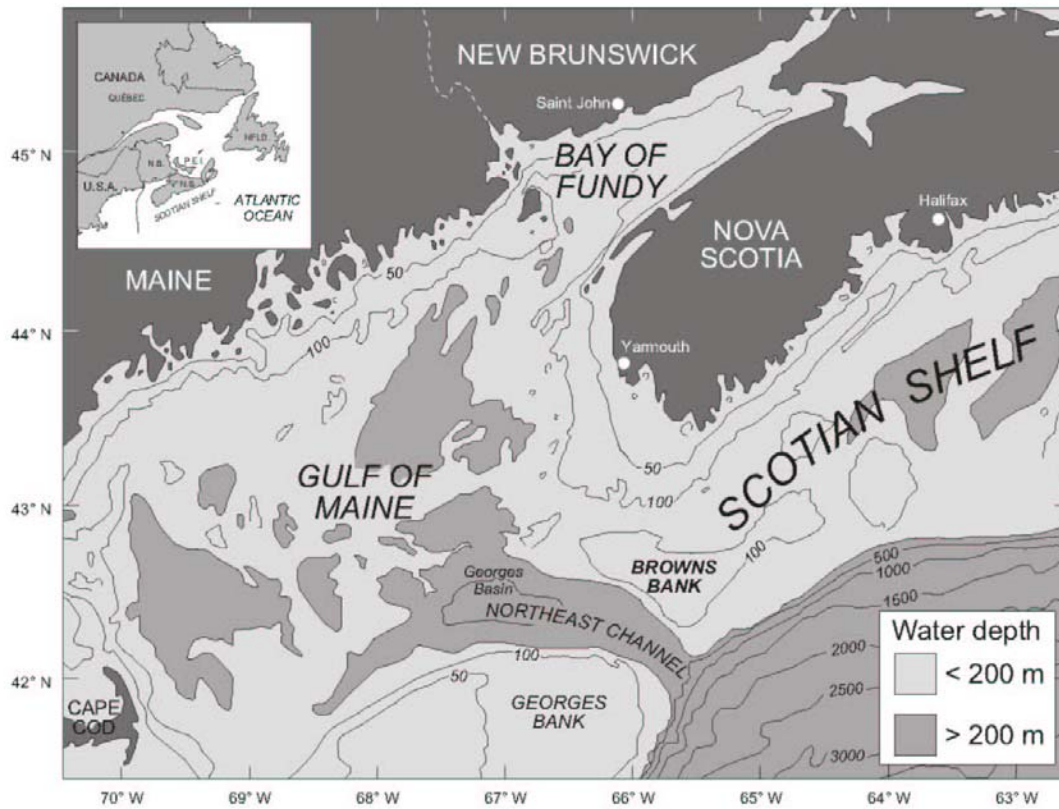


Figure 1. Location of Browns Bank, southern Scotian Shelf.

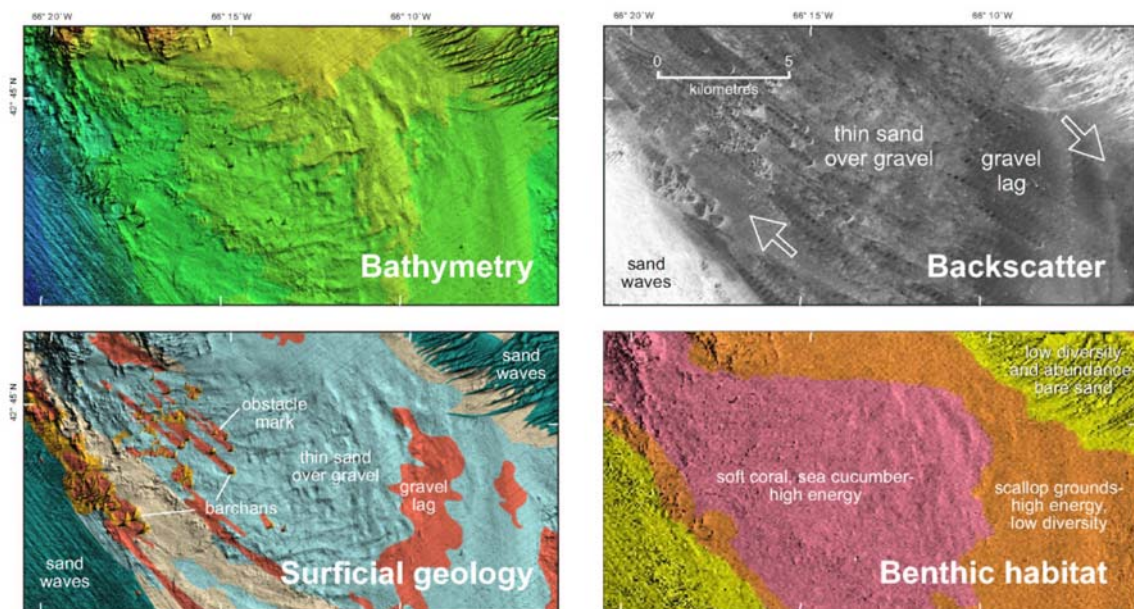


Figure 2. Detail of multibeam data and interpretation on northwest Browns Bank. The upper left shows the multibeam bathymetry. Artificial sun illumination is from the northeast at an angle of 45 degrees above the horizon. Isobaths are in metres and the red colour denotes shallow water; blue denotes deeper water. The upper right shows multibeam backscatter in grey scale. Light tones denote sand; dark tones denote gravel. The open arrows indicate the predominant current direction. The geological interpretation is shown in the lower left. Gravel lag refers to glacial material reworked during sea level rise and by modern currents. Barchans are large, lunate-shaped sand dunes. Obstacle marks are areas of non-deposition of sand in the down-current direction in the lee of barchans. Sand waves are flow-transverse, constructive bedforms. The lower right shows three benthic habitats mapped on the basis of sea floor geology, sediment samples and bottom photographs of animals and plants.

Electronic fishing-charts are currently being produced by CHS and GSC. For any region, four “layers” are provided: the two quantitative layers are bathymetry and backscatter strength, and the two interpretive layers are surficial geology and benthic habitat. Each layer can be used independently to interactively guide a variety of fishing operations. The benefits to the fishing industry have been immediate. After just one year, there was a significant change in fishing practice; for a fixed scallop quota, time spent dragging the seabed was reduced by as much as 75 %. While the economic benefits of using these tools are obvious, the reduced environmental impact is equally profound. Knowledge of the bottom-type has resulted in scallop rakes being much lighter, reducing benthic disturbance. Areas of sensitive habitat or areas devoid of scallops can be avoided. Improved management of the scallop fishery lessens the impact on other commercial fisheries; by-catch is reduced, and lobster and groundfish habitat avoided. The detailed habitat maps provide a powerful tool for fisheries management, enabling the fishery to be managed at a much finer spatial scale and enhancing the capacity for multiple stock management in a relatively small area.

Discussion

Multibeam technology, when integrated with data from other survey tools, can generate powerful imagery and interpretive maps of both the physical nature and the benthic communities of the sea floor. For the first time, we are able to map relatively large areas of the sea floor at resolutions comparable to those obtained onshore. From the developments in sea floor mapping that have evolved over the last decade, minimum survey requirements, standards and map products are being defined to provide basic data to support integrated ocean management and to support the regulatory requirements of governments at the federal, provincial and local levels. Experience from the Browns Bank mapping suggests that nearly all decisions regarding use and management of seabed resources can be addressed by mapping three core elements of the environment:

- the depth and shape of the sea floor,
- the texture and composition of the sediments at, and immediately beneath, the sea floor, and
- the plants and animals that constitute the benthic community.

In recognition of both the urgent need for improved data for ocean management, and the utility of new mapping technology and products, a conceptual model for provision of data and maps for ocean management is proposed (Figure 3). The input multibeam bathymetry and backscatter data generate sea floor topography and backscatter maps. Geophysical surveys, combined with geological sampling and biological assessments are interpreted, in conjunction with the sea floor topography and backscatter maps, to produce maps of sediment type and distribution, and benthic habitat. The maps are produced in a GIS format and distributed electronically. Interpretive reports and scientific publications on the mapped areas are also electronically available. A number of ocean management applications are listed on Figure 3.

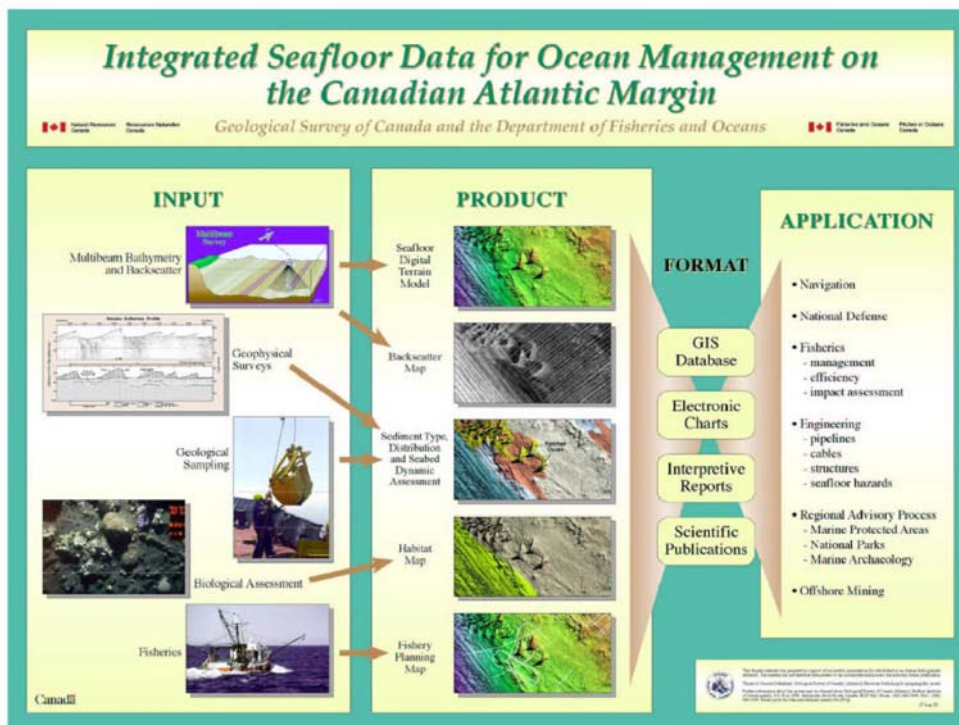


Figure 3. A conceptual model for provision of data and maps for ocean management listing, from left to right, the data inputs, map products and ocean management applications.

In Canada, the success of the integrated mapping programs between hydrographers, geologists, and habitat ecologists demonstrates the necessity for cross-disciplinary research; no one group has the required skill sets or resources to independently deliver the necessary suite of data and maps. The team approach has also strengthened existing, and created new, multidisciplinary research partnerships between the government agencies and with the private sector. Development of high-resolution mapping capability was initially driven by government research and development needs. Through partnerships and technology transfer, industry has recognized the power of sea floor mapping technologies and assumed leadership in accelerating mapping programs faster than government resources can deliver. Partnerships between government and the private sector are essential; irrespective of government priorities, industry will continue mapping on its own initiative to address sea floor issues of the ocean economy. However, mapping is expensive, and a coordinated mapping effort is necessary to address the spectrum of ocean management needs. Data sharing agreements are required to prevent unnecessary duplication, to avoid data distribution being restricted by confidentiality agreements, and ultimately to optimize the decision making process.

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ANNEX 12: DRAFT TERMS OF REFERENCE FOR 2004 WGMHM

The **Working Group on Marine Habitat Mapping** [WGMHM] (Chair: D. Connor, UK) will meet in Brest, France from 30 March–2 April 2004 to:

- a) actively present, discuss, consider and work towards a generic benthic/pelagic habitat mapping framework for the North Sea, and to produce a prototype habitat map of the North Sea that could be useful for the interpretation of the North Sea Benthos Project;
- b) present and review National Status Reports on habitat mapping according to the standard reporting format;
- c) review existing pelagic habitat classification systems and assess their relationship to benthic habitat classifications;
- d) review the application of habitat maps in a management context;
- e) further progress the development of guidelines for habitat mapping;
- f) review progress on intercalibration and quality control of mapping techniques, including the proposed workshop on AGDS (RoxAnn) techniques.

WGMHM will report by 23 April 2004 for the attention of the Marine Habitat and Fisheries Technology Committees and ACE.

a) 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	<p>a) WGMHM has met for a number of years and has extensively discussed issues related to habitat mapping including:</p> <ul style="list-style-type: none"> - data collection methodologies, technologies, - data management, - habitat classification systems, and - data exchange and integration. <p>It is apparent that adequate technologies presently exist, significant data holdings exist and that there are a large number of approaches and pilot products demonstrating the generation of habitat maps. A number of these approaches have been developed and presented by Working Group members for the southern North Sea, northern Spain, shallow water and intertidal UK, eastern North American, and other areas.</p> <p>The challenge is to develop an agreed framework for habitat mapping; the North Sea should be used as a pilot area, based on existing data which, as a minimum, should include bathymetry, surficial sediments and relevant ICES information on the distribution of marine benthos. The working group will develop a framework and test it for usefulness across national boundaries. If successful, this framework could be tested and revised for larger ICES areas.</p> <p>The product will be a generic habitat mapping framework, demonstrated as a habitat map of the North Sea and highlighting a recommended approach to integrating and interpreting various data layers into useful maps. It is anticipated that this will be a habitat analogue to the accepted International Hydrographic Organisation (IHO) nautical charts that are used world-wide to provide a synopsis of varied and diverse hydrographic information in a consistent and useful format.</p> <p>The geographic area to be covered is from the high water mark to deep water of the North Sea (according to the OSPAR Quality Status Report Region II and ICES divisions VIIe, VIIId, VIa, IVb, IVc).</p> <p>Preparation: Before the meeting, GIS map layers will be compiled into an appropriate system for overlaying available information for active querying during the meeting. Efforts will be made to allow meeting participants access to all information layers three months before the meeting.</p>

	<p>b) 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.</p> <p>c) Approaches to the classification of pelagic habitats require further development, including assessment of their relationship to seabed habitats and ecosystem functioning.</p> <p>d) Whilst habitat maps may have many different purposes, their use in a management context is particularly important to show the benefits of this field of work.</p> <p>e) and f) Continued development of guidelines and standards is necessary to improve the quality of habitat mapping studies, to increase the compatibility of generated data and to facilitate the aggregation of habitat mapping information for national and international reporting purposes.</p>
Relation to Strategic Plan	Scientific Objective 1e.
Resource requirements	
Participants	Representatives from Member Countries with experience in habitat mapping and classification.
Secretariat facilities	None
Financial:	
Linkage to Advisory Committees	ACE
Linkages to other Committees or groups	Discuss need for joint meeting with BEWG and WGEXT; Baltic Committee
Linkages to other organisations	OSPAR, HELCOM, EEA
Cost share	ICES 100 %