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Report of the

Working Group on Marine Habitat Mapping

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International Council for the Exploration of the Sea

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1 INTRODUCTION

1.1 Opening of the Meeting

The Working Group on Marine Habitat Mapping (WGMHM) convened in San Sebastian, Spain from 2–5 April 2002. The participants at the meeting were welcomed by Yolanda Sagarminaga, on behalf of AZTI, San Sebastian, the host of the meeting. After having gone through the necessary housekeeping arrangements, the group proceeded with a short round of introductions, since several new Working Group members were present at the meeting table.

HELCOM has requested ICES to explore if the EUNIS classification currently under development in WGMHM can be extended to the Baltic area. WGMHM had accepted to work on this request, provided that new members from the Baltic countries can contribute to this work. As a result, new Working Group members from Norway and Finland (both present), as well as Sweden (not present) were added to the group.

The meeting was attended by twelve people, representing eight European countries. Members from USA and Canada had initially planned to attend the meeting but were not able to come due to budget cuts. A full list of participants is included in the report as Annex 1.

1.2 Adoption of the Agenda

A preliminary Agenda was distributed to the participants in advance of the meeting. This Agenda was discussed, and filled in with a more detailed timetable for the meeting. The Agenda, as it was adopted, is included in the report as Annex 2.

1.3 Terms of Reference for the Meeting

The Terms of Reference (ToR) for the meeting were introduced by Eric Jagtman (Chair). He started by briefly recapitulating the ToR adopted in Galway, 2001. The first three items of the ToR (a–c) aim to give an overview of progress in the field of habitat mapping and classification, based on the discussion of collated national status reports. Furthermore, developments in setting up a data exchange platform (ToR d) were to be discussed by the Working Group.

In addition to these points, two new items were included in the ToR, one being a request from the OSPAR Commission to carry out a review of the evidence upon which a priority list of threatened and endangered species and habitats is proposed to be based. The OSPAR Commission has decided to adopt such a list in implementation of its Biodiversity Strategy. WGMHM was asked to ensure that the data used for producing the justification are sufficiently reliable and adequate to serve as a basis for conclusions that the species and habitats concerned can be identified consistently with the Texel-Faial criteria. This work is dealt with in Section 4 of the report.

The second additional item in the ToR relates to the development of Ecological Quality Objectives (EcoQOs) for the North Sea. Since 1999, OSPAR has coordinated the development of EcoQOs for ten issues, focusing on the North Sea as a test case. This development work has been coordinated by the OSPAR Biodiversity Committee (BDC), with Norway and the Netherlands as co-leading countries and the assistance of ICES. OSPAR BDC has presented a report to the Fifth North Sea International Conference for the Protection of the North Sea summarizing the progress to date on this work. WGMHM was asked to review the EcoQOs as proposed for habitats in this process. The result of this work is presented in Section 5 of the report.

2 REVIEW OF NATIONAL STATUS REPORTS ON MARINE HABITAT MAPPING

ToR a) collate and review national status reports on marine habitat mapping and, on basis of this, evaluate the practicability of classification systems developed thus far;

WGMHM discussed national status reports after brief introductions by national representatives in the Working Group. A short informative note on a new project in the Gulf of Maine was received from Tom Noji (NOAA, USA). This paper is included in the report as Annex 11.

2.1 Spain (Yolanda Sagarminaga)

In Spain at a national level there are programmes to map bathymetry and the seabed; to date, only a part of the Spanish coasts has been covered, mainly in the Mediterranean area.

In 2000 there has been an initiative to gather information and data regarding habitats in the Spanish littoral: its present status is unknown. Furthermore, a study on sand distribution was carried out all along the Spanish coast for dredging purposes.

There is also work going on at a regional level. For example, on the Basque coast, there is a project to map bathymetry and sediments, although no habitat mapping has been done so far.

There are also some activities being done in this field linked with EU or international projects (coastal management, protected areas, habitat modelling).

Regarding the marine pelagic zone, Y. Sagarminaga is preparing a Ph.D. dissertation on epipelagic habitat classification in the Bay of Biscay.

2.2 Ireland (Francis O'Beirn)

A national status report is included in this report as Annex 3. There were a number of mapping surveys carried out in Ireland in 2001. These surveys were primarily identified from replies to a short questionnaire circulated to other state agencies. The surveys outlined in the report (Annex 3) reflect surveys that had the involvement of state agencies only. These surveys ranged from a large-scale survey of Ireland's territorial seas to smaller regional efforts focused upon (mainly fishery) resource estimation. A variety of survey techniques were utilised. These ranged from multibeam and seismic technology to advanced video and ROV (IFREMER "Victor" ROV as part of the CARACOLE survey). It was pointed out that, given the broad range of techniques and goals used to map habitats in Ireland, the potential for overlap and redundancy of effort was high, particularly if communication among the agencies involved was lacking. The Marine Institute is funding a desk study to review inshore mapping activities and to recommend a management strategy to map inshore resources. The steering group for this project comprises representatives of numerous state agencies involved or interested in mapping activities. It is proposed that this steering group also act as a coordination group for marine mapping activities in Ireland.

2.3 United Kingdom (Craig Brown)

The national status report is attached to this report as Annex 4. A questionnaire was circulated to organisations and individuals involved in seabed mapping activities within the UK. Ten replies were received in time for the meeting, including many of the major mapping initiatives. CEFAS has undertaken two RandD mapping programmes since 1998 and reports from these are now available. The UK nature conservation agencies (Scottish Natural Heritage, English Nature) have also carried out a large number of mapping programmes in SACs around the UK coastline. A number of other smaller, more localised activities are also listed in the report (see Annex 4).

Additional information was given at the meeting by Dave Limpenny, CEFAS, by means of a presentation of project A1033 "Role of seabed mapping techniques in environmental monitoring and management" (Annex 12). Site-specific applications include:

- small-scale and localized applications (less than 10 km²): for example, aggregate extraction, dredged material disposal, construction activities (e.g., wind farms), maintenance dredging, oil, and gas exploitation, survey design/selection of monitoring sites. These are suitable for high-intensity acoustic/biological surveys;
- broader-scale applications (reconnaissance-style survey): prospecting for resources, essential fish habitat, fishing impacts, monitoring/mapping biodiversity, broad-scale habitat classification. All these activities are relatively large-scale and costly to conduct high-intensity acoustic/biological surveys.

The following eight project objectives have been determined:

1) To consolidate and expand methodologies developed during project AE0908, and to evaluate additional physical and geophysical techniques for mapping seabed habitat.
2) To evaluate the utility of seabed mapping techniques for determining the significances of several types of anthropogenic disturbances at the seabed.
3) To evaluate seabed mapping techniques as monitoring tools for assessing temporal changes in community structure.
4) To develop a strategy for the investigation of seabed conditions over different spatial scales.
5) To determine the implications of any biogeographical variations in community composition associated with areas of similar substrates for predictive capability.

6) To examine the scope for linkage between surveys conducted at different spatial scales (e.g., site-specific extraction of marine aggregates versus wider evaluations relating to the fisheries resource).
7) To report the significance of the findings for the management and monitoring of a range of anthropogenic activities.
8) To produce guidelines on cost-effective applications of mapping techniques to a variety of circumstances of interest to MAFF.

This presentation triggered a debate about the degree of confidence in habitat maps based on various acoustic and ground-truthing methodologies. It was agreed that by linking data collected in the field to an existing (i.e., EUNIS) classification this would help in verifying the practicability of the classification developed thus far.

A third contribution from the UK came from David Connor, "Marine habitat classification, the MNCR BioMar habitat classification for Britain and Ireland" (see Annex 5).

A revised classification is being prepared based on multivariate analyses of 30,000 biological samples to provide a robust classification. Each classification unit is described in terms of: characterizing species, distribution, species composition, abundance and frequency of occurrence, and a profile of habitat characteristics (salinity, mean depth range, depth range frequency, sediment analysis). Classification framework and matrices have been constructed. A modified Folk triangle has been used for classification of sediment habitats (mud/sand/gravel), but also bathymetric layers, estuarine/brackish influence, gravel fraction, presence of macrophytes and biogenic communities. This classification has been developed to comply with the EUNIS classification.

Specific habitats have been mapped (e.g., sand banks in shallow waters). In some cases, potential habitats have also been mapped like reef habitats, highlighting a lack of precise data.

2.4 The Netherlands (Eric Jagtman)

The Dutch national status report is attached as Annex 6.

Kerstin Jerosch at the University of Berlin, Germany is working on developing a habitat map for the southern part of the North Sea and for the Wadden Sea. The first results of this work were presented at the ICES Annual Science Conference in Bruges, Belgium in 2000. At that time, a data report was published describing the multiple sources the data stem from, and the way they were processed in order to be able to produce a high resolution, international habitat map. A second report has now been drafted, resulting in habitat maps for both the southern North Sea and the Wadden Sea. Both reports are currently integrated and will be made available for discussion in WGMHM, either intersessionally by correspondence, or during the next WGMHM meeting.

Within the Netherlands, studies have been carried out to fulfil national needs for a more detailed habitat classification that takes into account some typical Dutch situations. This has resulted in draft proposals for a classification of brackish water and pelagic habitats, as well as a classification for hard substrata.

The tools developed are increasingly being used in Environmental Impact Reports, assessing for instance the effects of dredging activities in estuaries.

In addition, Ingeborg de Boois reported on habitat related activities within the National Fisheries Research Institute (RIVO). A report on shrimp distribution has been made for the Dutch coast in relation to infrastructural plans. An English summary by Henny Welleman has been included as Annex 7. Prediction maps for *Spisula subtruncata* have been prepared by Johan Craeymeersch (in Dutch). E. Jagtman added that prediction maps of Cockle and *Arctica islandica* have been made by the Netherlands.

Finally, Habimap GIS application was demonstrated, as developed by Dick de Jong for the Netherlands part of the North Sea. It holds layers on sediment type and bathymetric data, and biological assemblages have been presented as EUNIS categories down to levels 3 and 4. (The biological assemblages may need to be added to the EUNIS classification.) This tool serves to demonstrate what a high resolution, international habitat map for the North Sea, as currently under development, might look like. It was agreed that a lot of end users will find this type of product very useful.

2.5 Norway (John Alvsvag)

John Alvsvag gave an oral presentation; no national status report is included in this report.

Many small coastal areas have been defined as Marine Protected Areas (MPAs). These were selected based on the fauna, or were areas that had some historic interest as reference points. For the offshore area, two areas with *Lophelia pertusa* coral reefs are protected. Compared to the distribution of the reefs along Norway, these two areas are small. There is an ongoing process to evaluate the need for an increased number of protected areas.

In Norway the offshore region is poorly mapped. However, there is an application to the government for a large joint project (MAREANO) between different research organisations to do this mapping. The focus will be aimed at an Internet-based GIS system where the different users can get information on basic data for the seabed, on bathymetric information, biotopes, pollution, and geology. The system will also be open for input from additional sources. All information included in the system must be traceable for quality control. The project will cover the Norwegian Sea.

Norway has started a 4-year offshore project covering a much smaller area to compare classical sampling equipment such as grabs and sledges, and results from multibeam backscatter data, single-beam multi-frequency data and video transects to map habitats in deeper waters (200–400 m).

Eric Jagtman informed the meeting that a newly planned Norwegian project is to be undertaken by Ph.D. student Trine Bekkby from Norway (A landscape ecological approach to coastal zone planning, Bekkby *et al*., 2001). This project awaits funding.

2.6 Finland (Jan Ekebom)

The slides of the PowerPoint presentation and the written status report are attached as Annex 8. The presentation included:

- a brief introduction of the characteristics of the Finnish Baltic Sea coast;
- the available classification of marine habitats;
- a more detailed presentation of Habitat Directive Annex I habitats (a total of 8);
- the mapping concerning these habitats;
- the available field, remote sensing and GIS methods; as well as
- the environmental officials involved in marine habitat mapping.

2.7 France (Brigitte Guillaumont)

Brigitte Guillaumont reported on the REBENT project she is involved in, a programme commissioned by the Ministry of Environment.

Starting event: ERIKA, in 1999

- Phase 1 (start in December 2000 and end in mid-2001; the REBENT approach has been developed in a test area: Brittany):
  - Analysis of the demand (e.g., oil spill sensitivity maps, EIA, Habitats Directive, WFD, protected areas, integrated management, global change, regulation rhythms: 3, 6 years);
  - New techniques evaluation, e.g., imagery (satellite, aerial photographs, LIDAR), acoustic methods (e.g., side-scan sonar, multibeam);
  - Inventory of regional data available;
  - Determination of REBENT approach and products. This includes the production of general and local maps of intertidal and sublittoral areas using imagery, morphosedimentary interpretation, *in situ* observations, habitat classification and characterization. A selection of areas and habitats/communities has been made for local mapping and survey monitoring programmes, including biodiversity surveys on sample stations.

- Phase 2 (start 2001, continues until end of 2002):
  - Communication and validation of approach and products by scientists and users;

- Finalization of typology and habitats units/mapping, production of the monitoring handbook and prototypes;
- Definition of point and map databases;
- Assessment of organization scheme for operational monitoring, planning and cost evaluation.

A national inventory related to geological surveys using acoustic methods has been published. The main recent activities in habitat mapping concern seagrass (*Zostera* in Brittany, *Posidonia* in Mediterranean). Aerial photographs, side-scan sonar and ground-truthing techniques were used.

2.8 Germany (Heye Rumohr)

Heye Rumohr reported on ongoing and completed mapping projects in German waters. The Alfred Wegener Institute (E. Rachor, Bremerhaven) is presently engaged in mapping habitats and zoobenthos communities that may fall under the EU Habitats Directive. They have problems with the depth definitions (<20 m) and wish a connection with benthic primary production that would allow the inclusion of offshore banks >30 m. They put high importance on "habitat complexes/mosaic habitats (e.g., Helgoland Area) and they see a special importance in ecosystem functions" such as spawning and nursery areas (e.g., eelgrass meadows) and refuge areas for harsher winters.

From the fishery side (BfA) there is no actual mapping project although they have valuable data from the IBTS surveys and from the EU epifauna monitoring project (2000 and 2001) that produced actual distribution charts of several species in the North Sea.

A very comprehensive mapping project was the thematic mapping and sensitivity grid of the German Wadden Sea (Bernem, K.-H. *et al*., 1994). This was the first thematic mapping in the German Wadden Sea. It was later complemented by similar chartings in estuaries of the German coast.

The same approach is currently followed along the Baltic coast with a detailed sensitivity charting in relation to pollution and oil combatting. The phytal region (0–10 m) was mapped and eight transects are regularly surveyed by divers. The habitat classification follows the one issued by HELCOM (red book).

H. Rumohr also mentioned that HELCOM had started a new information service on its web page a few weeks ago (www.helcom.fi), and this will include maps, site-specific information, and photographs.

2.9 EUNIS Classification (Cynthia Davies)

In addition to the presentation of the national status reports, Cynthia Davies introduced the EEA's European Nature Information System (EUNIS) which comprises a series of linked databases for reporting the state and trends of nature at a European level. There are linked modules dealing with sites, species and habitats. There is a predefined accepted system of nomenclature for species, but for habitats there has been no "common language". The EUNIS habitat classification aims to meet this need and to provide a tool for naming and describing habitats. The EUNIS habitat classification provides a European framework to enable local and national classifications to be fitted into a European perspective. The marine part of the classification is based mainly on the BioMar work, and OSPAR and ICES Working Groups have contributed to its development to cover the wider geographical area.

Help was requested from members of the WGMHM to fill in the parameter frame to describe habitat units and to check for duplication, overlap and gaps in the existing units.

The presentation is included in full as an Annex 9 to this report.

Eric Jagtman, in reaction to an earlier remark that field data need to be linked to the EUNIS classification in order to be able to test its practicability, asked how data could be put into the system. Cynthia Davies replied that feedback on the classification and descriptions of the units can be made via the EUNIS website (http://www.mrw.wallonie.be/dgrne/sibw/EUNIS/home.html) or by contacting the classification development team (Cynthia Davies and Dorian Moss) at CEH, Monks Wood.

David Connor reported on the involvement of OSPAR with the EUNIS classification.

There have been two joint OSPAR/ICES/EEA workshops on habitat classification. In addition, there is an ongoing literature review on habitats by each OSPAR Contracting Party. The collation of this information will be used to advise on changes and adaptations to the EUNIS classification system.

2.10 Standardized Format for the National Status Reports

On the basis of the national status reports, Eric Jagtman summarised the items that needed further discussion during the meeting:

- WGMHM to develop a standard format for National Status Reports (NSR) for use in future years;
- the need to organise a meeting to develop standardized guidelines on habitat mapping;
- the need to link field data to the EUNIS habitat classification;
- clarify the relationship between mapping and classification (scale issues).

The meeting took forward the discussion on the main elements that should be contained in the next round of national status reports to be produced by WGMHM members.

Key elements which should be included in a status report were identified as follows:

1) Organisation, name of contact person*;
2) Project title;
3) Date of work, expected year of reporting*;
4) Geographical coverage (country, region)*;
5) Techniques used (e.g., acoustics, ground-truthing)*;
6) Data sets generated (e.g., bathymetry, physical habitat, biological, photographic)*;
7) Brief description of work (including depth range);
8) Outputs: Reports, publications, maps, reference lists;
9) Classification used; local (within project), national (state), EUNIS;
10) Targeted end-users.

The group agreed to use this format for the next year's meeting. The standardized NSR to be presented at the WGMHM meeting should cover the points marked with * for each organisation's activity and a national summary. In addition, each country will produce a map of national activities showing the geographical coverage. The full list may serve as a basis for filling out a national inventory. This map could provide a basis for EU/HELCOM to identify gaps in habitat mapping.

2.11 Discussion

Although technical meetings setting standards for mapping techniques have been organised in the past, it was felt that further work on this topic is needed. Several options were discussed, including a joint meeting with the Benthos Ecology Working Group (BEWG) and the Working Group on the Effects of Extraction of Marine Sediments on the Marine Ecosystem (WGEXT), with the aim of reviewing techniques used for habitat mapping and initiating the production of summary guidelines for the conduct of this type of work (from field data collection through to final map presentation). If any meeting were to be organised, then a preferred date would be by the end of 2002. That would enable the organisers to take into account the outcome of the theme session at the 2002 Annual Science Conference dealing with imagery techniques. Craig Brown agreed to take the idea forward.

It was apparent from the considerable number of mapping studies under way that the following issues needed to be addressed:

a) the present difficulty to exchange or pool data between projects due to differences in data collection standards;
b) the variety of ways of interpreting and presenting data that make amalgamation of end maps unfeasible;
c) the insufficient linking of field data with the EUNIS classification or to provide feedback on the practicability of the EUNIS classification. Further practical testing of this classification was therefore needed.

3 PROGRESS IN HABITAT MAPPING

3.1 Broad-scale Maps

ToR b) discuss progress in the development of high resolution habitat maps, with a focus on the North Sea and Irish Sea, and identify the needs for further development;

ToR c) discuss progress in the development of low resolution, broad-scale, coarse habitat maps for the whole ICES area.

In the Netherlands, a habitat mapping project has been carried out for the international southern North Sea and the Wadden Sea. Data from Germany, Denmark, Belgium, the Netherlands, and the United Kingdom have been used. The report and habitat map of the international southern North Sea and Wadden Sea will be available for review by WGMHM by the end of 2002. The EUNIS classification is implemented in the project. A general problem in habitat mapping is the number of different types of data and processing. When working in international geographical areas, it often is difficult to put everything together. Although processing data from a range of countries proves to be troublesome, it was concluded that merely time will overcome this trouble, and that there is no direct need for further development.

For the North Sea, BEWG has developed a benthos database, which should provide useful data for habitat map production.

The development of habitat maps is not just restricted to the North Sea and Irish Sea but also includes the Baltic Sea. There is an ongoing project on sensitivity mapping in the German Baltic coast, within the HELCOM coastal monitoring project. There is, as yet, no coordinated effort to produce habitat maps, although a lot of habitat mapping is carried out, e.g., in relation to development of wind farms at sea. A meta-database should be set up (see Section 6, below) to better coordinate mapping efforts.

David Connor provided an update on habitat mapping in relation to the OSPAR Biodiversity Committee and the North Sea Ministerial Conference. OSPAR wishes to develop both detailed maps of the North Sea and low resolution maps of the entire OSPAR area. There is a wish for these habitat maps in relation to better infrastructure planning, but also to meet scientific research needs.

An OSPAR workshop is planned for autumn 2002 to develop a plan for how such maps could be achieved. Proposals on how to achieve such a map need to be presented to the Biodiversity Committee next year, including information about which type of map can be created with certain amounts of money/time. It may be sensible to develop demonstration maps in the short term, whilst working towards more sophisticated maps on a longer time frame. One particular issue that needs to be addressed is that there are a lot of different map producers and end-users and ideas about habitat mapping. We have to define much more clearly what is required and what is achievable.

There was discussion on the merits of using existing data (which are recognised as varying in quality and spatial coverage and have problems with compatibility between data sets) and undertaking a major new survey to get high quality data (which is likely to be costly). The time seems to be right for an integrated multi-beam survey for the whole North Sea. This would supply a good baseline habitat map. It was considered ultimately better to invest in a single comprehensive project than to invest piecemeal in smaller projects, and end up with a less useful product.

Points of concern raised were:

- Once things are on a map/in a system, they will be assumed to be the truth. There needs to be an assessment of the confidence in the maps supplied.
- The issue of temporal change in communities was discussed and whether this could be accommodated in maps and the EUNIS habitat classification. There is a difference between a classification system and a site map. The component habitat units in a site may change over time, but the classification system of those units does not need to be changed. Temporal change needs to be presented within any mapping system.
- The issue of the age of data to be included was discussed. Assessment needs to be made on the data quality and the scale of interpretation before deciding whether to use old data.

The draft text from the Bergen scientific meeting on habitat mapping was examined and modified to take account of the WGMHM discussion. The meeting concluded that the proposed workshop was required to move the development of an

international North Sea GIS-based multi-layered map forward. They recommended that ICES jointly contribute to the workshop. Amended terms of reference for the proposed OSPAR Workshop to assess the feasibility of preparing a GIS-based habitat map were endorsed by WGMHM and are included as Annex 10.

3.2 Requests for Future Work

The Chair was contacted by the ICES Secretariat concerning an informal request from EEA to extend the area of interest of WGMHM to the Mediterranean and the Black Sea areas. In discussing this request, the Working Group felt that the issues in these areas are the same as those in the Northeast Atlantic. The Working Group accepted that the EUNIS classification has to cover those areas as well, and that EUNIS already includes the Mediterranean classification that was developed for the Barcelona Convention. France has a lot of activities in the Mediterranean; Spain has some projects going on which are quite well developed. The situation in Italy, Greece and the Black Sea area was not very well known by the participants at the meeting.

In conclusion, the Working Group expressed its willingness to exchange experience with other scientists in the areas mentioned. A special workshop organised by EEA was seen as a good step ahead, rather than including these new areas in the remit of WGMHM (and which is, in the case of the Black Sea, outside the geographical coverage of the ICES Convention). In contact with the ICES Secretariat, the following points need further clarification:

- EEA expectations should be more exactly specified;
- Working Groups operate on the basis of voluntary contributions from Working Group members. Additional work is more easily taken on if EEA is willing to fund some of the activities, e.g., a workshop for the Mediterranean;
- The same might apply for the invitation of the necessary experts to such a workshop.

3.3 Towards a Baltic Marine Classification

ToR e) discuss whether the habitat classification system, under development, can be extended to the Baltic Sea area and, if so, develop a draft work plan for this.

WGMHM has accepted to extend its area of attention to the Baltic Sea area, provided that there will be major input of expertise from the Baltic countries. This item is now for the first time included in the ToR of WGMHM, but since only two representatives from Baltic Sea countries were present at the meeting (Germany and Finland), the Working Group acknowledged that only limited progress is possible during this meeting. For future meetings, input from all Baltic countries is essential (Sweden, Finland, Russia, Latvia, Denmark, Estonia, Lithuania, Germany, Poland). The Working Group decided upon a discussion as a starting point, and to explore what approach could be taken in order to be able to prepare a draft work plan for the development of a Baltic marine classification.

First of all, the Working Group agreed that it is possible to connect the principles of the EUNIS classification to the Baltic Sea. Expertise from the Working Group was offered, but input from the Baltic Sea area is essential to extend it to that area. It was advised to invite specific people from the Baltic Sea countries to be sure to have the right expertise in the Working Group.

As a good example of a project approach in developing a classification, David Connor was asked to give an overview of the BioMar classification system. This was a LIFE-funded project to develop a classification system for the UK and Irish waters for a wide range of users.

The project started by reviewing the classifications available at the time and identifying the best points from each to develop the new classification. The worst points were also identified and avoided. Many systems are complicated by having many levels of information, and it was important to decide the level of complexity to be aimed for. The CORINE classification (the forerunner to EUNIS) was a hierarchical system with five levels. Two international workshops were organised to discuss the way forward for the general development of the system and to ensure that the framework had wide application across Europe. The marine part of the EUNIS classification has subsequently been developed from the BioMar system.

On-going field survey programmes collected biological samples and regional classifications were developed. This exercise took a significant amount of effort but produced a beneficial end product. Combining data from the regions was time consuming as they were at the bottom of the learning curve.

It was felt that a Baltic system should not have to spend an equivalent amount of time on this aspect of the project. More emphasis should be spent on the mapping aspect of the end product than was done for BioMar. This will help the drawing of boundaries around communities. Local classifications can be identified from the scientific literature, i.e., a local estuary study might describe a number of locally distinct communities, which could be used within the larger classification system. However, the literature may not always exist, or it might be of insufficient quality. Communities may be able to be predicted in some areas where biological data does not exist. In the Baltic, different driving forces will affect the distribution of communities from those prevalent in the Atlantic system.

The BioMar system allowed the consistent mapping of habitats which help the decision-making process for marine managers. It allows the assessment of site quality and status, and also allows for the consistent comparison of communities.

Jan Ekebom, in response to the presentation, agreed that this type of classification could be used effectively as a management tool in the Baltic. Some general points were then discussed to promote the development of a Baltic classification, including the provision of historic data (remote sensing, Remots), and the need to look for EC funds to provide money for the meeting of Baltic interested parties.

The HELCOM Baltic Red List of habitats, available at the meeting, might provide a starting point for the development of a Baltic classification system, but it would need to be developed in some way. WGMHM felt that the Red Book does not describe the biology at a sufficiently detailed level; it is more of a substrate description. It needs to include the biota in more detail.

In order to enable WGMHM to progress in this field, HELCOM needs to provide a clear definition of what they expect from a classification system to allow the proposed meeting to focus on the relevant issues. Does HELCOM want the contents of the Red Book to be further developed? The Working Group discussed if a position paper on the way ahead needs to be written, and who should do it. This paper should not pre-define a system that should be used, but rather describe the issues and (after discussion with interested parties) end up with an appropriate suggestion. In this respect, reference was made to two proposals dealing with the classification of Baltic habitats but these were not further considered at this meeting. It may be appropriate that a representative from WGMHM should present available systems to a wider audience. It was proposed that the available literature be considered in an overview paper along with other systems. This may be possible if the EEA were able to fund a meeting to take this work forward. HELCOM should be made aware of this as potential joint funders/participants. ICES should provide expert classifiers to assist in this work.

WGMHM agreed to propose that Cynthia Davies and Heye Rumohr, either together or separately, produce an overview paper on the description of EUNIS, a description of current and potential Baltic classification systems, and also include the HELCOM statement of their requirements (Jan Ekebom). Depending on further endorsement for a meeting from either HELCOM, EEA or ICES, invitations should then be sent out to national experts to attend a meeting, in plenty of time to allow funding to be secured. Names of national experts to be invited were suggested by WGMHM. Others that should attend should include the Baltic Marine Biologists (contact: Pauli Snoeijs), the Conference of Baltic Oceanographers, and the Baltic Geologists. A timescale for the preparation of an overview paper and the meeting needs to be decided. The position paper should be completed by September 2002, and official endorsement by ICES needed to be explored. The paper should be placed on the ICES and HELCOM websites for comment. General notification of the meeting to interested parties should be carried out as soon as possible. It should be noted that travel funding is often spent by November/December each year. As soon as our report is presented to ICES, the Chair will advise ICES to send a letter to HELCOM, copied to EEA, suggesting that the overview paper be produced. We should note in our report to ICES/HELCOM that, whilst a literature review will be very useful, further work will need to be carried out to fill in significant gaps in data, and also to further define the unusual environmental conditions present there (temperature, anoxia, geological youth, freshwater mixing). Other funding options (e.g., Large Marine Ecosystems) should be investigated.

4 ASSESSMENT OF OSPAR PRIORITY LIST FOR ENDANGERED HABITATS

ToR: The Working Group was asked to consider a request from OSPAR to "Provide an assessment of the data on which the justification of the habitats in the OSPAR Priority List of Threatened and Endangered Species and Habitats will be based; this assessment should be to ensure that the data used for producing the justification are sufficiently reliable and adequate to serve as a basis for conclusions that the habitats concerned can be identified, consistently with the Texel-Faial criteria, as requiring action in accordance with the OSPAR Strategy on the Protection and Conservation of the Ecosystems and Biological Diversity of the Maritime Area."

Background papers:

2002 Report of the Working Group on Ecosystem Effects of Fishing Activities, Section 13: Threatened and declining habitats: are the data sufficient.

Document 21: Management Committee on the Advisory Process. "Priority list of threatened and endangered species and habitats." (Details of the OSPR request).

The same request had been made to WGECO, who had undertaken a thorough assessment at its meeting in March 2002. Their report was available at the meeting. WGMHM agreed to review the conclusions of this group (WGECO, Section 13). The document was discussed by means of an item-by-item discussion of the proposed priority habitats for the OSPAR list.

4.1 Carbonate Mounds

Conclusions of WGMHM: There was insufficient expertise in the WGMHM group to comment on this habitat type.

4.2 Deep-sea Sponge Aggregations

Notes: There was no direct expertise in the WGMHM group, but the work of the BioFar and BioIce projects should be considered. There may also be further information available through the Atlantic Frontier and Environmental Network (AFEN). David Connor will provide references to work by Brian Bett.

Additional references which should be considered: Brian Bett; BioIce; BioFar;

Conclusions of WGMHM: There was insufficient expertise in the WGMHM group to comment on this habitat type, but further literature references were suggested.

4.3 Marine Intertidal Mudflats

Notes: Heye Rumohr was concerned that there was no reference to work under the trilateral Wadden Sea agreement. The habitat in the Wadden Sea is highly dynamic owing to natural as well as anthropogenic processes. There are documented cases where there has been an increase in the number of marine intertidal mudflats, and that there were differences between OSPAR regions. There appears to be a contradiction in the conclusions reached by WGECO (compare assessment of the literature cited and used and the WGECO assessment). There is a possible confusion between marine and estuarine intertidal mudflats and this needs to be clarified.

Additional references which should be considered: (Heye Rumohr will provide references for the Wadden Sea).

Conclusions of WGMHM: The group felt that there was a possible confusion between two habitat types in the assessment and that there was insufficient evidence presented to determine the threat status of marine intertidal mudflats throughout the OSPAR region. They advised that the habitat type should be considered more carefully before adding to the list for the whole OSPAR area.

4.4 Littoral Chalk Communities

Notes: The literature cited were overview reports, which refer to more detailed reports. The habitat is also found on the Møn and Rügen islands.

Conclusions of WGMHM: The group supported the statement "The quoted literature is convincing and it is not considered that further justification is necessary, although an assessment of the status of chalk communities elsewhere in European coastal waters would be helpful." However, the statement "Good evidence for decline and threat throughout the whole OSPAR area" was not supported. The problem occurs mainly in Britain and the threat is less elsewhere. Further research on the extent of the threat was recommended.

4.5 *Lophelia pertusa* reefs

Notes: It was assumed that Mark Tasker's report to ICES on this habitat type had been considered in the assessment of threats to the habitat, although no reference was made in the literature cited. Jan-Helge Fosså's work and that of Anthony Grehan should be considered.

Additional references which should be considered: Norwegian report, 1998; video film as shown during the meeting by Jan Alvsvag.

Conclusions of WGMHM: The WGECO evaluation was confirmed.

4.6 Oceanic Ridges with Hydrothermal Effects

Notes: This is a very rare habitat type and there is little available literature. While there is little evidence for damage at present, this does not mean that there is no threat.

Conclusions of WGMHM: There is insufficient data to show existing decline.

4.7 Seamounts

Notes: More literature is available within the OSPAR area and should have been reviewed, especially for Germany. The habitat is threatened by trawling.

Additional references which should be considered: no detailed information was available at the meeting.

Conclusions of WGMHM: There is a potential threat, but no evidence for decline. Further assessment is needed taking into account additional literature.

4.8 *Ampharete falcata* Sublittoral Mud Community

Notes: This is believed to be a very rare community, which is poorly documented. Ivor Rees and Matt Service have worked on this habitat in the Irish Sea and produced reports in the grey literature.

Conclusions of WGMHM: The group agreed with the WGECO assessment, but recommended that Ivor Rees should be asked to provide supporting evidence.

4.9 Intertidal Mussel Beds

Conclusions of WGMHM: Agreed with the WGECO conclusions.

4.10 Estuarine Intertidal Mudflats

Notes: See comments under marine intertidal mudflats, above.

Conclusions of WGMHM: The distinction between the threats to marine and estuarine intertidal mudflats should be clarified.

4.11 Maerl Beds

Notes: Brigitte Guillaumont suggested that further references were available but agreed with the conclusions in general.

Additional references which should be considered: no detailed information was available at the meeting.

Conclusions of WGMHM: Additional literature should be reviewed and OSPAR Regions II and IV should be added.

4.12 *Modiolus modiolus* Beds

Notes: Additional literature should be reviewed.

Additional references which should be considered: (John A. to provide references for Norway).

Conclusions of WGMHM: Agreed with WGECO.

4.13 *Ostrea edulis* Beds

Conclusions of WGMHM: Agreed that this habitat was under threat and should be on the list.

4.14 *Sabellaria spinulosa* Reefs

Notes: There is another species (*S. alveolata*) which forms reefs; in French waters in OSPAR Regions II and IV it is considered under threat.

Additional references which should be considered: (HR to provide references for Germany, e.g., Riese and Reise; BG for France). Berghahn and Vorberg (1993) is cited in the text of WGECO's report and should be included in the literature list.

Conclusions of WGMHM: Agreed with WGECO. It was suggested that *S. alveolata* reefs should also be considered for inclusion.

4.15 Sublittoral Mud with Seapens and Burrowing Megafauna

Additional references which should be considered: Lindeboom, H.J., and de Groot, S.J. 1998. IMPACT-II: The effects of different types of fisheries on the North Sea and Irish Sea benthic ecosystems. NIOZ rapport 1998–1. Den Burg, the Netherlands.

Conclusions of WGMHM: Agreed with WGECO.

4.16 *Zostera* Beds (*Z. marina, Z. angustifolia* and *Z. noltii*)

Notes: These habitats are under threat in the region.

Additional references which should be considered: (BG to supply references for France)

Conclusions of WGMHM: Further evaluation of OSPAR Region IV is required based on French references.

WGMHM concluded that WGECO's work had been thorough but the conclusions drawn had sometimes been too general. More specific evidence should be provided on a regional basis.

Additional references should be added to this report and the relevant OSPAR representative should be notified that additional research is required in particular areas.

WGMHM also concluded that a distinction should be made between natural and managed communities, particularly with reference to *Ostrea* beds and intertidal mussel beds.

5 PROPOSED EcoQOs FOR HABITATS

Tor f) Review EcoQOs for habitats as proposed at the North Sea Ministers Conference (NSMC).

5.1 Introduction

OSPAR is developing Ecological Quality Objectives (EcoQOs) for the North Sea as part of its implementation of the Biodiversity Strategy. A list of ten proposed objectives was presented to the North Sea Ministerial Meeting (Fifth North

Sea Conference) in Norway (March 2002). A distinction was made with regard to the stage of development of the objectives:

1) EcoQOs in an advanced stage (some EcoQOs finalized);
2) EcoQOs less advanced (identified issues but no details; habitat quality objectives are in this group).

An output of the Ministerial Meeting was a declaration that a preliminary list of subject areas (List B) was agreed and the work should be taken forward on the other lists (including the development of habitats EcoQOs).

5.2 Discussion

Discussion centred on a document provided by OSPAR. The Working Group was asked to comment on the content of the paper in terms of the information provided for Habitats EcoQOs only. It was recommended that the observations from the Working Group should be general, as the level of detail provided was not great. It was concluded that the objectives were vague and needed elaboration. The first goal suggested was that a practical course of action would be to identify (name) more specific habitats under threat and to assign the quality objective in light of the specific characteristics of the habitat. The proposed OSPAR priority list of endangered habitats may serve as a good basis for this. It was pointed out that rudimentary objectives/goals may be set, based upon historical distributions and records; however, this will not fully address the quality aspects. The practicality of restoring habitats was also raised, in that it was not deemed feasible (economically, ecologically) in many impacted areas to restore habitats. For example, it may actually be impossible to return large amounts of aggregate to areas. It was suggested that the goals of the EcoQO's should not be to restore the habitat *per se*, but that restoration goals should improve the overall environmental quality to provide the basis or potential for natural recovery of the habitat.

The definition of quality was also discussed. It was pointed out that the definition of quality, in many instances, was a value judgment. The issue of setting specific goals may not account for temporal variation in habitat parameters. It was agreed that the quality goals should be strictly defined in light of the habitat under consideration.

WGMHM developed a list of potential quality labels that could be used to develop more specific EcoQOs for habitats. Potential quality goals would require the identification of:

a) Natural processes within habitats. Identify the range of dynamic parameters within a habitat that would support, for example, larval to adult development of species characteristic of the habitat;
b) Community composition and structure;
c) Unique (rare/sensitive) habitats;
d) Recovery potential of habitat;
e) Reproductive potential of habitat;
f) Production potential of the habitat;
g) Natural distribution and extent of habitat;
h) Diversity of functional groups;
i) Disturbance levels:
    - Biological (non-native species);
    - Chemical (contaminants);
    - Physical (anthropogenic; natural catastrophic events);
j) Aesthetic aspects.

The discussion concluded with a number of recommendations on how best to facilitate the further development of EcoQOs for habitats:

1) The EcoQOs can only be developed in light of specific habitats chosen. It may not be feasible to establish EcoQOs that are generic for all habitats.
2) The habitats chosen should be based on the OSPAR priority list of threatened and declining habitats being developed by the Biodiversity Committee.
3) A comprehensive review of all literature pertaining to the habitat should be reviewed in order to establish baselines or benchmarks for specific quality standards. This review may avoid redundancy of effort and may identify gaps in information that could direct future research efforts.

A number of more general recommendations were also given:

1) The description of the objectives to develop habitat EcoQOs is vague and requires elaboration specifically in relation to the overall goals of the strategy.
2) Investigate the experiences of other similar strategies that have been instigated previously to attain EcoQO-type objectives (e.g., HR cited a strategy in Europe 20 years ago).
3) The development of objectives should take cognisance of one of the requirements of the Water Framework Directive to develop metrics to assess environmental quality for marine habitats.

6 DATA COLLECTION AND EXCHANGE

ToR d) discuss progress in the setting up of a data exchange platform to service the above initiatives and to develop standards or best practices for data handling with regard to habitat maps, taking into account the report produced by WGMDM.

Eric Jagtman introduced this subject by reiterating some statements made at the Galway 2001 meeting of WGMHM (WGMHM, 2001), stating that:

> *There was general agreement amongst WGMHM participants that there is a need to coordinate and compile a catalogue/database of existing data sets which are of use in habitat mapping activities. There was a suggestion that metadata should be collated by ICES to allow greater integration and distribution of data sets which would facilitate the production of broad-scale habitat maps. It was commented that ICES is already attempting to "stream-line" their existing databases.*
>
> *(……)*
>
> *There was agreement that the role of setting standards for data formats, metadata, etc., should not fall to WGMHM. This is a huge and costly process and other organisations are better placed to do this (e.g., International Hydrographic Organisation). WGMHM should, however, be establishing guidelines for the production of habitat maps (e.g., EUNIS Level 3 habitat maps).*

In San Sebastian, the Working Group, once again, agreed that there was a need for the exchange of information (and data), and proposed steps to implement this process:

1) Communication between organisations working in the field of habitat mapping should be improved. This could initially be achieved through a dedicated website, where organisations could post summaries/information/reports regarding their activities. CEFAS is suggesting the development of such an initiative for the UK.
2) Dissemination of information should initially take place at a national level, coordinated by WGMHM members. This would facilitate the compilation and production of national status reports. National status report forms could be filled in online.
3) ICES should be asked for the possibility of using its website to link national sites together (if this is possible). The access to this site, and information within, should be open to the public.
4) The ICES Working Group on Marine Data Management (WGMDM) should also be contacted in order to ask them for their opinion and/or recommendation on this initiative (action by WGMHM members).

7 CLOSING OF THE MEETING

On Friday morning, the Working Group discussed in plenary the draft report that was produced on the basis of the contribution of the rapporteurs. After several amendments had been made, the text in the main body of the report was accepted. Final arrangements were made for completing the report by correspondence (inclusion of the Annexes).

Yolanda Sagarminaga was thanked for the hospitality and the provision of meeting facilities.

7.1 Election of New Chair

Eric Jagtman had announced in advance of the meeting that he was planning to resign as Chair, relating to his new position within the policy department of the Dutch Ministry of Transport and Public Works. David Connor (UK) announced that he was willing to stand as candidate for the Chair position. In the ensuing election, he was elected with

general votes. The new Chair-elect was congratulated by the outgoing Chair, who expressed the hope that the Working Group would continue to contribute to the dynamic field of habitat classification and mapping.

The Working Group expressed their thanks to Eric Jagtman for his commitment and guidance in establishing this new Working Group and steering it through its initial meetings.

7.2 The Agenda for 2003

The **Working Group on Marine Habitat Mapping** [WGMHM] (new Chair: D. Connor, UK) will meet in Sandy Hook, New Jersey, 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 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;
f) assess progress in 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) *(optional) review the progress in the intersessional workshops on standardising techniques for habitat mapping, to include members of WGEXT and BEWG and national agencies.*

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

The supporting information for these terms of reference is contained in Annex 13.

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ANNEX 2: AGENDA

Tuesday April 2, 2002

Opening session at AZTI

- Welcome by Host, Yolanda Sagarminaga on behalf of AZTI
- Domestic arrangements
- Selection of rapporteurs for the meeting
- Finalising the Agenda, setting the timetable
- Introduction of Terms of Reference

Discussion of Terms of Reference a) collate and review national status reports on marine habitat mapping and, on basis of this, evaluate the practicability of classification systems developed thus far;

Lunch

Review of national status reports continued

Wednesday April 3, 2002

Terms of Reference b) discuss progress in the development of high resolution habitat maps, with a focus on the North Sea and Irish Sea, and identify the needs for further development

Terms of Reference c) discuss progress in the production of low resolution, broad-scale, coarse grid maps for the whole ICES area;

Form: Presentations by Working Group members

Lunch

Terms of Reference e) discuss whether the habitat classification system, under development, can be extended to the Baltic Sea area and, if so, develop a draft workplan for this [HELCOM 2002/5];

Form: Workshop on basis of contributions by Cynthia Davies (EUNIS) and Baltic Working Group members

Thursday April 4, 2002

09.00 **Continuation of TOR e)**

Probably in parallel:
Terms of Reference d) discuss progress in the setting up of a data exchange platform to service the above initiatives and to develop standards or best practices for data handling with regard to habitat maps, taking into account the report produced by WGMDM;

Lunch

Terms of Reference f) review EcoQOs for habitats as proposed at the North Sea Ministers Conference (NSMC).

Friday April 5, 2002

Election of new WGMHM Chair

Draft Working Group report distributed for reading

Plenary discussion of draft report

Setting the Agenda for next year

- Terms of reference 2003
- Date and venue for 2003 meeting (Tom Noji has offered to arrange the meeting at his laboratory in Sandy Hook, New Jersey, USA)

13.00 End of meeting

ANNEX 3: NATIONAL STATUS REPORT FOR IRELAND

A selection of habitat surveys carried out in Ireland in 2001

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There were numerous mapping surveys carried out in Ireland in 2001. These surveys were primarily identified from replies to a short questionnaire circulated to other state agencies. The surveys outlined reflect surveys that had the involvement of state agencies only. This report identifies a wide range of goals and technologies used to achieve those goals.

It is apparent that given the broad range of techniques and goals used to map habitats in Ireland, the potential for overlap and redundancy of effort was high, particularly if communication among the agencies involved is lacking. The Marine Institute is funding a desk study to review inshore mapping activities and to recommend a management strategy to map inshore resources. The Terms of Reference for this project are appended to this report. The steering group for this project comprises representatives of numerous state agencies involved or interested in mapping activities. It is proposed that this steering group will also act as a coordination group for marine mapping activities in Ireland.

The following descriptions are intended to provide a cursory overview of mapping activities carried out in Irish waters in 2001. They reflect some of the mapping efforts that have involvement of state agencies. The surveys described are not intended as a comprehensive list of surveying activities in Ireland, as some efforts were privately sponsored. In addition, the report highlights some surveys that are scheduled for 2002.

Broadscale Surveys

Survey Title: National Seabed Survey

- Organisation: Geological Survey of Ireland (GSI; primary coordinating agency).
- Reason for survey: Acquire baseline information on seabed characteristics for Ireland's territorial waters with the goal of efficient management and sustainable development of potential resources.
- Location and coverage (sq km): Ireland's territorial waters 525,000 km^2. The overall area is divided into three zones, according to depth contours (Figure A3.1):
  - Zone 1 (0–50 m contour) ;
  - Zone 2 (50–200 m contour) ;
  - Zone 3 (200–4500 m contour).
- Technology used: Multi-beam (bathymetry and backscatter), single-beam, sub-bottom profiler, magnetometer, gravity meter.
- Targeted users of output: Resource managers, government agencies, academia and private sector.
- Any other relevant info: Zone 3 (completed); Zone 2 (start in 2002); Ground-truthing to be carried out in targeted areas (areas of interesting geomorphological structures) beginning in 2002.

Survey Title: Galway Bay Survey (Aug/Sept 2001)

- Organisation: Marine Institute, Geological Survey of Ireland.
- Reason for survey: As a precursor to the Zone 2 (50–200 m) survey of the GSI National Seabed Survey, an inshore survey was carried out to calibrate and fine-tune mapping capabilities aboard the RV "Celtic Voyager".
- Location and coverage (sq km): Galway Bay.
- Technology used: Multibeam, magnetic and sub-bottom profiler.
- Targeted users of output: Geological, navigational and fisheries interests.
- Any other relevant info: Surveying carried out according to standards set by the Geological Survey Ireland for the seabed survey.

Survey Title: CARACOLE (Carbonate mound and coral investigations using ROV)

- Organisation: IFREMER, Martin Ryan Marine Science Institute Galway.

- Reason for survey: Detailed geo-referenced inspection and mapping of geology and biology of known deep-water coral areas. Trialing of ROV-mounted SeaBat multi-beam for microbathymetric mapping.
- Location and coverage (sq km): Five carbonate mound and coral reef areas in the Porcupine Seabight, and Rockall Trough margins (Figure A3.2). Approx. 95 km surveyed.
- Technology used: IFREMER "Victor" ROV (5000 m rated) with vertical and oblique video and high-resolution digital still cameras.
- Targeted users of product: Scientific community and conservation agencies.
- Any other relevant info: Joint Irish-French(IFREMER)-EU survey.

Regional Surveys

Survey Title: Dingle Scallop Survey, July 2001

- Organisation: Marine Institute.
- Reason for survey (fisheries, bathymetric, etc.): Scallop stock assessment and fishery management - A new scallop fishery is developing in the area. A project was developed in cooperation with BIM and the local fishermen to develop the fishery together with a management plan for the fishery. This survey was designed to map the currently exploited grounds in an attempt to relate catches to a ground type. Biological data: length, weight, age, and fishery data: catch, effort, etc., have also been collected from the fishery in this area.
- Location and coverage (sq km): 71.6 sq km.
- Technology used: Single-beam echosounder with ECHOPLUS.
- Targeted users of product: Fishery Assessment Scientists and Fishing Industry.
- Any other relevant info: Data set consists of Longitude, Latitude, Seabed classification, Depth (tidally corrected), E1, E2, Time, and Date. There was some validation using UWTV.

Survey Title: cSAC Mapping Survey

- Organisation: Marine Institute, Dúchas (Heritage Service).
- Reason for survey: Generate baseline biotope maps to be used to develop management plans for the SACs.
- Location and coverage:
  - Valentia Harbour and Port Magee Channel cSAC;
  - Kilkerrin Bay and Islands cSAC;
- Technology used: Single beam echosounder with RoxAnn.
- Targeted users of product: Government agencies for conservation and resource management.
- Any other relevant information: Surveys complemented by ground-truthing (drop video, grab sampling programme and diver surveys).

Survey Title: South Wexford Fish Habitat Survey

- Organisation: Board Iascaigh Mhara (BIM: Irish Sea Fisheries Board).
- Reason for survey: Classification of essential fish habitat – to identify important spawning, nursery and fishery grounds.
- Location and coverage: Ballyteigue Bay and Saltee Islands (approx. 51 km^2).
- Technology used: Echosounder with RoxAnn.
- Targeted users of product: BIM, other development agencies, management agencies and fishermen.

Survey Title: South Coast Scallop Habitat Survey

- Organisation: Board Iascaigh Mhara (BIM: Irish Sea Fisheries Board).
- Reason for survey: Classification of scallop habitat – relating habitat to catch rates to develop predictive models.
- Location and coverage: South of Waterford (approx. 512 km^2) in 30–50 m water depth.
- Technology used: Multi-beam backscatter.

- Targeted users of product: BIM (Irish Sea Fisheries Board), other development agencies, management agencies and SE Scallop Association.

Survey Title: Acoustic Survey of Herring Stocks (Pelagic Survey)

- Organisation: Marine Institute.
- Reason for survey: As a consequence of collapse of fisheries in recent years, the need for effective management of the stock is evident. To facilitate the development of management plans, acoustic surveys of stocks were undertaken to estimate stock size.
- Location and coverage:
  - The Celtic Sea and Div. VIIj Stock;
  - The Div. VIa South and Div. VIIb Stock;
  - The Div. VIIa North Stock;
- Technology used: Simrad scientific echosounder with Simrad EP500 software.
- Targeted users of product: Fisheries managers and industry.
- Any other relevant information: Surveys are carried out in these ICES boxes annually. The echograms are interpreted according to certain biomass characteristics of the target species. Consequently, these surveys may also serve to determine estimates of other stocks (e.g., mackerel, horse mackerel, sprat) and phytoplankton characteristics also.

2002 Surveys (Proposed)

Survey Title: National Seabed Survey

To commence Zone 2 surveys

Survey Title: *Nephrops* UWTV, June 2002

- Reason for survey: *Nephrops* stock assessment - for *Nephrops* burrow density estimation. Also to investigate the effects of trawling on benthos.
- Location and coverage (sq km): Back of Aran Islands and Galway Bay *Nephrops* grounds, 950 sq km.
- Technology used: UWTV on sled, RoxAnn, trawl (multi-beam, benthic grab possibly).
- Targeted users of output: Fishery Assessment Scientists, Fishery managers.
- Any other relevant info: Methodology and Objectives as per MARLAB Aberdeen *Nephrops* UWTV surveys.

Survey Title: cSAC Mapping Surveys

- Reason for survey: Generate baseline biotope maps to be used to develop management plans for the SACs.
- Location and coverage:
  - Kenmare River cSAC (to 50 m contour);
  - Roaringwater Bay cSAC;
  - Clew Bay cSAC.
- Technology used: Not yet decided.
- Targeted users of product: Government agencies for conservation and resource management.
- Any other relevant information: Surveys to be complemented by ground-truthing (drop video, grab sampling programme and diver surveys).

Survey Title: Malin Head Crab Habitat Survey

- Reason for survey: Identify habitat relevant to crab recruitment.
- Location and coverage: Malin Head, Co. Donegal.
- Technology used: Echosounder with RoxAnn.
- Targeted users of product: BIM fisheries monitoring programme.

Survey Title: South Wexford Fish Habitat

Goal is to survey an expanded area (described above) using similar techniques.

Survey Title: Acoustic Survey of Herring Stocks (Pelagic Survey)

Same as above.

Figure A3.1. National Seabed Survey zones.

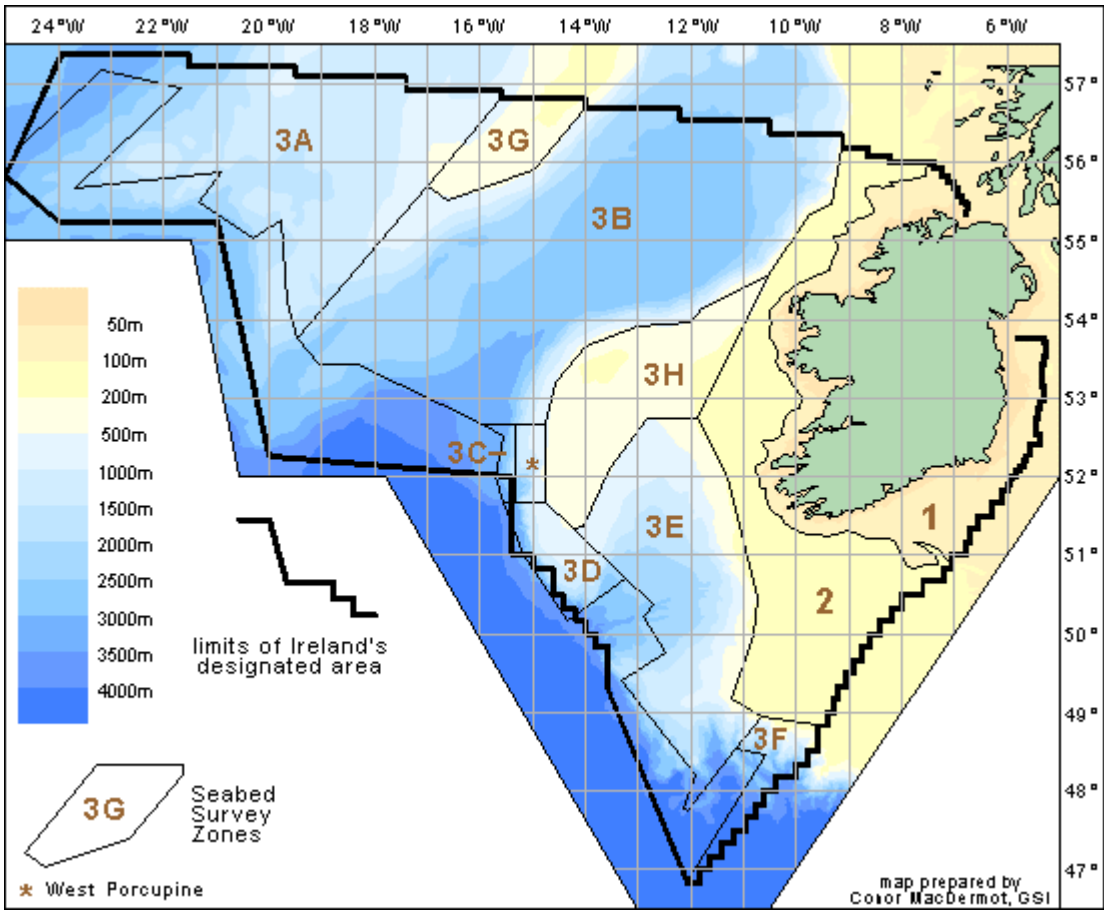
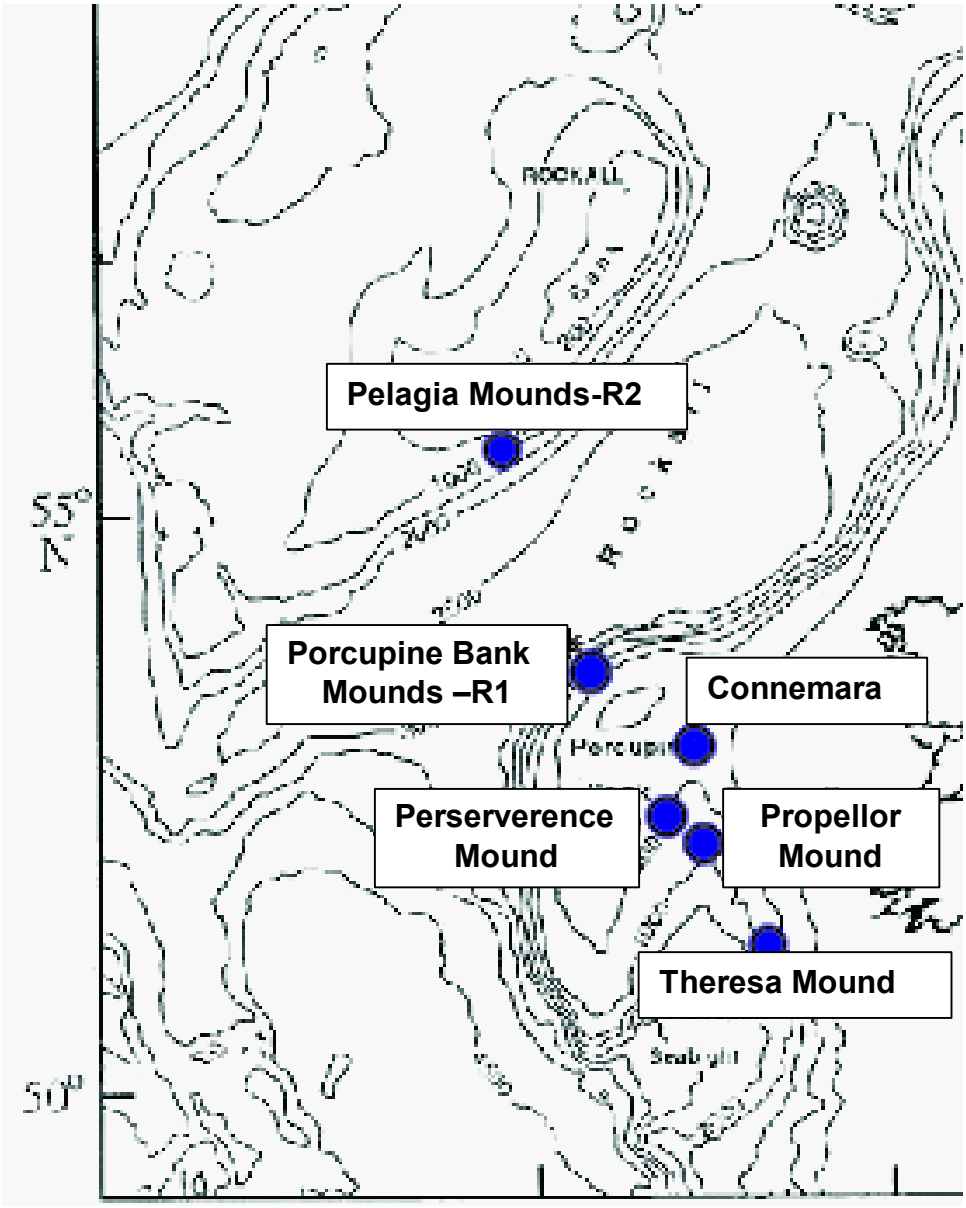


Figure A3.2. CARACOLE survey locations.



Feasibility Study on the establishment of a Large-Scale Inshore Resource Mapping Project

Deliverables/objectives

1) Identify national (including statutory) seabed mapping requirements for inshore resource assessment and development (depth range: 0 – 50 m);
2) Identify existing Irish inshore seabed mapping programmes and relevant digital mapping data holdings;
3) Identify and evaluate current inshore resource mapping techniques (to include: data collection, processing and map production);
4) Identify, by way of international case histories and "best-practice", how other coastal states have addressed their inshore resource mapping requirements;
5) Undertake a cost-benefit analysis of existing inshore mapping techniques relevant to the Irish situation;
6) Recommend, on the basis of identified national needs, a prioritised and costed inshore mapping strategy for Irish coastal waters.

Background

The sustainable development of the inshore marine resource (0–50m depth) requires strategic information on bathymetry, currents and living and non-living resources, etc., preferably in map format. To date, while a number of thematic and site-specific marine resource mapping programmes have been undertaken, there has been no concerted programme to prepare a comprehensive map of all Irish inshore resources.

There is general agreement that an interactive inshore resource map/database would provide an invaluable tool for resource evaluation, and sustainable resource development and would in assist in conflict resolution.

This desk study will identify priority requirements, evaluate mapping techniques and provide a basis for dialogue amongst the relevant national agencies with a view to initiating the establishment of a Large-Scale Inshore Resource Mapping Project.

Other instructions

The consultant will liaise closely with relevant national agencies to determine their legislative and research requirements related to seabed mapping and the type of outputs they require.

ANNEX 4: UK MARINE HABITAT MAPPING ACTIVITIES – 2002

(Edited by Craig Brown)

There are many marine habitat mapping initiatives currently under way or recently completed within UK coastal waters. The following list of UK marine habitat mapping activities has been compiled to provide an overview of activities which can (potentially) be used to test the EUNIS habitat classification system. The list includes major mapping activities and is by no means all-inclusive. There are many smaller mapping initiatives which are currently taking place, or which have been completed in recent years, which are not included in this report.

Centre for Environment, Fisheries and Aquaculture Science

Several mapping initiatives have been undertaken (and are still ongoing) by CEFAS, as detailed below.

Project Title: Mapping of gravel biotopes and an examination of the factors controlling the distribution, type and diversity of their biological communities. (AE0908).

Date(s) of the work: 01/04/98–31/03/01.

Geographical areas covered: Four sites in the Eastern English Channel (between Isle of Wight and Dungeness).

Techniques used (acoustic and ground-truthing methods):

Acoustic: Side-scan sonar, QTC, Bathymetry.

Ground-truthing: Hamon Grab (PSA and macrofauna), 2-m beam trawl, Camera dip.

Data sets generated (e.g., side-scan sonar mosaic, species data, photographic, particle size data, etc.):

Side-scan mosaic, interpolated QTC, species abundance data, particle size data, video, still photographs.

Brief description of the work:

Four 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.

Output from the work (reports/papers/maps/websites, etc., please give references):

Brown, C.J., Hewer, A.J., Meadows, W.J., Limpenny, D.S., Cooper, K.M., Rees, H.L., and Vivian, C.M.G. 2001. Mapping of gravel biotopes and an examination of the factors controlling the distribution, type and diversity of their biological communities. Sci. Ser. Tech. Rep., CEFAS Lowestoft, 114:43 pp. http://www.cefas.co.uk/publications/tech114.pdf

Foster-Smith, B., Brown, C., Meadows, W., White, W., and Limpenny, D. 2001. Ensuring continuity in the development of broad-scale mapping methodology – direct comparison of *RoxAnn* and *QTC-View* technologies. http://www.cefas.co.uk/publications/report_ae0908.pdf

Brown, C.J., Cooper, K.M., Meadows, W.J., Limpenny D.S., and Rees, H.L. 2002. Small-scale mapping of seabed assemblages in the Eastern English Channel using sidescan sonar and remote sampling techniques. Estuarine, Coastal and Shelf Science (in Press).

At least two additional papers are being prepared for publication in peer-reviewed journals.

Contact name and address for further details of the work:

Chris Vivian/Alison Hewer
CEFAS Burnham Laboratory,
Remembrance Avenue,
Burnham-on-Crouch
Essex, CM0 8HA
United Kingdom

Project Title: Role of seabed mapping techniques in environmental monitoring and management (AE1033).

Date(s) of the work: 01/04/01–31/03/05.

Geographical areas covered: North Sea, English Channel, Irish Sea.

Techniques used (acoustic and ground-truthing methods):

Acoustic: Side-scan sonar, dual frequency RoxAnn and QTC, Sub-bottom profiling.

Ground-truthing: Hamon Grab/Day Grab (PSA and macrofauna), 2-m beam trawl, Camera dip.

Data sets generated (e.g., side-scan sonar mosaic, species data, photographic, particle size data, etc.):

Side-scan mosaic, species abundance data, particle size data, video.

Brief description of the work:

To date pilot studies have been carried out at 5 sites, three of which are dredged material disposal sites and one of which is a current aggregate extraction site.

Further work is planned in the English Channel, Liverpool Bay and additional sites in the North Sea.

Output from the work (reports/papers/maps/websites, etc., please give references):

Annual report to funding agency, further reports and publications are planned as the project proceeds. A UK interest group in marine habitat mapping is being set up in parallel with this and other related project work.

Contact name and address for further details of the work:

David Limpenny / Alison Hewer
CEFAS Burnham Laboratory,
Remembrance Avenue,
Burnham-on-Crouch
Essex, CM0 8HA
United Kingdom

Project Title/description of work:

Monitoring work carried out as part of the CEFAS memorandum of understanding to DEFRA at dredged material disposal sites. The techniques used as part of dedicated habitat mapping projects are frequently used as part of our ongoing monitoring programmes at marine dredged material disposal sites. This information serves to provide the UK government with information which will help it make informed environmental decisions relating to this disposal activity.

Date(s) of the work: Ongoing.

Geographical areas covered: Many of the major UK marine dredged material disposal sites in the North Sea, English Channel and Irish Sea.

Techniques used (acoustic and ground-truthing methods):

Side-scan sonar and AGDS (RoxAnn and QTC) with physical and photographic ground-truthing techniques. Biological sampling using Day, and Hamon grabs for infauna, and 2-m beam trawls for epifauna. Occasional use of sub-bottom profiling techniques. Geological interpretation of the acoustic output.

Data sets generated (e.g., side-scan sonar mosaic, species data, photographic, particle size data, etc.):

Side-scan sonar hard copies for earlier surveys, and mosaics for later ones. Photographic transparencies for early surveys and digital stills for later ones. SVHS video footage. Species lists. Full particle size distributions. AGDS data processed interpolated.

Brief description of the work:

We also have the opportunity to overlay other data sets collected outside of this work, such as fisheries, oceanographic and chemical data.

Output from the work (reports/papers/maps/websites, etc., please give references):

Various internal reports.

Contact name and address for further details of the work:

D. Limpenny
CEFAS
Remembrance Ave
Burnham-on-Crouch, Essex, CM0 8HA
United Kingdom
d.s.limpenny@CEFAS.co.uk

English Nature

EN are currently involved in a number of mapping activities, mainly linked to the mapping of SACs, and future mapping of SACs offshore outside Territorial Waters, although details of individual initiatives are not included in this report. Much of this work is done in close association with the JNCC.

Contacts through which to obtain further details on these activities are listed below.

Kimmo Evens (kimmo.evans@english-nature.org.uk)
Leigh Jones (leigh.jones @English-nature.org.uk)
Charlotte Johnstone (Charlotte.Johnston@jncc.gov.uk)

Scottish Natural Heritage

Project title/Description of the work:

1) Broadscale sublittoral habitat mapping of the Sound of Barra pSAC, Loch Laxford cSAC and Loch Sunart cSAC (July and August 2001).
2) Broadscale sublittoral habitat mapping of the St. Kilda cSAC/WHS (Sept. 2000).
3) Broadscale sublittoral habitat mapping of Loch Torridon MCA (2000/2001).
4) Approximately 20 broadscale mapping projects since 1993.

Geographical areas covered:

Please refer to the attached map of marine Special Areas of Conservation (Figure A4.1) and the summary table of surveys undertaken since 1993. More details are available on request.

Techniques used (acoustic and ground-truthing methods):

Acoustic –

Single-beam acoustic ground discrimination systems (e.g., Echoplus or RoxAnn), swath bathymetry and sidescan sonar.

Ground-truthing –

ROV, drop-down or towed video, grab sampling, coring and *in situ* diver observations.

Data sets generated (e.g., side-scan sonar mosaic, species data, photographic, particle size data, etc.):

Side-scan sonar mosaics, IKONOS panchromatic and multispectral satellite imagery (for Sound of Barra only), biotope complex mapping, species data, PSA, photographs and diver and ROV digital video.

Brief description of the work:

SNH has been involved in the development of acoustic mapping projects since 1993. The drivers for the undertaking of such work have stemmed from routine casework issues, sustainable resource management and the 1992 EC Habitats Directive. The 2000 survey of St Kilda was undertaken following the UK Government's proposal to extend the World Heritage Site (WHS) boundary into the sublittoral.

Output from the work (reports/papers/maps/websites, etc., please give references):

A series of published and unpublished SNH reports – available through SNH publications department (c.f. the attached survey list. Further details available on the SNH website - http://www.snh.org.uk/).

Details of the rationale and work undertaken pre-1999 are summarised in the following papers:

Downie, A.J., Donnan, D.W., and Davison, A.J. 1999. A review of Scottish Natural Heritage's work in subtidal marine biotope mapping using remote sensing. International Journal of Remote Sensing, 20(3): 585–592.

The results of two individual projects are given in the following papers:

Donnan, D. W., and Davies, J. 1996. Assessing the natural heritage importance of Scotland's maerl resource. *In* Partnership in Coastal Zone Management, edited by J. Taussik and J. Mitchell, (Cardigan: Samara Publishing Limited), pp. 533–540.

Hull, J., and Nunny, R. 1998. Mapping intertidal sediment distribution using the RoxAnn system, Dornoch Firth, NE Scotland. In: Black, K.S, Paterson, D.M. and Cramp, A. (Eds.) Sedimentary Processes in the Intertidal Zone. Geological Society, London, Special Publications, 139, 273–282.

List of biotopes identified:

A broad range of biotopes representative of Scottish coastal waters out to approx. 150 m depth. Biotopes classified according to the relevant MNCR biotope manuals.

Contact name and address for further details of the work:

Various staff within the Maritime Group, Scottish Natural Heritage, 2 Anderson Place, Edinburgh, EH6 5NP. Specific projects have been undertaken in collaboration with external partner contributions including:

1) A collaborative project undertaken with St. Andrews, Heriot Watt and Edinburgh Universities.
2) Fisheries Research Services - Marine Lab. Aberdeen.
3) SeaMap (Bob Foster-Smith, SeaMap, Centre for Coastal Management, University of Newcastle, Newcastle upon Tyne, NE1 7RU) have collaborated on a number of the mapping projects (including work under the auspices of the BioMar project).

Figure A.4.1. Distribution of marine Special Areas of Conservation (SACs).

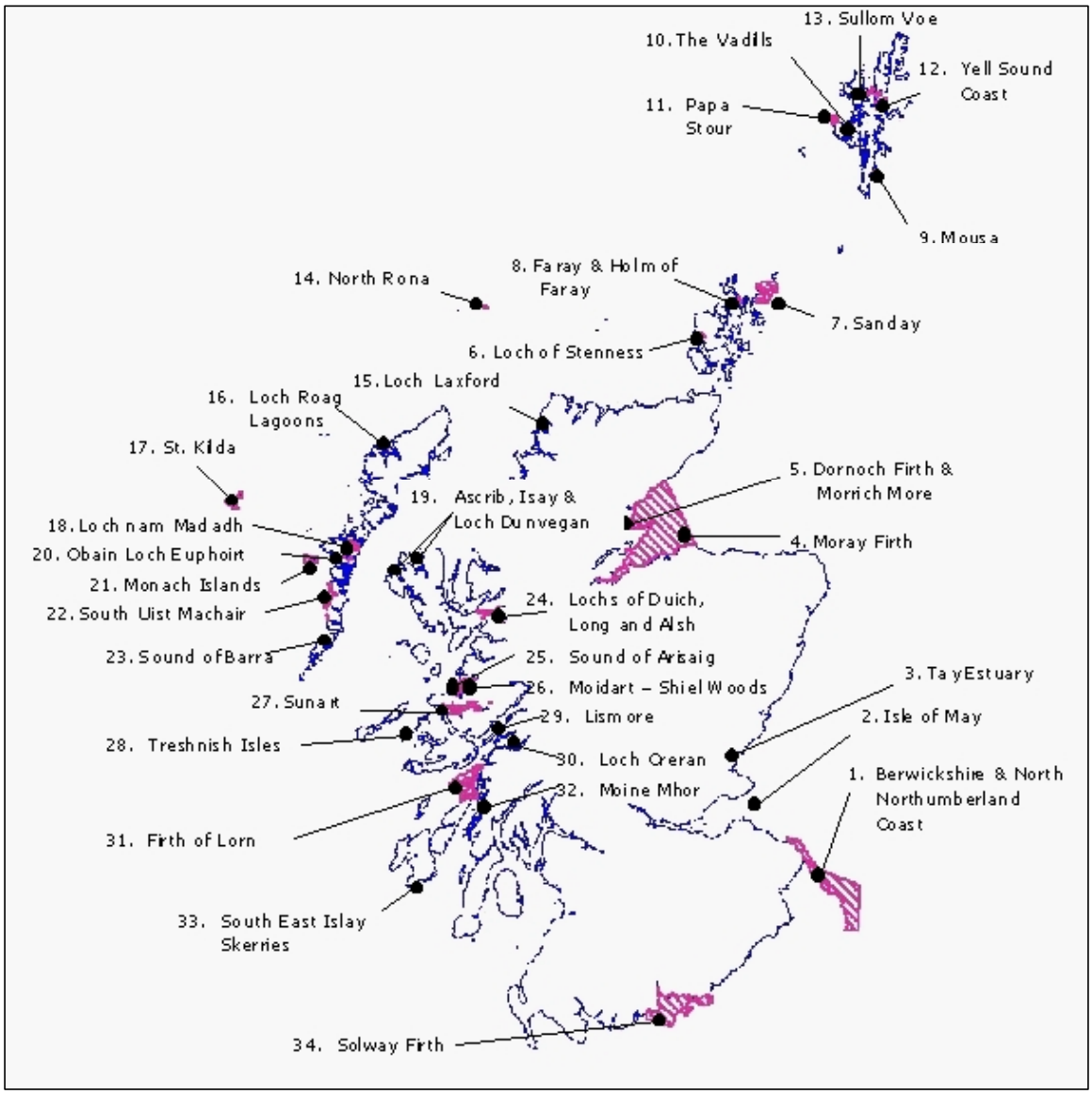


Table A4.1. Outline list of SNH broadscale mapping projects.

Location	Year	Intertidal or Subtidal	Acoustic techniques? and ground truthing methods	Reference (s) – Internal SNH publications
Rousay and Wyre Sounds, Orkney	1993	Subtidal	Yes - RoxAnn™ AGDS. Towed video, grab and dredge	Foster Smith *et al.* (1993). *Studies in Orkney. Maerl deposits*. Report No. NE/07/93/221
Berwickshire coast pSAC	1994	Sub. and Int.	Yes – RoxAnn™ AGDS. Drop/ towed video and grab	Foster Smith *et al.* (1996). *Mapping survey of the sublittoral and littoral biotopes of the Berwickshire coast*. Report No. RSM No. 60
Solway Firth cSAC	1994	Sub. and Int.	Yes – RoxAnn™ AGDS. ROV and grab	Institute of Estuarine and coastal studies (1996). *The Solway Firth: Broadscale habitat mapping*. Report No. RSM No. 46
Lochs Laxford, Inchard and Loch Eriboll	1994	Sub. and Int.	Yes – RoxAnn™ AGDS. Drop video and grab	Unpublished contractors report
South Uist, Western Isles	1995	Subtidal	Yes – RoxAnn™ AGDS. Towed video, grabs and diver (inc. core collection)	Unpublished contractors report
Busta Voe and Olna Firth, Shetland Islands	1995	Subtidal	Yes – RoxAnn™ AGDS. Towed video and grabs	Entec (1996). *Broadscale habitat mapping of intertidal and subtidal coastal areas: Busta Voe and Olna Firth*. Shetland. Report No. RSM No. 75
Sound of Arisaig cSAC	1995	Subtidal	Yes – RoxAnn™ AGDS. Towed video, grabs and divers	BioMar (1996). *Mapping of benthic biotopes in the proposed Sound of Arisaig SAC*. Report No. RSM 83
Loch Maddy, North Uist cSAC	1995/ 1996	Sub. and Int.	Yes – RoxAnn™ AGDS. Towed video, and grab	Entec (1996). *Broad scale habitat mapping of intertidal and subtidal coastal areas: Loch Maddy, North Uist*. Report No. RSM No. 76
Papa Stour, Shetland cSAC	1996	Sub. and Int.	Yes – RoxAnn™ AGDS. Drop video and divers	Entec (1996). *Broad scale survey and mapping of the seabed and shore habitats and biota*. Report No. F97PA06
Wyre Sound, Orkney Islands	1996	Subtidal	Yes – RoxAnn™ AGDS. ROV and divers (inc. coring)	Unpublished contractors report
Dornoch Firth pSAC	1996	Sub. and Int.	Yes – RoxAnn™ AGDS. Drop video, grabs and divers	Munro and Nunny (2000). *Broad scale survey and mapping of the seabed and shore habitats and biota: Dornoch Firth pSAC*. Report No. F97PA02
Lochs Duich, Alsh and Long pSAC	1996	Sub. and Int.	Yes – RoxAnn™ AGDS. Drop down video and grabs	Entec (2000). *Broad scale survey and mapping of the seabed and shore habitats and biota: Lochs Duich, Long and Alsh pSAC*. Report No. F97PA05
Summer Isles, Wester Ross	1996	Subtidal	Yes – RoxAnn™ AGDS. ROV and drop video and diver records	Unpublished contractors report
Firth of Lorne cSAC and Iona	1996/ 1997	Sub. and Int.	Yes – RoxAnn™ AGDS. Side-scan sonar. Drop video and diver records	SeaMap (1999). *Broad scale remote survey and mapping of the sublittoral habitats and their associated biota in the Firth of Lorn*. Report No. RSM No. 157 Posford Duvivier Env. (2000). *Broad scale survey and mapping of the shore habitats and biota: Firth of Lorn, western Scotland*. Report No. F97PA03
St Kilda, Western Isles cSAC	1997	Sub. and Int.	Yes – RoxAnn™ AGDS. ROV video, grabs and diver records	Posford Duvivier Env. (2000). *Broad scale survey and mapping of the seabed and shore habitats and biota: St Kilda cSAC*. Report No. F97PA01
The Vadills cSAC	1997	Intertidal	No	Entec (2000). *Broad scale survey and mapping of the shore habitats and biota: The Vadills cSAC, Shetland*. Report No. F97PA04

Location	Year	Intertidal or Subtidal	Acoustic techniques? and ground truthing methods	Reference (s) – Internal SNH publications
Loch nam Madadh cSAC	1998/ 1999	Subtidal	Yes – RoxAnn™ AGDS. Swath bathymetry and side-scan sonar. ROV and towed video, grabs and divers (inc. cores)	Howson, C.M. and Davison, A.J. (2000). *Trials of monitoring techniques in Loch Maddy cSAC, North Uist: 1998 Report*. Report No. F98AA409 SSRG and Submetrix Ltd. (2000). *Swath-sounding survey of Loch Maddy using submetrix system 2000*. Report No. F99PA19 Foster-Smith, R.L., Sotheran, I., White, W. and Davies, J. (2000). *Loch Maddy cSAC acoustic monitoring trials 1999: field survey and a summary of the 1998/99 monitoring trials*. Report No. F99PA16
Loch Creran cSAC	1998	Subtidal	Yes – RoxAnn™ AGDS. Towed/ ROV video, grabs and divers	Black *et al*. (2000). *Broadscale survey and mapping of seabed biota in Loch Creran, Argyll*. Report No. F98AA408
Loch of Stenness cSAC	1999	Subtidal	Yes – RoxAnn™ AGDS. Snorkelling records	SeaMap (2000). *Broadscale survey and mapping of seabed and shore habitats and biota*. Report No. F99PA09
Sanday cSAC	1999/ 2000	Sub. and Int.	Yes – RoxAnn™ AGDS. Towed/ drop video, grabs and divers	SeaMap (2000). *Broad scale survey and mapping of seabed biota: Sanday kelp beds*. Report No. F99PA06 Chris Howson *et al*. (2000). *Intertidal survey of Sanday SAC and SPA*. Report No. F00PA26
St Kilda cSAC	2000	Subtidal	Yes – Multibeam swath bathymetry, side-scan sonar and single-beam AGDS. ROV/ Towed video, grabs and diver records	Not yet finalised
Loch Torridon MCA	2000/ 2001	Subtidal	Yes - RoxAnn™ AGDS. Towed/ drop video, grabs and divers	Not yet finalised
Loch Laxford cSAC	2001	Sub. and Int.	Yes - Echoplus AGDS and bathymetric side-scan. ROV and drop video, grabs, cores and divers	Not yet finalised
Loch Sunart cSAC	2001	Subtidal	Yes - Echoplus AGDS and bathymetric side-scan. ROV and drop video, grabs, cores and divers	Not yet finalised
Sound of Barra pSAC	2001	Subtidal	Yes - Echoplus AGDS and bathymetric side-scan. IKONOS satellite imagery. ROV and drop video, grabs, cores and divers	Not yet finalised

Department of Agriculture and Rural Development, AESD, Aquatic Systems Group, Northern Ireland

Several projects/surveys have been completed, or are under way, some of which are listed below.

Project title/description of the work:

NI Inshore Mapping Project;
DARD NW Irish Sea Mapping;
SAC monitoring.

Date(s) of the work: 1997 onwards

Geographical areas covered: NW Irish Sea, North Atlantic.

Techniques used (acoustic and ground-truthing methods):

UW video, RoxAnn, Side-scan sonar.

Data sets generated (e.g., side-scan sonar mosaic, species data, photographic, particle size data, etc.):

Particle size maps ;
Habitat level 3–4 ;
Photographs and video;
Quantitative video assessment.

Brief description of the work:

See below Figures A4.2–A4.4.

Output from the work (reports/papers/maps/websites, etc., please give references):

Papers.

List of biotopes identified:

Megafaunal Burrowed mud;
Biogenic Reefs – *Modiolus* and *Mytilus*;
Sand waves;
Boulders circa littoral and infra littoral.

Contact name and address for further details of the work:

Matthew Service
AESD
Newforge Lane
BELFAST BT9 5PX

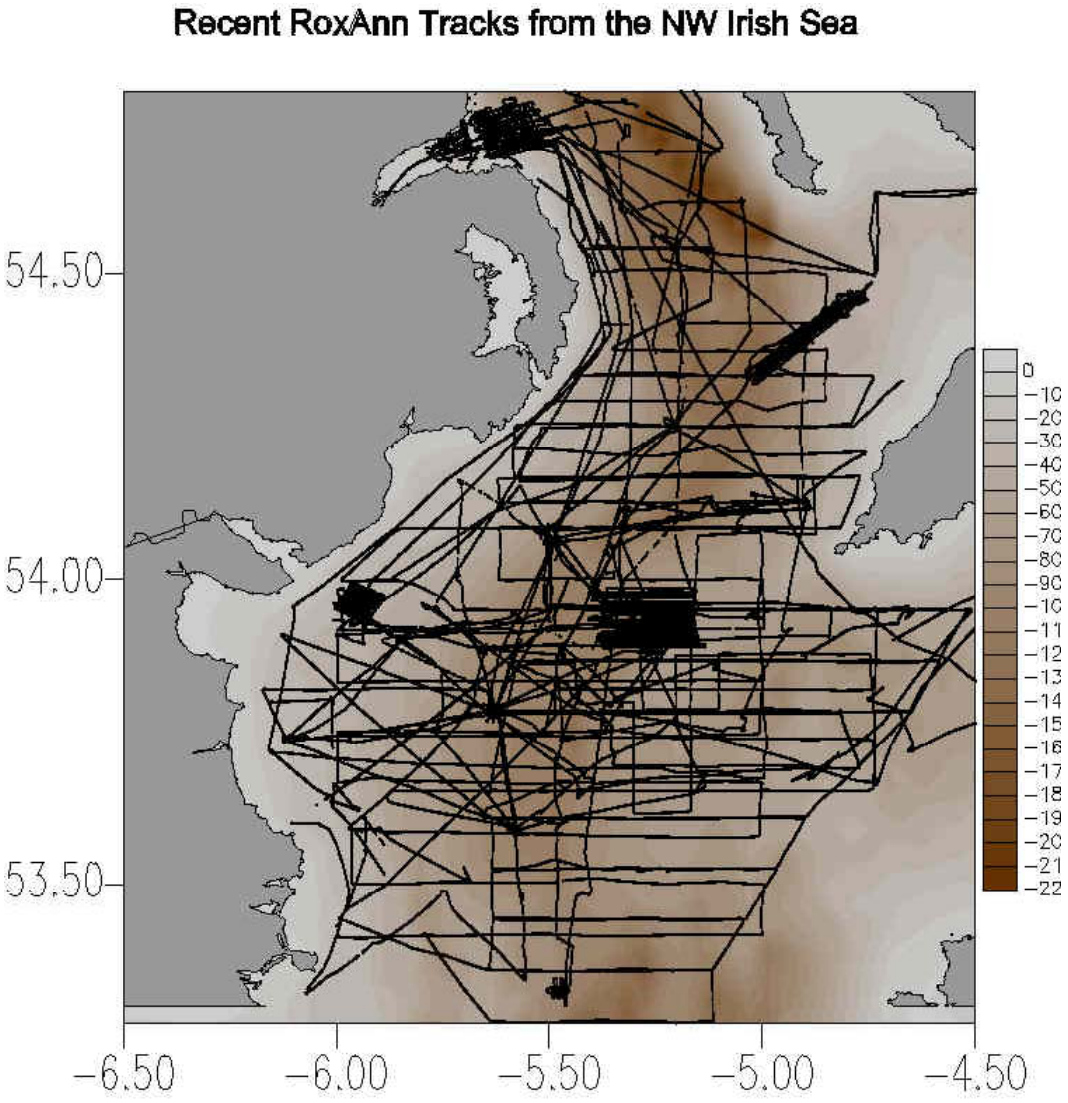


Figure A4.2. Recent RoxAnn tracks from the NW Irish Sea.

ENVIRONMENT AND HERITAGE SERVICE

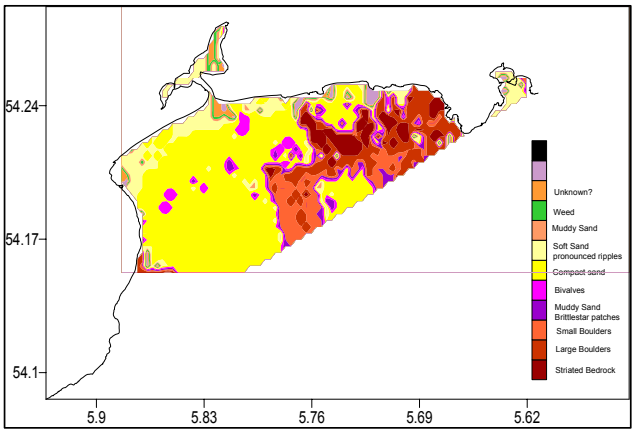
Broadscale Mapping of the Nearshore Benthic Habitats of Northern Ireland

N. Golding[1] and M. Service[2]

[1]Agriculture & Environmental Science Division, Queen's University, Newforge Lane, Belfast, BT9 5PX and
[2]Agriculture & Food Science Centre, Department of Agriculture & Rural Development, Newforge Lane, Belfast, BT9 5PX.

Over recent decades, our view of the marine environment has undergone a radical change. Increasing pressure on marine resources, legislative requirements and heightened public awareness have meant that marine conservation is now an essential element when considering any marine activity or development. In 1998, the Oslo and Paris Commission (OSPAR) recognised the need to assess which marine habitats required protection, through the production of an inventory of habitats. Further drivers for such habitat studies have come from the increasing development of mariculture and the forthcoming implementation of the EC Water Framework Directive.

Ground-truthing: **(left)**A benthic sledge fitted with u/w video and stills. The position of the sledge relative to the ship is recorded in "real time" using acoustic tracking equipment (ORE LXT System). **(right)**A Van-Veen grab is used to collect samples for Particle Size Analysis.



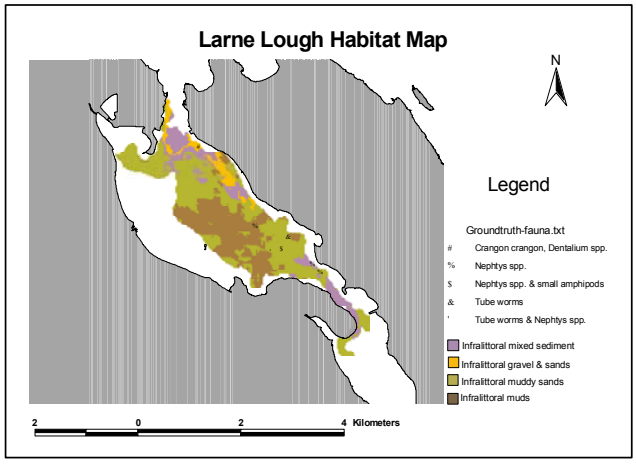
A provisional habitat map produced in *Surfer for Windows* for Dundrum Bay following a RoxAnn™ survey completed 8th August 2000. The relatively sheltered sandy western end contrasts sharply to the exposed rocky eastern end.

Modern remote sensing technologies such as RoxAnn™ and side-scan sonar, along with GIS (Geographical Information Systems) allow the production of broadscale maps, providing spatial information on the distribution of biotopes, at a relatively low cost compared to traditional survey techniques. To date RoxAnn™ surveys have been carried out in the five Northern Ireland Sea Loughs, the County Down coast and South Rathlin Island/Church Bay. Ground-truthing has been carried out using towed underwater video techniques and grab sampling. Data is analysed using IDRISI image analysis software, and then imported into a GIS application where the final maps are compiled.

Broadscale maps of benthic habitats along the Northern Ireland coastline and sea loughs will broaden knowledge of the marine life of Northern Ireland. They will greatly assist in the designation of further Marine Nature Reserves and Special Areas of Conservation (SAC), as well as allowing managers to gauge the potential impacts of new projects. In addition, broadscale habitat maps may be useful in monitoring the "conservation status" of particular biotopes such as maerl or *Modiolus* beds.

Acknowledgements:

The authors would like to thank IRTU for the use of RV Capitella, Mark Charlesworth, Tim Mackie and Crawford Jordan



A habitat map for Larne Lough completed in ArcView, using MNCR Biotope mapping colours.

Queen's University Belfast

Department of Agriculture and Rural Development

Figure A4.3. Broadscale Mapping of the Nearshore Benthic Habitats of Northern Ireland.

A preliminary classification of Irish Sea mud patch megafauna

Richard Briggs & Matthew Service

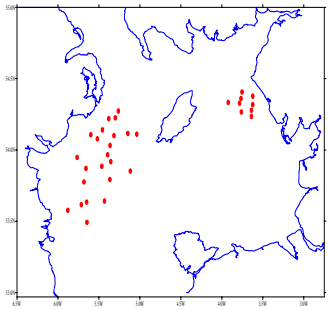
Agricultural & Environmental Science Division, DARD

Methods

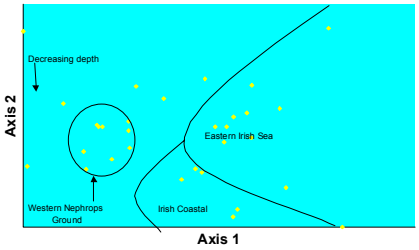
A 2-metre beam trawl fitted with a fine mesh (<10mm) has been used to sample megafauna during DARD *Nephrops* surveys since 1997. A technique has been developed whereby 5 minute tows at around 2 knots by *RV Lough Foyle* gave the best results. The catch is passed through a 2mm sieve and the retained fauna identified and quantified.

Beam Trawl

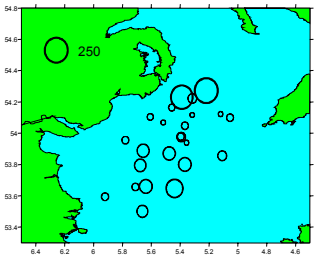
Catch



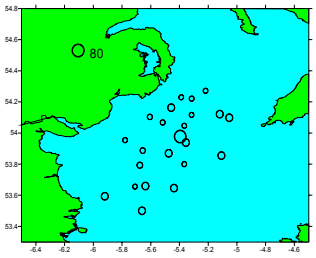
Beam trawl stations



Ordination plot



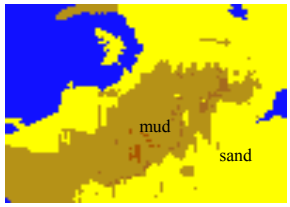
Nos *Calocaris macandrae*/ 5 minute tow



Nos *Brissopsis*/ 5minute tow

Results

Multivariate analysis splits the stations clearly.The deeper sites from the western Irish Sea are dominated by the burrowing crustacean *Calocaris macandreae* and the heart urchin *Brissopsis lyrifera.* Those on the shallower eastern side are dominated by starfish *Asterias rubens* and more mobile taxa such as the swimming crab, *Liocarcinus depurator*



Initial Acoustic Ground Discrimination map of the western Irish Sea

Nephrops on *Ampharitid* worm turf

Further more detailed analysis of 4 years survey data is currently underway. The main thrust of the investigation will be to investigate the relationship between the major fisheries and the benthic communities of the area. This will be coupled with sediment particle size data gathered from geochemical studies and acoustic mapping to produce broadscale habitat maps.

Figure A4.4. A preliminary classification of Irish Sea mud patch megafauna.

Other UK Mapping Initiatives

There are many small, localised seabed mapping initiatives under way, a selection of which is detailed below.

Scottish Association for Marine Science

Project title/description of the work: Loch Linnhe Artificial Reef Project.

Date(s) of the work: 2001 onwards.

Geographical areas covered: Lynn or Lorne.

Techniques used (acoustic and ground-truthing methods):

RoxAnn, side-scan sonar, Hamon grab, underwater video, SCUBA surveys.

Data sets generated (e.g., side-scan sonar mosaic, species data, photographic, particle size data, etc.):

Side-scan sonar mosaic of the area (4km × 3km). RoxAnn interpolated plots (E1 and E2) of the reef site (1km × 1km). Benthic community distribution maps based on side-scan sonar output (in progress). Hydrographic data sets based on current meter deployments.

Brief description of the work:

The FEPA licenses were issued in August 2001. Construction of the reef has started, and mapping techniques will be used to produce detailed biotope maps of the region. This will underpin the science programme, provide comprehensive baseline data and allow impacts of the reef construction to be assessed. A side-scan sonar survey of the site has been recently carried out in collaboration with Imperial College, London (Dr Jenny Collier) and this work is ongoing.

Contact name and address for further details of the work:

Dr Craig J. Brown,
Scottish Association for Marine Science,
Dunstaffnage Marine Laboratory,
Dunbeg, Oban, PA37 1QA
United Kingdom

(cjbro@dml.ac.uk)

Scottish Association for Marine Science

Project title/description of the work:

Mapping INshore Coral Habitats (MINCH) project to assess cold-water coral habitats in the Hebridean Sea.

Date(s) of the work: 25 May–1 June 2002.

Geographical areas covered: Survey areas are in the Hebridean Sea (Minch).

Techniques used (acoustic and ground-truthing methods):

Acoustic side-scan sonar and bathymetric survey with ground-truthing using video and stills photography.

Data sets generated (e.g., side-scan sonar mosaic, species data, photographic, particle size data, etc.):

Side-scan sonographs, bathymetry, video and still photography (conspicuous megafauna survey).

Brief description of the work:

Records of cold-water coral from inshore Scottish waters were first made in the nineteenth century. Coral occurrence was confirmed east of Mingulay in the late 1960s and by the Scottish Association for Marine Science in 2001. The MINCH survey will produce detailed surveys of these areas and describe the status of these biogenic reef habitats. It will also assess whether these areas have been affected by any demersal trawl fishing activity.

Contact name and address for further details of the work:

J. Murray Roberts,
Scottish Association for Marine Science, Dunstaffnage Marine Laboratory,
Dunbeg, Oban, PA37 1QA
United Kingdom
(m.roberts@dml.ac.uk)

Cardiff University, Dept of Earth Sciences

Project title/description of the work:

Developing methods to characterise small-scale topographic roughness in multibeam echo-sounder data for correlation with biotopes (in collaboration with a group from University of Wales College, Swansea, contact: Andrew Woolmer).

Date(s) of the work: 2002 onwards.

Geographical areas covered: Currently sand banks off South Gower coast and Swansea Bay.

Techniques used (acoustic and ground-truthing methods): Multibeam echo-sounder (Reson SeaBat 8101).

Data sets generated (e.g., side-scan sonar mosaic, species data, photographic, particle size data, etc.):

Multibeam-derived Digital Terrain Model and acoustic backscatter mosaics.

Brief description of the work:

Numerical calculations on the multibeam sonar data.

Output from the work (reports/papers/maps/websites, etc., please give references):

The project is at an early stage.

Contact name and address for further details of the work:

Mr Thierry Schmitt (PhD student)
Dept of Earth Sciences
PO Box 914
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Scottish Environment Protection Agency/Heriot Watt University

Project title/description of the work: Firth of Forth Habitat Mapping.

Date(s) of the work: February 2001.

Geographical areas covered: Inner Firth of Forth around Inchkeith Island.

Techniques used (acoustic and ground-truthing methods):

RoxAnn acoustic survey;
Drop Camera Video;
Grabbing;
Bottom Trawling.

Data sets generated (e.g., side-scan sonar mosaic, species data, photographic, particle size data, etc.):

Acoustic map;
Epibenthic species abundance data;
Particle size data.

Brief description of the work:

This study was undertaken as part of a benthic survey of the whole of the Firth of Forth which began in 2000. Sites originally surveyed in the early 1970s were re-sampled using the same grabbing methods applied in the original survey. Data collected included: infaunal species and abundance, particle size structure, organic carbon and nitrogen and sediment metal contamination.

To date, habitat mapping has been carried out over an area (see below for coordinates) around Inchkeith Island in the inner Firth of Forth. Ground-truthing samples were taken at 21 sites over the survey area. The video, grabbing and bottom trawl samples were used to generate a supervised classification of the data. It is intended that mapping of the remaining areas of the Firth will be undertaken over the coming years.

Output from the work (reports/papers/maps/websites, etc., please give references):

SEPA internal reports.

Contact name and address for further details of the work:

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Southampton Oceanographic Centre (Ken Collins)

Project title/description of the work:

Several small-scale projects aimed at specific species/habitats around the Dorset coast looking at maerl, *Sabellaria* and *Zostera* beds.

Date(s) of the work: Recent.

Geographical areas covered: Small areas (several km^2).

Techniques used (acoustic and ground-truthing methods): RoxAnn, diver, video sledge, (side-scan sonar planned).

Output from the work (reports/papers/maps/websites, etc., please give references):

http://www.cix.co.uk/~pmwr/kimmeridge/seasearch/survey.htm.

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ANNEX 5: REVISION OF THE MNCR BIOMAR MARINE HABITAT CLASSIFICATION FOR BRITAIN AND IRELAND

David Connor

Since the classification was published in 1997, there has been considerable further data collection and practical testing in the UK, particularly from surveys of marine SACs (EC Habitats Directive sites). End-users have requested more detailed information on each of the biotopes defined, including further clarity on the differences between biotopes and information on spatial and temporal variation. JNCC has therefore undertaken further analyses, using multivariate techniques on data from 30,000 habitat samples, to further define the biotopes within the classification. This has led to the definition of some new types, particularly for sublittoral sediments, whilst recent developments in the structure of the European EUNIS classification system have also been taken into account. It is expected to release the revised classification onto JNCC's website in mid 2002 (see www.jncc.gov.uk).

One area where improvements have been made is in presentation of the classification for sediment habitats. A new approach has been used, which has linked the communities defined from the data analyses with different sediment types, as reflected in the Folk trigon system used by marine geologists, and with various depth bands. This, together with other major influences, such as the salinity regime, the presence of stones and shells on sediment surfaces (enabling epibiota growth), and the presence of macrophyte and biogenic reef communities, has led to the restructuring of the classification to largely follow the EUNIS system. A modified Folk trigon, showing the main sediment type categories, is shown below, with a second trigon showing biotopes overlain (Figures A5.1a and A5.1b). This approach has led to the proposed structure for sublittoral sediment habitats in Figure A5.2.

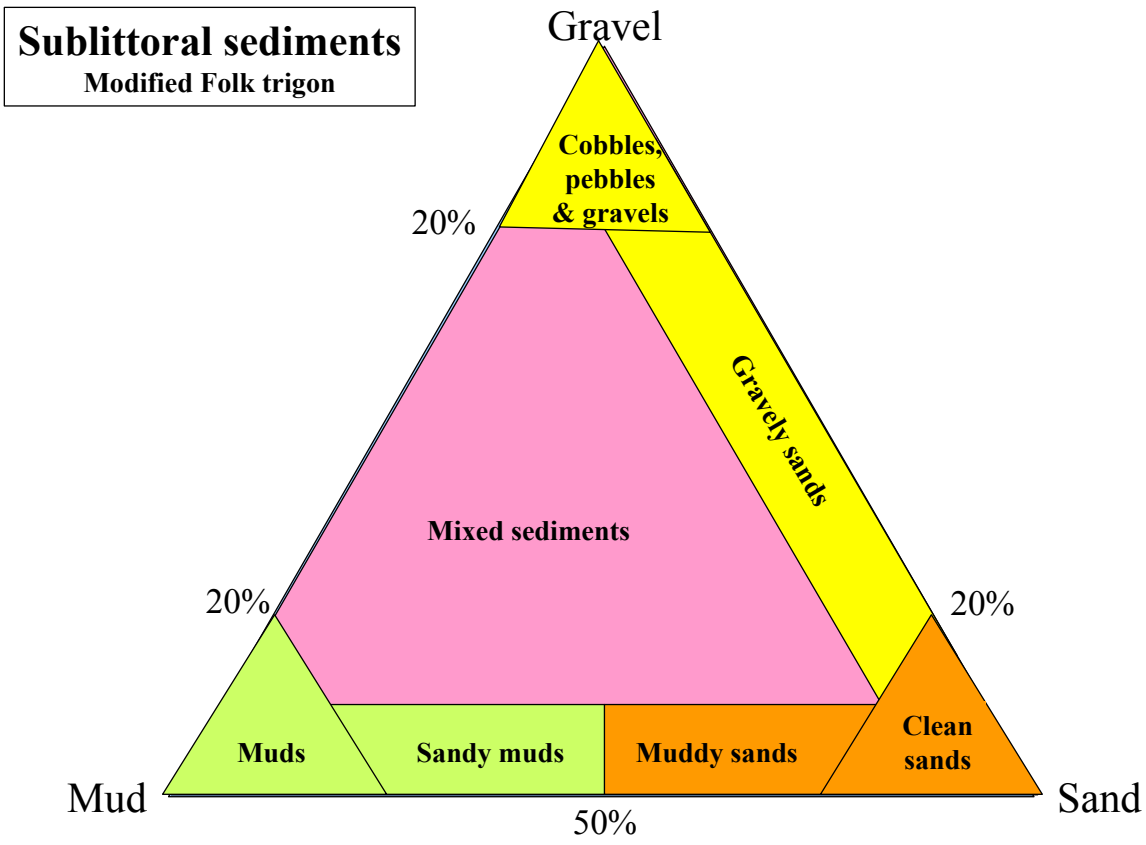


Figure A5.1a. A modified Folk trigon.

Figure A5.1b. A modified Folk trigon.

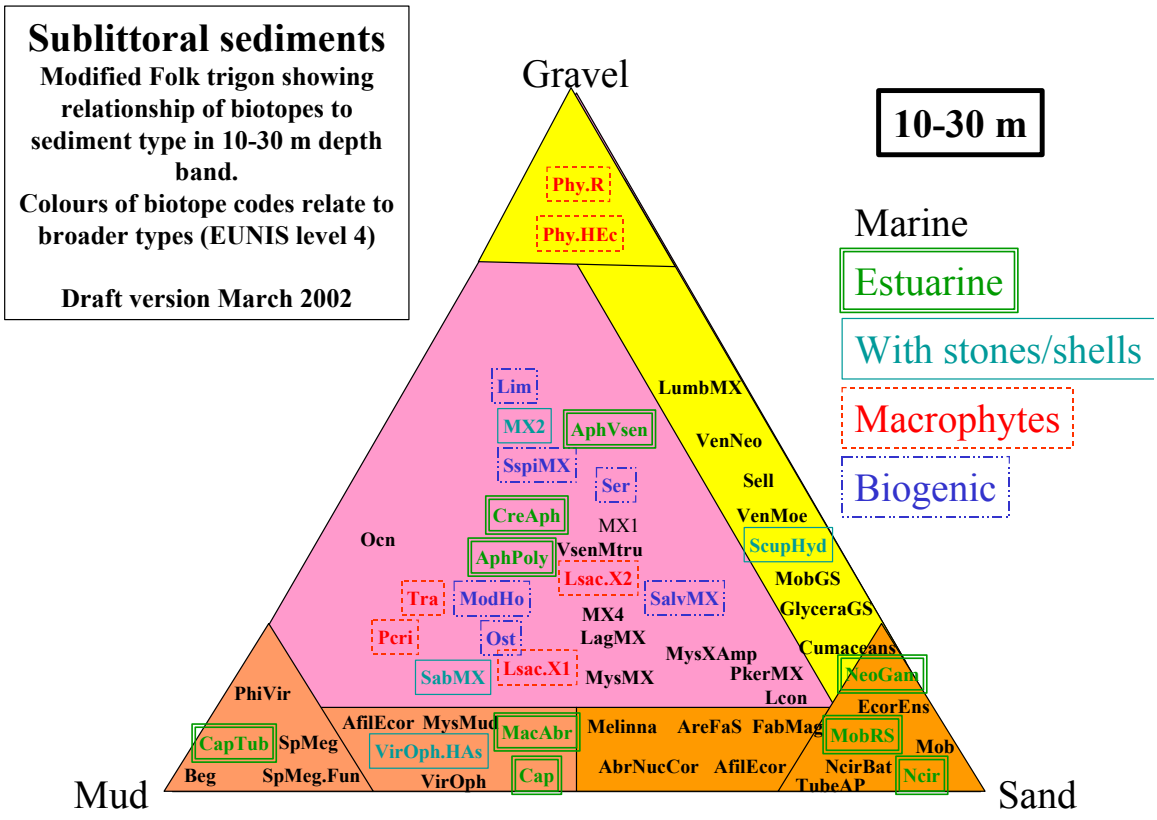
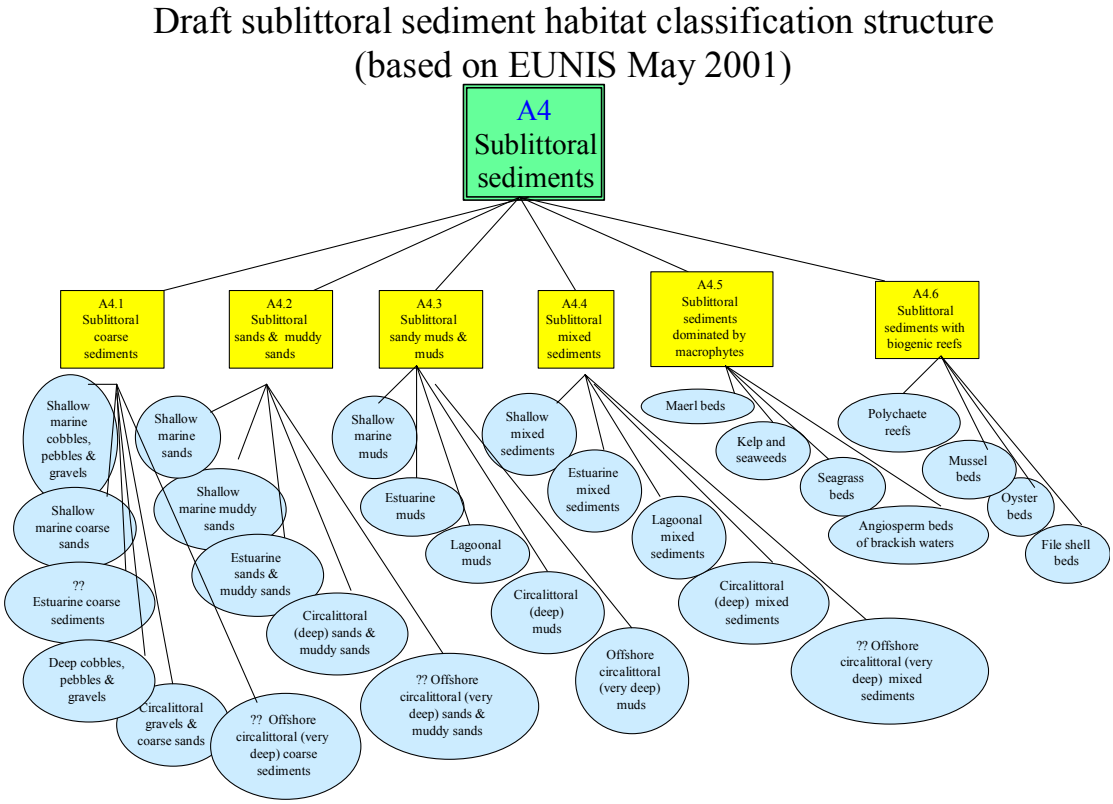


Figure A5.2. Draft sublittoral sediment habitat classification structure.



ANNEX 6: NATIONAL STATUS REPORT FOR THE NETHERLANDS

by Dick de Jong

Review of activities at the National Institute for Coastal and Marine Management/RIKZ (Directorate-General of Public Works and Water Management) as part of WGMHM during the period April 2001–April 2002

The following activities are being carried out at RIKZ with regard to the Marine Habitat Mapping in the Netherlands:

1) Habitat map southern North Sea (student report);
2) Classification of brackish habitats (both stagnant and tidal waters);
3) Classification of pelagic habitats;
4) Classification of hard substrata;
5) Overall classification of marine and estuarine habitats;
6) Use of marine habitats in the Netherlands.

Habitat map Southern North Sea

As a result of the meeting in The Hague in April 2000, student Kerstin Jerosch (University of Berlin, Germany) collected many data to produce a habitat map of the southern North Sea (extending as far as the Doggerbank) in the period 2000–spring 2001. This was first mentioned at the meeting of ICES ASC in Bruges. In spring 2001 the first report was published, and in winter 2001/02 the rest of the data has become available in a report. In the coming summer/autumn both reports have to be combined into one report for ICES WGMHM that will be submitted at the next WGMHM meeting.

Some primary main conclusions are that: a) many of the data are available somewhere, but it is very difficult to get them actually at one's disposal; b) gearing of data to one another is often very difficult due to differences in methods of measurements and differences in way of input of data, classification of data that have been carried out already, etc.; and that c) the differences in density of measurement between the various parts of the southern North Sea are very large.

Classification of brackish habitats

As the classification of brackish waters has been very unsatisfactory to us, among other things because in the Netherlands it is a question of stagnant waters with relatively stable salinities, as well as estuaries with relatively strongly fluctuating salinities, we have asked experts in the field of brackish waters to set up a better classification for this type of water. Under the auspices of Prof. Dr W.J. Wolff of the University of Groningen, a proposal has been made that can be used in both relatively stable and relatively fluid brackish water areas. The essence of their report is that both the average salinity is considered and the amplitude of its fluctuation. This fluctuation of salinity can be calculated as the coefficient of variation:

Fluctuation of salinity = coefficient of variation
Coefficient of variation = standard deviation / average *100 %

In this way, three salinity fluctuation classes can be distinguished: low < 12.5 %), medium (12.5–50 %) and high (> 50 %). These classes are still an "educated guess", but will be tested by practical experience in the near future. In order to come to average salinities, the "Venice-system" has been chosen (with boundaries at 0.3, 3, 10 and 17 g Cl/l).

Classification of pelagic habitats

The proposal for a pelagic habitat classification from Galway and Southampton is being elaborated upon for the Dutch situation. We have started a classification for the estuarine Western Scheldt and we are intending to continue further with the other large marine and brackish waters in the Netherlands, both tidal and without any tide. Not many concrete things can be mentioned about this. Some important classification criteria seem to be transparency, salinity (including its variations) and (current) dynamics. Transparency (I) is calculated as the relation between euphotic depth and depth of mixing: I = Zeu/Zm. Class boundaries arising from this are, e.g., I = <1/6: too dark, I = 1/6 – 1: light restricted, I = >1: sufficient light.

We hope that we can report more on this in the autumn or at the next WGMHM meeting in 2003.

Classification of hard substrata

A third sub-classification that has been elaborated is that for hard substrata. In the Netherlands this involves the (natural) peat and clay banks and (artificial) pitchings on the sea walls. Although as far as area is concerned they are not extensive, these hard substrata are a very important series of habitats for the Netherlands. A proposal for these for a habitat classification has been set up by specialists in this field as well.

Overall classification of marine and estuarine habitats

Based on the proposals made for marine waters, for brackish waters and for hard substrata, complemented with knowledge about the stagnant brackish and saline lakes, next summer will be spent to work on a total habitat classification for the marine and brackish, stagnant and tidal waters in the Netherlands, fitting within the EUNIS classification.

This classification should be finished at the end of 2002, so that it can be applied for the EU Habitats Directive and the EU Water Framework Directive, and for activities of a more local nature.

In addition to the classification, a "Habitat atlas of the Dutch marine and brackish waters" will be made based on existing maps. The basic method in making these maps will be the "HABIMAP-method", as described in Ecotopes in the Dutch Marine Tidal Waters (D.J. de Jong; RIKZ-report 99.017; ICES CM 2000/T:69).

Use of marine habitats in the Netherlands (for Directorate-General of Public Works and Water Management in particular)

Marine habitats have been used, or will be used, in the near future in various ways. Important issues are in EIRs (Environmental Impact Reports) on possible restoration of salt-fresh water gradients, the evaluation of the deepening of the Western Scheldt and in descriptions of the state of water systems. Habitats are increasingly applied in making concrete lay out plans as well. The use of habitats for the benefit of the Water Framework Directive and the Habitats Directive is still under discussion.

To conclude, a species-aimed habitat map has been made of the Ocean quahog (*Arctica islandica*) in order to see if human activities play a part in the actual occurrence of this species at the Dutch Continental Shelf. For this, first a potential habitat map was made based on depth and soil composition (no map was available of the important parameter of temperature near the seabed). Next, a current distribution map was made based on the potential distribution map with added to it the trawl fishing as a disturbing factor (measure of disturbance relative to intensity of fishing). Both maps correspond rather nicely with the earlier and current occurrence, respectively. (Distribution and threats of *Arctica islandica*, Y. Wessels, W. Gotjé, K.W. Broersen, D.J. de Jong and F. Twisk; made by order of Rijkswaterstaat North Sea Directorate on behalf of OSPAR IMPACT).

Reference

Wessels, Y., Gotjé, W., Broersen, K.W., de Jong, D.J., and Twisk, F. Distribution and threats of *Arctica islandica*. Rijkswaterstaat North Sea Directorate on behalf of OSPAR IMPACT

ANNEX 7: QUANTIFYING THE EFFECTS OF INFRASTRUCTURAL WORKS ON BROWN SHRIMP POPULATIONS: A HABITAT MODELLING APPROACH

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Running headline: Quantifying effects with habitat modelling.

Abstract

The brown shrimp (*Crangon crangon* L.) is one of the key species in the coastal ecosystem in the southern North Sea. Years of autumn survey catches are analysed in combination with environmental information for the catch location (sediment characteristics, salinity, temperature and depth). GLM analysis showed that catch variability decreased significantly with depth and salinity, whereas sediment characteristics are much less important. A simple model including depth and salinity is used to estimate shrimp abundance in the Dutch coastal zone and Wadden Sea. Results indicate that these two environmental factors explain 49 % of the variation in shrimp catches. The fitted relationship between salinity, depth and shrimp abundance is visualised for the whole coastal zone based on a grid map with salinity values and a contour map of depth. The map allows predictions to be made about the direct effects of infrastructural works like an artificial island off the Dutch coast. Results also indicate the need to consider the risk that environmental parameters like salinity and depth are permanently altered over larger areas.

Keywords: brown shrimp; *Crangon crangon*; geographical information system; habitat; Dutch coast

Introduction

The freshwater discharge of the river Rhine makes the Dutch coastal zone a relatively highly productive and dynamic ecosystem. The outflow is not hindered by coastal or bathymetric structures and mixing and spreading of the discharge plume follows the tidal characteristics of the southern North Sea, commonly resulting in stratification. On-shore transport of suspended matter is stimulated by a strong shoreward residual current in the bottom layer. The river water exits into the coastal zone as successive low-salinity pulses and, when wind conditions are favourable around neap tide, a typical Rhine pulse may exist in the order of a week (Ruijter *et al.*, 1997).

Assessing the potential impact, in both biological and morphological terms, of coastal engineering in this complex ecosystem is of great public concern particularly because most coastal and estuarine areas fall directly under European conservation legislation. One of the important elements of biological impact studies is the prediction of species distributions after major construction works. A go or no-go decision might, for instance, depend on the probability of a stock collapse of a key species or disruption of its associated habitat. Since the early 1980s, landscape ecology studies have commenced on this subject (e.g., Braak, 1986). Nowadays, multivariate models are often used in combination with geographical information systems (GIS) to construct habitat-suitability models for different aspects of ecosystems (e.g., Hirzel *et al.*, 2001).

The brown shrimp (*Crangon crangon* L.) is one of the most abundant species in the epibenthic community of the southern North Sea coastal zone (Beyst *et al.*, 2001). It is considered a key species of the shallow sandy coasts because shrimp serve as a major food source for many fish species (e.g., gadoids; Berghahn, 1996) as well as representing an important predator of juvenile flatfish (Modin and Phil, 1996). In addition, the brown shrimp fishery occupies the fourth position in economic value among the different commercially exploited species in the North Sea (Revill *et al.*, 1999).

General Linear Modelling (GLM; McCullagh and Nelder, 1989) is used in combination with GIS to construct a habitat-preference model of brown shrimp in the Dutch coastal zone, based on survey abundance data. This is the first step in an environmental impact assessment of coastal engineering with particular reference to the construction of an artificial island.

Materials and methods

Data source

The data stem from the Demersal Fish Survey (DFS) that has been executed on an annual basis since 1969 (Boddeke *et al.*, 1970) in August–October. During this time of the year, the abundance of shrimps reaches a maximum off the Dutch

coast, coinciding with the maximum in water temperature (Boddeke, 1976; Beukema, 1992). All major parts of the coastal nursery area from the Belgian border (including the Scheldt estuary) up to Esbjerg (Denmark) are routinely covered (Figure A7.1a). The gear used is a 4-m beam trawl rigged with a shrimping gear. In additon, RV "Tridens" fished a grid of 76 stations located on 10 transects (some of which were perpendicular to the coast) with the same shrimping gear in August 1970–1986 (Figure A7.1b). Of these, 32 stations were situated in Dutch continental waters and all hauls made at these locations were included in the analysis.

Earlier analyses of these survey data indicate a standing stock in September–October for the entire survey area (Belgian border up to Esbjerg) of 9,000–60,000 tonnes with a long-term average of 25,000 tonnes, assuming that the catchability of shrimps > 40 mm equals one (Welleman and Daan, in press). The Dutch coastal zone between 2 m and 20 m depth includes 19.8 % of the total survey area and yields on average 20.6 % of the total catch.

To model the effect of an artificial island off the Dutch coast, GIS-based environmental data for the Dutch continental part of the North Sea were provided by our partner institutes in the project. Brown shrimp have a high, but length-specific and temperature-dependent, tolerance for low salinity and preference for shallow areas (Berghahn, 1983). However, their bottom-dwelling lifestyle does not appear to demand specific sediment types (Boddeke**,** 1986). Maps with fixed depth contours were used, weekly averaged salinity (modelled), sediment characteristics (proportion of shell remains, median grain size and mud fraction) and weekly averaged chlorophyll concentration (modelled) as eco-geographical predictors for explaining survey catch rates of shrimp. The depth contour map was in m below N.A.P[1]**.** Sediment data were provided as ASCII raster maps on a 250 m × 250 m grid. Grain size is given for the top-layer of the sediment in µm and the mud content (particles < 63 µm) is given as fraction. During the RV "Tridens" surveys, ambient salinity and water temperature were observed directly.

Analysis

Because shrimp abundance can be affected by prior environmental conditions, accumulated data have been used. The weekly modelled salinity values were condensed to the lowest salinity observed in each cell on an annual basis. For the chlorophyll map, the mean during the survey period was taken as proxy for the productivity of the water mass.

The sediment parameters originated from observations extrapolated to raster information. All geographical information in the different data sets was converted to UTM positions and connected to the catch positions by using ArcView software. Translation was completed through raster and vector data by the Spatial Analyst plug-in (ESRI, 1996). Depth has been used as a nominal variable in strata corresponding to the survey design, as well as a continuous variable (actual depth). The strata are 2–5 m, 5–10 m, 10–20 m, and > 20 m.

The two survey series originated from different sampling designs and their relationship with the different (a)biotic variables was first analysed by means of correspondence analysis. Subsequently, GLM (McCullagh and Nelder, 1989) has been used to explain the variability of log-transformed shrimp catches as a function of independent co-variables. Models were fit by the Genmod procedure in SAS (SAS Institute Inc., 2000). The data of the two series were combined and all available predictor variables were tested in a Type III analysis in successive runs leaving each investigated variable out to calculate its contribution to the explained variance. The final model used for GIS application was based only on spatially varying explanatory variables, because in this case year is a nuisance variable.

Results

Model development

Figure A7.2 provides the correlation of all variables with the combined set of shrimp catches. Except for year, all parameters are linked to geographical location. Grain size and mud fraction are obviously working in opposite directions and are not independent, whereas shell fraction is correlated in a different direction. The ambient salinity measurements and the modelled minimum salinity work in the same direction, while latitude and depth are strongly aliased in the data set.

Table A7.1 summarises the Type III model outcome for the nominal variables year and depth strata and the continuous variables shell fraction and minimum salinity as main effects and including the first-order interactions. Chlorophyll, ambient salinity, water temperature, and grain size or mud content did not contribute significantly to the explained variance of the catches. Also, quadratic and higher order polynomial fits of the continuous predictor variables (shell

[1] N.A.P. stands for "Normal Amsterdam Level", a vertical reference level used for triangulation.

fraction and minimum salinity) did not improve the model and were excluded because they were biologically difficult to interpret. The main effect of shell fraction was not significant.

The full model with main effects showed a high percentage explained by co-linearity (31 %), which means that this part of variance cannot be attributed exclusively to one of the predictor variables. The four fixed depth strata explain 15 %. The contributions of the minimum salinity to the explained variance, both as main effect and in interaction with depth, are highly significant.

Given the results for the full model, the predictive model was based on the continuous factors depth and minimum salinity (Table A7.2). Co-linearity was not investigated further but must have been high. The estimates of the coefficients were used to build the predictive model:

$$\text{Log}(c+1) = 4.3685 - 0.3972\, d + 0.0298\, d^2 - 0.0026\, s + 0.0059\, d\, s + 0.0008\, d^2 s + \varepsilon$$

where catches (c) are a logarithmic-link function of depth (d), minimum salinity (s) and the Normally distributed error term (ε). Year was excluded because it has no meaning in this case. Except for salinity, all coefficients are highly significant.

The GIS approach

Outside of the range of observations, the behaviour of the predictive model is uncertain. The quadratic depth term causes an increase in catch rates in deep waters, for which data are limited (Figure A7.3). However, available information does not suggest that brown shrimp abundance increases again in deeper water and, therefore, from the minimum function value onwards the model is replaced by an exponential regression for deeper waters (> 27 m). The thus corrected model is plotted in ArcView on a joined map of depth contours and the minimum salinity grid. The window of the resulting map focuses on the area of interest for an artificial island in sea (Figure A7.4). The predicted catches for a given depth show an increase if the minimum salinity drops. The width of the area where catch rates exceed 100 individuals per 1000 m^2 is at its broadest in front of the uninterrupted coastline where the island has been planned.

Discussion

So far, our GIS-application of the model assumes that infrastructural works do not lead to changes in the spatial distribution of the different environmental parameters such as salinity and depth. However, any artificial isle will affect the hydrography of a large area and sand extraction will change the depth profile and thereby shrimp abundance. Therefore, reliable predictions about the effects of an artificial island off the Dutch coast should take into account hydrographical alterations over larger areas. This is beyond our present goal, but once the hydrographical effects can be modelled, it is relatively easy to apply the same model to evaluate the expected distribution.

Such regional effects may be either positive or negative for brown shrimp. For instance, the Delta works during the past fifty years involved the (partial) closure of some major estuarine inlets in the south (Oosterschelde, Grevelingen and Haringvliet) and this undoubtedly has had major effects on the width and speed of the coastal river. During this period, the shrimp stock and the associated fishery has also undergone major changes. Shrimpers moved from estuarine areas to the coastal zone and catch rates remained comparable (Boddeke, 1978), suggesting that the negative effects experienced in traditional areas were balanced by positive effects elsewhere.

Virtually all catches in coastal waters yield at least some shrimp. However, offshore stations may yield zero hauls. The model uses this information in the log transformation by adding arbitrarily one, which may cause an artefact in the fitted relationship and may be a weakness of this approach. More generally, the model is unreliable outside the range of the observed parameter values and therefore a correction algorithm was required in the GIS presentation.

Boddeke (1996) reported that the zone of high abundance along the coast had narrowed during the 1990s compared to the early 1980s, which he ascribed to the reduction in nutrient loads. However, he did not correct for river runoff and the modelling efforts show that the interaction of depth and salinity explains a high proportion of variability in shrimp abundance in the coastal area.

The resulting maps are in line with previous work (Boddeke, 1996) and integration of the grid values yields a standing stock (2360 tonnes) of a similar order of magnitude as earlier estimates (19.8 % of 25,000 tonnes, Welleman and Daan, in press). Unfortunately, the surfzone in less than 2 m depth has not been sampled in these surveys. This zone acts as an

important nursery for several fish species (Breyst *et al.*, 2001) and maybe also for brown shrimp. Thus, the standing stock may be underestimated.

The data from the RV "Tridens" were gathered during the 1970s and early 1980s, but the survey has regretfully been discontinued in later years. The transect-based sampling design turned out to be extremely useful for the modelling approach, because the depth range is relatively large and the "coastal river" is crossed at different latitudes. The DFS sampling design is quite different with widely spaced fixed stations within the 20 m depth contour. It seems possible that the limited survey period of the RV "Tridens" may have biased the results. Therefore, further work on fluctuations in salinity levels, temperature and catches appears to be warranted.

Unfortunately, brown shrimp landings are not subjected to restrictions of the Common Fishery Policy (EU) and therefore no legal obligation to collect statistics exists. Consequently, it is not possible to make a detailed comparison of the modelled distribution and the distribution of the fishing fleet. However, it is well known that the commercial fishing grounds are particularly concentrated in the vicinity of freshwater outlets, which is in broad correspondence with the map produced.

Acknowledgements

This work is funded by "Flyland" and conducted in cooperation with other national research institutes (Delft Hydraulics (WL), Netherlands Institute of Applied Geoscience (NITG-TNO), Netherlands Institute for Sea Research (NIOZ), Green World Research (Alterra)) to assess ecological and morphological effects of a possible new airport on an island situated in the coastal zone. The environmental data were obtained from NITG-TNO and WL. The authors wish to thank Niels Daan for improving the manuscript and Willem Dekker for advice in using GLM methods.

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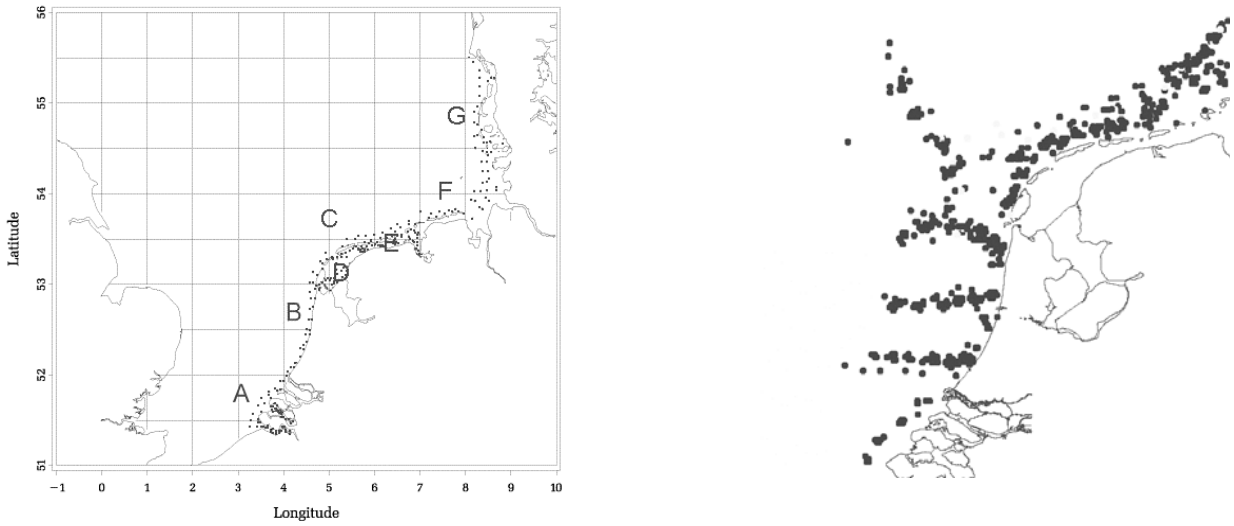
Table A7.1. Analysis of deviance for variation in shrimp catches with year, depth, shell fraction and minimum salinity. All terms were tested by excluding them from the full model.

Source	deviance	%	df	MS	F	P(F)
Main effects only:						
year	259.6	6.0	30	8.7	9.7	<0.0001
depth	657.7	15.1	3	219.2	245.0	<0.0001
shell fraction	7.6	0.2	1	0.9	1.0	0.32
min_salinity	54.8	1.3	1	54.8	61.3	<0.0001
Main effects colinearity:	1334.3	30.7				
Main effects total	979.7	22.5	35	28.0	31.3	
interactions:						
year*depth	94.6	2.2	79	1.2	1.6	<0.0001
year*shell fraction	34.2	0.8	30	1.1	1.5	0.032
year*min_salinity	42.0	1.0	30	1.4	1.9	0.003
depth*min_salinity	198.4	4.6	3	66.1	89.0	<0.0001
depth*shell fraction	0.01	0.0	3	0.00	0.01	0.99
min_salinity*shell fraction	1.79	0.04	1	1.79	2.40	0.1212
Interactions total	369.3	8.5	145			
explained	2767.4	63.6	146	19.0		
unexplained	1586.5	36.4	2134	0.7		

Table A7.2. Analysis of deviance for variation in shrimp catches with depth and minimum salinity. All terms were tested by excluding them from the full model.

Source	Deviance	%	df	MS	F	P(F)
depth	17	0.4	1	17.5	20.1	<0.001
depth*depth	47	1.0	1	47.1	54.1	<0.001
min_salinity	4	0.1	1	0.9	1.0	0.310
depth*min_salinity	42	0.9	1	41.7	47.9	<0.001
depth*depth*min_salinity	42	0.9	1	41.7	47.9	<0.001
explained	2295	49.1	5	459.0		
unexplained	2383	50.9				
total	4678		2743			



a b

Figure A7.1. a) Station grid of the Demersal Fish Survey (September-October, 1969–2000). b) All hauls made by the RV "Tridens" with the same gear at the end of August 1970–1989. Of both data sets a selection was made to include Dutch continental waters only.

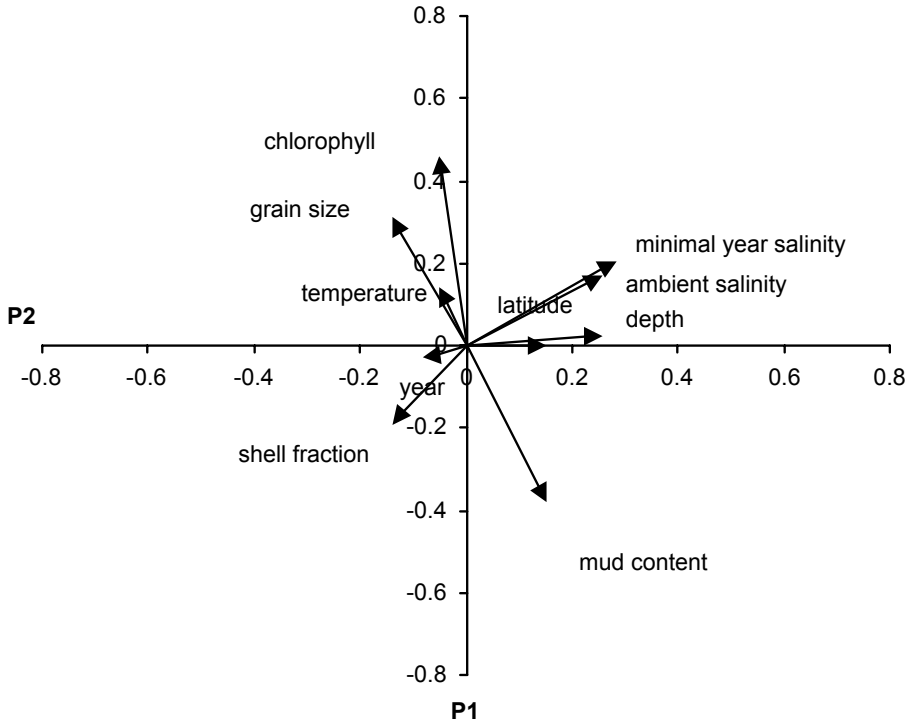


Figure A7.2. Bi-plot of the correspondence analysis of brown shrimp catch rates within Dutch coastal waters, and potential explanatory variables. Except for "year", all variables have a link to geographic positions.

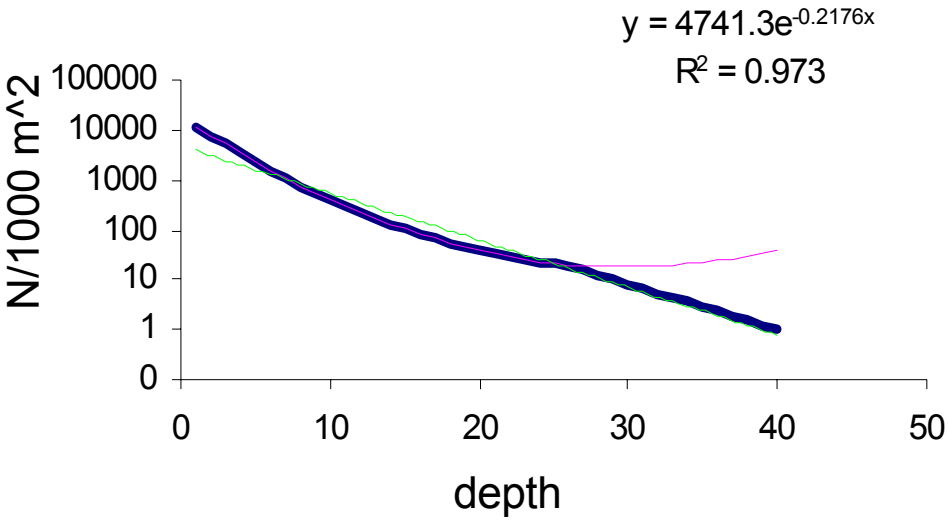


Figure A7.3. Catch rates according to the predictive model (pink line) at a given minimum salinity of 33. The green line is the exponential regression function. The corrected model (blue line) switches to the regression function at the curve minimum (27 m).

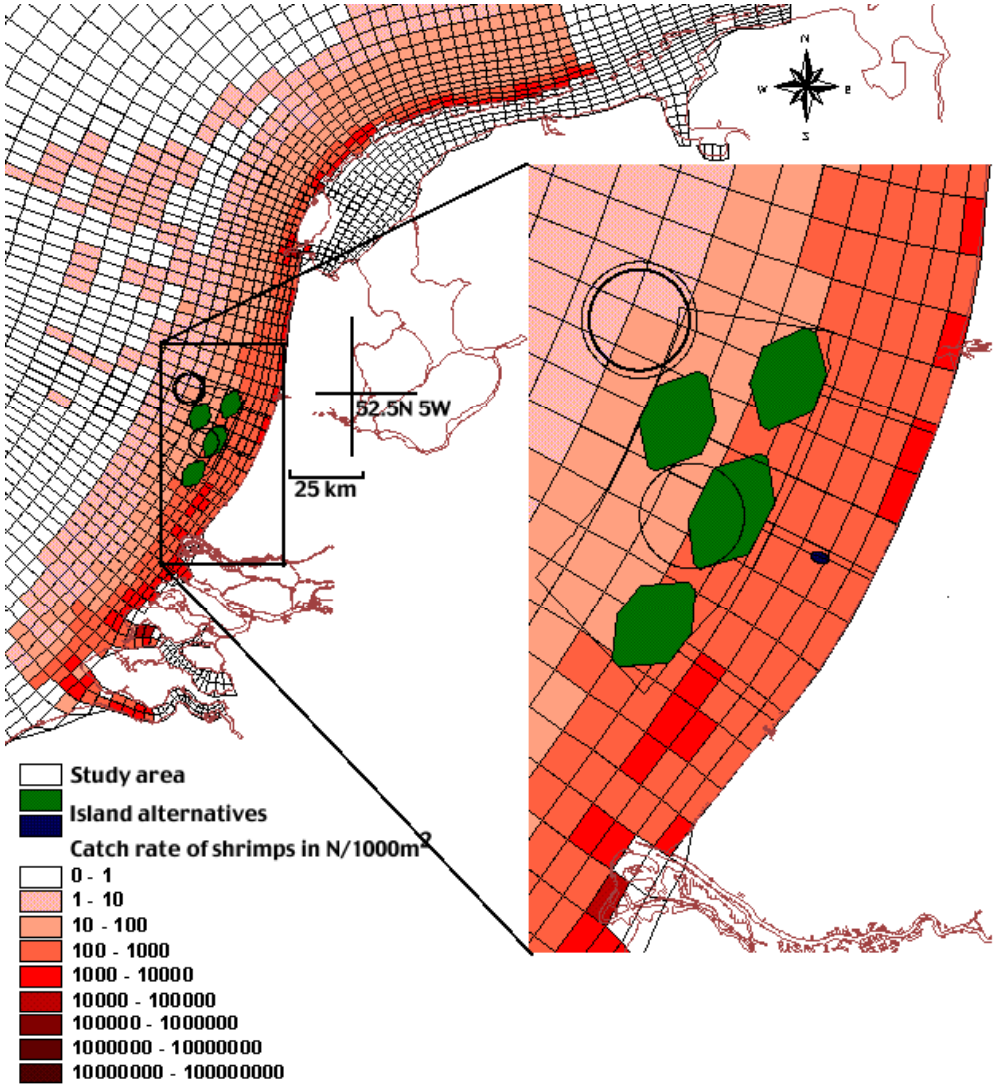


Figure A7.4. Model expectations of spatial distribution of shrimp catches in N per 1000 m^2 given observed depth and minimum salinity. Five alternative locations for an artificial isle and three potential sand extraction sites (circles) are plotted on the map as an example for assessing direct effects.

ANNEX 8: NATIONAL STATUS REPORT FOR FINLAND

Jan Ekebom/Finnish Environment Institute

This status report is based on the oral presentation given by Jan Ekebom at the meeting.

Mapping marine habitats in Finland – a status report

Landscape ecological studies on the marine and coastal environment were very active in Finland in the beginning and middle of the 20th century (e.g., Häyrén, Brenner, Luther and Granö) but after World War II most of that research tradition faded away, being replaced by, e.g., marine system ecological studies, marine microbiology and nutrient dynamics. During the last twenty years, habitat ecological studies have been very few and it was not until Finland joined the EU and began to implement the Habitats Directive that marine habitats and habitat conservation received more attention. Until today, the selection of sites for the Natura 2000 network remains as the largest single effort in compiling information and inventorying marine habitats in modern times, in Finland. A total of eight marine or partly marine habitats described in Annex I of the Habitats Directive occur in Finland (sandbanks, estuaries, large shallow bays, lagoons, reefs, esker islands, small islands and islets and narrow bays). The Finnish proposal includes 141 sites with at least one of these habitats and the sites include almost 9000 km of shoreline (18.7 % of the entire Finnish coastline). Compared with the Habitats Directive, other classification systems have played only a minor role in mapping marine habitats. Nevertheless, those worth mentioning include the 1998 HELCOM-developed biotope classification that was published by the Nordic Council of Ministers and some national systems.

Mapping habitats in the marine and coastal areas of Finland is exceptionally challenging due to the environmental conditions. The fragmented and long shoreline, the winter conditions with ice cover, and the turbid waters are just a few of the problems that slow down any effort to map all coastal areas.

However, there are currently a wide variety of methods that can be used for mapping marine habitats. SCUBA diving is still the most reliable field mapping method, although underwater videography and acoustic methods develop constantly and broaden the set of available methods used in the field. The use of SCUBA diving for mapping marine habitats is mainly limited by the high costs and time consumed per area covered.

Aerial photography makes it possible to map habitats in shallow areas relatively quickly but the results must always be ground-truthed by field mapping. According to a recently submitted study, it is possible to identify sandy beaches, lagoons and reefs with 66 %, 71 % and 39 % accuracy, respectively, when using high altitude black and white aerial photographs (Ekebom and Erkkilä, submitted). More detailed photographs, e.g., low altitude colour or IR photographs, are likely to provide much better results.

The selection and quality of numerical maps (GIS data) have improved rapidly in Finland over the last decade. Map elements used in topographic maps are now available from the entire country, while numerical nautical charts are available from the Gulf of Finland and most of the Archipelago Sea. Such GIS data can be analysed in order to categorise the marine and coastal environment, e.g., regarding wave exposure vs. shelter, or identify physiographic features such as sand bottoms or reefs. The Geological Survey of Finland has published maps of the sea floor in four coastal areas in southern Finland and the data may, for example, be used for identifying sites with sand banks.

Several environmental authorities are currently cooperating in order to map the Finnish marine environment. These include: the regional environment centres (Hab.Dir. habitats), the Finnish Environment Centre (Hb.Dir. habitats), the Forest and Park Service (Hb.Dir. habitats), the Finnish Institute of Marine Research (offshore bottoms), the Geological Survey of Finland (land cover/sea floor), the Maritime Administration (hydrographic surveys), the Game and Fisheries Research Institute (spawning grounds). NGOs (WWF) and private companies (environmental consultants, IT companies) have also mapped the marine environment in some regions.

In my opinion, the development of a detailed classification system for marine habitats and/or biotopes would be very difficult if relying solely on existing data on the distribution and abundance of marine habitats or species. The main reason is the lack of data for a large number of habitats and species for many biogeographical regions. Also, the quality of the existing data varies too much between different geographical regions. Additional data on the marine habitats and species must be collected in order to provide a scientifically sound base for the development of a classification system. The best approach would probably be to launch an international project for this purpose that would carry the main responsibility for developing a useful system. Whether or not this approach could be applicable, or useful, when developing the EUNIS classification system for the Baltic Sea remains to be seen.

ANNEX 9: EUNIS CLASSIFICATION

EUNIS HABITAT CLASSIFICATION

CYNTHIA DAVIES & DORIAN MOSS

CENTRE FOR ECOLOGY AND HYDROLOGY
MONKS WOOD, UK

EUROPEAN ENVIRONMENT AGENCY - EUROPEAN TOPIC
CENTRE ON NATURE PROTECTION AND BIODIVERSITY

1. The European Nature Information System, EUNIS, has been developed on behalf of the European Environment Agency. The system is designed to be a reservoir of information on environmentally important matters in Europe and comprises a number of linked databases. These databases will contain data on species, sites and habitats.

EUNIS

- **EUNIS consists of a central unit integrating data models on species, habitats and sites; several secondary databases which are managed by different partners; and an increasing number of satellite databases**
- **3 modules: species, habitats and sites**

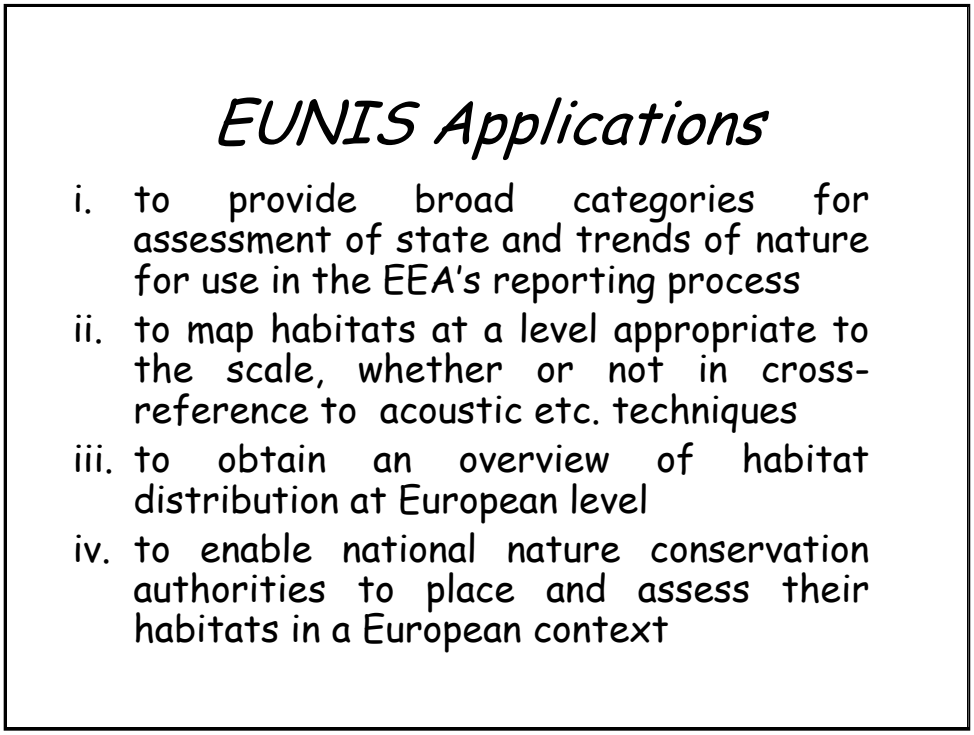
2. EUNIS contains three modules:

- species nomenclature and attributes;
- habitat classification;
- common database of designated areas.

These are being made available through the EC Clearing House Mechanism (reached through http://nature.eionet.eu.int/): the species module has been completed (May 2001) and plans are being developed to include the habitats module.

In order to make best use of these data, terminology and definitions need to be harmonised across the countries, which are contributing data. Species nomenclature follows an accepted system; there has been no similar system for naming and describing habitats

The EUNIS habitat classification has been developed on behalf of the EEA as part of this European Nature Information System to provide an agreed common language to name and describe habitat units at a European level.

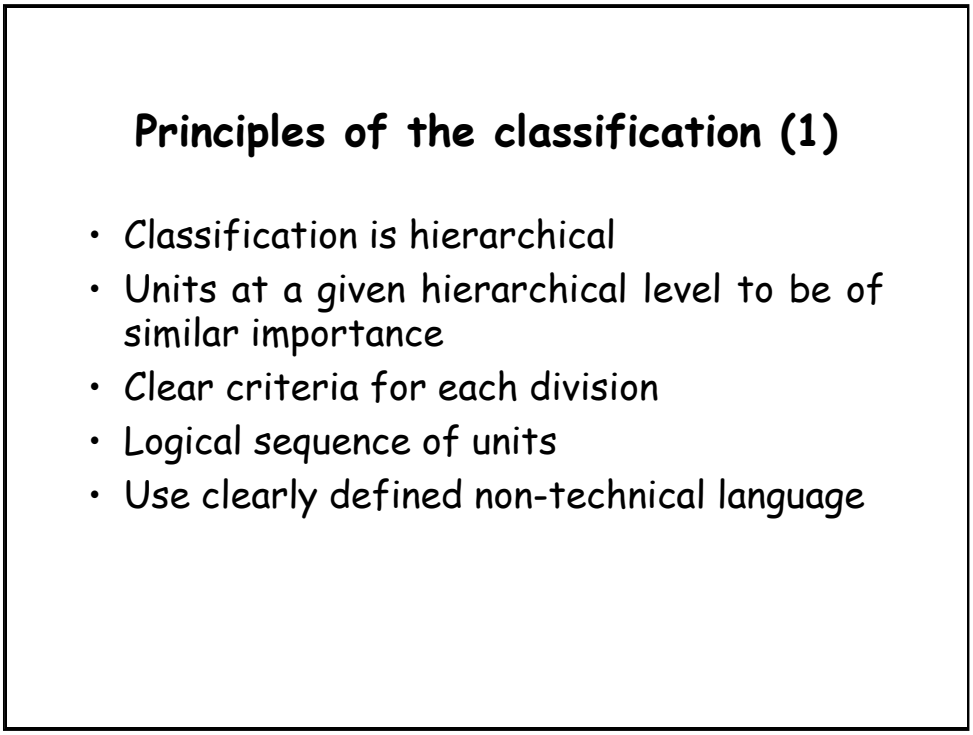


3. A common classification provides a tool whereby data can be compared and analysed to provide an overview across country boundaries. It will also allow data, which have been collected by a variety of different techniques, to be compared.

The classification is designed to allow description of European habitats through the use of criteria for habitat identification. It is primarily based on a restructuring of the Palaearctic Habitat Classification and for marine units; it is based on the BioMar marine classification among others. The development has been carried out through a series of consultations and workshops since 1996 with the majority of work on marine habitats being carried out since 1998. OSPAR and ICES WGMHM have contributed fully to the development.

The classification was first published on the Web and in a report dated November 1999. The EUNIS classification has been amended since 1999 in response to proposals received at the OSPAR/ICES/EEA workshop held in Southampton in September 2000 and at the ICES WGMHM meeting in Galway in April 2001. Further amendments have been made in response to comments from a number of users of the classification and also in order to ensure the direct links between the EUNIS classification and other initiatives, notably the Palaearctic habitat classification, CORINE Land Cover nomenclature and Annex I of the EU Habitats Directive 92/43/EEC. In parallel with the update of the EUNIS classification, its links to these other systems have been reviewed and updated

This latest update - March 2002 – has been posted on the website.



4. In order to fulfil its stated aims, the classification follows certain carefully defined principles:

1) The classification has a hierarchical structure.
2) Wherever possible, units at a given hierarchical level should be of similar importance at least within a particular section of the classification.
3) There are clear criteria for each division, and although these criteria are not imposed uniformly across the whole classification, units at lower levels in the hierarchy **must** fit the criteria, which apply to "parent" units at higher levels.
4) Habitats within a particular branch of the hierarchy should be ordered following a logical sequence when possible, e.g., depending on levels of a particular abiotic factor such as exposure, particle size, salinity, etc.
5) Names and description of habitat types should use clearly defined non-technical language and the nomenclature should be systematic and reflect the habitat's location within the classification.

Principles of the classification (2)

- Ecologically distinct habitat types supporting different plant and animal communities should be separated
- Habitats from different locations differing on the basis of geographical range only should not be separated
- Habitat units and habitat complexes are separated

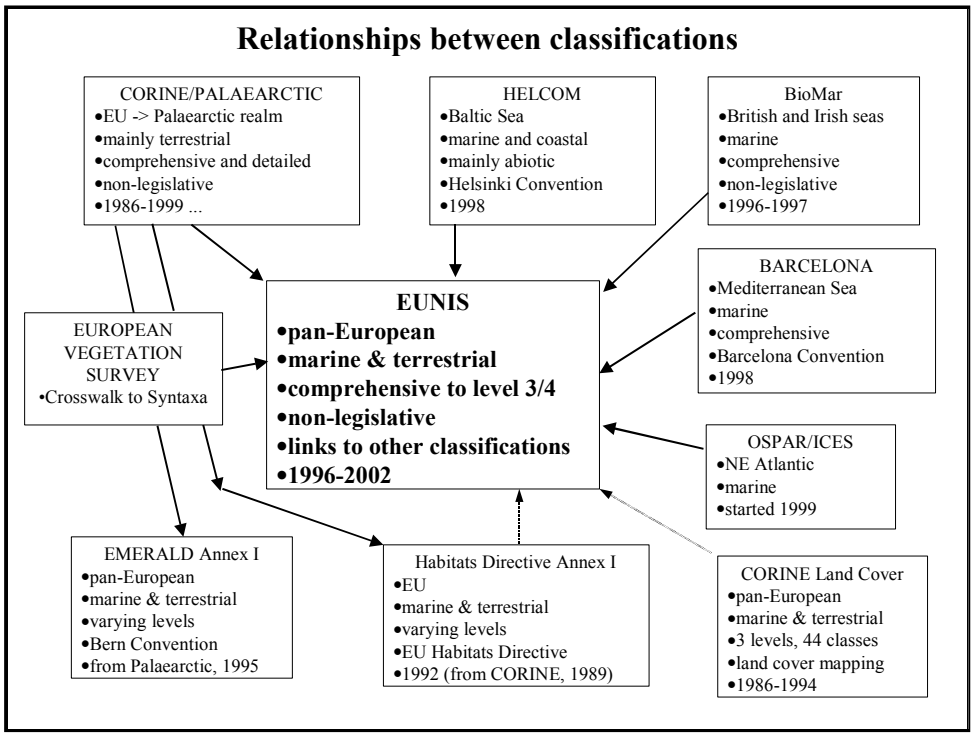
5. Ecologically distinct habitat types supporting different plant and animal communities should be separated at an appropriate level in the hierarchy.

Habitats described from different locations distinguished on geographical grounds only should not be separated.

Habitat units and habitat complexes are separated in the classification.

A Complex comprises a distinct set of individual habitat units, some of which are highly characteristic of, but not usually unique to, the complex. All of the component units must exist independently within the classification.

Complexes are often related to physiographic features, for example, estuaries and lagoons in the marine environment. They are often useful units for nature conservation management purposes and mapping at different scales.



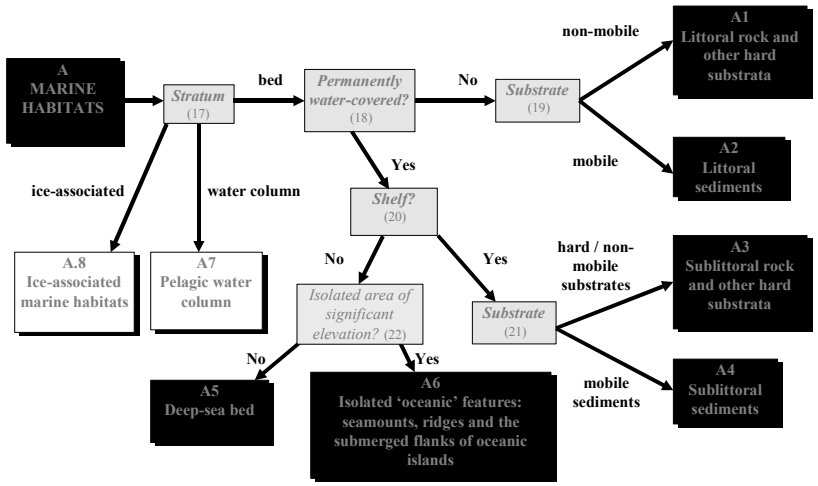
6. It is particularly important to adopt an inclusive approach to other initiatives, so that they can use and add to EUNIS rather than independently develop their own classifications.

Where other classifications already exist, we make sure that EUNIS can accommodate them through database links.

Note that the Habitats Directive Annex I and Emerald Annex I are not classifications as such, but lists of habitat types designated under the EU Habitats and Species Directive and the Council of Europe Bern Convention, respectively.

The EUNIS habitat classification is not intended to replace detailed local classifications where these already exist, but rather to provide a framework to provide an overview in a European context and enable data from different countries or regions to be compared.

EUNIS Habitat Classification: criteria for marine habitats to Level 2

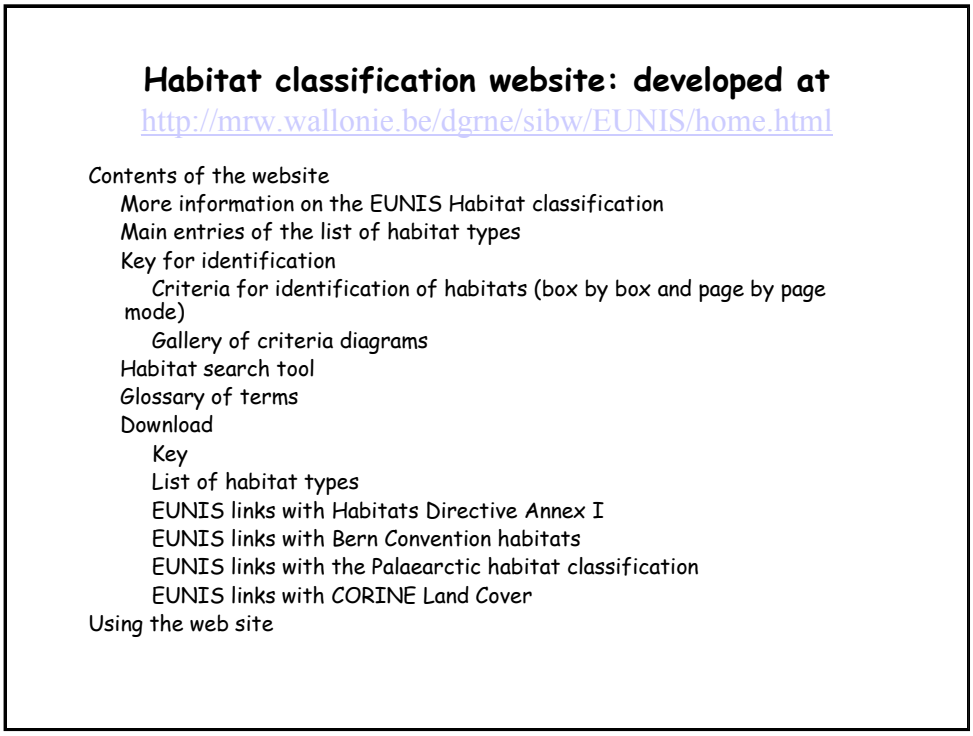


17. The criterion distinguishes between strata: the sea *bed* (non-tidal, inter-tidal and sub-tidal); the *water column* (in shallow or deep sea, or enclosed coastal waters); and ice or *ice-associated* marine habitats.

18. …..

7. In accordance with the above-mentioned principles, criteria for separating habitats at each hierarchical level from 1 to 3 have been defined to produce a key to habitat types. Criteria have been defined also for units at level 4 in the case of saltmarshes. The criteria are presented in the form of "decision diagrams" with a visual representation for the paths to be followed. Each grey "decision box" is accompanied by detailed explanatory notes to explain how the box is to be applied, and these form an integral and essential part of the criteria. This diagram illustrates the revised level 2 marine habitat units.

The classification is held in a database and parameters which describe and identify the habitat units can be stored within the database, which will allow it to be searched, and units selected, on the basis of common factors. Filling in the parameter framework constitutes part of the current year's work programme on the classification. Members of the WGMHM are invited to contribute information, which can be used to complete this descriptive framework. The classification requires testing against "real" data to ensure that it is workable and fulfils its stated aims of providing a Europe-wide framework. Duplication, overlap and gaps in the units need to be identified and help is again requested from this expert forum to enable this work to be completed for the marine units.



8. Latest update - March 2002.

Feedback on the classification can be made via the feedback form on the web pages, or directly to Cynthia Davies (cd@ceh.ac.uk) or the Project leader Dorian Moss at CEH, Monks Wood (dor@ceh.ac.uk)

ANNEX 10: OSPAR HABITAT MAPPING WORKSHOP, WITH PARTICULAR EMPHASIS ON THE NORTH SEA

Modified from the outcome of the Bergen North Sea Conference Scientific Event in February 2002 after discussion at ICES WGMHM, San Sebastian, April 2002.

Overview

Compared with other components of the environment of the North Sea (e.g., hydrography, nutrients, plankton), our knowledge of the distribution and extent of seabed habitats (i.e., the biological communities) at a North Sea level is very scattered and of variable quality and detail. As a consequence, we are currently unable to provide a holistic map of seabed habitats within the North Sea. This is largely due to the lack of consistent interpretation of biological data (according to a common habitat classification 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.

Holistic views of seabed habitats are required:

1) As an essential element in improved spatial planning and management of the North Sea. Improving the management of activities in an ecosystem-based manner requires knowledge of the distribution, extent and status or quality of habitats. This will facilitate 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).
2) As a contribution to improving our understanding of the North Sea ecosystem. Seabed habitats are an essential component of the ecosystem and our overall understanding of ecosystem function needs to relate seabed habitats to hydrography, nutrient cycling, plankton changes and the distribution of wide-ranging species (i.e., fish stocks, cetaceans, birds).

A North Sea habitat map will provide the first element in longer-term goals to map the OSPAR and ICES areas, and provide essential information for the development of EcoQOs and the protection of threatened habitats in the North Sea. Whilst preparing more detailed maps of the North Sea, there should be parallel development of low-resolution maps at a wider OSPAR/ICES level.

Goal

To assess the feasibility of preparing a multi-layered habitat map for the North Sea, in a GIS (Geographical Information System), which will meet the priority needs of management, 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.

Specific issues that need to be addressed:

1) Define the spatial scales and temporal aspects at which habitat information needs to be assessed and presented for different purposes, including the necessity for different scales for coastal and offshore regions.
2) Assess the availability and utility of existing data[1] 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.
3) Examine issues related to the compatibility of data sets from different sources and establish common data formats to facilitate future exchange of data.
4) Determine the relationship of data for seabed geology/morphology, acoustic data and benthic data (both epibiota and infauna), in order to arrive at interpreted habitat maps.
5) Establish a time frame 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

[1] Maps to be examined should include the CEFAS North Sea atlas, Maxi and Seamaps digital maps (fishermen's maps), 1986 North Sea Benthos Study map, national seabed sediment and bathymetric maps.

working towards higher quality maps in a longer time frame. This will include determining the access to data and public access to interpreted data sets.

6) Use the development of habitat maps to test the EEA's EUNIS habitat classification and, if necessary, propose amendments to it.

Outcome of the workshop

A report, which addresses the issues above and presents clearly defined proposals for mapping at North Sea and OSPAR levels, for discussion at BDC 2002.

ANNEX 11: GULF OF MAINE

For presentation to the Working Group on Marine Habitat Mapping (WGMHM), Annual Meeting, San Sebastian, Spain, April 2002.

New Initiative by USA and Canada

Mapping the Gulf of Maine: building the link between marine geology and benthic habitat to improve ocean management

Susan Snow-Cotter,
Massachusetts Office of Coastal Zone Management, Boston, Massachusetts, USA.

Brian Todd,
Geological Survey of Canada.

Page Valentine,
U.S. Geological Survey, Woods Hole, Massachusetts, USA.

Thomas Noji (WGMHM member),
National Marine Fisheries Service, Sandy Hook, New Jersey, USA.

Challenge: Off the Atlantic coast of North America, Canada and the United States share jurisdiction of the Gulf of Maine. This "sea within a sea" measures almost 91,000 square kilometres in size and has an average depth of 150 metres. The gulf exhibits a complex bathymetry of banks, basins, channels and ridges which reflect its geological history. The Geological Survey of Canada (GSC) and the U.S. Geological Survey (USGS) have a long-standing legacy of marine geological studies in the gulf. Over the past five years, an integration of geoscience and marine biological information has led to a greater understanding of the diversity of benthic and pelagic habitats. Ocean management necessitates encapsulating this knowledge in the form of geological and habitat maps extending over the entire gulf.

Description: This presentation will highlight a new collaboration between researchers and managers entitled the Gulf of Maine Mapping Initiative (GOMI). GOMI has the ambitious, but very practical, goal of mapping the entirety of the Gulf of Maine basin. This transboundary effort, initiated by the Gulf of Maine Council for the Marine Environment, will link the capabilities and expertise of the region's private and public sectors with the immediate needs of coastal managers. In addition to undertaking extensive seafloor mapping utilizing a range of the latest technologies, this project will develop a suite of digital mapped products addressing the interests and needs of different end users. Visualization technologies will be employed to assist users in understanding the complex data. Presently a GOMI steering committee exists to initiate these activities. The committee consists of representatives from GSC (B. Todd, Co-chair), NOAA/U.S. National Marine Fisheries Service (T. Noji, Co-chair), USGS (P. Valentine), U.S. State Coastal Zone Management (S. Snow-Cotter), Division of Fisheries and Oceans, Canada (P. Boudreau) and regional universities (L. Mayer at University of New Hampshire).

Application: Detailed maps of bathymetry, sediment and habitat in the Gulf of Maine will provide a context for existing, ongoing and planned (Census of Marine Life) physical and biological oceanographic studies. This coordinated mapping effort and the resulting map products will enhance the research, management and private sectors in the Gulf of Maine. An increasing array of human uses of the Gulf of Maine including oil and gas development, gas pipelines, fiber optic cables, aquaculture, commercial fishing, and wind power have accelerated the need to better understand the location, extent and sensitivity of ocean habitats. The region's interest in designating marine protected areas, as well as federal concerns regarding national security, will also be well served by this project.

Strengths: GOMI's strength lies in the collaboration between researchers and managers, as well as between the private and public sectors. Additionally, the transboundary aspect of this project taps the enormous technical capacity on both sides of the border. Regional collaboration on GOMI will clearly result in cost savings, efficiency, and mapping standardization.

Capacity Needs: The GOMI project most directly addresses the capacity theme of "Measuring and understanding coastal ecosystems", specifically through the development of tools and technologies to collect and assess data, and manage them for effective decision-making.

Keywords: habitat mapping, Gulf of Maine, transboundary, regional seas.

CEFAS

Project A1033

Role of seabed mapping techniques in environmental monitoring and management

CEFAS

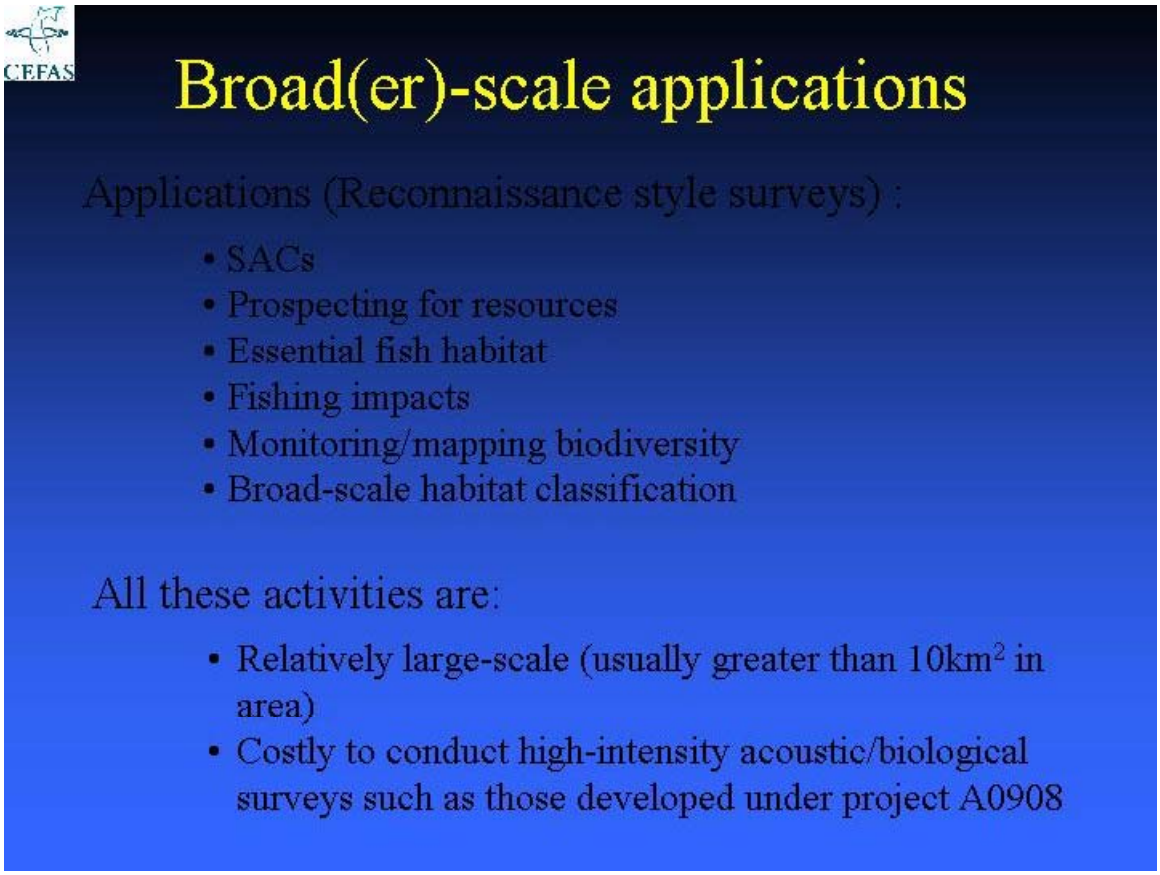
Site-specific applications

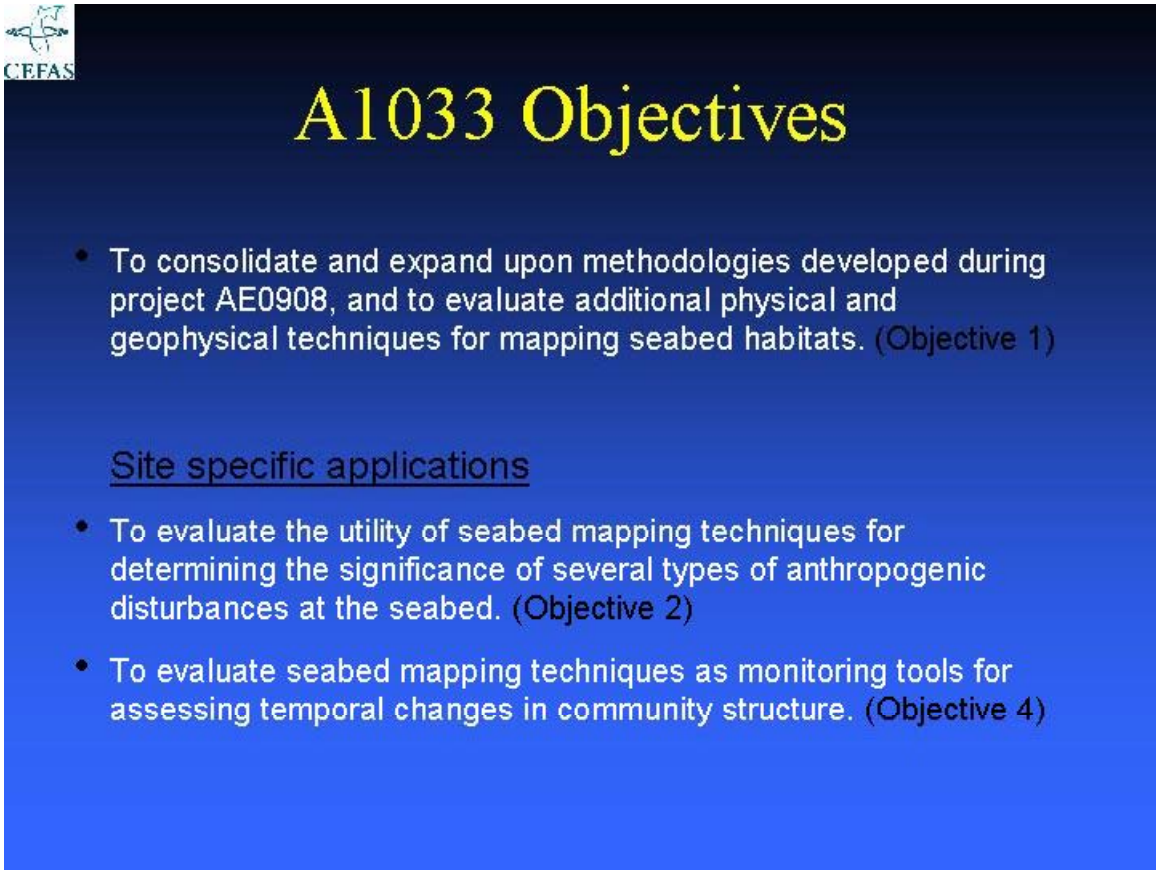
Anthropogenic activities:

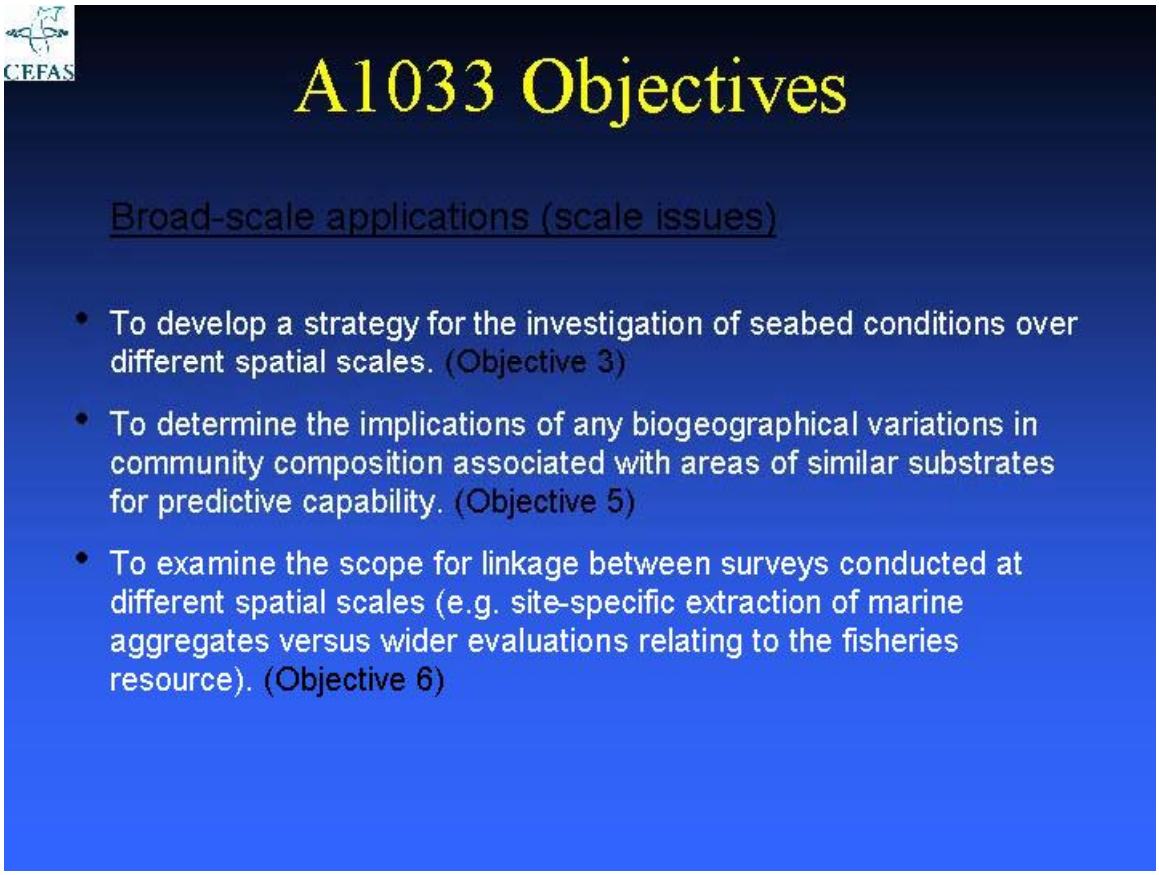
- Aggregate extraction
- Dredged material disposal
- Construction activities (e.g. wind farms)
- Maintenance dredging
- Oil and gas exploitation
- Survey design/selection of monitoring sites
- Fishing?

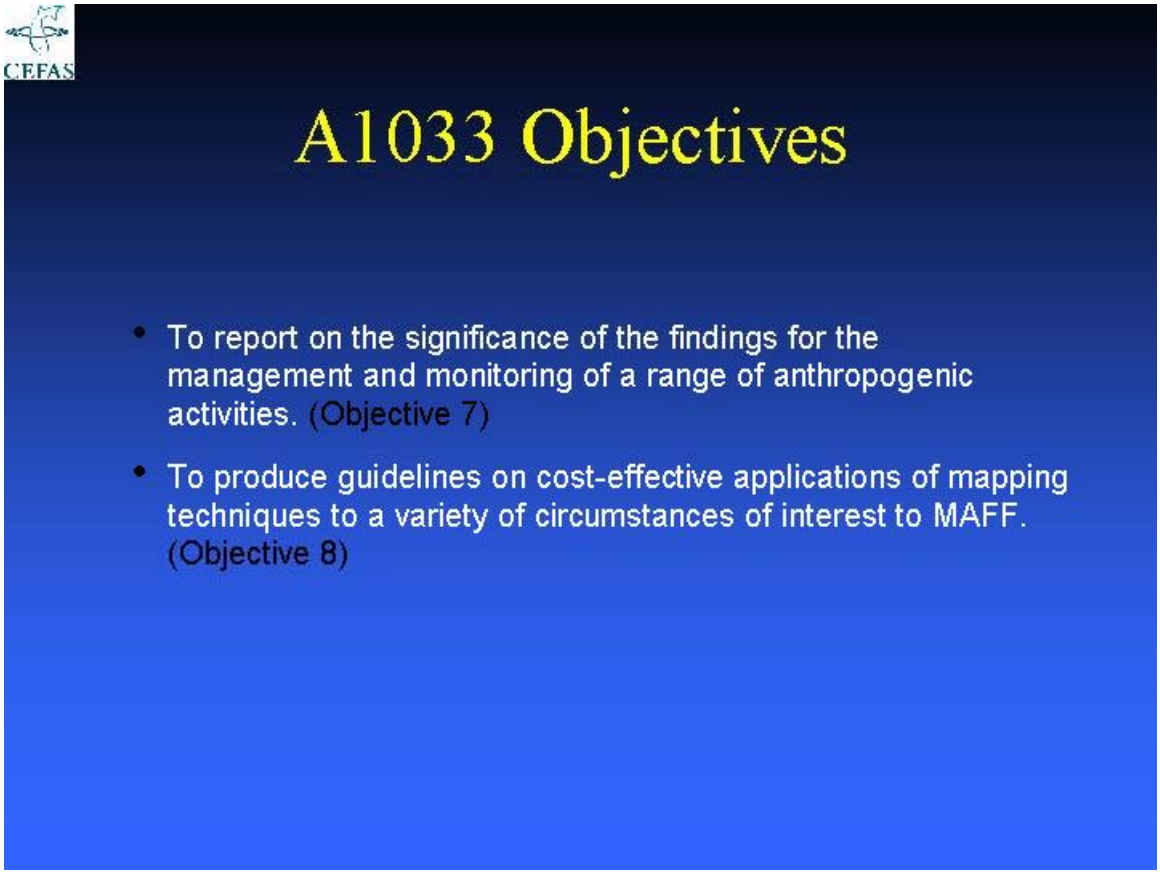
All these activities are:

- Relatively small-scale and localised (usually less than 10km^2 in area)
- Suitable for high-intensity acoustic/biological surveys such as those developed under project A0908


CEFAS
Broad(er)-scale applications
Applications (Reconnaissance style surveys) :
• SACs
• Prospecting for resources
• Essential fish habitat
• Fishing impacts
• Monitoring/mapping biodiversity
• Broad-scale habitat classification
All these activities are:
• Relatively large-scale (usually greater than 10km^2 in area)
• Costly to conduct high-intensity acoustic/biological surveys such as those developed under project A0908


CEFAS
A1033 Objectives
• To consolidate and expand upon methodologies developed during project AE0908, and to evaluate additional physical and geophysical techniques for mapping seabed habitats. (Objective 1)
Site specific applications
• To evaluate the utility of seabed mapping techniques for determining the significance of several types of anthropogenic disturbances at the seabed. (Objective 2)
• To evaluate seabed mapping techniques as monitoring tools for assessing temporal changes in community structure. (Objective 4)


CEFAS
A1033 Objectives
Broad-scale applications (scale issues)
• To develop a strategy for the investigation of seabed conditions over different spatial scales. (Objective 3)
• To determine the implications of any biogeographical variations in community composition associated with areas of similar substrates for predictive capability. (Objective 5)
• To examine the scope for linkage between surveys conducted at different spatial scales (e.g. site-specific extraction of marine aggregates versus wider evaluations relating to the fisheries resource). (Objective 6)


CEFAS
A1033 Objectives
• To report on the significance of the findings for the management and monitoring of a range of anthropogenic activities. (Objective 7)
• To produce guidelines on cost-effective applications of mapping techniques to a variety of circumstances of interest to MAFF. (Objective 8)

ANNEX 13: RECOMMENDATIONS

The **Working Group on Marine Habitat Mapping** [WGMHM] (new Chair: D. Connor, UK) will meet in Sandy Hook, New Jersey, 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 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;
f) assess progress in 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) *(optional) review the progress in the intersessional workshops on standardising techniques for habitat mapping, to include members of WGEXT and BEWG and national agencies.*

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

Supporting Information:

Priority	High
Scientific justification	WGMHM has considered the development of the EUNIS classification system over its rapid development. 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 this will be monitored by reviewing national status reports. 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 accepted to take a positive attitude towards this request, providing 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. 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. 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. Mapping projects in U.S. and Canada waters can provide valuable aspects for work in enclosed/estuarine sea areas (e.g., the Baltic Sea) and vice versa. 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.
Relation to Strategic Plan	Scientific Objective 1e.
Resource requirements	

Priority	High
Participants	Further participation from the Baltic Sea area is obligatory
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 100 %