ICES STATUTORY MEETING 1993

C.M. 1993 / D:44
Sess. T

«MARINE RESOURCE DATA BASE» (MRDB), A DATABASE ON VULNERABLE MARINE RESOURCES IN NORWAY.

by

J.R. Selvik, H.L. Behrens, L.M. Gjetrang, J.N. Langfeldt, E. Lystad, I. Marthinsen, K.A. Moe, M. Nedrebø and G.M. Skeie

Cooperating Marine Scientists a.s.
Billingstadsletta 19B
N-1361 Billingstad
Norway

Introduction

The Norwegian coastal and open sea areas include some of the most important marine areas in the world, both with regards to exploitable and non-exploitable resources.

The operating companies on the Norwegian continental shelf have a particular need for up-to-date information on vulnerable resources at sea and along the Norwegian coast. As one of the preventive measures against oil pollution, such information is an essential part of the environmental impact assessments (EIA) which are required with applications to build new offshore installations. Such information is also necessary if a major oil spill occurs; in such cases it may be necessary to assign priorities, and to identify the localities of greatest importance for nature conservation.

Cooperating Marine Scientists a.s. (CMS) was commissioned the task of developing a marine resource database in 1987, and presented the completed version covering all Norwegian areas in 1993.
The project have been jointly funded by nine operating companies on the Norwegian continental shelf. the Norwegian State Pollution Control Authority (SPCA) is a partner in the project, while the Directories of Fisheries has an observation position in project. Recently the Institute of Marine Research has evaluated the system as a part of a joint discussion on improvements in presentation of resources in open waters.

The data base contains information on resources along the coasts of mainland Norway, Spitsbergen (Svalbard) as well as Norwegian shelf and oceanic areas. Database information can be listed or visualized on digital maps.

Use

A sustainable idea and challenge in the project have been to develop a simple user interface without loosing details and integrity of original data. The continuous cooperation between programmers, biologists and «users» throughout the four years development period has been essential in this context.
Fulfilling the different users expectations of such a system has not been without obstacles. At least three levels of users have been identified.

At the first level, we find the «browser», looking at different kinds of information with no specific aims except from learning more about regional distribution of resources.
Another type of user is the person in a contingency situation, who needs specific information from a specific area at a specific time as soon as possible, in order to decide on which resources to protect. This user does not want any fringe information presented, only the essential facts are of interest.
A third kind of end user is the person using the system in the preparation of a contingency plan or an EIA. This user needs the highest level of detail in order to select and evaluate the data to be presented and discussed further.

The above problem was addressed by designing several levels within the database. As the user enters the system the appropriate level can be chosen.

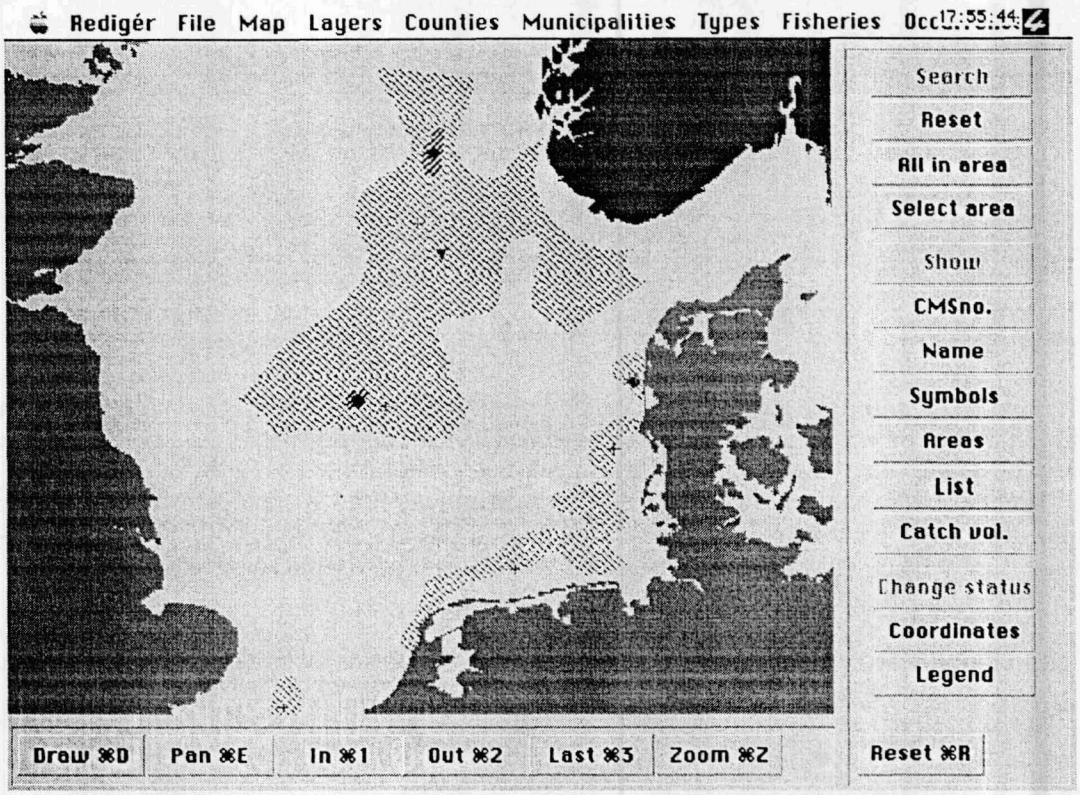

Figure 1. A typical screen layout at the «browse level». Mackerel egg distribution in June 1990 showing 3 different concentrations per square meter. Egg distributions seen on the map was selected from the database by pull-down menus and predefined active objects.

The system

A full description of the system will exceed the frames for this presentation, and only an outline of some important aspects will be given here. Technical details on the system may be obtained from the authors.
In our experience, there are two major approaches to linking information in a data base to digital maps. One is to start with a geographical information system and construct a data base from there, the other is to start with the data base and obtain a system for presenting the information on digital maps. Our choice was the second approach.

The data base is constructed in 4th DIMENSION™, a database development program for Apple Macintosh computers. The structure of the data base is relational, with information stored in 15 different files, related as appropriate. The user interface is constructed in 4th DIMENSION™. Via a "sub-GIS" program (GEDAP) developed by CMS, information in the data base may be interactively presented on vectorized digital maps in any resolution. The system utilise the object oriented user interface of Apple Macintosh computers in the construction of screen layouts as seen in figure 1. Available functions include zooming, panning, coordinate presentation, etc. A tailored version of the database is developed for IBM-PCs, although not as a relational system.

A library, containing information on species of fishes, birds, marine mammals and source references is available on-line for the user.

Data

The data base contains information on resources along the 57 000 km coasts of mainland Norway, Spitsbergen (Svalbard) as well as 950 000 km^2 of Norwegian shelf and oceanic areas. Data has been obtained from more than 300 official publications or scientific articles and include information on more than 22 000 sites or areas (figure 2).

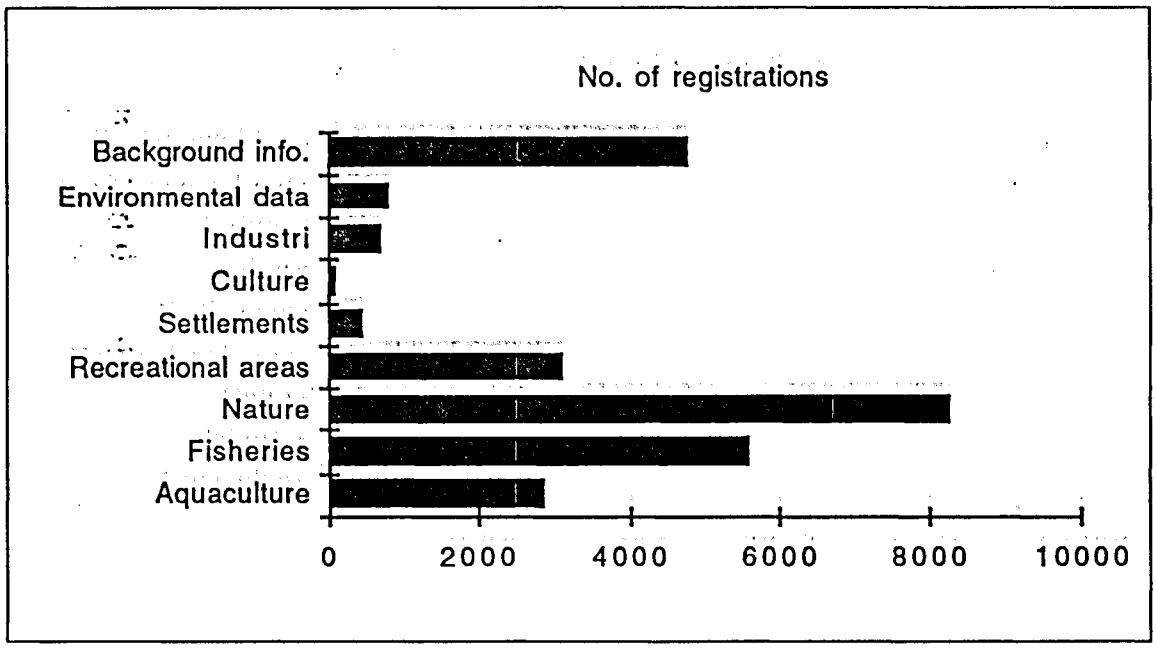

Figure 2. Distribution of registrations on different categories of information.

Within the geographical area covered, a wide range of resources may be found, including exploitable resources, mainly fish and petroleum. A large number of commercial fish species, e.g. Atlantic cod, herring and capelin, spawn in the area. With regards to non-exploitable resources, the area is important for sea-birds and marine mammals, sustaining both major populations of some species, as well as populations of several species becoming rare in middle and southern Europe. Along the Norwegian coast a number of nature conservation areas has been established, and the process on increasing this number is continuing. Having a reputation of being an «outdoor people», the coastal areas are widely used for recreational activities and amenity use.

The information in MRDB is categorised through a three-tiered system consisting of

- Category (e.g. Nature)
  - Main type (e.g. Fish)
    - Subtype (e.g. Egg)

There is a total of 170 different subtypes. Selected examples of subtypes related to fish on which information is stored in MRDB are given below.

- Eggs
- Larvae
- Spawning area
- 0-group
- Nursing area
- Post larvae
- Fingerlings

Each record (site / area) in the database contains several different types of information. A maximum of 60 different types of information can be entered for each individual record, but by referencing related files, additional 250 information types can be related to each record. Some groups of information are listed below:

• Species	e.g. mackerel, cod, herring
• Positions;	map sheet, UTM-grid, UTM North and east, Latitude & longitude, distance to oil spill combat group etc.
• Cruise period;	period of data collection
• Size;	concentrations per unit area, like no. of eggs / m^2
• Remarks	information regarding this specific registration, like «measurements made from surface to 50 m depth»

One of the main problems in our work has been data input. Although it would seem a quite straightforward task to select relevant information for identifying and evaluating a site, this was not so. Our problems with input may be divided in three groups:

A quite large percentage of the input data (up to 10 %) contains incorrect information on spatial coordinates. A major reason for this is that the UTM coordinate system has been unfamiliar for the workers entering information, and also that in our region, the number of UTM zones are quite large. Checking out and correcting such erroneous information is a painstaking work.

Most of the data available has been collected with the aim of describing the sites in reports and tables, in some cases accompanied by maps. As a result, often coordinates to the site are not given, and must be reconstructed and filled in on the basis of indications/names in the report and indications of areas on maps.

Although a tedious process, incorrect and incomplete data may be checked and verified resulting in complete and consistent sets of data. However, variations in the data is another matter not easily resolved. MRDB contains information collected from several administrative units (counties and municipalities), as well as from various disciplines (data on fisheries, flora, sea-birds, marine mammals etc.). When compiling this information and attempting to use the data in an evaluation, one immediately encounters the problem of varying data. Abundance of resources can e.g. be given with different denomination in different references. Description of fishing activity can be given with different priority of importance by different authors etc. Anyhow, the integrity of the original data is given priority. These issues are still not completely resolved, and not expected to be in the near future.

As a consequence of the variability of data presentations in source literature, the proper use of the database demands professional skills of the user in the interpretation of resource distribution and grouping of information.

Experiences

A typical use of the system in environmental impact assessment studies is the documentation of possible effects of pollution in the marine environment, where the temporal and spatial cooccurance of pollutants and vulnerable resources is the crucial question. Figure 3 describes a situation where an exploratory drilling outside the coast of Møre may cause the sedimentation of drilling mud and cuttings in spawning areas of Norwegian spring spawning herring. Such presentations are not time consuming and colour maps can be directly inserted in the written assessment report.

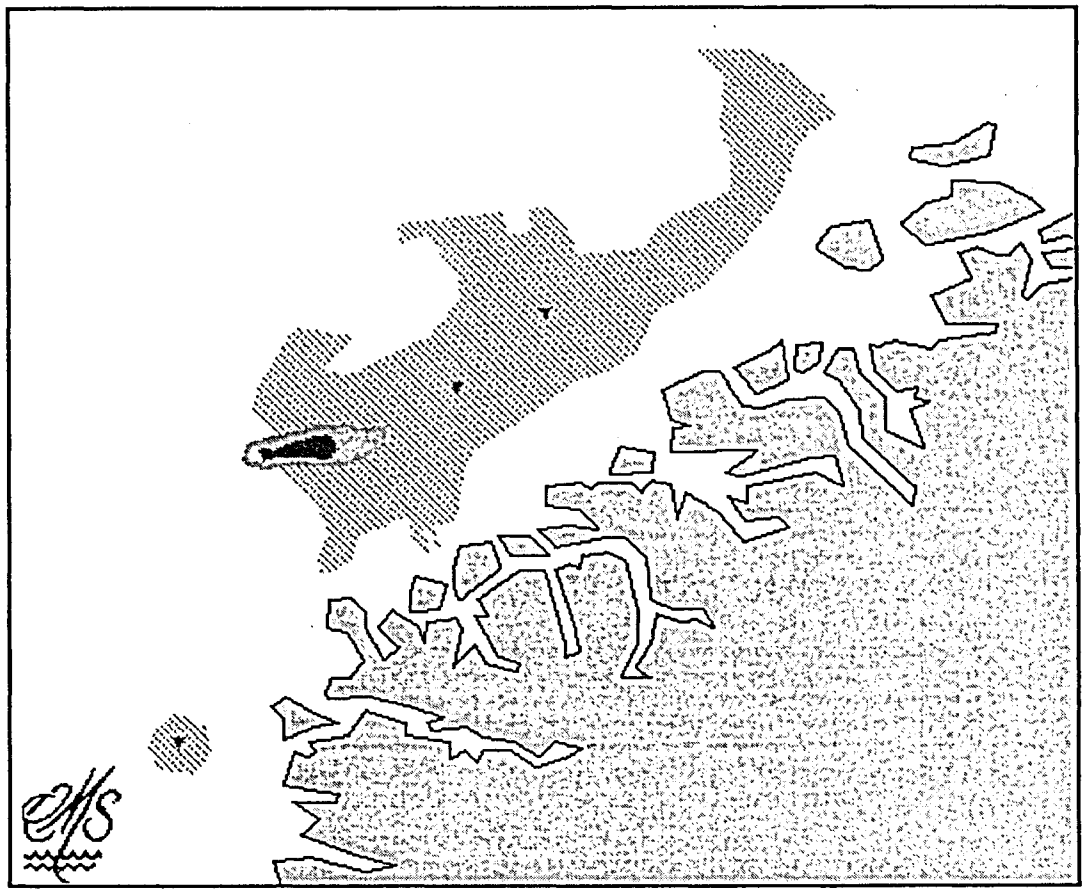

Figure 3. Example of MRDB presentations. Spreading of drilling fluid and cuttings in spring overlapping with the temporal and spatial distribution of spawning activity of Norwegian spring spawning herring outside the coast of Møre.

The use of the complete collection of resource information stored in MRDB allow a rapid scanning and selection of relevant information needed for specific tasks. The use of the system in environmental impact assessment studies have also revealed gaps in knowledge on temporal and spatial distributions of vulnerable resources.

Two examples from fisheries activity in Norwegian waters are

• errors detected in reports and maps necessitated new extensive mapping of fisheries activity in relation to offshore environmental impact assessments.

and

• variable interpretation of old data by different authors and lack of details regarding ongoing fisheries activity have led to incorrect conclusions in environmental impact assessments.

Such facts have recently initiated a discussion on a program for updating existing knowledge on fisheries activity.

The need to distinguish between areas of different vulnerability to pollutants in open waters have motivated a development toward more semiquantitative analysis, which include the use of area aggregated data. In open waters data can be aggregated on a 15 km grid. The grid analysis allow for a simple comparison of the distribution of several vulnerable resources without applying a more rigid GIS-system.