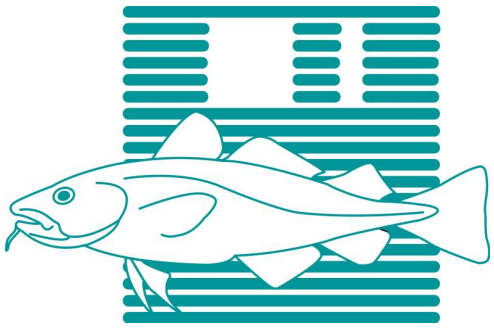

THE COLOUR OF OCEAN DATA

International symposium on oceanographic
data and information management
with special attention to biological data

BOOK OF ABSTRACTS

Brussels, Belgium
25-27 November 2002

VLIZ

OSTC

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

CENSUS OF MARINE LIFE

VLIZ Special Publication 11
2002

Conference secretariat

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This publication should be cited as follows:

Brown M., M. Costello, C. Heip, S. Levitus, J. Mees, P. Pissierssens, E . Vanden Berghe, eds (2002). The colour of ocean data – international symposium on oceanographic data and information management with special attention to biological data. Brussels, Belgium, 25-27 November 2002. Flanders Marine Institute (VLIZ): Oostende, Belgium. xi, 93 pp.

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ISSN 1377-0950

PREFACE

More and more, ocean data management has to play a crucial role in global as well as local matters. Vast amounts of physical, chemical and biological oceanographic data are collected in all seas and oceans of the world. International networks are created, to standardise data formats and facilitate data exchange. Global databases of existing data have been compiled, global programmes are operational and new ones are developed, data are routinely exchanged. The Intergovernmental Oceanographic Commission, with the network of National Oceanographic Data Centres, and the International Council of Scientific Unions, with the World Data Centres, have played a major catalysing role in establishing the existing ocean data management practices.

No one can think of data management without thinking of information technology. New developments in computer hard- and software force us to continually rethink the way we manage ocean data. One of the major challenges in this is to try and close the gap between the haves and the have-nots, and to assist scientists in less fortunate countries to manage oceanographic data flows in a suitable and timely fashion.

So far major emphasis has been on the standardization and exchange of physical oceanographic data in open ocean conditions. But the colour of the ocean data is changing. The 'blue' ocean sciences get increasingly interested in including geological, chemical and biological data (e.g. the newly created IODE Group of Experts on Biological and Chemical Data Management and Exchange Practises – GE-BCDMEP). Moreover the shallow sea areas get more and more attention as highly productive biological areas that need to be seen in close association with the deep seas. How to fill in the gap of widely accepted standards for data structures that can serve the deep 'blue' and the shallow 'green' biological data management is a major issue that has to be addressed.

And there is more: data has to be turned into information. In the context of ocean data management, scientists, data managers and decision makers are all very much dependent on each other. Decision makers will stimulate research topics with policy priority and hence guide researchers. Scientists need to provide data managers with reliable and first quality controlled data in such a way that the latter can translate and make them available for the decision makers. But do they speak the same 'language'? Are they happy with the access they have to the data? And if not, can they learn from each other's expectations and experience?

The objective of this symposium is to harmonize ocean colours and languages and create a forum for data managers, scientists and decision makers with a major interest in oceanography, and open to everyone interested in ocean data management.

Edward Vanden Berghe
on behalf of the Scientific Committee

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The UNESCO Bilko project: developing training capability for coastal and marine remote sensing

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This presentation reviews the UNESCO Bilko project that commenced in 1987 and continues today. The primary aim of the project is to make remote sensing training materials accessible to those without specialist resources at their disposal, and to promote good teaching practice by tapping the diverse skills and expertise of an expert community. Considerable resources have been generated by the project including a Windows-based image processing software package. Pedagogical materials include a wealth of short self-study lessons focused on particular remote sensing techniques, oceanographic phenomena or sensors, that students can work through in their own time. Collectively, the Bilko project provides a remarkably diverse but comprehensive resource for teaching marine remote sensing. Recently, the project has adopted a thematic framework in order to deliver more focused material and to keep pace with rapidly evolving remote sensing sensors, platforms and algorithms. The project currently serves some 1800 users located in over 70 countries and has supported several international workshops and training courses with both teaching materials and expertise. Several networks have been developed that are monitored by the Bilko steering committee, including a network dedicated to Bilko lesson authors and a network for Bilko users. All material is available from the Bilko project website (http://www.bilko.org) or from the UNESCO Coastal Regions and Small Islands (CSI) Division.

Developing an Oceanographic Data and Information Network: the Experiences of ODINAFRICA.

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The utilization of available data and information for management of marine resources and environment has been one of the major challenges facing the coastal states of Africa. The development of the 'Ocean Data and Information Network for Africa' (ODINAFRICA) aims at enabling these countries to get access to data and information available in other data centres, develop skills for manipulation of data and preparation of data and information products, and develop infrastructure for archival, analysis and dissemination of data and information products. IOC, in collaboration with twenty Member States from Africa (Benin, Cameroon, Comores, Côte d'Ivoire, Gabon, Ghana, Guinea, Kenya, Madagascar, Mauritania, Mauritius, Morocco, Mozambique, Nigeria, Senegal, Seychelles, South Africa, United Republic of Tanzania, Togo, Tunisia), are developing the network with funding from the Government of Flanders-Belgium.

Activities implemented include: (i) identification and official designation of National Oceanographic Data and Information Centres, (ii) provision of computer equipment and software, (iii) organization of data and information management training courses (iv) provision of operational support including access to the Internet; and (v) development of the ODINAFRICA website. The institutions designated as the NODCs/DNAs by the participating member states have now commenced the development of national meta databases and data archives.

The success of the various NODCs differs greatly from country to country, and depends on the support of the host institution, linkages with other stakeholders, and the qualification and personal initiative of personnel.

The ‘colour’ of remotely sensed and GIS data in the sustainable management of tropical coastal biocomplexity

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The sustainable use and management of the very important ecological, social and economic values of tropical coastal ecosystems (mangrove forests, seagrass beds and coral reefs) cannot be advanced without understanding the direct and indirect impacts of man, without foreseeing the consequences of the latter (in terms of the ecosystem’s lag-time, resilience and recovery capacity), or without considering mitigating measures. The study of these aspects in tropical coastal zones requires fundamental and applied research and merits a scientific approach from the viewpoint of marine and coastal changes (incl. changes in biotic population structure, in biodiversity and biocomplexity, and in ethnobiological uses) in order to assess or to predict the extent of anthropogenic impacts or changes. Remote sensing and geographic information systems (GIS) are excellent tools to do this.

This presentation is based on ‘Dahdouh-Guebas, F. (Ed.), 2002. Remote sensing and GIS in the sustainable management of tropical coastal ecosystems, Kluwer Academic Publishers, Dortrecht, The Netherlands’. This publication reviews the state of the art and application of remote sensing and GIS tools in tropical coastal zones and highlights a selected number of remote sensing case-studies on land cover patterns and disasters, population structure and its dynamics, and stand characteristics from South-East Asia, Africa and South-America, with a particular emphasis on mangroves. It further shows how remote sensing technology and other scientific tools can be integrated in long-term studies, both retrospective and predictive, in order to anticipate degradation and take mitigating measures in an early stage.

These technical tools are essential elements in the spirit of sustainable development and management, particularly in developing countries. Not only do these countries lodge a large part of our planet’s biodiversity (particularly from tropical coastal ecosystems), but also they are the most vulnerable to environmental degradation. Using case-studies as examples of current remote sensing applications, this paper shows how remote sensing and GIS can be applied, developed and integrated in a sustainability framework to fulfil the local and global aims and needs stated above. It is illustrated how air- and space-borne very-high-resolution imagery can help in identifying species or areas from a fundamental point of view, or for prioritizing areas for protection and conservation, for development, or for sustainable exploitation.

The paper also highlights the guidelines towards sustainable management that result from remote sensing and GIS studies, and identifies existing gaps and research priorities for the future. It should be emphasized that next to technological innovation and multidisciplinary integration there is also need for fundamental understanding of the biocomplexity (incl. human factors) of tropical coastal ecosystems.

Keywords: mangrove; seagrass; coral reef; biocomplexity; human ecology; spatial resolution; temporal resolution; spectral resolution.

OceanTeacher: building capacity in oceanographic data and information management

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Within the framework of the International Oceanographic Data and Information Exchange (IODE) program, the IOC has developed a capacity building program to train data and information managers in developing countries with the objective of establishing and strengthening National Oceanographic Data and Information Centres. As part of these capacity building activities, IODE has developed OceanTeacher, a comprehensive self-training and resource tool for oceanographic data and information management.

OceanTeacher is a browser-driven system designed to provide training tools used primarily during IODE capacity building courses but can also be used for self-training and continuous professional development. The OceanTeacher system comprises two components: the IODE Resource Kit and the Resource Kit Training Manuals. The Resource Kit contains a wide range of marine data-management and information-management material, including software, quality control and analysis strategies, training manuals, and relevant IOC documents. The Resource Kit Manuals are collections of outlines, notes, examples, and miscellaneous class work documents used in conjunction with the Resource Kit to organise a training program in marine data and information management. Due to the extreme size of the Kit (over 10,000 files at present) structured access via the Manuals has proven quite valuable.

This paper details the OceanTeacher system and describes the approach being taken by IODE in providing capacity building to assist developing countries including regional group training courses and workshops to instruct centre managers in the different aspects of oceanographic data and information management.

Integration of environmental datasets, formats and software in the IODE resource kit

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The Intergovernmental Oceanographic Commission's (IOC) International Oceanographic Data and Information Exchange Program (IODE) manages a training program in marine data management, oriented towards the development of national oceanographic data centres in developing coastal states. Supported chiefly by contributions from Flanders, the IODE program has developed an extensive suite of Web-based training materials called the IODE Resource Kit. A component of the Kit is a major section entitled 'Data Analysis and Products' designed to introduce mid-level oceanographers to global and regional environmental datasets, the principal formats used for their storage and distribution, and public-domain software for marine data quality-control and analysis. This section of the Kit is the modern-day incarnation of the 'OceanPC' Project operated in the 1990's by the IOC/IODE.

A principal aim of the 'Data Analysis and Products' section has been to achieve integration between the major datasets selected for IODE training, using existing pathways between them afforded by specific format compatibilities. This functionality was sought in the predecessor program, but was never fully realized due to the lack of suitable software, particularly in the area of satellite imagery and other spatial data. Fortunately, it is now possible to identify a large suite of public-domain software programs that not only provide bridging functions between various databases (based on their individual abilities to import and export important formats), but also perform many analysis and quality-control functions. The exceedingly complex diagram that would be necessary to illustrate these connectivities has been split into three functional schematics used in the IODE training curriculum. Virtually every dataset used in the classes can be located on the diagrams, and easy paths can be traced to any desired software program. A set of 50 illustrated tutorials has been developed to give step-by-step directions on the processes involved.

The processing levels within the IODE Resource Kit schematics range from raw data (on physical log-sheets), to spreadsheet and relational database software, to popular grid-and-contour software, to multi-parameter synthesis in Geographic Information System (GIS) applications. All but one of the software programs used in the Kit are available freely (from either the Web or from special CD-ROMs used in IODE workshops), but students are responsible for obtaining individual licenses, where required. At the present time, there are no major global or regional environmental datasets that cannot be identified on the IODE schematics, and synthesis of all types is easily possible in a public-domain GIS browser program.

Building global ocean profile-plankton databases for scientific research: World Ocean Database 2001

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During the past 10 years the international ocean data management and scientific communities have worked together on ocean data management projects that have resulted in the development of the comprehensive ocean profile-plankton databases that are available internationally without restriction.

This presentation describes the results of these efforts which have culminated in the release of World Ocean Database 2001. Some scientific results made possible with these comprehensive databases will be presented. In particular, a comparison of observed upper ocean temperature changes using the data from World Ocean Database 1998 and results of Ocean General Circulation Models forced at the sea surface (NCEP/NCAR surface fields, sea surface salinity,...) will be given.

A hydrographic and biochemical climatology of the Mediterranean and the Black Seas: some statistical pitfalls

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The aim of the MEDAR/MEDATLAS II project was to archive and rescue multi-disciplinary in-situ hydrographic and biochemical data of the Mediterranean and the Black Seas through a wide cooperation of countries and to produce a climatological atlas of 12 core parameters, which include temperature and salinity, dissolved oxygen, hydrogen sulfure, alkalinity, phosphate, ammonium, nitrite, nitrate, silicate, chlorophyll and pH. Gridded fields have been computed using the Variational Inverse Model and calibrated by Generalised Cross Validation, by making usual assumptions on the statistical distribution of data and errors. They have been produced for both entire Mediterranean and Black Seas and several additional sub-basins including the Alboran Sea, the Balearic Sea, the Gulf of Lions and the Ligurian Sea, the Sicily Strait, the Adriatic Sea, the Aegean Sea, the Marmara Sea and the Danube shelf area at climatic, seasonal and monthly scale when relevant. Inter-annual and decadal variability of T/S for both basins has been computed as well. The resulting atlas is made available free of charge at http://modb.oce.ulg.ac.be/Medar and on CD-ROM. We review here the different biases that occur locally when one of the statistical hypothesis is not satisfied, we assess the quality of the climatology and propose further possible improvements to the analysis method.

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The present and future of an integrated database on oceanology of the Southern Scientific Research Institute of Marine Fisheries and Oceanography (YugNIRO, Kerch, Crimea, Ukraine)

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A brief description of Southern Scientific Research Institute of Marine Fisheries and Oceanography (YugNIRO) status and activities is presented.

The state of archives dating from the middle of the 20th century is described, and measures for its safe storage, processing and future use are considered. Four principal data sets, namely: environmental, ichthyological and hydrobiological, fisheries statistics, and references, are described; their origin, means of QC, methods of analysis and data presentation specified by their origin, means of QC, methods of analysis and data presentation are specified. A listing of 15 databases available at present , and their current status is also given.

The value of the databases originated from the method of research: the collection of the information on the state of the ecosystem was carried out simultaneously with oceanographic surveys, which were supplemented with meteorological observations. The multidisciplinary nature of the primary data collected offers a plethora of opportunities for further research of the marine ecosystems. On the one hand, it opens a way to analyse the situation on a synoptic spatial-temporal scale, i.e. to define the state of fish population and its behaviour in relation to the water properties. The type of data obtained may serve as a ground to expand the knowledge of the ecosystem functioning mechanism (scientific aspects), and for implementing operative regulations of fishery (closed seasons/areas, quota management, etc.) and scientific advice to improve efficiency of fisheries fleet operations (short-term forecasts), administrative and commercial applications to support rational and sustainable use of MLR. Data obtained by standard methods in terms of repeated (through a number of years, in the same geographic regions) integrated surveys allow to access the long-term dynamics of the state of population of certain species against long-term fluctuations of the oceanographic and meteorological modes. Besides the science-related aspects, such data maintain applied information on changes in the overall stocks and estimation of the Total Allowable Catches in the different regions, as well as the development of middle- and long-term forecasts for fisheries on catches of particular commercial species in the future.

The available databases and current YugNIRO monitoring activities are an important basis of satisfying Ukrainian obligations in the framework of international conventions, agreements and membership in the international organizations involved in fisheries regulations CCAMLR, NAFO, CITES. These involve monitoring of the state of fisheries ecosystems in the high seas areas of active Ukrainian fisheries, monitoring of fishing fleet activity, and development of sound management advice on the use of fisheries resources, forecasts of resource state, as well as estimation of the Black and Azov Seas' principal commercial species stocks for fisheries regulation and setting fishing quota by the State Committee of Fisheries of the Ukraine.

Recent advances in oceanographic data management of the Mediterranean and Black Seas: the MEDAR/MEDATLAS 2002 database

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As the marine biological ecosystem is the most sensitive to any climatic change, the availability of basic oceanographic data like temperature, salinity, oxygen concentration and nutrients are necessary for monitoring the system. For the Mediterranean and Black Seas, temperature, salinity, oxygen, nitrate, nitrite, ammonia, total nitrogen, phosphate, total phosphorus, silicate, H_2S, pH, alkalinity, and chlorophyll-a vertical profiles have been collected for several decades by about 150 laboratories of 33 countries, most of them from the bordering countries. However, many remained dispersed in scientific laboratories and national data centres at different format and various level of documentation. To facilitate the access to these dispersed data, an EU concerted action MEDAR/MEDATLAS (MAS3-CT98-0174 & ERBIC20-CT98-0103) was initiated for developing a joint comprehensive database through a wide co-operation of Mediterranean and Black Sea countries. The partners were mainly National Oceanographic Data Centre or Designated National Agencies for International Oceanographic Data and Information Exchange (IODE) of UNESCO Intergovernmental Oceanographic Commission (IOC), and had the duty to compile and safeguard copies of the data sets collected at sea by the scientific laboratories of their country. These data have been reformatted at the common MEDATLAS format, and checked for quality according to a common protocol based on the international IOC, ICES and EC/MAST recommendations, with automatic (objective) and visual (subjective) checks.

This international cooperation work was successful in doubling the volume of available data, which includes 286426 stations (vertical profiles from bottle casts, CTD, Xbt, Mbt), and presently represents the most complete database for the Mediterranean and Black Sea studies. Among these stations, the spatial coverage of each parameter is not homogeneous. The coverage of the nutrients decreases dramatically from phosphate, which is considered by the biologists as a control parameter of the biota (20808 profiles) to total nitrogen (153 available profiles only). H_2S is measured only in the Black Sea, in relation with the lack of oxygen in the subsurface layers. The middle of the deep basins and on the Lybian shelf is poorly covered, even for temperature. Data selected with acceptable quality flags have been interpolated at 25 horizontal levels and objectively analysed to produce the gridded climatological fields, vertical sections and horizontal maps, by using a variational model for objective analysis. Finally, all the meta-data (cruise inventory), observed data, gridded data, maps, documentation and software are to be published on a set of four CD-ROMS.

There are plans to maintain and further develop this data system. New data produced by recent projects and real time data produced by operational oceanography programmes will be integrated. Easy integrated on line access to distributed datasets will be provided by using enhanced standards and information technology tools. Furthermore, the quality control protocol will be improved by incorporating in routine checks, theoretical relationships between nutrients such as the Redfield ratio. However the QC of the nutrients in areas with poor data coverage remains difficult and there is still a need for a better data coverage as the quality checks are based on the pre-existing knowledge of the distributions. This is critical in the middle of the deep basins and along the Southern Mediterranean coasts. As this action provides an innovative and leading system for data exchange, it will represent a key action in the broader data management system for Europe and Mediterranean oceanography. MEDAR/MEDATLAS co-ordinating website: www.ifremer.fr/medar/

RIVELA – Database for the research on Venice and the Lagoon

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The Consortium for coordination of research concerning the Venice Lagoon System (CORILA) is an association of the University of Venice, the University of Padua, the Venice University Institute of Architecture and the National Research Council of Italy. Established in 1999, it manages scientific research on Venice, funded by the Italian Special Law for Venice via the Ministry for Teaching, Instruction and Research. The current research programme (2000-2004), of the value of around EUR 10 million, involves an international network of 70 research institutions in different disciplines. The integrated management of information across the disciplines constitutes un important goal of CORILA.
RIVELA is a relational and flexible database for storage and management of information with facilities making readily available the research results of CORILA to the scientific community, decision makers and the general public. RIVELA allows the permanent and secure archival of results from research activities and the wide dissemination of the data, subject to appropriate user authorisation. All interactions between users and RIVELA occur via the Web.
The RIVELA database consists of two principal components: a *static* part, relative to the auxiliary support data, and a *dynamic* part, relative to surveys effected in the field activities.
The static part contains the following information:
research groups and performed activities (research projects, work packages, activity);
geographical location of the data (zones, environmental units, localities);
data type (matrixes, types of sample, parameters);
data acquisition methodologies (method, apparatus).

The dynamic part contains four connected fundamental entities: Measurements, Samples, Stations and Sampling Activities. A measure is the value of a parameter deriving from a certain sample, which has a precise spatial (station) and temporal location. The samples are, in turn, classified according to type (sample types), depending on the environmental matrix.
The classification of samples and parameters is the result of long and complex interaction with the Research Groups to collect and define, in a singular way, the different modes in use within groups in individual research.
All information in the static part can be easily searched and visualized. Furthermore, via specially predisposed pages, users can suggest integrations.
Currently, three principal applications, all available via the web, are anticipated: insertion of data from field activities, search and extractions of data with guided interrogations, data visualization within a GIS system.
Data input is via connection to the appropriate webpage, containing a series of fields to manually fill and buttons to send one or more files, CSV format, prepared on the user's computer.
In addition to the measurements themselves, information relative to the methodologies used must also be inserted, and auxiliary data like bibliographies, images, etc. can be inserted too.
As RIVELA is a relational database, users have at their disposal all the usual modes of access to data: SQL, "individual productivity" tools such as Excel and Access which are useful to extract sets of data in tabular format and to carry out operations using one's own computer. Moreover, two additional

access and extraction modes have been provided: a guided interactive search and interrogation through GIS.
In formulating an interactive interrogation, the user is guided in a way that allows specification of information requirements through a selection of the parameters of interest, spatial location, temporal location.
The interrogation result is a user-configurable chart, immediately visualized on the webpage, but which can also be downloaded in CVS format for further elaborations, or visualized on geo-referenced maps of the Lagoon.
The availability of a GIS system also allows visualisation via the web of the results of modelling simulations, statistical data analysis, and thematic representations of these.

The BMDC database: a tool for scientists and decision makers

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In 1996, the Belgian federal government launched its first 'Scientific support plan for a sustainable development policy'. One of the main themes of this five–year programme was the sustainable management of the North Sea. This action gathered the skills of more than 25 teams, active in a wide variety of scientific disciplines.

It appeared early and clearly that one of the most important challenges to make the programme effectively support the policy–making process was to 'ensure a smooth and scientifically sound flow of data between the data producers and the end users'. This was the motto of the IDOD project, partly funded by the scientific support plan. It still is the motto of the Belgian Marine Data Centre (BMDC) created within MUMM to carry out the project and, afterwards, to run this marine database as a permanent public activity.

THE CHALLENGE: INTEGRATING MANY DATA TYPES IN ONE INFORMATION SYSTEM

The data to be considered cover a wide range of physical, chemical or biological processes, from, *e.g.*, salinity to community structures through contaminant concentrations in biological tissues or optical properties of the seawater. Our choice was to design the system in such a way that it would be able to handle as many data types as possible in one consistent structure. For the data manager, the main benefit is to minimise the variety of procedures necessary to validate, incorporate and manage the various data sets. To the user, this design offers an easier cross–handling of different data types, from different sources. Such a strategic decision means more userfriendliness, and more time for the data managers to concentrate on the data, but at the price of more effort during the design phase.

FROM A DATA BASE TO AN INFORMATION SYSTEM

Data, especially those collected at sea, are invaluable because of the information they contain on the state of our environment at a given place and time and because of the considerable resources they required for their collection and analysis. It is therefore of the utmost importance to preserve the data in the best possible condition for their present uses and for the future. This requires a database, and associated quality control procedures, designed according to far-sighted technological choices. However the mission given to the BMDC is more ambitious, *i.e.* to deliver tools and services fitting the practical needs of the users. Thanks to the comprehensive but versatile design of the core database, a set of spatial and statistical analysis tools has been developed. These tools, together with the basic browsing and retrieval functions, are made available to the users through the Web, making the whole a true information system.

THE RESULTING SERVICE

The first version of the information system was released during summer 2002. Our presentation will discuss the early strategic decisions, the resulting design and the implementation, and, last but not least, will detail some specific scientific applications it has already made possible, such as eutrophication level assessment in marine coastal waters and habitat classification.

JGOFS data management: What has been done? What has been learned?

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The JGOFS Project has been highly successful in providing new insights into global biogeochemical cycling in the oceans through a multi-national effort. During the JGOFS Project, key biological and chemical variables were sampled by over twenty countries at the regional scale (process studies in the North Atlantic, Arabian Sea, Equatorial Pacific, Southern Ocean and North Pacific), global scale (carbon survey) and from long-term measurements at key ocean sites.

To be readily available and fully usable for current and future studies, the JGOFS datasets need to be organised in a central system under the supervision of the international project, or within a national framework. Because of the complexity of interdisciplinary data and the extent of JGOFS itself, much remains to be done to secure the accessibility of all data collected in the project. The lack of a centralized International Project Data Centre severely hampers the use of JGOFS data for synthesis and model validation, now and in the future. It is only recently that the JGOFS Data Management Task Team (DMTT) began working to compile a single database (so-called, the International JGOFS Master Dataset), in a single format and in a single location (in the WDC system, thanks to an initiative of PANGAEA / WDC-MARE; and on CDs or DVDs) before the end of the project (Dec. 2003). This should be achieved by adapting previously developed tools, especially from the US-JGOFS DMO (for the user query interface) and from ODV/PANGAEA (for the datasets visualization and metadata handling).

In this framework, and as new programs are being designed or implemented, we must learn from the JGOFS data management experience. The major, past and current DMTT activities and achievements will be presented, along with a set of recommendations elaborated for international program managers and funding agencies, regarding the data management in future international projects, which should result in the rapid and full availability of data, and its long-term preservation and accessibility, thanks to a better, integrated data management system.

Global Monitoring for Environment and Security (GMES): marine data management and policy issues

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The GMES Initiative seeks to bring the needs of society associated with the environment and security together with the advanced capability offered by in-situ and remote sensing observation systems, to ensure by 2008 European operational and autonomous access to relevant information at global, regional and local level. Towards this end, the Council of the European Union has formally requested the Commission, in close co-ordination with the European Space Agency, to build on the capabilities and existing infrastructure (terrestrial, air-borne, sea-borne and space based) and to start pilot projects in line with users' views. In this context, the Commission is required to report to the Council and to the European Parliament at the end of the GMES Initial Period (2001-2003) on the definition of the system. This report will be based on users' requirements, the expected services, the possible support to the various Community policies, the results obtained from the pilot services, the economic and social benefits, the possibilities for international co-operation at global level and the possible scenarios for an organisational framework.

Marine observing and forecasting systems will be one of the principle components within the GMES Initiative. Significant advances have been achieved in recent years in implementing near-operational physical oceanographic forecasting systems. Considerable developments are also underway towards achieving pilot pre-operational biogeochemical monitoring and forecasting systems for ecosystem management. Whilst all of these systems have the potential to make a major contribution towards meeting the GMES objectives, many institutional and organisational matters must be resolved in addition to the scientific and technical challenges that remain. Not the least of these are the many issues associated with achieving a GMES data management structure that will work across different domains - atmospheric, marine and terrestrial - and different disciplines – e.g. physical, chemical and biological sciences - whilst also accounting for different national data policies within the EU Member States.

The presentation will provide an overview of the GMES Initiative, concentrating on achievements in the marine sector and future ambitions. Particular attention will then be given to data management and policy issues, including matters relating to real-time data flow and quality control.

Using the integrated information technology based on GIS for marine environmental data management and creation of reference books of the hydrometeorological conditions

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The efficiency and validity of the World ocean investigations and decisions made in the course of exploitation of marine resources depend considerably on the level of information support for this activity. This makes it necessary to treat a full technological cycle of data management (integrated “end-to-end” information technology - IIT), from acquisition of observational data to provision of an end-user with complex information on all environmental aspects. The paper discusses the aspects of the realizing IIT and its use in the development of the specialised information systems.
The application domain of IIT is defined by the requirements imposed on the information support of marine environment investigation and exploitation. Generally these requirements may be divided into several classes of tasks such as provision of data and information by requests as hard copies or in the electronic form; obtaining climatic characteristics of marine environmental conditions in the region of investigation; monitoring of the current state of marine environment and dangerous natural phenomena; etc. The principal role of the integrated information technology consists of implementing a connected sequence of operations and procedures for acquisition, accumulation, modelling and transformation of marine environmental data in order to obtain information required for decision making and planning of environmental and other actions.
Now Russian NODC is developing such IIT (as a part of Special Federal Programme) based on modern geographical information system (GIS) to provide successful support of the marine environment data management and climatic research. Today GISs are actively used for solve different kinds of scientific and practical problems. Modern stage of using GIS in oceanography is characterized by the expansion of traditional static mapping of parameters up to the point of creating dynamic animation maps, which show the time variability of hydrometeorological fields. Modern specialists cannot do without GIS. Moreover, it is practically impossible to dispense with GIS in analyzing and displaying environmental information, when working with hydrometeorological data.
The paper analyzes the concept, architecture and development state of IIT, based on GIS. The paper examines the practical samples of the specialized integrated information systems. Technology of making environmental reference books based on GIS-technology is considered in the paper. The paper discusses the results of analysis of modern electronic reference books on the Black Sea hydrology. The fragments of a new electronic guide to the Black Sea hydrology, created on the basis of GIS-technology are shown.

Data requirements for biodiversity indicators

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The rational use and conservation of biodiversity requires programmes of inventorying and monitoring that allow understanding the past and present states of biodiversity and the causes of its change. Inventories establish a baseline distribution of biodiversity for a particular place at a particular time. Monitoring addresses the issue of change or lack of change of biodiversity through time at particular places. Ideally some sort of modelling should allow for predicting future states of biodiversity.

Biodiversity is a dynamic property of an ecosystem. The goal of a monitoring program is to document natural patterns of change or lack of change in order to establish a baseline for understanding the impact of natural disturbance on species composition and abundance in communities and ecosystems. Once this baseline is established it can be used to detect changes in biodiversity that result from human disturbance.

An inventory will establish the magnitude of biodiversity over relatively short time spans whereas monitoring will serve to connect these observations over time, to assist in hypothesis testing and to help establish an early warning system that may be part of a global biodiversity assessment.

The total assessment of biodiversity at a given site, let alone for a country or a region, through enumeration of the genetic diversity, the species and habitats is an impossible task to fulfil. A number of indicators or proxies is therefore required that provide information that is as unbiased as possible. Besides indicators for biodiversity other indicators are used to measure environmental health.

The choice of an appropriate indicator is very important in terms of information and cost. To increase the usefulness of an indicator several frameworks have been developed. One of the most widely used is the Drivers-Pressure-State-Impact-Response DPSIR framework, but simpler and perhaps more convenient schemes are in use as well. At the European level, loss of biodiversity is one of the about ten policy fields to which these schemes are applied

All these indicators require massive collection of data and the good use of these collections is still a major problem in applied and fundamental ecological research both on governmental and academic level. Dealing with the massive information that has already been gathered and the still more massive information that will be collected in the future is one of the major challenges of the scientific community and the end-users of scientific information in general. The networking efforts of marine biodiversity in Europe provide a good example of the problems and the ways towards their solution.

All an ecologist wants to know, but never can find

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Biogeochemists have long recognized the high potential of cross-system comparisons and the analysis of large oceanic databases to discover governing principles of system functioning. A classical example is the Redfield ratio and similar analyses along this line.

Cross-system comparisons are, in principle, also a promising approach for ecological studies. I will give examples from the study of macrobenthos. Based on published values, we recently drew up relations between macrobenthic biomass and system primary production, between benthic oxygen consumption, water depth and benthic biomass, between benthic feeding types and spatial distribution of biomass in systems. Using our own databases derived from government monitoring programmes, we derived statistical models predicting the occurrence of macrobenthic species in estuaries from physical characteristics. We are currently trying to generalize these predictions for other systems in the world.

From these examples, I want to discuss the characteristics that make a database useful for an ecologist. Problems in the intercomparison of ecological datasets may arise from differences in field and lab methodology and, probably more important, in taxonomic practices. A worldwide effort to standardize taxonomy for ecological applications is badly needed. Categorizing species by ecological rather than taxonomic characteristics would be very useful. Further, a major effort would be needed in the provision of physical and chemical metadata that are georeferenced at the same scale as the ecological data. Cross-references between hydrographic data (bathymetry, current structure, t-S characteristics), biogeochemical data (nutrients, oxygen, production and consumption rates) and ecological data (community composition) could provide the basis for large-scale analysis of functional relations of biodiversity on ecosystem functioning. National monitoring programmes often combine these different measurements and provide, to a varying degree, national data banks. Global integration of these data banks could be a goldmine for ecologists, but will involve major efforts from a group of ecologists.

Limitations and solutions to the exchange of macrobenthos community data between scientists and CZM managers as shown in the frame of human impact monitoring studies in SW Netherlands

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Because of their sessile character and relatively long life-span, benthos integrate environmental fluctuations and influences at a particular place over a relatively long time span. It makes that community data of benthos can be a suitable indicator for changes in environmental quality.

The aim of the long-term monitoring studies on benthos at NIOO-CEMO is to obtain insight in the natural development of estuarine and coastal areas and the anthropogenic influences in those areas in order to safeguard natural resources and to allow optimal use of a system's potentials.
As most monitoring programmes, this kind of continuous long-term assessments is perfect to detect slow and small deviations from a standard or norm: year-to-year changes may not be significant but longer series of data may reveal trends.

Since in the Netherlands most of these monitoring studies depend on restricted funding by governmental agencies, two major problems arise in the present-day evaluation and use of the monitoring data.
These problems, and the consequences and solutions to these problems, will be exemplified with a series of monitoring data of the brackish lake Grevelingen.

The first problem is that the basic data sets (on species, numbers, biomass) of macrozoobenthos are stored by the funding governmental agencies, yet remarkably, hardly processed and used for further analyses. Because of such, the benefit of monitoring-programmes has been strongly debated: the projects were costly, yet did not yield a proper end-product for the end-users (managers and the public at large).

Nowadays, modern analyses and communication (web-page structured) techniques, allow us to analyse and visualise monitoring data in a limited time and at (relatively) limited costs. A first visualisation of a long-term (10-year) dataset showed dramatic changes in the macrobenthos species composition of Grevelingen without having been noticed before by the managers. Therefore, it is proposed to adjust the handling and processing of monitoring data in order to fulfil more the needs of managers and the public at large.

The second problem is that nowadays coastal managers frequently ask for causal relationships related to changes in environmental quality. Then, information is needed on temporal and spatial distribution and dynamics of benthic populations, together with environmental variables. A first analysis of the available extensive databases showed a mismatch (in time and place) between the macrobenthos and environmental data in Grevelingen. Further analyses (by means of e.g. ordination, correspondence analysis) helped to explain the changes in macrobenthos in relation to variation in sediment and water characteristics (e.g. grain size, chlorophyll, Secchi disk, TBT concentrations).

Accordingly adjustment of strategic monitoring projects is proposed.

Biogeochemical assessment of shallow sea environments (White Sea, Russian Arctic)

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Shallow sea areas and enclosed estuarine systems are characterized by extreme diversity of biological communities as well as very active fronts and biogeochemical barriers creating small-scale variability in hydrodynamic, lithological and geochemical patterns. Therefore, the problem of separating hazardous anthropogenic loads from geochemical baseline, crucial for analysis of data on vulnerability of various environments, needs special attention.

The present study attempts to develop environmental monitoring parameters and objective criteria for environmental assessment using Kandalaksha Bay of the White Sea (Russian Arctic) as a case study. The approach involving both geochemical and biochemical parameters was exercised. In particular, element composition of the grounds studied served as a parameter reflecting global geochemical composition, hydrolytic enzymatic activities were employed as a dynamic index of organic matter decomposition rate and enzymatic test-systems were utilized as an indicator of contamination. In the framework of the above-mentioned study, surface sediment and adjacent shore soil samples were collected in June 2000 in six small bays along the Karelian shore of Kandalaksha Bay. These include Ermolinskaya, Chernorechenskaya, Rugoziorskaya, Griaznaya bays, Poyakonda and Podvolochie. In the samples major (C, N, S, P, Al, Fe) and trace (Mn, Co, Cu, Ni, Cr, Cd, Li, Zn, Pb) element contents and enzymatic activity parameters were determined.

For all estuarine systems investigated terrigenous inflow seems to be a minor factor in shaping geochemical composition of the sediments. Nevertheless, small-scale hydrodynamic processes specific for each particular area affect natural material fractionation and further determine sediment formation of the restricted exchange environments. The most vivid example is Ermolinskaya Bay where the fine-grained sediments enriched in organic matter and thus in nutrients and metals are formed due to pronounced trapping effect of the separating process.

The found geochemical composition of marine sediments at studied bays corresponded to that of unpolluted Arctic coastal environments. The distribution of azocasein turn-over period in azocasein-trypsin test showed no significant contamination of examined sediments. Therefore, the values of trace heavy metals obtained in this study can be perceived as a natural background, with Cu, Ni, Li and Pb contents lower and Zn and Cr higher than in other parts of the White sea. This conclusion is also supported by the fact that the grain size was the main determinant in geochemical composition and enzymatic activities patterns among sites studied.

The comparative study of the pristine (Ermolinskaya Bay) and man-affected (settlement Poyakonda) soils revealed significant enrichment of Poyakonda soil in organic carbon, organic nitrogen, Fe, Mn, Cr and Zn. In Poyakonda soil enzymatic activities were strongly depressed thus indicating the low self-purification capacity of the environment in response to an increasing load of organic matter. Results obtained from applying of enzymatic test-systems show low-level and no contamination in Poyakonda and Ermolinskaya soils, respectively.

The present study has shown that the local hydrodynamic situation predisposes geochemical and biological patterns of the environment and thus possesses considerable ecological relevance. Comprehensive biogeochemical approach exercised in the current research provides valuable information on grounds state of health and can thus serve as a basis of objective environmental assessment of a region.

Application of rule induction techniques for detecting the possible impact of endocrine disruptors on the North Sea ecosystem

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In recent years, there has been increasing concern by scientists, regulators and general public about possible adverse effects of chemicals present in the environment on the endocrine system of humans and wildlife. Since the sea is the final sink for many (persistent) pollutants, endocrine disruptive chemicals are also thought to affect our marine ecosystems. Based on available scientific literature a database of 765 chemicals with (potential) endocrine disruptive activity was developed for the North Sea Ecosystem (ED-North database, OSTC-PODO I Programme). This relational database contains information on the hormone disrupting potential, including effects and physical-chemical properties of these chemicals.

This database was used as starting point for the induction of classification trees. Classification trees predict the value of a discrete dependent variable with a finite set of values (called classes) from a set of independent variables (called attributes). Data describing a real system, represented in the form of a table, can be used to automatically construct classification trees. The use of rule induction methods, such as classification trees allows a unique interpretation of complex databases. In this perspective, future use of these and other inductive logic programming techniques can aid researchers in better understanding fundamental relationships between complex data. Classification trees will be used to explore possible relationships among exposure-effect data for the various substances in the ED-North database and the main conclusions on exposure-effect relations of these chemicals will be presented.

A quality control system for biological oceanographic data in the Northern Indian Ocean

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A quality control system (qcs) has been developed for checking the quality of primary production (pp) and chlorophyll-a (chl) data collected during the International Indian Ocean Expedition (1960-66), and cruises of R.V. Gaveshani (1976-94) and O.R.V. Sagar Kanya (1985-1997) from the Northern Indian Ocean. Besides the standard quality control (qc) measures, the qcs has specific norms for checking the quality of 'pp' and 'chl' profiles based on photosynthesis theory. The first norm was that when the rates of 'pp' i.e. carbon fixation due to photosynthesis are normalized to 'chl' (pp/chl), the ratio (Assimilation Number) will be maximum at light saturation and that this would not exceed 25 µg C $(\mu gChl)^{-1}$ h^{-1} (Falkowski, 1981; Balch and Byrne, 1994). When a maximum ratio of 250 was used for a day length basis, the results of the qcs showed that about 5% of the 'pp' and 'chl' data exceeded this. The second norm was that the decrease of 'pp' with optical depths is exponential and that the 'pp' rates at the bottom of the euphotic zone (depth at which ambient light intensity is 1% of that at the surface) cannot be higher than those above. A tail end increase, therefore, would render the values suspect. Analyses based on this norm showed that in about 11% of the cases, the 'pp' values were unreliable.

The qcs, in general, were used to check the metadata information, duplicate records, range and statistical limits of the 'pp' and 'chl'. These checks were based on visual inspection, comparison with supporting information and statistical computation. Visual inspection of the qcs was performed by comparing the individual profiles at selected stations with 'standard' vertical profile of 'pp' and 'chl' in the region. The qcs also compare the 'pp' and 'chl' profiles with temperature profile of the same station, if available. Statistical qc check was performed by grouping the 'pp' and 'chl' profiles in 1^0X1^0 or 2^0X2^0 latitude-longitude square depending on the number of profiles available. Mean and Standard Deviation (SD) at each observed depth for the square were computed from the available 'pp' and 'chl' profiles irrespective of the season. Range for 'pp' and 'chl' at observed depths in each square was fixed as mean $\pm$5SD, when the site was in coastal water and the depth was above 50m. With the rest of the cases, it was fixed as mean $\pm$3SD. All the above 'pp' and 'chl' profiles passed this test.

Keywords: primary production; chlorophyll-a; quality control; Northern Indian Ocean.

An overview of the Fisheries Resource Information System and Tools (FiRST): a database management system for storing and analyzing trawl survey and related data

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Demersal trawl surveys have been used for assessments of fisheries potential and monitoring the status of fish stocks in many countries in South and Southeast Asia. This paper presents the development of a database system, the "Fisheries Resource Information System and Tools" (FiRST), from a regional collaborative effort between eight counties and ICLARM - The World Fish Center. The effort has collated trawl survey data of about 21,000 hauls/stations from research trawl survey hauls across the South and Southeast Asian region.

FiRST was designed as data container (to organize, store, retrieve and exchange) for extant trawl surveys. In addition, the database system includes generic socioeconomic data, as well as catch and effort statistics and an analytical routine to approximate biomasses. Analytical modules from other software needed for data analyses have also been made accessible via the database system.

This paper also presents some insights on the utility of retrospective analysis of trawl survey data in establishing resource baselines and to improve understanding on the biology and exploitation status (e.g. biomass declines and species composition changes) of coastal fishery resources. The database system is now an important regional repository of information for sustainable management of coastal fish stocks in developing Asian countries and is envisioned to provide solid foundations for formulation of appropriate fisheries management strategies and action plans at the national and regional level.

History of the CPR database

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The Sir Alister Hardy Foundation for Ocean Science (SAHFOS) is an international charity responsible for managing the Continuous Plankton Recorder survey in the North Atlantic and North Sea, providing a unique multi-decadal data set of plankton abundance since 1931. Subsequent to 1931 technology has advanced and the system for storing the CPR data has developed considerably. The CPR database has been affected by performance related factors such as processor speed and disk capacity as well as economic factors such as the cost of software. These issues have been overcome and the system for storing and retrieving the data has become more user friendly at every development stage.

Prior to 1969 calculations for sample positions, the time of sample and the quality control of CPR data were carried out manually. Processing to calculate year to year changes in abundance, seasonal cycles and geographical distributions of the CPR data was prepared by hand, and in 1969 the first steps were taken to automate these tasks. The CPR data were entered into a computer using punch cards and processing routines developed (Colebrook, 1975). When punch cards became obsolete, data were stored in text files and data processing was done using programs developed by CPR staff. The difficulty with this system was the reliance on “in-house” experience and skills, and there were problems interrogating the raw data files. To address this problem the data were transferred to a relational database and then to the Access database which SAHFOS uses today.

The fundamental principles behind the original data entry system and processing have not changed. For example at each development stage the same algorithms have been used to calculate the sample position and the local time. This ensures that the CPR database remains consistent, and historical information can be confidently compared with present day data. Though some automatic quality control processes have been developed over the years, CPR data is still scrutinised personally by senior analysts to maintain the standard of the data, as a computer cannot replace their specialist knowledge.

The computerised database currently contains data from 1946 to 2000 consisting of 181,262 CPR samples with 2,135,072 taxonomic abundance entries. In 2001 there were 25 separate data requests from 11 countries, highlighting the usefulness and interest there is in the CPR database.

The emphasis now is on the need to develop a system allowing users easy and immediate access to available data, and this is achieved via the World Wide Web. Phytoplankton colour and *Calanus finmarchicus* data are already available on the web for CPR standard areas. This will be developed allowing researchers to input their own geographical areas. This paper/poster is to show the developments and changes in the CPR database, highlight SAHFOS plans for the future, and emphasise the need to keep up to date with current developments.

Monitoring and predictive modelling of estuarine benthic macrofauna and their relevance to resource management problems

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Practical considerations in estuarine management, as well as prediction of the consequences of global change on coastal protection, urgently require a better understanding and better modeling of estuarine ecosystems as influenced by ecological, physical, chemical and morphological processes. Recent Dutch examples of such questions are: the impact of enhanced dredging in the Schelde estuary, the impact of sea level rise on the Wadden Sea and Delta area, concerns about the loss of salt marsh habitats, etc. Benthic communities are good indicators of biotic integrity and reflect the present state of the estuarine ecosystem. The analysis of benthic infauna is a key element of many marine and estuarine monitoring programs. In the Dutch Delta area (SW-Netherlands) there is a relatively long tradition on estuarine macrozoobenthos monitoring, such as implemented e.g. in the BIOMON program. This program was designed to detect long-term trends in the average density, biomass and species composition of large parts of different systems (e.g. Schelde estuary, Oosterschelde, Grevelingen), in order to obtain insight in the natural development of estuarine and coastal areas and the anthropogenic influences on these systems. Running now for over a decade, these programs, together with other field campaigns, provide a unique data set on benthic macrofauna (e.g. for the Schelde estuary over 5000 samples are available at the moment). Until recently these data were hardly processed and used for further analysis. However, such data sets offer the opportunity to analyze and predict patterns in occurrence of benthic macrofauna in a much more profound way. Recently, within a cooperation between decision makers (Rijkswaterstaat, Directie Zeeland), advisers (RIKZ) and scientists (NIOO-CEMO), the possibilities and limitations of using these data sets for the predictions of benthic macrofauna at scales relevant to resource management problems are evaluated. In our approach we use different statistical methodologies to quantify, model and predict patterns at different spatial and temporal scales, going from patterns on a single tidal flat to inter-estuary comparisons and from monthly patterns to decennial trends. Several examples are shown that illustrate the use of these data, going from simple classification techniques to more sophisticated predictive modeling: Changes and shifts in benthos communities are shown for a land reclamation area of Rotterdam harbour in the Haringvliet-delta using classification techniques. Ordination analysis on the saline lake Grevelingen, a former estuary, showed long-term changes in macrobenthic community structure as a consequence of changes in salinity, light penetration, etc. This case study will be dealt with in more detail in a separate contribution. In the Schelde estuary, a detailed study was performed to unravel the use of environmental data in predicting benthic macrofaunal species distributions at different spatial scales (from a single tidal flat to the whole estuary). Statistical techniques such as geostatistics, hierarchical analysis and logistic regression were applied. At these different scales a distinct relation between the environment (e.g. salinity, sediment characteristics) on the one hand and macrofaunal species distributions on the other hand was observed. As a consequence, predictions of macrofaunal distributions can be made quite successful from environmental data within the Schelde estuary. An inter-estuary comparison between the Schelde estuary and Oosterschelde revealed that predictive models should also incorporate system-wide properties of estuarine systems, such as primary production and suspended matter concentrations, in order to perform in a more generic way. The results clearly show their use in making more sensible long-term decisions about matters having direct environmental effects. The results also provide information on how the design of monitoring programs could be improved or optimized, depending on the questions asked. As such, a more synergetic and flexible approach is urgently necessary, in which decision makers, advisers and scientists communicate in a more efficient way.

New internet development: marine XML

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With the emergence of XML as a data transfer protocol a mechanism to support the exchange of marine data is now available. The development of a marine XML will support the tracking of data from collection through to the generation of integrated global and regional datasets. XML can support the metadata describing the data collection, quality control and subsequent processing.
The IOC, through the IODE programme, is involved in the development of marine XML applications. One of the objectives of the IODE Group of Experts on the Technical Aspects of Data Exchange (GE-TADE) is to develop marine XML as a mechanism to facilitate format and platform independent information, metadata and data exchange. The IOC metadata system, MEDI, uses XML to validate and transfer metadata (http://ioc.unesco.org/MEDI). The IOC hosts a community portal website for Marine XML that provides a central location for document distribution and general discussion forum (http://MarineXML.net).
Cooperation between IOC and ICES on the development of a marine XML commenced in 2002 with the creation of the ICES-IOC Study Group on the Development of Marine Data Exchange Systems using XML (SGXML). This group met for the first time in April 2002 and developed a work plan to guide the investigation into how XML technology could be used in an oceanographic context.
Other activities in the development of a Marine XML include the EU Marine XML project *Marine XML: a pre-standardisation development for marine data interoperability using XML*. This project will demonstrate that XML technology can be used to develop a framework that improves the interoperability of data for the marine community and specifically in support of marine observing systems .The project will develop a prototype of an XML-based Marine Mark-up Language (MML).

The colour of distributed internet resources available through the Global Change Master Directory (GCMD)

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NASA's Global Change Master Directory (GCMD) is effectively using XML, Java, and in-house developed Local Database Agent (LDA) software to offer a distributed directory of Earth science data sets and Earth science data-related services. The GCMD staff members are also capitalizing on the vast offerings of "Open Source" software available through the Internet by incorporating several of these software packages in the design of the directory.

The innovative development of customized portals for organizations that wish to offer their data and services, both through the directory and through their own portal subset, has resulted in new collaborations within the ocean community. The offering of Earth science keywords for the search interface, as well as the ongoing maintenance of the keywords, has attracted interest from a broad range of users - including those interested in the semantic web. The latest XML enhancements, the current MD8 software, the Local Database Agents, the Operations Facility, and a new XML authoring tool developed in Python (DOCbuilder), along with the open source software will be discussed.

XML in Russian NODC and perspectives – MEDBLACKDODS and other

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XML (eXtensible Markup Language) as a component of modern information technologies becomes more and more widely used. XML has a number of advantages before other languages/formats of the information resource description for exchange and distribution under Web-technologies. We consider XML first of all as the important element of technology of the distributed marine databases. It is possible to distribute the basic fields of XML use on some groups: metadata description on a website; metadata and data description for software applications under Web; the creation of «uniform information space» for distributed data management.
Within the framework of the national programme «Creation of uniform system of the information about World ocean conditions» the design decisions were formulated Interagency Metadata System (IMS) about information resources on World ocean. The access to IMS is organised through ESIMO Web-portal (http://www.oceaninfo.ru, only in Russian).
Some Java applications were developed in the Russian NODC using XML data and metadata files. As an example the structure of XML-files used in software developed for access and visualisation of metadata from MEDAR/MEDATLAS II dataset is described below.

For data exchange and data processing special language Meteorological Data description (MetDD) Application Program Interfaces (XmlMeteoDocument) based on XML DOM model was developed. MetDD includes DataTransmit XML document for hydro meteorological data presentation and request XML document as query language. XmlMeteoDocument allow parsing, controlling and processing hydrometeorological data. At present time MetDD can be applied only for data structure, characterised by temporary and spatial coordinates.
The Russian NODC plans to use XML in two applications: setting up the IMS, and creation of a distributed marine database system. This way, two main tasks – unification of metadata description and construction of dynamic websites – would be solved in the near future, using the same framework.
Under the mentioned Russian programme the development of distributed ocean data system - DODS (sometimes the terms «virtual datahouse or virtual data centre» are used) are actively carried out. For DODS development J2EE middleware of Sun Microsystems was chosen. XML plays the extremely important role in the integration module of providing an environment for the description of various information resources. It is obvious that for this purpose an XML extension (such as marine XML) is needed. As a basis we are going to use MetDD, which was considered above as a basis for marine XML development. To the present time software applications for data access from separate local information sources (GTS database, ocean R/V cruises inventory of Russian NODC) are developed. In 2002 it is planned to carry out a test interface of several local data sources placed at the centres Obninsk, Saint-Petersburg, Vladivostok, and to start developing a prototype of distributed marine database system.

Ocean Information Technology
Some new opportunities for marine data management

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Through the last twenty years, oceanography and the marine environmental sciences have drawn great benefit from advances in technology. This Symposium will hear of several of these, particularly those associated with non-physical observation. The management of data and products, though recognized as fundamental, has not enjoyed the benefits of technological advances to the same degree as other areas and is, to some extent, still working to the modes and methods established several decades ago. Many things have changed in that time, not the least being the revolution in information technology. Though we are now starting to see some impacts of this technology, this impact still falls well short of the potential and, more importantly, far short of the need. Among other things, the community needs (i) telecommunications that will permit all data from remote and autonomous platforms to be communicated to laboratories in real-time; (ii) data communication and exchange mechanisms that will allow data and associated products to be shared quickly and easily; (iii) adoption of protocols and formats that are open and widely used, greatly easing the difficulty of access; (iv) recognition of methods and practices that improve quality and add value, and a methodology for representing and retaining that value; (v) data and products servers that provide rapid and functional access for the specialists and, equally, for the itinerant or opportunistic users; (vi) generalised ocean customer and user interfaces that facilitate imaginative and novel use (ocean data 'wizards'); and (vii) a community approach that recognizes the value and advantage of ocean information technology and one that demands and values a close working relationship between the scientists and data managers. All of this is within reach *now*. Data managers and scientists within the ocean community have accepted that immediate action is required and have agreed to develop a joint Ocean Information Technology Pilot Project to ensure all of the above needs are fully satisfied before this decade ends. The initial sponsors mostly derive from the global ocean community, with a strong focus on operational activities. However it is also emphasized that the Project must embrace less conventional data derived from interdisciplinary observations and novel instruments. This paper will discuss the prospects for this Project and actions already underway to deliver the required enhancements.

New satellite based e-services to serve the marine and coastal community

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Detailed information on wind, waves, currents and sea level is important for the analysis of ocean colour data and to support practical applications of these observations in for instance environmental assessment studies or for the planning of dredging activities.

Over the last few years new algorithms have been developed to assess information wind and waves out of multi sensor (wind scatterometer, SAR and Altimeter) satellite observations. Currently, at www.waveclimate.com satellite based wind (vector) and two-dimensional wave data are made available at a global scale. These data are all quality checked and through a web interface easily accessible and cover more than 17 years of observations. Interactively and user friendly, users can select a geographical area and can process the selected data online to generate value added products such as scatter diagrams and extreme conditions.

To provide information on tidal sea level and currents a service has been developed through www.tidal-info.com where a user can get worldwide sea level and currents, at an effective spatial resolution of around eight kilometres. The data are based on the integration of eight years satellite altimeter observations with approximately 7300 measurements of tidal stations
Users can interactively specify a location of interest, for which statistical tidal information or time series can be generated. Time series, for water level, flow velocity or flow direction, are computed at a ten-minute interval, starting from a user specified time/date, and cover a full tidal cycle of four weeks. Statistical information comprises histograms (water level and flow velocity) and scatter diagrams (e.g. flow velocity versus flow direction). All generated information can be viewed on screen and downloaded for further processing.

At the conference the scientific background of e-services will be presented and the practical use demonstrated. Examples will be given using wind data and how this information can be combined with ocean colour data to support offshore companies and coastal authorities.

Marine XML – Using XML technology for marine data interoperability

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OVERVIEW OF THE PROJECT

MarineXML is a project part-funded by the European Commission Fifth Framework Programme to demonstrate that eXtensible Mark-Up Language (XML) technology can be used to develop a framework that improves the interoperability of data in support of marine observing systems. With the advent of XML, the global oceanographic community has available an opportunity to create a truly universal marine data standard. Unlike earlier standardisation initiatives, XML can support existing data formats and information systems while providing maximum benefits when included in the development of new systems.

By linking with related projects and initiatives, this project will develop a prototype of an XML-based Marine Mark-Up Language (MML) to show the integration between MML and data supported by other established standards. These include the International Hydrographic Organisation (IHO) S-57 standard, the OpenGIS Consortiums (OGC) Geographic Mark-Up Language (GML) standard and proprietary data formats such as those from marine instruments such as ADCP, expendable bathythermographs and ARGO floats, etc. It will specifically demonstrate how this MML approach supports data interoperability, widens data re-use and improves end-to-end data management in marine observing systems.

XML AND DATA INTEROPERABILTY

XML was developed by the World Wide Web Consortium (W3C) to improve data transfer over the Internet. The potential of XML to support multi-formatted data, provide automated processing, increasing accessibility and improve data exchange has been widely recognised by a number of industries, scientific disciplines, government agencies and the IT industry. For example the Geographic Mark-Up language (GML) developed by the Open GIS Consortium (OGC) for the use and exchange of geographic data or the Bioinfomatic Sequence Mark-Up Language (BSML) developed for the exchange of data related to the human genome project.

Similar to the way that GML enables the same geographic to be re-used in a GIS, mobile phone or in-car navigation system; MML could enable marine data (e.g. temperature, wave height) from any source to be used in a mathematical model, navigation system or webpage. This also opens the possibility for data to be used more readily in mobile devices such as cell phones or PDAs (Personal Digital Assistant e.g. PalmPilot).

MARINE XML AND THE OCEANOGRAPHIC COMMUNITY

The success and acceptance of XML across other disciplines has prompted the International Oceanographic Data Exchange (IODE) Committee of the International Oceanographic Commission (IOC) and the International Council for the Exploration of the Seas (ICES) to form a joint Steering Group on XML (SGXML). MarineXML will work closely with this committee and look to this panel for the long-term post-project development of a MML standard based on the MarineXML demonstration. More information can be found on the project website; www.marinexml.net.

Use of XML technology in the Baltic Sea Fishery Database

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INTRODUCTION

The assessment of the sizes and composition of the fish stocks in the Baltic Sea is coordinated by ICES. In order to make fish catch data from the different countries available for all partners, a common Internet based database was designed and implemented by DIFRES. With this application the users can upload data to the database via the Internet, and data can also be requested from the database and received in this way. The structure of the tables in the database is the same as the column separated ICES formats normally used to exchange fishery data. However for several reasons it was decided to use XML formats for the exchange of data. The benefits of this are described in this presentation.

XML SCHEMAS

The structure of the XML file is defined in a XML schema file, which is a XML file itself. When data are uploaded to the database, the XML file is validated against the XML schema. In the XML schema it is possible to check for the order and occurrence of record types, the data types (integer, real, date), minimum and maximum values and allowed enumeration data. From the database website the user can download a program, which converts the data from ICES formats to XML formats according to the defined XML schema. By using a XML aware editor the user can instantly check the validity of the data before uploading. The validity of the file can also be checked by a downloaded program. Hence the XML schema is both a specification of the exchange format and a data validation program, which the data from all partners must apply to.

XML AND DATA HANDLING

Since XML is a standard, the Baltic Sea fishery database system and its web program can use XML directly. The data records in the XML file are stored in the database without much programming. When the users download requested data, the data can easily be converted to e.g. spreadsheets for analysis. By using the XPath and XSLT (XML Style sheet Language Transform) facilities, which are part of the XML standard, it is easy to pass a XML file and use the data elements in a custom made program. In the Baltic Sea fishery database XSLT is used to pass the uploaded XML files in order to perform further data validation checks and to log some information about the uploaded data. When the users want to browse the database, XML is used to build a tree structure of the data in the left frame on the HTML page. When the user clicks on a data node in the tree, e.g. a year or a cruise, the tree expands and the selected data record is shown in the right frame. By using XSLT it is also possible to make a dynamic HTML form based on the XML schema.

THE PRESENTATION

The presentation will focus on the use of XML and XML schemas in the Baltic Sea Fishery database. The structure of the XML schema and the built in configuration of data validation will be shown. The uploading of data to the database and the user interface with the XML tree structure will also be demonstrated.

An interactive hydrographic data visualization and retrieval system for the Indian Ocean

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A window-based software system has been developed for hydrographic data selection, visualization and retrieval. The system was coded in Visual Basic 6.0 on the Windows 98 platform. The software is distributed together with the data profiles from CTD (Temperature, Salinity), Hydro-Cast (Temperature, Salinity, Oxygen, Nutrients, (NO_2, NO_3, PO_4, SiO_3), Ammonia, Alkalinity, and pH), XBT (Temperature.), and MBT (Temperature). The base module operates on a selected variable, and allows area selection by providing the ranges of latitude and longitude or by scrolling mouse on station distribution (locations) map of the variable. The variable within the area will display originator's cruise and station references in the same window; further selection criteria can be set by the user for the period selection by month, by season and by year. Selected variable profile can be viewed through the graphic module, which plots the profile depth (y-axis) versus variable (X-axis); a maximum of five variables can be viewed in a single window. The graphic module has an option to compute average cruise profile of the variable over the selected area and overlay a particular selected station profile of the variable in a single window for comparison and visualization. The system has been tested and interfaced with the ninety years (1906-1996) historical hydrographic data (25,291 profiles) available on the NIO-HYDRO-CD for the Indian Ocean.

The experience of using XML for a wide class of metadata objects

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The diversity of metadata (information on data sets, observant platforms, cruises of RV, organizations, information production etc.) generates problems consisting of increasing of processing time, information size so in increasing of the complexity of the structure of representation of the data; as a consequence, the efficiency of their processing falls. In the beginning, metadata were represented in an HTML-format. Drawbackx of this method are the large sizes of files, absence of an opportunity of processing of the information and effective search.

These problems are solved via new technology of metadata representation – the XML language and its subsets like XSL, XSLT, XLink etc. The use of this technology has allowed to organize sorting and transformation of the XML-file given in an HTML-format. This technology can display results on web too. The described metadata representation is submitted to the address http://www.oceaninfo.ru in section “Metadata”.

In the Russian NODC the part of metadata (information on cruises of RV, experts, coastal stations, etc.) is stored in a database DBMS Oracle and most part of objects – as XML files. One of the tasks is the loading of all metadata objects and creating an access method through a database. The reduction of all metadata objects has required using of the converting various methods.

A uniform description of all objects’ metadata, containing a set of tags for each object without duplication of the information is created. The problem of interaction between separate metadata objects, submitted in various XML files, sometimes from different organizations has to be dealt with. Language XLink supports links not only inside one XML document, but also between several documents located on the Internet. This language is applied to the current problem. These active links facilitate synchronization of files between the different organizations, excludes duplication of the information in various objects metadata, allows to organize sample of the necessary information of the distributed base metadata, and to apply the dictionaries and codes.

The experience with the variety of metadata objects has revealed the need to create an XML files control system, which would contain such functions as creation, editing, viewing XML documents in a treelike form, control of the logic content using DTD and XML-Schema, representation of the information in Russian and English, sample and sorting metadata on several attributes with the further displaying on the screen using XSL and CSS, performance of export and import metadata between a database and XML documents and vice versa.

Why marine species play a central role in biological oceanography data management

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'Species', and their levels of classification (genera, families), represent biological resources of both economic and ecological importance. It is arguable that the primary reason we need to understand physical and chemical oceanography is to manage these biological resources. The presence and absence of species in samples are tools for biodiversity assessment, nature conservation management, pollution monitoring and assessment, and provide measures of ecosystem change (colonization theory, stability etc.). They are the most practical and widely applicable measure of biodiversity, and the only one with a well-established standardised code of nomenclature. The correct names are a prerequisite for more complex information systems (e.g. atlases), and are the basis for quality control in biodiversity research and management. A globally accessible database of all species names would minimize nomenclatural confusion, and save significant amounts of taxonomists time in searching literature and re-describing already known species. The experience of compiling the European Register of Marine Species will be summarized, and role of federated databases (e.g. Species 2000) described. Species lists are most effectively edited by taxonomic experts, and their compilation has added benefits in networking. The lodging of biological data into on-line databases should become 'good practice' in the same way that taxonomic specimens are lodged in museums. The internet will result in greater demand for taxonomists to quality-control the data, and will free up taxonomists time to describe new species instead of correcting the errors of the past.

Species lists are most informative when associated with biogeography. The Ocean Biogeographic Information System is providing an on-line portal to marine species distribution data (http://www.iobis.org). Some data are on the OBIS server ('centralised') and some accessed through other on-line databases ('federated'). OBIS is the data server for the global Census of Marine Life, and an Associate Member of the Global Biodiversity Information Facility. The added value of the OBIS web site is that it will provide synoptic ocean climate and environment data for comparison with species distributions. In addition, it will provide a range of mapping and geo-statistical tools. All the data and tools will be freely available on-line. OBIS aims to be a global marine component of GBIF, and a major force in unifying biological oceanography at a global level.

The Integrated Taxonomic Information System

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The Integrated Taxonomic Information System (ITIS) is a scientifically credible, quality-controlled, standard reference for taxonomic information on species. It encompasses all major taxonomic groups, with a focus on North America and its surrounding waters, including world coverage where feasible. Currently it contains about 400,000 names, both scientific and vernacular. ITIS has been developed through a partnership of US agencies, non-governmental organizations, and Canadian and Mexican governmental groups, in collaboration with the systematics community and other list keepers. International collaborations also include the Global Biodiversity Information Facility and Species 2000. This presentation provides an overview of ITIS; history of its development; and, review of technical aspects of the database, data processes, and available tools. Benefits of ITIS use, with examples of uses and users, and plans for its continuing evolution are presented. I close with discussion of the challenges encountered and lessons learned in the development of the Integrated Taxonomic Information System.

Using US and Canadian Atlantic research trawl surveys to lead development of a standards based ocean observing system

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Remotely observed data is only as good its ground truthing. We propose that stratified random research trawl surveys, widely used throughout the world for estimating distribution and abundance of bottom dwelling fish and invertebrate species could provide a rich collection of in-situ measurements for that purpose. Since 1963, the Canadian Department of Fisheries and Oceans and USA National Marine Fisheries Service fisheries laboratories have conducted standardized trawl surveys along the east coast of North America from Cape Hatteras North Carolina to Cape Chidely Labrador. From their inception, these surveys were intended to be the most comprehensive set of fishery-independent data in this area and as such have been fundamental to resource management activities of the two countries. Depending on the observations made for a given species, data from these surveys can be used to track fish weight at length (condition), length at age (growth), length and/or age at maturity as well as estimate total mortality. Furthermore, hydrographic observations made at the actual fishing locations can be used to quantify species preference for oceanographic conditions such as depth, temperature, and salinity. Although the underlying experimental design of these surveys has not changed, the frequency of the various surveys has increased and the scope of observations and collections has evolved in many ways. Equipment used to collect and manage the data is constantly being upgraded, thus improving the accuracy and precision of the observations. In the last two years, the Bedford Institute of Oceanography (BIO) has, as part of the International Census of Marine Life (ICoML) developed web-enabled data products (maps, graphs and tables) to facilitate exchange and integration of survey results between the various laboratories. Building on these highly visual products, BIO is now proceeding to present these surveys as ANSI/NISO Z39.50 metadata and datasets following ICoML Darwin Core standards thus superceding the US National Oceanographic and Atmospheric Agency's East Coast North America Strategic Assessment (ECNASAP) website. Current expectations are that these surveys will play a lead role in the development of an international multi-faceted standards based ocean observing system for the study of environmental issues like marine biodiversity and climate change.

Species 2000 Europa and the Catalogue of Life

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The Species 2000 organization is one of the leading partners in a global programme to assemble a Catalogue of Life. This Catalogue comprises a quality synonymic taxonomic checklist of all species, including the major marine groups. Its operation is as a 'virtual catalogue' with different sectors provided by an array of supporting taxonomic databases. The EC is supporting a Species 2000 Europa Project which will take this programme to production scale operation from 2003 – 2005. Major components of the Species 2000 Europa Project are to assemble taxonomic sectors for marine taxa from participating global databases (e.g. FishBase, AlgaeBase, CephBase, UNESCO Marine Register), and to integrate these with European regional databases such as the European Register of Marine Organisms, Euro+Med PlantBase and Fauna Europaea.

The Gulf of Maine Biogeographical Information System project: developing a spatial data management framework in support of OBIS

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Central to the development of an inventory of marine life and improved conceptual understanding of the mechanisms that dynamically shape species distribution patterns is the implementation of strategies aimed at enhancing assimilation and access to existing biogeographical information. Using the Internet as a medium, the Gulf of Maine Biogeographic Information System (GMBIS) project provides a framework and set of reusable tools for the integration, visualization, analysis and dissemination of diverse types of biogeographical and oceanographic information. End-to-end viability of this approach is demonstrated in the context of a series of scientific storylines and a pilot application for the Gulf of Maine (GoM), a well-studied ecosystem that has been subject to large-scale perturbation due to overfishing. Databases at the core of the information system include those of the DFO Bedford Institution of Oceanography and Atlantic Reference Centre, which are the product of multidisciplinary research efforts over the last several decades. Development of GMBIS may serve not only as a model for OBIS, but it may also provide a tool supporting new international and Canadian directives for integrated marine resource management. This paper summarizes the status of the GMBIS project currently in its final phase, and outlines possible future directions in information system development for the CoML.

Integrating heterogeneous databases in Ocean Biogeographic Information System

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Ocean Biogeographic Information System (OBIS) is an on-line, open-access, globally-distributed network of systematic, ecological, and environmental information systems. Collectively, these systems operate as a dynamic, global digital atlas to communicate biological information about the ocean and serve as a platform for further study of biogeographic relationships in the marine environment. Emphasis is on accurately-identified, species-level, geo-referenced abundance data. Heterogeneity exists at all levels of data management of OBIS members, ranging from the underlying computer hardware and operating system to data format and semantic modeling. Smooth interoperation of these heterogeneous data systems is critical to OBIS development. The interoperability is accomplished after a distributed infrastructure and interoperation standards are established. In OBIS structure development, globally distributed data nodes are established for experts to store, manage, version and quality- control data in their specialty fields. Meanwhile, a portal server is placed between data nodes and the end user to support one-stop data "shopping" via a uniform user interface. Taxonomy name service, environmental mapping service, genetic information service, biogeographic modeling service, and education programs are also being developed, tapping into system-wide data resources. Such a structure combines the effectiveness and scalability of distributed systems with the efficient user access offered by an information portal. To facilitate communication within the distributed system, the OBIS technical working group selected HTTP as the communication protocol and XML as the data exchange format. XML technology is enormously scalable as long as data content is not contracted. HTTP and XML technology have broad industrial support, and system development based on them is less time-consuming and technically demanding than competing approaches. A call interface over HTTP and a global federation schema based on the Open GIS standard (GML) are also defined. OBIS node servers and the portal server implemented this set of interfaces and standards so that the OBIS portal can provide a Web-based transparent search capability across all databases. The successful operation of the interoperable OBIS demonstrates that XML can be used to facilitate not only the exchange of structured data, but also semantic data integration through the construction of a global schema. The rapid development of OBIS calls for extension of its global schema to support complex spatial data types and operations. Incorporating both grid and vector based data into one semantically-integrated system is one major problem that the oceanography and GIS community have to solve together. Whether a pure XML-based system or a mixed system should be adopted to deliver the spatial operations is a research topic that needs to be addressed in the near future.

Development of a national aquatic biodiversity information system for New Zealand

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The New Zealand Biodiversity Strategy 'Our Chance to Turn the Tide' was launched in February 2000. The associated funding package to implement the strategy included development of a National Aquatic Biodiversity Information System (NABIS). The original scope for the NABIS stated, 'the system will use available data as the core of a linked system of distributed national databases of aquatic biodiversity'. This ambitious aim has been reviewed through a scoping process in consultation with key individuals from agencies with a potential interest in the NABIS.

One of the key outcomes of the consultation was that managers identified that they required access to information about marine biodiversity, but not necessarily direct access to the data upon which that information was based. There was a clear indication that, with better information support tools decision makers would have a more complete picture of what might be impacted by their decisions (or what might constrain their decision making). They would also know where to go for further information, or in-depth analysis, and would, therefore, be in a better position to make well-informed decisions. As a result a new vision has been developed for the NABIS. The new vision identifies the NABIS as a web-based Geospatial Information System (GIS) containing a limited number of pre-defined layers of aquatic biodiversity information. The information layers will be compiled primarily for the purpose of supporting decision-makers and planners in making decisions that affect aquatic biodiversity. In the first phase of development the NABIS will be independent from the source databases, however, this does not preclude the possibility of NABIS holding metadata, data points or being an access point to dynamic data at some time in the future.

The development of the NABIS is not without risks. A number of agencies have an interest in the NABIS as potential users, information contributors or because they are developing related information systems. Expectations of what the NABIS might deliver within the existing timeframe and budget need to be carefully managed. This paper will describe the process and environment within which the NABIS is being developed. Progress on implementation will be reported and the risks and constraints described.

Development of a biodiversity information system: a case study

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The Atlantic Reference Centre (ARC), a joint operation established in 1984 between the Huntsman Marine Science Centre and the Department of Fisheries and Oceans, houses unique, extensive collections of marine life. These collections –are well known both nationally and internationally. Presently, the catalogued and computerized ARC collections hold a total of 125,222 lots of invertebrate and fish specimens ranging from freshwater, estuary, and marine environments. The process of developing a Canadian Atlantic Biodiversity Information System based on these collections has spanned decades of trial and error. In the beginning, the collections of the parent organizations were in various stages of computerization. Various database restructuring has occurred over time, and in recent years the museum-dedicated MUSE software was adopted, followed by its successor SPECIFY. Biodiversity funding programs in Canada and the US together with various government internships and summer employment programs have allowed completion of the database. With the prospect of future funding in GeoConnections, the database will be transformed into an accessible, online version. Ultimately, the ARC will be linked to complementary biodiversity initiatives, both nationally and internationally, as well as to environmental data and tools to analyse these records. This will provide a comprehensive and easily accessible biodiversity information system, allowing researchers and managers to better protect the natural environment and promote sustainable use of natural resources.

Corals and sea anemones on line: a functioning biodiversity database

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The database 'Biogeoinformatics of Hexacorals' (http://www.kgs.ukans.edu/Hexacoral/) is an on-line resource that consists of two interactive databases, one dealing with taxonomy and biogeography of hexacorals (corals, sea anemones, and their allies) and one dealing with environmental information for the marine environment. The two databases began separately, as resources concerning sea anemones and the environment of the coastal zones, respectively. Linking them has created synergies, such as the ability to assess the environmental parameters that characterize the habitat of a species and determine localities where members of a species might exist but from which they are currently not known. Synonymous names are linked so that records for occurrences displayed on a map use symbols of a different color for each synonymous name. These functionalities, among others, make 'Biogeoinformatics of Hexacorals' useful as a research tool. In applied research, for example, it can be used to determine species and habitats that might be invasive and vulnerable to invasion, respectively, and in the more academic realm, it can be used for investigating whether a synonymy is justified. Data and functionalities are constantly being added to increase the usefulness of 'Biogeoinformatics of Hexacorals'. In particular, the database is being linked to others. It interacts with data for fossil corals in NMITA (Neogene Marine Biota of Tropical America; http://porites.geology.uiowa.edu). It is a component of OBIS (the Ocean Biogeographic Information System; http://www.iobis.org), a federation of databases that are, like 'Biogeoinformatics of Hexacorals', taxonomically resolved (not necessarily at the species level) and georeferenced, and that contains tools and maps for analyzing those data. Thus increasingly, data on hexacorals can be compared with and used in conjunction with data from other databases to compare information across taxa, through space, and through time.

Twelve years of FishBase: lessons learned

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In 1990, the European Commission supported the initiative to put up a database on fishes called FishBase. This database was seen as a transfer of information and knowledge to the developing countries. The FishBase-concept was developed at ICLARM by Rainer Froese and Daniel Pauly, together with many other partners and institutions such as FAO. In 2000, a FishBase Consortium was funded in order to maintain the database permanently. This FishBase Consortium consists of seven members, which are all complementary in their specialisation: FAO, ICLARM, IfM, MNHN, MRAC, NRM and UBC-FC. A CD-ROM version of FishBase was released every year since 1996, and since 1999 FishBase is also available on the Internet. The number of hits increased from 500,000 in December 1999 to over 4,000,000 in August 2002. Visitors are mostly originating from North America, Europe and Asia. Availability of Internet-connections is much higher in these parts of the world than in, e.g. Africa. Individuals form the greatest part of FishBase-users, followed by universities, the private sector and governments. The common names of fishes are used heavily as well as the species summaries and the photos. Compared with this, specialist topics and scientific names are less frequently used. Therefore we can conclude that FishBase is well used by non-professional people looking for correct information on fishes. But FishBase citations in scientific journals prove also the usage of FishBase by scientific researchers. The information offered by FishBase is originating from scientific publications, which are a reliable source for correct information. However interaction with FishBase-users is not neglected. Critical comments and questions of people are followed up by FishBase Team members, and they will make corrections if necessary. The important factors for FishBase are data quality and quantity. Different databases are incorporated in FishBase like Eschmeyer's Catalog of Fishes, FAO Databases, IUCN's Red List, National Fish Databases and others. More than 600 webpages are now linked to FishBase. New useful topics like e.g. identification keys, distribution maps and common names in language scripts other than Latin, will further increase the FishBase usage on the internet.

The colour of biodiversity data

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Over the recent decade, the importance of information about biodiversity for the management of marine and coastal resources has increasingly been recognised. It has become evident that the model of sustainable development cannot function unless biodiversity aspects are fully taken into account in the process on the same footing as physical, chemical, and socio-economic data. Moreover, integrated models need to be developed including all these aspects, thus allowing forecasting of natural changes and prediction of the effects of human measures and intervention.

In order to improve our knowledge about biodiversity, large scale global and regional projects and programmes have been established, and have received ample funding. These include the Global Biodiversity Information Facility (GBIF), the Census of Marine Life (CoML) and the European Network for Biodiversity Information (ENBI).

Changes in biodiversity, both increases and decreases, often are linked with changes in the physical and chemical environment. Therefore an interpretation of changes and trends in biodiversity requires an adequate access to environmental data. Moreover, an integration of the data from these different sources is needed to allow for an integrated analysis.

In most countries, the biodiversity community is quite remote from the community dealing with the traditional oceanographic sciences, and contacts are rare. As a consequence, the developments of procedures and tools for data and information management in both communities have taken place along separate tracks. The current trend towards integrated resource management implies the need for an integrated access to and management of biodiversity and other ocean data with dedicated tools and procedures.

ETI, the UNESCO Expertcentre for Taxonomic Identifications, has over ten years of experience in the management of biodiversity information. Besides a range of more than 60 CD-ROM products on various aspects of biodiversity, ETI has developed several on-line products, such as the World Biodiversity Database and the World Taxonomists Database. Furthermore, ETI has established a worldwide network of over 1500 biodiversity experts, of whom most have contributed to one or several of ETI's products. ETI has developed a series of ICT tools for biodiversity data management, that allow the users to build digital biodiversity data archives following standardised procedures and including a rigid quality control. ETI regularly provides training in the application of these tools. Finally, since December 2001, ETI hosts and supports the Netherlands Node for GBIF.

The paper will present the background, history and achievements of ETI in more detail, and will highlight its various products and services. The paper will also provide a more extended overview of current projects and programmes in marine and coastal biodiversity. The conference forms a unique and welcome opportunity for an exchange of experiences with data management tools and procedures. This might lead to a closer cooperation, which would definitely be in the interest of the final user.

Encyclopaedia Taxonomica: a taxonomic tool for marine biological monitoring

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Marine research that depends on data from biological monitoring is always hampered by the lack of consistency in names of biological species. When data from several sources need to be used, a lot of effort is always spent on harmonisation of the data. Inconsistencies arise from both different views and expertise in naming of organisms, as well as new insights in taxonomy that come with time. For example, the names of toxic phytoplankton species have changed upon introduction of new molecular techniques that make clear that algae found near Japan are identical to species in the North Sea. To deal with these changes and inconsistencies, and serve as a major tool to standardise biological monitoring, we have developed Encyclopaedia Taxonomica (www.taxonomica.com). Encyclopaedia Taxonomica is currently used as a standard for taxonomic information for the collaborating national and local water authorities in The Netherlands (CIW).

Encyclopaedia Taxonomica is an Internet based repository of taxonomic information, maintained by experts of specific taxonomic groups. Unlike most other systems, Encyclopaedia Taxonomica does not use coded name lists. Coding systems where created with the idea of bringing the taxonomical hierarchy in the code. This turned out to be an unfortunate choice since taxonomical hierarchy changes over time. Encyclopaedia Taxonomica uses the strength of the Internet to communicate with groups of people, whom all play an important role in getting all these different names (scientific names, names in their own language, synonyms) into the database.

We create a virtual office for teams of experts working with the same groups of organisms. This enables them to jointly create complete listings of species. Our software creates unique codes for taxa and names joining all different names for a taxon or species together for reference. Additionally, we enable users to enter their own coding system into the database. This makes it a system that is well suited to bring biological monitoring data together. Synonyms can be translated into currently used names. The coding information can be used to exchange data between different monitoring databases.

Encyclopaedia Taxonomica consists of two major tools. The database with validated taxonomic information is Internet based. Users and experts use the ‘EcoWorkBench’ as a local software tool that communicates with the central database. Information can be downloaded from Encyclopaedia Taxonomica to the user, and the user can upload new taxonomic information to the system, which needs to be validated by the experts before it is made available. The communication between the central system and the users is XML-based. The use of the system will be demonstrated as well as applications in the analysis of biological monitoring data.

NemasLan, MysidLan, TaxonLan: a story of database development Archiving marine species data for biodiversity, morphology and taxonomy research in a digital way

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During many years of extensive research at the Marine Biology Section (Ghent University) an almost complete collection of reprints on free-living marine Nematodes was built up. This collection still grows and more people are getting involved with it. Keeping the collection preserved for the future becomes a main worry. Therefore about four years ago we started making the collection also digitally available.

A software developer was contacted and given the task to write an application corresponding to the needs formulated by the future users:
Input of taxonomic data must be possible in an easy way (through a taxonomical tree structure)
Availability of morphological, ecological and distribution data at the species level
Connection to the data source (digitally available) must be kept at any time
Data access and input in a network environment had to be possible
Software was developed and data input was started. Confronted with data-input new questions and worries evolved, which had to be translated into software changes. NemasLan was born.

Two years later, interest was growing on starting a similar dataset on Mysidacea. Software had to be rewritten and new concepts were added corresponding to the needs for this taxon. MysidLan was born.

After working with both systems for about three years (each with their own software code), it was decided to create a generic system based on the former two systems but easily adaptable for datasets of other groups.

TaxonLan was born, but was aching of lot of child diseases.

As time went by, a big evolution within the world of taxonomic databases took place. All over the world similar projects arose and also in Belgium structural steps were taken through/by means of the establishment of a data center (VLIZ – Flanders Marine Institute).

Communication between different authorities, developing and working with taxonomical databases, as well as the growing expertise within our laboratory and the enormous costs associated with software development, made us decide to stop collaborating with a commercial software developer. The created datasets will be fine-tuned into a general database structure (as being used by the VLIZ or IT IS).

By heading in this direction we hope our data becomes more than an exclusive dataset for our laboratory/department and new possibilities will arise.

Servicing the end-user – AlgaeBase and the Internet

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AlgaeBase is an internet-compatible source of free information on algae that is rapidly becoming a definitive source (www.algaebase.org). Initially set up in 1996 as an attempt to list all the known species of seaweeds in the world and their nomenclatural authorities, it has been expanded to include other sources (literature references) nomenclatural information (including types), synonyms (often annotated), pictures (over 1000, mainly seaweeds), and common names (over 2,500). Although nearly 45,000 names of species, subspecies, varieties and formae have been entered together with nearly 3,000 generic names, freshwater algae, diatoms and planktonic algae are under-represented. Funding to complete marine phytoplankton has been received from the Irish Government and other support has been forthcoming from the EU. International recognition has been apparent through the incorporation of AlgaeBase data into Species2000 (www.species2000.org), BIOSIS (www.biosis.co.uk) and the CSIRO Australian biodiversity databases with direct links to the Galway servers. Specific users are now citing AlgaeBase in the print literature. Completion of the potential 125,000 names will require further, extensive support.

Biodiversity databases and database management systems for the World's Ocean: experience and outputs from five International projects

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The presentation highlights the experience to unite international efforts of scientists from 10 countries (Ukraine, Russia, UK, Panama, Kenya, USA, Italy, Kazakhstan, Azerbaijan and the Netherlands) funded by the Darwin Initiative (UK), INTAS (Brussels), and ONR (USA) in order to develop oceanographic databases for the Indian and Pacific Oceans and the Atlantic Ocean and its enclosed seas (the Mediterranean Sea, the Caspian Sea and the Aral Sea). The databases incorporate data on taxonomy, biogeography, and environmental characteristics of pelagic communities and are linked to a database management system. Apart from the database and database management system developed, the following problems encountered will be discussed:

- methods of data analysis on biodiversity;
- data dissemination;
- international co-ordination;
- regional legislation and data exchange;
- stability and prospective of funding for long-term international projects.

POSTER PRESENTATIONS

An interactive database on Antarctic echinoids

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The interactive database synthesizes the results of more than 100 years of Antarctic expeditions. It comprises informations about 81 echinoid species present southward the Antarctic convergence. It includes illustrated keys for determination of the species, and information about their morphology and ecology (text, illustrations, and glossary), their distribution (maps and histograms of bathymetrical distribution); the sources of the informations (bibliography, collections and expeditions) are also provided. All those data (taxonomic, morphologic, geographic, bathymetric…) can be interactively queried according to two main ways. (1) Display of listings allowing to browse, to sort according to various criteria, or to print. (2) Process interactive requests crossing the different kinds of data.

Using XML technology for data and system metadata for the MBARI Ocean Observing System

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The Monterey Bay Aquarium Research Institute (MBARI), a nonprofit, privately funded research institute devoted to the development of technology to support research in ocean sciences has been developing systems for long term environmental monitoring in Monterey Bay since 1987. The institute has initiated a project for expanding its ocean observing system capabilities through an expansion of existing moored data acquisition systems. The goal of this project is to develop highly flexible, configurable, and redeployable ocean observing systems utilizing a wide variety of sensors and platforms, including moorings, ocean-bottom substations, Remotely Operated Vehicles (ROVs), Autonomous Underwater Vehicles (AUVs), autonomous gliders, and ships, to provide semi-continuous observations of important physical, biological, and chemical variables extended in space and time to support long term monitoring and event detection, such as the onset of an El Niño, as well as support for focussed intermediate-term scientific process studies.

A fundamental goal of the MBARI Ocean Observing System (MOOS) effort is to utilize recent advances in 'smart network' technology to design an instrument software infrastructure to provide real-time reconfiguration, remote device control, and automated event detection and response within a network with limited bandwidth links (radio-frequency and acoustic). Smart networks also provide a capability for 'plug and work' instruments, automated device and service discovery, and a distributed, object oriented software architecture. These are some of the features that characterize the 'wet side' of the MOOS system. The software (and hardware) infrastructure being designed to support these features is called MOOS Instrument Software Infrastructure or MOOS-ISI and has been described in the literature.

A companion to the 'wet side of MOOS' is a shore side data system (SSDS). The purpose of SSDS is to be the repository for managing all the scientific data collected, and to provide users with access to this data. A primary requirement is to insure that all the metadata (data about the data) required for properly interpreting the data from the system sensors is collected and managed along with the sensor data. In the context of a highly flexible and reconfigurable observing system such as MOOS, this problem is particularly challenging.

A third aspect of the MOOS system is the operational need to monitor, control, diagnose and recover from system failures in 'real' time. This aspect places further demands on the MOOS-ISI architecture. The architecture must be capable of capturing the current status of system elements (sensors, instrument clusters, platforms and communication links), as well as controlling and modifying them. An audit trail or 'history' of the system state is also required to support diagnostics and recovery and to fully identify the system state as an aspect of data interpretation.

In this presentation we provide an overview of the MOOS ISI system design, and an overview of both the scientific and system capabilities and requirements that must be met by the metadata architecture. We then describe how XML technology has been utilized to develop a metadata architecture by describing the XML schemas that have been prototyped to meet various capabilities and requirements of the system.

Biodiversity data of the Southern Ocean: The 'ANT'PHIPODA' project

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In the benthic and pelagic ecosystems of the Southern Ocean, the amphipod crustaceans constitute a key group in terms of species richness and niche diversity as well as in terms of trophic fluxes.

To contribute to document and understand the Southern Ocean biodiversity and to assess the ecofunctional role of the crustacean taxocoenoses, the 'ANT'PHIPODA' project was initiated in the framework of the SCAR programme 'Ecology of the Antarctic Sea Ice Zone' and the Belgian Scientific Research Programme on the Antarctic (OSTC).

The 'ANT'PHIPODA' project includes the development of a 'Biodiversity Reference Centre' for Antarctic Amphipoda at the Royal Belgian Institute of Natural Sciences, Brussels.
This reference centre comprises three complementary elements:
a comprehensive database on taxonomy, distribution and bio-ecology of all marine amphipod species of the Antarctic and Subantarctic regions south of 40°S;
extensive reference collections;
a specialized documentation.

The 'ANT'PHIPODA' database, developed in ACCESS, includes the following data:
taxonomy: classification, synonymy, type locality, types specimens location (860 spp, 2210 names);
distribution: more than 8000 species occurrence records from collections and literature; 1124 collecting stations documented from 118 expeditions, a hierarchically organised gazetteer with more than 20 000 geographic localities to facilitate information retrieval and mapping applications);
bio-ecological characteristics of species (life style, habitat, trophic type, abundance, size,..);
collections (120 000 specimens inventoried on a total of 400 000 specimens);
bibliography: complete bibliographic references on Southern Ocean amphipod species and numerous references on amphipods, crustaceans in general, Antarctic benthos and marine ecology (12000 references with a few hundred thematic, taxonomic and geographic coded keywords).

The database is intended to be mostly used for biodiversity research (taxonomy and systematics, biogeography, ecology, biology), museum collection management and exploitation, information for conservation policy and biodiversity monitoring.

The 'ANT'PHIPODA' reference centre is supported by the 'Antarctic Amphipodologist Network (AAN)', an international team of 13 specialists engaged in the taxonomic revision of the Antarctic amphipod fauna, the preparation of conventional identification guides and web-based interactive keys and the synthesis of the Antarctic amphipod biogeographic and ecological traits.

The ANT'PHIPODA database will be integrated with two other Antarctic marine biodiversity databases - NEMASLAN, Biodiversity of Antarctic Nematodes (Univ. Ghent) and ANTARCTIC ECHINOIDS, an interactive database (Univ. Dijon & Brussels) - to form a common portal on Antarctic Marine Biodiversity as the nucleus of the SCAR Marine Biodiversity Information Network.

North Sea marine matrices under high surveillance: a preliminary study of dioxins and dioxin-like compounds

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The general objective of a sustainable development of the marine ecosystem and in particular of the North Sea has led the Belgian federal authorities to launch several short and long-term action programmes. Among those, the determination of organic pollutant levels, their distribution and effects on the marine ecosystem are of particular concern. Such a scheme should help the authorities to establish a general ecotoxicological assessment of different marine matrices representing a marine trophic chain.

In addition, the recent Quality Status Report of the greater North Sea (QSR, 2000) clearly identifies the need of reliable techniques and monitoring programmes for a better understanding of the distribution and effects of dioxin and dioxin-like compounds (PCDDs/Fs) in the marine environment. Those lipophilic compounds bioaccumulate through the food chain to top predators and humans. However, very little information on levels of dioxins, furans and dioxin-like PCBs in marine invertebrates, fishes, birds and marine mammals is available. Preliminary measurements performed in our laboratory (SSTC Report, MN/12/85, 2001) and others indicated that levels in seafood often exceed by far the regulatory prescriptions that have been established for farm terrestrial animals (Focant et al., 2001a).

During this project, a three level strategy of analysis, developed at the Laboratory of Mass Spectrometry, is proposed:
at the screening level with the use of two bioassays both responding to PCDDs/FS and coplanar PCBs compounds (a competitive binding enzyme immuno-assay or EIA and the chemically activated luciferase expression or CALUX);
a semi-quantitative level using tandem mass spectrometry (MS-MS) (Focant et al., 2001b);
a reference quantitative method using the high resolution mass spectrometry (HRMS) which allows unambiguous detection and quantification of all isomers (Beltest accredited) (Windal et al., 2000; Pirard et al., 2002).
Furthermore, EROD (7-ethoxyresorufin-O-deethylase) activity, a biomarker of cytochrome P450A1 ("CYP1A1") induction, will be monitored in the biological samples in order to determine whether this effect assessment is correlated to the measured concentrations in "dioxin-like" contaminants (ULB, Marine Laboratory).

These analytical techniques will be applied to different marine matrices representing both ecotoxicological and public health targets, namely sediments, invertebrates (starfishes and mussels), commercial fishes (plaice), seabirds (common guillemots) and marine mammals (harbour porpoises). These samples will be collected along known gradient of pollution:
mussels, starfishes, and sediments in intertidal locations along the Belgian coast and mouth of the Scheldt River;

plaices, starfishes, and sediments from the mouth of the Scheldt River to offshore stations outside the river plume;
beached birds and mammals will be assessed as well, as they are local top-predators in the North Sea and consequently bio-indicators of the health of the global ecosystem.
Finally the project aimed at extending the scope of developed methods to other organic pollutants of high concern such as the known 'flame retardants' or polybromated diphenyls ethers (PBDEs) which have been recently added to the OSPAR list of priority contaminants.

Analyses are currently undertaken for most of the above-mentioned marine matrices. However, preliminary results obtained on seabirds (the common guillemot, *Uria aalge*), collected stranded at the Belgian coast, showed that high levels of dioxin and dioxin-like compounds tend to accumulate in these marine top predator (Huart, 2001). Most of these individuals presented a long and chronic debilitating pathology referred to as 'cachexia' which is characterised by a mild to severe atrophy of the pectoral muscle and depletion of subcutaneous and abdominal fat reserves (Jauniaux et al. 1996, 1998). Previous studies have demonstrated that higher levels of heavy metals are associated to this debilitating cachectic status (Debacker et al. 1997, 2000). As other pollutants such as the dioxin and dioxin-like compounds are clearly suspected to enhance such a pathology, tissues levels of dioxins and dioxin-like compounds were thus related to the general health status of the guillemots. Preliminary results indicated that these contaminants tend to increase with increasing cachexia severity. In addition, levels were clearly higher in individuals collected at the Belgian coast compared to those detected in guillemots collected stranded on the Brittany coasts after the Erika oil spill.

For the top predators such as the common guillemots, dioxin and dioxin-like compounds alike other contaminants such as heavy metals, could adversely affect the individuals with degrading body condition.

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PANGAEA and the World Data Center for Marine Environmental Sciences

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The World Data Center for Marine Environmental Sciences (WDC-MARE) is aimed at collecting, scrutinizing, and disseminating data related to global change in the fields of environmental oceanography, marine geology, paleoceanography, and marine biology. WDC-MARE uses the scientific information system PANGAEA (Network for Geosciences and Environmental Data) as operating platform (www.pangaea.de).

Essential services supplied by WDC-MARE / PANGAEA are project data management (e.g. for the PAGES project IMAGES, the International Marine Global Change Study), data publication, and the distribution of visualization and analysis software (freeware products). Organization of data management includes quality control and publication of data and the dissemination of metadata according to international standards. Data managers are responsible for acquisition and maintainance of data. The data model used reflects the information processing steps in the earth science fields and can handle any related analytical data. The basic technical structure corresponds to a three tiered client/server architecture with a number of comprehensive clients and middleware components controlling the information flow and quality. On the server side a relational database management system (RDBMS) is used for information storage. The web-based clients include a simple search engine (PangaVista) and a data mining tool (ART). With its comprehensive graphical user interfaces and the built in functionality for import, export, and maintainance of information PANGAEA is a highly efficient system for scientific data management and data publication.

WDC-MARE / PANGAEA is operated as a permanent facility by the Centre for Marine Environmental Sciences at the Bremen University (MARUM) and the Alfred Wegener Institute for Polar and Marine Research (AWI), Bremerhaven.

ESIS: a prospective 'European Salmonid Information System'?

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A web-based information system was developed for the storage of telemetry and monitoring data gathered in a national sea trout migration study. Additional data like results of DNA and scale analysis are stored as well. Next components in the information system can be distinguished:

1. Detection data from telemetry projects.
2. Data on re-introduction projects on Salmonids.
3. Fish monitoring data, including DNA and scale analyses.
4. Physical and chemical monitoring data; data used for analyses of migration patterns.
5. Analyses tool.

At the moment, ESIS only serves as a database for Dutch fish telemetry projects. However, developing the database, the outcome of a feasibility study into possibilities of a web based Information System demonstrated the need for a central information system on a wider scale. One of the outcomes was the need for exchange of information (project information and/or project data). If ESIS should serve as a European Information System, next extensions are necessary:

1. Components

DNA databank of salmonid strains.
Meta information on salmonid research projects.
Discussion platform.

2. Functionality

Internet: Availability of data through the Internet.
GIS: To make a selection in the database and as a presentation tool.
Data input: Data mutation via the Internet.

- Safety: Protection against violation.
- Validation: Development of validation procedures.
- Existing systems: Connection with existing systems (using open specifications and XML-data exchange).

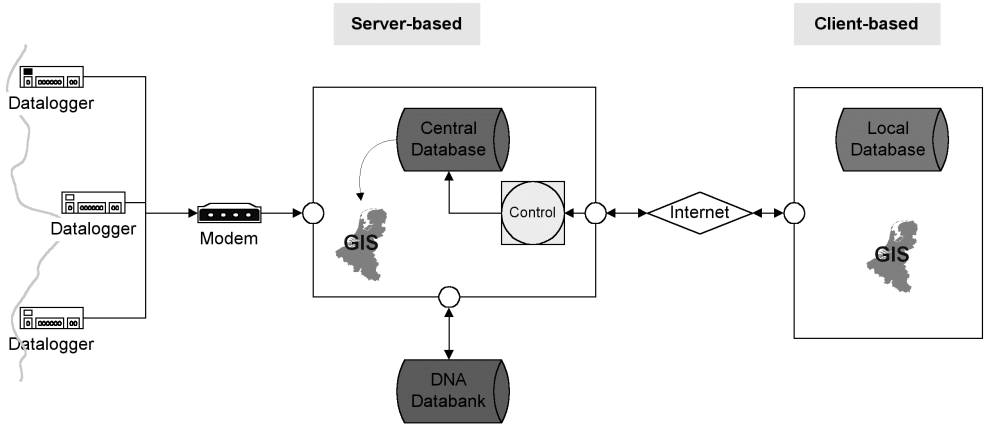

Figure 1. A fully browser based Information system, with an external DNA databank.

Hydrometeo system Flemish Banks

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The Hydrometeo System Flemish Banks consists of The Monitoring Network Flemish Banks (Meetnet Vlaamse Banken) and the Marine Forecast Centre (OMS). The Monitoring Network was set up for the acquisition of real-time oceanographical and meteorological data along the Belgian coast and continental shelf. The oceanographic parameters monitored are waves, tidal height, current and water temperature; meteorological parameters are wind, air pressure, air temperature and rainfall. The network consists of small measuring platforms on the North Sea with hydro-meteo sensors, of wave buoys, meteorological stations and telemetric water level gauges on the coast.

The Network is sponsored by the government of Flanders, and set up and maintained by the Waterways and Maritime Affairs Administration (Administratie Waterwegen en Zeewezen: AWZ). AWZ is also responsible for the central server and quality control of the data.

The data resulting from the Monitoring Network are primarily intended for the daily redaction of marine weather forecasts of tidal heights, waves, wind and visibility along the Belgian coast and in the shipping lane to the coastal harbours and to the estuary of the River Scheldt. The marine meteorologists of the Royal Meteorological Institute of Belgium at the AWZ Oceanographic Meteorological Station (OMS) in Zeebrugge produce these forecasts several times a day.

Flanders Marine Institute (Vlaams Instituut voor de Zee - VLIZ) was invited by AWZ to distribute the data to the academic world, and to create a website offering public access to the most recent measurements. The website also gives a description of the Network, including location of the measuring platforms and buoys, sensors used, and frequency and precision of the measurements.

AWZ participates in several international projects on the strength of its Measuring Network. The most important of these is SeaNet, a European project involving nine countries that maintain operational networks in the North Sea. SeaNet Data Interface is a European MAST project, joining measuring networks of six SeaNet partners for the exchange of data in near-real time.

CERES 5.0, a dynamic toolkit to turn the chaos of data into convenient Internet reports

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Since years, scientists accumulate, store and publish some data. Nevertheless, the traditional methods of disseminating scientific information, such as presentation in congresses and publications in journals, are not adapted to some aspects of the scientific activity. Every level from scientists to decisions makers wants something unique from the data and they do not speak the same language. Modern science needs a convenient way to have access to data and to transform them into information.

Internet induces many modifications in the scientific system and a new culture of science appears beyond this technology. It is a powerful tool that could be used for a rapid and transparent diffusion of scientific information. That's why we have created CERES 5.0, an easy-to-use toolkit that can be used as a tool for scientific diffusion on Internet. This product is a combination between Java technologies, Internet tools and Appdev studio (SAS software's capabilities). Using CERES, classical statistical analyses (descriptive, general linear model, canonical discriminant analysis, etc.) could be performed online from any standard database. From a web page, the reader can ask for the analyses that are immediately performed by SAS software and the results are presented on a new web page in only a few seconds.

This system constitutes a good solution for data warehousing. (i) It is easy to access to data from disparate sources since CERES 5.0 is available from any web browser. (ii) It is easy to add, modify or retrieve data in various formats. (iii) It provides an effective and dynamic analysis tool.

CERES 5.0 will be illustrated by an example of ocean biological data. We will demonstrate that it constitutes a good way to improve the classical publications. It provides different information from the same database for different partners and for the different needs.

Minimum requirements for reporting analytical data from marine environmental samples

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Data concerning chemical pollutants in the various environmental compartments find high attention by the general press and the public and may even be used to support advisory or regulatory measures. Obviously, there is a need to publish data with a proven quality, known uncertainty and sufficient additional information about the sample history. The minimum information should include all the factors that might have an impact on the result or are important for the interpretation of the result. The present recommendations address the marine environmental samples.

The researcher must develop a suitable sampling strategy and the location of sampling sites must be reported, by indication of their longitude and latitude. At least, the sampling day must be reported. A description of the technique used for sampling is mandatory, including a description of the equipment and the type of samples. The sample size has to be chosen carefully depending on whether the sampling should maintain or average out the possible inhomogeneity. Additional information about circumstances that may affect the concentrations, like meteorological conditions during sampling and prior to sampling should be recorded.

The following information should be provided for the analytical procedure: the storage conditions including the material of the sample containers; any pre-treatment of chemical or physical nature; reported details of the method used for homogenization and taking sub-samples.

The entire analytical method must be described. It must include a sufficiently detailed description of the calibration of the analytical system. An estimate of the uncertainty of the final analytical result must be reported. Preferably, the estimate should be based on regularly repeated validation tests, such as recovery experiments or analysis of reference materials. It should be clearly indicated whether the reported results are single measurements or averages of replicates. In case of replicates make clear whether they refer to replicate samples, replicate analysis, or replicate determination. Internationally accepted SI-units must be used, and traditional units such as pounds, acres, inches avoided. Concentrations should be reported in units such as ng/L, µg/kg or mmol/l rather than in ratio numbers like %, ppm, or ppb which may lead to misunderstandings. Figures have to be rounded to significant number of digits; no more than the last of the given digits should be uncertain due to the variability of the method.

Minimum information for seawater samples consists of sampling depth and total sea depth at the sampling site; salinity; temperature; dissolved oxygen; pH; separation method, if suspended material is separated.

Minimum information for marine sediment samples consists of: ‘Horizon’ sampled, height of overlaying water column; sediment texture (% clay, % silt, % sand); organic and inorganic carbon content; pH, redox potential.

MASDEA

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The Marine Species Database for Eastern Africa (MASDEA) is a taxonomic database on the species of marine plants and animals found in the Eastern Africa region. After the Rio Conference, and increased awareness on Biodiversity and need for integrated coastal zones management and planning, the gap in knowledge of the marine species of the region became glaring. In spite of the existence of a number of taxonomic databases, there was still a lack of this important information in that: the databases are worldwide and therefore not specific for the region. Furthermore, they cover mainly terrestrial species or are based on specific groups.

The goal of MASDEA is to fill in the gap of knowledge on the taxonomy of marine species in the region and to have a database on all the marine species of this region. Its objectives are as follows:

collect all available literature on the marine species of the region;
enter data on the species into the database;
seek the support of taxonomic experts (of different groups) of the region;
search for more literature to be entered in the database:
eventually make the database available to scientists in the region and beyond.

The database is important and has several uses. Useful in conservation that it gives knowledge on the diversity of the species in the region. One can keep track of extinct species and also keep track of old information and literature. Current and valid names as well as synonyms of species are clearly indicated as well as the authority (author who described the species) therefore avoiding confusion. The database can also serve as a repository for new species reports from the region.

EU/MAST-MATER database 1996-1999: a reference database of high quality multidisciplinary data collected within the framework of a major international research project, in the Mediterranean Sea

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The EU/MAST-MATER Project (Mass Transfer and Ecosystem Response) has been a major multidisciplinary research effort carried out within the framework of the Marine Sciences and Technology (MAST) Programme of the European Union, during the period 1996-1999. The overall objective of this project was an integrated approach to the entire Mediterranean basin, in its physical, sedimentological, chemical and biological aspects, to study and quantify transfer processes of mass (water, particles, natural and anthropogenic, stable and radioactive elements) and energy between the different compartments (land-sea, sea-atmosphere, upper-deep waters, water-sediment, living-nonliving, pelagos-benthos) in contrasting environments (from eutrophic to oligotrophic), for the examination of the complex interplay of natural processes that operate on a broad spectrum of spatial and temporal scales leading access to the variability of ocean systems. Fifty-four institutions from 11 European countries participated in the project (Belgium, Denmark, France, Germany, Greece, Italy, Norway, Spain, Switzerland, The Netherlands, and United Kingdom) as well as Morocco and Tunisia, corresponding, on the whole, with more than 330 researchers and technicians. During the project implementation, a total of 108 oceanographic cruises (representing more than 1000 days of ship time) were carried out by 12 research vessels and about 254 main scientific equipments were used. This resulted into the collection of a data set consisting of a large amount of a great diversity of various measured parameters.

To achieve a harmonized data management, within the EU/MAST-MATER Project, the "code on data management" issued by EU/MAST was adopted. Due to the large number of research teams participating in the project, it was necessary not only to get and circulate the meta-data and the data, but also to check the coherence and the compatibility of the different data sets and to prepare a final integrated data product. This has been made possible by developing a qualified data management structure, a common protocol (was based on the IOC/ICES and MAST manuals and guidelines) for data formatting and checking and, finally, appropriate software tools to insure timely and standardised implementation of the data management tasks.

The Data Management structure consisted of a Data Manager, with a «Data quality» group and three regional archiving centres, operating in the three sub-basins. To ensure the data management tasks in a timely and practical way, the data centres operated in two ways:

The basic data of physics and bio-chemistry have been formatted at the common MEDATLAS format and full quality control checks have been performed, to insure coherence and compatibility between the different data sets provided by the different laboratories.

The specific data collected in the atmosphere, sediment and biota, were in general, not reformatted at the exchange format, but archived at the original source format of the scientific file. Quality control limited to date and position availability has been made on these data, in addition to the validation made at the source laboratory.

The result is a large data set of recent and high quality data, which can be used not only for the project itself, but also for further studies, including the qualification of new and historical data. To facilitate data dissemination and their use by non-specialists, a data product on CD-ROM was prepared with simple and user friendly software tools for data retrieval and visualisation. A www site was also developed (www.ifremer.fr/sismer/program/mater).

Marine Information and Data Acquisition System

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The Marine Information and Data Acquisition System (MIDAS) was developed by the Flanders Marine Institute. It is used in planning and follow up of all activities onboard the RV Zeeleeuw and for capturing of monitoring data. The system captures underway data of different types (navigation, meteorological and oceanographic), and stores them in a relational database. It will also register all ship movements (leaving/arriving at ports and stations) as well as research activities (CTD casts, seabed and water sampling...).

The ship track, stations and sampling locations can be displayed on the workstations of the on-board LAN. It uses a GIS interface with a direct link to the UW data stored in the database. Drift from station calculations and distance-long-track-analysis for trawling activities are automated giving instant QC feedback to scientists and crew.

All data can be directly exported onboard or consulted some days later through the VLIZ website. The data is provided as is, meaning no further QC steps are implemented as to date. The database replication from shore to board and vice versa is based on XML files, but is still a manual process. Optimisation planned and possible as soon as a direct telecom link is available.

The ship programs have a two-tier client-server infrastructure with a database server, an acquisition server and two client applications (one for the bridge crew and one for the scientists). The shore components are a database server, a planning application and a CGI-BIN based web interface.

VLIZ being a non-profit organization and believing in the free exchange of software and data, has decided to make the system freely available to fellow institutes under the terms of the GNU license agreement. For more information please visit the site http://www.vliz.be/Vmdcdata/midas/.

Practical application of Marine Life Information Network (www.marlin.ac.uk) resources for environmental protection and management

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WHAT IS *MarLIN*?

The Marine Life Information Network (*MarLIN*) is an initiative of the Marine Biological Association supported by the main agencies involved in environmental protection and management in the UK and with links to the Republic of Ireland. *MarLIN* was established in 1998 and is publishing information on the Internet to support marine environmental management, protection and education.

HOW DOES THE *MarLIN* PROGRAMME SUPPORT ENVIRONMENTAL PROTECTION AND MANAGEMENT?

The Biology and Sensitivity Key Information (BASKI) sub-programme researches species and biotope information to assist in answering "will it matter if ….?" questions and in interpreting results of monitoring. Sensitivity to 24 factors is assessed and recovery prospects of species and biotopes following change are identified. Information reviews are subject to peer review.

The Data Access sub-programme identifies and obtains seabed survey data to add to the national resource via the UK National Biodiversity Network. Interpreted survey data provides information to indicate the frequency of occurrence and distribution of species and biotopes and to give a context to localised data.

Research has been prioritised so that nationally rare and scarce species, UK Biodiversity Action Plan species, and biotopes that characterise Annex I Habitats in the EU Habitats Directive have been researched first in the BASKI sub-programme.

Key information on over 400 species and 100 biotopes is available on-line. Users can identify survey points from maps and obtain full detailed survey data on-line.

MAPPING SENSITIVITY

MarLIN is now able to link survey data to sensitivity assessment so that the presence of species and biotopes that are of 'high', 'moderate' or 'low' sensitivity to selected factors can be mapped in a much more scientifically-based and sound way than has previously been possible. Sensitivity mapping is currently being developed with colleagues in Britain and Ireland.

BIOMARE - Implementation and networking of large-scale long-term MARine BIOdiversity research in Europe - a framework for future biodiversity research

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Consensus has grown that concertation and co-ordination at European scale is required to implement long-term and large-scale marine biodiversity research and to plan the adequate use of the European research infrastructure. Many research questions cannot be addressed at a local scale and require cooperation and the establishment of a committed network of scientists and institutes. There is no agreed common methodology for many aspects of biodiversity research; this needs careful preparation.

The BIOMARE concerted action aims at establishing the infrastructure and conditions required for marine biodiversity research at the European scale. The objectives of the Concerted Action are to achieve a European consensus on the selection and implementation of:

a network of Reference Sites as the basis for long-term and large-scale marine biodiversity research in Europe;

internationally agreed standardised and normalised measures and indicators for (the degree of) biodiversity;

facilities for capacity building, dissemination and networking of marine biodiversity research, by a) workshops, b) improving training and mobility, c) an internet website including an overview of ongoing research programs and existing infrastructure for marine biodiversity research in Europe, d) a database on, reviewed and evaluated, available data, aiming at employing data for socio-economic questions such as the impact of fisheries or tourism.

To implement the objectives a series of evaluations, recommendations, regional meetings and joint workshops are carried out. The Concerted Action started in November 2000.

The first results on the selection of reference sites, a tentative model for a protocol on indicators of marine biodiversity in Europe, and an overview of the database on available data will be demonstrated.

ICES data type guidelines - data and metadata

ICES Working Group on Marine Data Management*

The International Council for the Exploration of the Sea (ICES) organises many working, study and steering groups to examine general and specific issues related to the ocean environment. One such group, the Working Group on Marine Data Management (WGMDM), takes an active role in promoting proper data management practices for the marine community.

Over the past several years, the WGMDM has worked toward a set of guidelines designed to describe the elements of data and metadata important to the ocean research community. These guidelines are targeted toward physical-chemical-biological data types traditionally collected on oceanographic cruises. Each guideline addresses the data and metadata requirements of a specific data type. Although there is much overlap between guidelines, individual guidelines exist to make the process of selecting the proper one more client-friendly.

The guidelines promote the proper documentation of data. For example, the provider is reminded that all processing applied to the dataset should be documented. This includes such things as flagging procedures, precision of methods, and handling of null values. Submission formats are suggested, although data centres will accept submissions in a variety of formats. Cruise collection information is also itemised, which can serve as a metadata checklist to ensure the collector acquires all required metadata at the source and time of initial sample collection.

The guidelines also emphasize the value-added service provided by the ICES member data centres. In this avenue, the guidelines describe quality control procedures applied to the dataset by the centre. During these procedures, any detected problems with the dataset are brought to the attention of the provider and problem resolution between the centre and provider is sought. The data centre also maintains procedure and problem histories to provide value-added information to the dataset. This value-added information is provided to other clients requesting the data.

The guidelines also include information on the general service of data delivery provided by the data centres. This service includes data descriptions and a full history of procedures and processing. Data quality flagging is described and any changes made to the dataset are noted. In the event a data centre cannot fulfil a client's need, the centre will provide a referral service to other data centres or experts.

Finally, a reference section includes links to other guidelines, quality control procedures or data management techniques specific to that data type. This provides valuable information and acknowledgement of other related activities in the international community.

For the list of currently approved guidelines, go to http://www.ices.dk/committe/occ/mdm/guidelines.

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BALTCOM Datawarehouse – Online data mining using MS Analysis services

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BALTCOM version 2.0 is an internet based datawarehouse (URL: http://www.BaltCom.org) where the countries represented in IBSFC (International Baltic Sea Fishery Commission) upload, download, validate and analyse discard data.

The development of the international datawarehouse was an EC funded project.

In the process of assessing stocks of commercially fished species in the Baltic Sea [mainly: Cod (*Gadus morhua*), Herring (*Clupea harengus*), Sprat (*Sprattus sprattus*) and Flounder (*Platichthys flesus*)] data needs to be aggregated and calculated to match the input formats required to run assessment software used in the Baltic Fisheries Assessment Working Group.

The need for a fast performing web based data mining application to analyse these formats on different aggregation levels was addressed by implementing a solution using Microsoft Analysis Server and Microsoft Excel Pivot Table Services.

The functionality of the solution is presented through use cases. Architecture and calculations are documented.

The selection of technology is discussed.

Recommendations are given on the basis of lessons learned during development and implementation.

Analysis of demersal fish assemblages on the Senegalese continental shelf considering changes and fishing impact over the last decades

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The assemblages of demersal fish and associated species (cephalopods, gasteropods and crustaceans) on the Senegalese continental shelf (West Africa) are analysed in order to characterize their structure, diversity and evolution during the last decades. The biological data come from historical series of scientific trawling surveys. The analytical process, as well as the interpretation of the results, are directed towards an evaluation of the ecosystems effects of fishing, in a zone which has undergone an increasing pressure of commercial exploitation for several decades. The adequacy of the data for such a purpose is also discussed.

Keywords: demersal communities; fish; fisheries impact; numerical analysis; West Africa; marine ecosystems.

The Netherlands National Oceanographic Data *Committee* A model for nationwide oceanographic data management

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In many countries a previously existing data centre has at some point been designated as the National Oceanographic Data Centre (NODC). In the Netherlands a different approach was chosen.

Eight oceanographic institutions joined forces in 1997 and established a National Oceanographic Data ***Committee***. Within this committee the institutions are represented by their data management experts. The eight institutions come from the governmental, scientific and private sectors and together manage over 90 % of all oceanographic data held in the Netherlands.

Since its inception this committee has become the national platform for oceanographic data management and represents the Netherlands in international bodies like IODE, ICES-MDM and the European eaSearch project.

In this poster the organisational structure is presented and both advantages and disadvantages of the decentralised approach are discussed.

Chemical and biological data holdings in the Russian Federation

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Chemical and biological observations are conducted in Russia mainly by organizations of the Academy of Sciences, the State Committee of Fishery and the Russian Federal Service for Hydrometeorology and Environmental Monitoring. In the recent decade many nongovernmental agencies started to be involved in conducting chemical and biological observations required for environmental monitoring in the period of industrial construction in coastal areas.

The organizations of the Russian Academy of Sciences **(**Shirshov Institute of Oceanology, Pacific Oceanological Institute, Marine Biological Institute) hold data of chemical and biological observations collected by more then 350 cruises, about 4500 stations of hydrochemical observations and up to 3000 stations of hydrobiological observations.

The institutions of the State Committee of Fishery hold the oceanographic data collected by more than 4000 research expeditions. The database contains more than 4 million records with different kinds of biological data.

Organizations of the Federal Service for Hydrometeorology and Environmental Monitoring (Arctic and Antarctic Research Institute, Far Eastern Regional Hydrometeorological Research Institute, State Oceanographic Institute) collect physical and chemical data during research expeditions in the ocean and sea and conduct monitoring of the environment of Russian seas using the network of long-term observations. Regular measurements of chemical parameters and contaminants are conducted on the network. Biological indicators are also included to evaluate the condition of ecosystem. Most of the physical and chemical measurements data are held in RIHMI-WDC. These data were collected by more than 20 000 cruises of national research vessels. Measurements of chemical parameters were taken in more than 13 thousands of cruises and observations of contaminants were made by 3560 cruises. Besides 35 reports with biological observations are stored in the holding.

The data holdings are managed using DBMS of different types (MsAccess, Oracle, etc.). Some of the historical and modern data are not yet digitized. Different code systems are applied for the data description. To improve chemical and biological data management RIHMI-WDC makes efforts to unify data, metadata and code systems through modern approaches and technologies for data processing and management. The Unified System of Information on the state of the World Ocean which integrates marine information resources through an advanced reference system, metadata standartization, code unification, and which provides web-access to the distributed multidisciplinary databases is under development.

Old fauna from old samples: the database and collections of the Liège Zoological Museum

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The zoological collections of the University of Liège contain many marine animals. The oldest ones come from South America and South Asia, collected in mid 19th century. Others were collected at the end of the 19th century by Edouard Van Beneden, who organised several trawls from Oostende. After this, the work on marine fauna and plankton continued at Liège with D. Damas, M. Dubuisson and others. Several marine expeditions or short trips to marine stations all over the world served to collect material for research or courses' illustration.

With the successive splitting up of one lonely professor's charges into several smaller departments, the museum has progressively lost its role of conservation centre of the studied material, particularly after the second war. Since its official opening to the public in 1962, with the new created Aquarium, its collections have been forgotten by the researchers, even the specimens are always conserved and systematically classified in depositories, as well as in the exhibition rooms. In 1992, we started to automate collections management, and created a database using Filemaker software on Apple computer (FMP 4.0 on Imac).

We began to transcribe the basic information from the sheets of hand-written first inventory register opened in 1837: inventory number, year of record, Latin name (genus, species), geographic origin (country, region), number of specimens, conservation mode, cost (when bought). Four years of work were required to complete the file with this strict kind of information. Progressively we are adding systematic information on taxonomic ranks (Family, Order, Class, Phylum, …) using world reference books on taxonomy; creating separated register numbers and cards for the individuals of a group of specimens or species previously registered on the same number; adding information on stock location, state of conservation, papers published on the material, reproductions available, status of the species, etc.

The taxonomic work takes a lot of time because we must update the synonymy. Today, the main base contents 21728 cards. The sorting power of Filemaker software allows search and sort of all kinds. Fields may be combined for presentation documents, and styles can be applied on the information. We chose to present here the content of our marine collections. The aim is to inform about the nature and origin of marine animals in collection so as to attract interested researchers for a valorisation of the material.

To meet all kinds of research requests on animal biodiversity, we created other databases for the microscopic slides collection, and for the entomological collections. Moreover, the FMP version 4.0 had been chosen for its applications on the web: indeed, we planned to allow access to the data through the Museum website.

Unfortunately, time available for this application is limited, and progress is slower than what we would wish: offering web access to the data has not been implemented. Potential partners for this venture are welcome to contact us.

To the question of biological databases designing

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The structure of a biological database, which provides some marine organism information storage, has been proposed. The biological database is a part of an oceanographic database, which consists of four main and some additional data tables. The main data tables are the following:
A table of cruises, which describes expeditions, their start and end dates, itinerary, who took part in them, etc.
A table of stations, which is a set of oceanographic samples sampled in some point of the World Ocean at the surface or on several discrete depths.
A table of transects, which is a set of oceanographic samples sampled through the fixed time or/and space intervals from one oceanographic station towards another.
Tables of values, which store either parameters of marine organisms (their dimensions, abundance, volume, taxonomic classification, etc.) or physical-chemical characteristics of the water.

We have used the term ‘oceanographic parameter’ as a general concept, which includes features of water environment, geomorphology of the bottom, characteristics of physical-chemical processes in the water, and properties of biological components. The oceanographic parameters are divided into two groups. The first group (species specific) is a set of only biological parameters, which may be classified according to the taxonomic scheme. The second group (general data) is a set of all other oceanographic parameters, including biological parameters, which describe features of the whole marine community or features of marine organisms community fractions.

There are two different types of data tables (4). The first type of data tables, storing species specific information, includes two linked data tables: a primary and a summary. Each of them keeps the taxonomic names of marine organisms and information about their dimensions, abundance, horizon(s) where they have been sampled, etc. The summary data table summarizes information from the primary data table, i.e. it has total values: total abundance, total biomass, etc.

There are three types of methods of oceanographic parameters measurements, which define the way of oceanographic values interpretation. The types are the following:
Single – the parameter value characterizes some feature of the water environment on the whole station (water transparency, depth of hydrogen sulphide zone, etc.);
Discrete – the parameter value characterizes the state of the water environment or the state of the biological community in the isolated point of the water column. For example, the water temperature, salinity, or the plankton abundance and biomass measured in a water horizon.
Continuous – the parameter value characterizes the general (total) state of the water environment or biological community in the water column. For example, the structural indices of zooplankton community in the water column are the continuous oceanographic parameters.

All species specific data are of the discrete type. General data can be any of the three types.

Special database management system for storing, processing, and analyzing of marine biological data at the species level

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Studies of interaction between biological and physical processes in the ocean are based on a collection and comprehensive analysis of large multivariable oceanographic data sets. The Database Management System OceanBase was developed for this purpose and successfully applied in several international and national projects in the Black Sea region (NATO TU Black Sea Project, NATO SfP ODBMS project), the Caspian Sea (Caspian Environment Programme), the Mediterranean Sea (IMS METU, Turkey), the Atlantic Ocean (NatMIRC, Namibia), and the World Ocean overall (Darwin Initiative Project).

The possibilities of the OceanBase were gradually upgraded recently. One of the modifications of the OceanBase (version 2.02.PLANKTON) allows to manage marine biological data at the species level. Individual plankton data loaded into the database consists of: species name, stage, size (min and max length), abundance, average species weight, biomass, sample volume, and sample depth range. Zooplankton and phytoplankton taxonomic classifications are stored in the database and used for selection of biological characteristics. Taxonomic classification is based on the Integrated Taxonomic Information System (ITIS Project, US). Limitations of the system on plankton data are as follows: up to 7 levels of taxonomic classification, up to 1000 species names in standard version (can be adjusted according to individual database needs).

The OceanBase system provides possibilities to make the complicated search in the database using multi-parameter criteria, prepare selected data for producing maps, sections and other standard types of oceanographic data presentation, moreover, it possesses a set of embedded graphical tools such as mapping, plotting, histogram calculation, etc. OceanBase allows one to select not only the biomass and abundance of individual plankton species but also to calculate summaries for taxonomic groups: from Genus and Family to total Plankton as the whole. To simplify this task, the special Plankton Query interface was designed, which represents taxonomic classification in the form of a hierarchical taxonomic tree. Each node of the taxonomic tree contains a check box, which, when checked, results to calculation of summaries on the sub-tree. After selection, plankton data can be processed jointly with other parameters using the full set of possibilities of OceanBase tools.

Several specialized databases, containing marine biological data at the species level, were created with the help of OceanBase version 2.02.PLANKTON. Among these, databases are created in the Marine Hydrophysical Institute and in the Institute of Biology of the Southern Seas of the National Academy of Science of Ukraine in the framework of the Darwin Initiative Project, and two databases are created in the Institute of Marine Sciences, Turkey, which contain time series marine ecological data collected in the Black Sea (Sinop) and Mediterranean Sea (Erdemli), including zooplankton and phytoplankton data.

Application of European funded technology for sustainable management of European coasts

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SUMMARY:
This abstract aims to describe the usage of recent developed technology in a prototype stage towards operational usage. Two projects are central in this paper, namely CoastBase, a fifth framework DG INFSO funded project and EUROSION a service contract commissioned by DG ENV. Within CoastBase the technology development and demonstration is the main point of gravity and limited resources available for the final contents. On the contrary, technology development within EUROSION is absent, but the project will produce a vast amount of information for policy makers, managers and various other stakeholders involved in coastal erosion.

COASTBASE:
CoastBase is an internet accessible, open system architecture for integrated, distributed coastal and marine information search and access in Europe. The prototype is developed for two fields of application: European environmental indicator assessment for the coastal and marine environment and integrated coastal zone management. At present, CoastBase provides access to four data sources in different countries. The metadata of another 100 key on-line information sources (such as legal and policy documents, reports) related to ICZM were uploaded into the CoastBase repository. Both data and information sources are sufficient to demonstrate the functionalities and potential of the system, but not yet enough to satisfy users in “real life” situations. However, the potential of developing CoastBase into an operation system and standard decision support system for ICZM is high. The European project EUROSION, for example, has decided to apply and modify the system for the needs of integrated coastal erosion management.

EUROSION:
The EUROSION project aims at providing the European Commission with a package of recommendations for policy-making and information management practices to address coastal erosion in the enlarged European Union, based on a thorough assessment of knowledge gained from past experiences, as well as the current status and trends of European coasts. To reach these objectives, the project takes stock of the outstanding amount of knowledge accumulated over the last decades at the European, national and local levels, and proposes an innovative assessment methodology combining GIS data and field investigations on: (i) physical processes, (ii) existing policy instruments, (iii) technical and engineering practices, (iv) social and economical profiles, (v) public perception and communication between stakeholders, and (vi) information availability and accessibility.The implementation of EUROSION has been awarded to a consortium led by the Dutch Institute for Coastal and Marine Management (RIKZ).

TECHNOLOGY SUPPORTING SUSTAINABLE MANAGEMENT:
During the initial stage of EUROSION the inception report was drafted and a user analysis executed. The approached persons expressed the clear wish that all information and knowledge generated through EUROSION should be transparent accessible. This included the EU level information, the existing national legislations, existing field experiences and relevant links. If information has limited access an abstract with the relevant co-ordinates should be generated.

CoastBase uses European standards for indexing and cataloguing information, has multilingual facilities and is using a standard environmental vocabulary (GEMET). CoastBase has been developed as a demonstrator proving the technological functionality and parts of the technology is being reused (e.g. www.waterbase.nl), however EUROSION offers the possibility to exploit the technological results in an operational manner.
The embedding of EUROSION generated information through a system allowing the information to stay where it belongs, while assuring access to the European public will be the main challenge.

FUNCTIONALITY:
From a functional point of view, the system is divided into three parts:
Firstly, a virtual catalogue module, providing means for a distributed search through coastal and marine data catalogues in Europe. Secondly, an access and manipulation module that provides tools to download and manipulate geographical information. Thirdly, the feed-back module, facilitating feedback to the information source, commenting on downloaded products and the uploading of aggregated products into the CoastBase repository. As part of the feed-back module, an update module was developed, allowing insertion and updating of meta data records stored centrally on the CoastBase server. As not all functionality will be used within EUROSION a list with requirements has been made. The ministry of Transport, Public Works and Water Management in The Netherlands has provided extra funds to customize CoastBase to the specific needs within EUROSION.

CONCLUSIONS:
The merging of a contents oriented project EUROSION with an information architecture allowing dissemination and European wide access is a challenge to offer the coastal community and citizens with some visible results at the European level.
Applied European research and development is important, but making developed technologies progressing from the demonstration stage towards an operational service requires efforts, a clear demand and solid institutional embedding. The main components are present here, now the challenge is up to technology to make it work.

Functions of the ODINAFRICA Information Services Centre in Mombasa Kenya

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The Information Services Centre of the Ocean Data and Information Network for Africa (ODINAFRICA) is located at the Kenya Marine and Fisheries Research Institute (KMFRI) in Mombasa, Kenya. Its general objectives are to provide marine scientists in Africa with scientific literature and promote communication and information exchange.

To achieve its objectives, the Centre provides the following services and products: document handling and delivery, Internet connectivity, and a quarterly newsletter on marine activities in Africa. It maintains various databases including: directories of marine institutions and marine scientists in Africa as well as library holdings of marine science information in Africa. These products are also accessible through the project website.

In the past year the centre has continued to subscribe to some 33 international journals. It has delivered on average 250 documents each month to marine scientists and information centres in Africa. The newsletter has a wide readership of more than 1,500. More than 900 contacts of marine scientists in Africa and a total of 287 marine institutions and information centres have been entered in the respective directories. The centre collaborates and exchanges documents with 13 libraries and information centres worldwide. On average, 80 new records are added monthly in the database of library holdings.

This presentation highlights the current status of the Centre in terms of the rate of growth of the databases and other products – services that are available to the developing African marine community – and the proposed way forward.

Application of light attenuation measurement for determination of vertical plankton distribution in sea water

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The investigation of the horizontal and vertical distribution of phyto- and zooplankton communities is extremely important for the assessment of the ecological status of marine environment, especially in conditions of increasing anthropogenic influence. There is much evidence that the Black sea coastal ecosystem has been under the severe impact of eutrophication during the last 20 years. As a consequence a dramatic increase of phytoplankton blooms was registered, accompanied by serious changes of its species succession, biological cycles and biomass, with corresponding alterations in zooplankton too. The high time-space variability, the patchiness of its horizontal distribution and vertical aggregation increase the necessity of reliable express methods for monitoring to be developed.
The increased abundance of plankton under the influence of high eutrophication of the Black Sea as a stratified basin, results in a dramatic change of the optical properties of the water masses especially in the coastal regions. Light attenuation in the water could be used for determination of vertical plankton distribution, abundance assessment and community aggregation down the water column.
A specially constructed device based on measuring attenuation of a directed light beam in water has been used. The relationship between light attenuation (extinction) and total plankton abundance and chlorophyll 'a' fluorescence is evaluated in laboratory experiments on sea water samples with modelled plankton biomass. A good relationship between extinction coefficient as a measure of light attenuation and total phyto- and zooplankton biomass as well as chlorophyll 'a' fluorescence has been established. The experimental results were used for calibration of the device for in-situ application.
Two series of in-situ measurements were accomplished in the region of Varna Bay canal connecting Varna Lake and Varna Bay. During the first one five points were sampled and during the second – tHree points. At each point light attenuation was measured at depths from 0.5m to 8.5m with an interval of 1m, additionally water bottle samples were taken at three depths 0.5, 4.5 and 8.5m. The samples were processed by classical methods. In addition the chlorophyll 'a' (as a measure of total phytoplankton biomass) was analyzed on a Turner Design Fluorometer (model 10-000R).
As a result of the study a well expressed and steady relationship between vertical distribution of extinction coefficient and chlorophyll 'a' measurement has been established. This gives ground to suggest that light attenuation could be used as an express method for determination of vertical plankton distribution in sea water. More detailed results could be obtained by applying “express” and “classic” methods of measurement in parallel.

Internet-based information resources on aquatic invasive species in Europe

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During the last two decades rates of invasions of European inland and coastal waters by alien species increased significantly. Ballast water release is considered as the main vector of aquatic species introductions in Europe, but other human-mediated vectors like intentional introductions and accidental release are also important. In many cases introductions of invasive species have caused significant losses in marine, estuarine and inland waters biodiversity and economy in Europe. Development of the Internet-based information resources on aquatic invasive species is considered as one of the most important mechanisms of information exchange within the European scientific community and worldwide. These resources may provide comprehensive information for management of aquatic invasive species in Europe, as well as for scientific and educational purposes.

The International Commission for the Scientific Exploration of the Mediterranean Sea (CIESM) Atlas of Exotic Species (http://www.ciesm.org/atlas/) is one of the most comprehensive Internet-based atlases of aquatic alien species in the world, and includes detailed description of alien crustacean decapods, fishes and molluscs, which invaded the Mediterranean Sea basin. The Baltic Sea Alien Species Database encourages the exchange of data within the Baltic Sea area, providing a competent system regarding biological invasions, vectors of introduction, spread of alien species and their impacts on environment and economy (http://www.ku.lt/nemo/mainnemo.htm). Presently it includes about 100 species, information on each species is standardized according to eight major features allowing search and data retrieving according to user formulated requests. Detailed information on the American ctenophore *Mnemiopsis leidyi*, which recently invaded Black and Caspian Seas, is available on the website of the UNDP Caspian Environment Programme (http://caspianenvironment.org/mnemiopsis/). Information on aquatic invasive species in Europe can be found at the FAO Database on Introductions of Aquatic Species (http://www.fao.org/waicent/faoinfo/fishery/statist/fisoft/dias/mainpage.htm), and in the Global Invasive Species Database, which include the List of 100 of the World's Worst Invasive Species (http://www.issg.org/database/welcome/). Information on European cooperation in ballast water management can be found on the website of the ongoing MARTOB project (http://www.marinetech.ncl.ac.uk/research/martob/), supported by the European Union. Comprehensive information of ballast water management is available at the Global Ballast Water Management Programme (GloBallast) web site (http://globallast.imo.org/).

Early 2001, the website of the Regional Biological Invasions Center (RBIC), provides access to the Internet-based information resources on aquatic invasive species research and management in Europe and worldwide (http://www.zin.ru/projects/invasions/). The development of the Geographic Information System 'INVADER' as international database on the Internet (http://www.zin.ru/projects/invasions/gaas/invader/invader.htm) is one of the RBIC priorities. On-line geo-referenced distribution maps of selected species, along with detailed descriptions of their taxonomy, invasion histories and biology, are available at the RBIC Illustrated Database of the Aquatic Invasive Species of Europe (http://www.zin.ru/projects/invasions/gaas/aa_idb.htm), linked to the Baltic Sea Alien Species Database, to the Global Invasive Species Database, and to the other species-specific on-line information sources.

ChEssBase: a database for deep-water hydrothermal vent and cold seep species

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ChEss is a recently-funded field project aiming to determine the biogeography of deep-water chemosynthetically-driven ecosystems under the Census of Marine Life initiative. The main objectives of ChEss are to assess and explain the diversity, distribution and abundance of hydrothermal vent and cold seep species at a global scale and to understand the processes driving these ecosystems.

The international Scientific Steering Committee (SSC) of ChEss is responsible for coordination of the programme, for ensuring collaboration at international levels and for promoting application of ship time at national levels. ChEss will follow two approaches:

1- A long-term discovery and exploration field programme will be developed. The ChEss programme proposes to select a limited number of target areas chosen at key locations for the discovery of new hydrothermal vents and cold seeps. The intention is to identify the maximum scientific return that could be achieved from detailed investigation of the minimum number of sites at key locations.

2- A web-based, relational database (ChEssBase) will be created for all vent and cold species. ChEssBase will be bio- and geo-referenced and will be available on the web through the ChEss web site (www.soc.soton.ac.uk/chess/) and integrated in OBIS (www.iobis.org). At the biological level, ChEssBase will include taxonomical information, basic biological data, distribution and literature references. At the geographical level, the database will include location data for the vent and seep sites, general characteristics of the sites, faunal community descriptions and references. There will be links to images and video for both the specimens and the sites.

The ChEss programme encourages participation on the database from projects involved in hydrothermal vent and cold seep research. ChEssBase is expected to be a centralised source of information for deep-water chemosynthetic ecosystems.

C-squares – a new method for representing, querying, displaying and exchanging dataset spatial extents

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Conventional metadata records (dataset descriptions) are intended for resource discovery and documentation. For spatial datasets, typically the dataset spatial extent (footprint) is indicated by a bounding rectangle (= bounding box) which thus forms a type of spatial index, and also supports spatial (geographic) searching using an overlapping rectangles test with an enquirer's designated search rectangle. However for many marine datasets (and for various terrestrial datasets as well), such representation is frequently a poor fit to the real data distribution. In the marine context, this can result from the nature of vessel-based sampling in particular (based around linear or irregular voyage tracks rather than filled rectangles) and the fact that significant unsampled regions (e.g. land, or unvisited areas of ocean) can exist within the dataset spatial boundary. The presence of substantial areas within the bounding rectangle which are devoid of data, for whatever reason, renders it likely that any list of hits resulting from a typical overlapping rectangles search will include an unknown number of false positives, where data is notionally present from the enquirer's area of interest but on closer inspection proves not to be so.

C-squares (concise spatial query and representation system) is a recently described (2002) method introduced to overcome this limitation for representing dataset spatial extents at the metadata level. Using c-squares, complex dataset footprints are represented more exactly, while at the same time not requiring the overhead of a GIS application to represent or query the dataset footprint. C-squares supports improved spatial querying as compared with bounding rectangles searches; rapid representation of the dataset footprint on a map of any portion of the earth's surface using an on-line utility (the c-squares mapper); and, since the representation is by a string of ASCII characters, the footprint is well suited to storage as metadata, and to metadata exchange as required (e.g. via XML).

Using c-squares, dataset footprints are represented by aggregations of squares (tiles) at a selected resolution such as 0.1 x 0.1 degrees, 0.5 x 0.5 degrees, 1 x 1 degrees, each of which is labelled according to a notation derived from subdividing 10 x 10 degree WMO (World Meteorological Organisation) squares, with the resulting set of codes assembled into a simple character string. Spatial searching then merely comprises looking for an agreement (text match) between any portion of the dataset's c-squares string and the enquirer's designated search area (itself represented by the equivalent c-squares code or codes).

This poster presentation gives further information about the basic principle of c-squares, together with examples of oceanographic dataset footprints as represented by this method, from the data holdings of CSIRO Marine Research (CMR). An example c-squares spatial search interface, for CMR's metadata system MarLIN, is accessible on-line at http://www.marine.csiro.au/marlin/csq-chooser.htm. Additional documentation on the c-squares system is available via the c-squares home page at http://www.marine.csiro.au/csquares/.

Sea-Search: a pan-European network for marine and oceanographic data and information management

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Four years ago the EURONODIM network was established as a European cooperative network of 16 national oceanographic data centres and marine information centres from 14 European coastal states and EC. Each partner is specialised in managing and giving access to extensive resources of oceanographic and marine data and information and is providing data management services and support to a wide range of institutes and research projects, both nationally and internationally. EURONODIM operates a Sea-Search network of partner websites and a joint European website (www.sea-search.net), that is developed into the key resource or 'portal site' for oceanographic data and information in Europe. It hosts an array of catalogues, overviews and links and acts as central gateway to ocean and marine information and data resources of EURONODIM partners, of national institutes in the EURONODIM partner countries and other related organizations in Europe.

Major catalogues in Sea-Search are:
EDMED – European Directory on Marine Environmental Datasets
ROSCOP – Research Cruises
EDMERP – European Directory on Marine Environmental Research Projects

The Sea-Search activities are continued as part of the 5th framework of the European Commission, whereby the following new challenges are targeted:
Horizontally by adopting a pan-European dimension
National oceanographic and marine data centres of Eastern European countries around the Baltic Sea and Black Sea, i.c. Poland, Latvia, Lithuania, Estonia, Russia, Ukraine, Georgia, Bulgaria, Romania, and Turkey and Denmark are joining as well as additional Mediterranean countries, i.c. Israel, Malta, Cyprus, Croatia, and Morocco. They will adopt the mechanisms and meta-databases of Sea-Search and will compile and submit their national entries for EDMED, ROSCOP and EDMERP directories, thus giving overviews of their national data holdings and marine research activities.

Vertically by extending the Sea-Search services and products and innovating the technological internet basis of the network with:
Common Data Index metadatabase for data sets held at partners
Pilots for online Data Access
Upgrading and innovating of present EDMED, ROSCOP and EDMERP mechanisms
Trial with high-bandwidth communication between the partner sites

The objectives of Sea-Search are:
To deliver a major contribution to the European Network for marine research infrastructures, through the further development and upgrading of the present Sea-Search network of ocean and marine data centres in Europe into a pan-European network for ocean and marine data & information management
To improve the exchange, availability and accessibility of ocean and marine data and information within Europe and including non-EC countries riperian to all seas bordering Europe;
To expand the online EDMED, EDMERP and ROSCOP metadatabases with input of research institutes in Eastern European countries around the Baltic Sea and the Black Sea and other Mediterranean countries; To foster exchange of experiences between the present Sea-Search partners and the new partners concerning data and information management practices;
To extend the online Sea-Search services and products with a Common Data Index metadatabase to datasets, held at partners and pilots for online Data Access and to innovate the technological basis of the network infrastructure by adopting XML, GIS (OGC) and high-bandwidth communication.

A new system for automatic measurement of biological-chemical parameters from ferry boats

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Operational monitoring of coastal areas and shelf seas is mainly carried out by manual sampling and analysis during ship cruises. In addition, automatic operating measuring systems on buoys allow routine measurement of standard oceanographic parameters, e.g. temperature, salinity, currents and in some cases other parameters, e.g. turbidity, oxygen and chlorophyll fluorescence. These systems are much affected by biofouling and the maintenance/operation costs are quite high mainly due to ship costs.

On the other hand, there are many routes for ferryboats and "ships-of-opportunity" which run quite frequently. Standardised measuring systems on such carriers have several advantages: 1) the measuring system is protected against waves etc., 2) biofouling can be more easily prevented (inline sensors) and 3) most important, the running costs are much smaller since the operation costs of the ship have not to be calculated. There are already some examples for scientific equipment on ferry boats, e.g. in Finland, UK, Norway and the Netherlands. However, most of these systems only measure oceanographic standard parameters automatically and have to take samples for nutrient analysis.

A new system has been developed which overcomes these restrictions. The "German FerryBox" consists of a fully automated flow-through system with different sensors and automatic analysers. For a reliable unmanned operation the system is supervised by an industrial programmable logic control which can shut off the system in case of very severe errors and operates automatic cleaning cycles, e.g. in harbour. At the time being, the FerryBox has sensors/analysers for the following parameters: *water temperature*, *salinity*, *turbidity*, *oxygen*, *pH*, *chlorophyll fluorescence*, *nutrients* (*ammonium*, *nitrate/nitrite*, *phosphate*, *silicate*), *main algal classes* (specific fluorescence). Data acquisition, -storage and telemetry is coordinated by an industrial PC. Data can be transferred to shore and the system can be remotely operated by GSM (mobile phone). Biofouling is prevented by pressure cleaning of the sensors with acidified tap water or under severe conditions (tropics) by chlorination. Sometimes clogging of the water inlet in the ship interface by debris or fish causes problems. Since all flow rates are supervised by the system in such cases a pressure back-flushing cycle is initiated which clears the inlet.

The system had been installed on the ferry Hamburg (Cuxhaven)-Harwich and is under test since November 2001.

Continuous chemical-biological data from the ferry route across the North Sea will provide scientists and monitoring authorities with information on the eutrophication status and enhance the existing knowledge on nutrient and plankton dynamics. Results from recent measurements will be presented and discussed together with future developments which could combine ferry data with remote sensing measurements and apply these data to numerical models.

Keywords: monitoring; oceanographic observations; eutrophication; automated systems.

Diagnosis of environmental impacts on the Mexican Coastal Zone with a comprehensive ad-hoc database

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Mexico is a country with 11,500km of littorals and almost $3.10^6 km^2$ of marine Economic Exclusive Zone, in contact with the Pacific, Atlantic and Caribbean and mostly under tropical and subtropical, but also temperate latitudes, thus ideally located for a large array of coastal habitats to thrive, from rich fishing areas, to coastal lagoons, mangroves and coral reefs. The main sources of revenue in the country: petroleum, tourism and shrimp catch, are all mainly found in the coastal zone, together with the highest population growth. This privileged situation contrasts with the current lack of knowledge and poorly developed legislation for the coastal zone, where a booming development of the varied activities has proceeded without adequate frames, protection measures for the environment or coordinated in any way by a central guiding plan.

The Mexican government, through the Ministry of the Environment, recognizing these problems, and in accordance with international treaties, modern views in sustainability and environmental protection, financed this project, the first of its kind, whose aim was to have an integrated state of the art knowledge of what had been done in the country to assess water quality of the coastal waters, in a custom-built database, which would help to define the necessary policies to ensure an adequate development of that area and could also be used to recognize what needs to be done in research to complement this effort.

To this end, a comprehensive bibliographic search was conducted in all the scientific libraries of the country (universities and public or government agencies and ministries) for the entire coastal zone. To construct the database, a total of 113 parameters were chosen as indicators of water quality and divided in six main categories: Biological (9), Physico-chemical (33), Geological (5), Metals (18), Persistent Organic Compounds (28) and Hydrocarbons (20). Of those, 106 were recorded from water, 88 from sediments and 68 from organisms, and can be divided by States (17).

The main activities performed in the coastal areas were divided in five categories: Fishing and Aquaculture, Petroleum extraction, Tourism, Portuary activities, and Urban and Industrial development. Conservation measures were also taken into account. The most common denominator of anthropic impact and practically ubiquitous, was contamination by fecal coliforms, sometimes found in very high concentrations and/or already incorporated to sediments.
The data gathering was complemented with field visits to the 48 most important centers of coastal development in order to corroborate the published data and interview key officials, public or private agencies and involved individuals.

The RAISON system was chosen to manage the information, in order to integrate the database, with the Excel Spread Sheet and a graphic editor to visualize the results in maps and figures. Hierarchization of the validated information was then performed to evaluate water quality at all sites where studies existed, comparing the values measured and the official permissible concentrations of all parameters. Since these norms only exist for water parameters in Mexico, for values recorded in sediments and organisms we resorted to international legislation and literature reports.
As a result, a diagnosis of the coastal localities emerged, which combined with our evaluation at the State level, allowed us to make a General Diagnosis of the Coastal Zone in Mexico.

A regional GIS for benthic diversity and environmental impact studies in the Gulf of Trieste, Italy

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The aim of this study was to build a database and apply GIS techniques with data obtained from 1966 to 2001 in the Gulf of Trieste, in order to determine, for management purposes, the diversity, distribution and evolution in time and space of the local macrofauna in this heavily anthropized region. The application to marine environments of modern tools such as GIS techniques to evaluate biodiversity or sensitivity areas in environmental impact studies is still very limited in Italy. This, in spite of its proved capacity for synthesis and comprehensive visualization of complex interactions among the different components of an ecosystem, which makes it an increasingly sought-after tool for management or protection of the coastal zone. The macrobenthos, in turn, constitutes a most effective indicator of the recent history and health of any given aquatic habitat.

A custom-built relational database was created compiling biological, physico-chemical and sedimentological data from 450 stations, 187 sampling sites and 20 projects. A total of 278,770 organisms from 691 species (Polychaetes: 145,950 individuals, 276 species; Mollusks: 100,432ind, 198sp; Crustaceans: 16,962ind, 109sp; Echinoderms: 10,181ind, 42sp; “Others”: 5,245ind, 66sp) were included. The methodological problems caused by different types of sampling gear and sieving used, as well as seasonal variability were solved, homogeneizing all data. Taxonomy was updated in all cases. Feeding guilds, biocoenotic characterization and Borja *et al.*’s (2000) Biotic Index were included for all the species where information existed. Interactive user-friendly operations as well as complex types of queries were also rendered possible and constant updatings are being carried out.

All the surface analyses were performed using Surfer 7, Didger 2, Idrisi 32 and Cartalinx 1.2. The vectorial map supplied is in Arcview shape file. The reference system is UTM 33-N. Distributions of the specific abundance maps were interpolated using the inverse distance to a 2 power gridding method.

The GIS analysis allowed us to individuate the main stress factors affecting the macrozoobenthic communities and determine the “sensitivity areas” based on intensity and persistence in time of the different disturbances (urban development, industrial and port activities, mariculture, fishing and tourism), as evidenced by their effect on the benthos. Severe impacts were evident in the eighties, while the application of ecological laws since then, seems to have had beneficial effects. The changes in time and space of the dominant species indicated the evolution of the bottom conditions in the Gulf. In this respect, the variations in distribution of the well-known instability indicator mollusk *Corbula gibba* was especially useful and helped to establish the resilience of the system.

Marine biodiversity data: regional and national efforts in Belgium

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To develop a marine biodiversity research strategy and analyses of the marine biodiversity research in Belgium are the objectives of the Belgian Biodiversity Platform (Federal Office for Scientific, Technical and Cultural Affairs). One of the research fields getting specific attention is the development of biodiversity databases. In the field of marine biodiversity genetic, taxonomic and biogeographical databases are developed by a multitude of Belgian research units.

This presentation gives an overview of the Marine databases developed in Belgium. Special attention is given to tools and formats used to share data on the regional, national and international level. Different examples of successful integration of biodiversity data on different levels will be presented.

The analyses by the Belgian Biodiversity Platform show the leading position of Belgian database teams in the field of biodiversity in general, and in the field of marine biodiversity in particular.

The Belgian Biodiversity Platform is also responsible for the use of scientific data in the decision making process. This presentation gives an overview of the problems and specific solutions used in the Belgian context.

What you want is what you get – a web interface for World Ocean Database 98

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The usefulness and importance of the World Ocean Database (WOD) cannot be overstated. Within the world of oceanographic data, this is probably the most comprehensive and most consulted database on physical oceanography parameters. The data from the World Ocean Database are available online, as is a specialised viewer – Ocean Data View (ODV). Unfortunately, the data come in zipped files, which typically contain many more data than the ones needed. ODV, while very powerful, is not trivial to learn to use. The specialist user will be able to invest the time and energy to learn how to download the WOD files, and open them in ODV. The occasional user, however, might be deterred by the complexities. VLIZ decided to build a user-friendly web interface for the WOD, and make the data for the North Sea available through this interface. This activity frames in the objectives of the VLIZ, to make access to data relevant to the North Sea as easy as possible, and where possible through the institute's web site.

All data from the six WMO squares overlapping with the North Sea where extracted from the WOD, and uploaded in a MS SQL-Server database, using a application written in MS VB. The resulting database was compared with extractions from WOD done with ODV, as a quality-checking procedure. The database contains 25 tables; all features of the WOD can be imported, including quality control flags and supporting documentation. Extra fields have been added to allow merging data from other datasets, keeping track of the origin of data.

Data available through the interface came from 10749 'Cruises', 361211 'Stations', 365008 casts. The size of the database is 530 MB. Data can be selected on the basis of measurement type, parameter, time/date or geography. The geographic selection can be done through a graphical interface developed in SVG. Stations can be displayed using the same SVG approach; interaction with the SVG maps (like picking one of the selected stations to display the actual measurements) is realised through a series of JavaScript routines. These data, and also the list of stations and/or cruises resulting from the queries can be downloaded through the browser. A more sophisticated download procedure, allowing users to choose between comma-separated or XML formats, is in preparation.

Distribution of chlorophyll 'a' in the equatorial Pacific Ocean (82°W-92°W), during 1988-1999 (Ecuador)

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During the last decade (1988-1999) 23 Oceanographic Cruises were carried out on board the B/I-ORION of the Oceanographic Institue of the Navy (Instituto Oceanográfico de la Armada INOCAR) in the Tropical Pacific Equatorial. The study area is geographically located between 81°W-94°W and 2°N - 3.23°S. These data are organized by season: dry season (May-October), with a total of 11 cruises, 258 stations and 1650 data; and humid season (December-April), with a total of 12 cruises, 228 stations and 1477 data.

The samples for chlorophyll (1 liter) were taken using Niskin bottles incorporated in a sampling rosette, deployed at eight depth levels. They were filtered with glass-fibre filters, placed in 10 ml of Acetone 90% and refrigerated for 24 hours; the optic densities were read in a Turner Fluorometer (10-005-R). The graphics of averages for both seasonal times of depth levels using the Surfer program.

The results emphasized two areas of higher than average productivity: Galapagos and Gulf of Guayaquil.

A high biomass of chlorophyll (>0.5 mg/m^3) was found toward the south region of Galapagos. Even higher readings (1.5 mg/m^3) were found during the dry season in the neighbourhood of Islands Isabela and Fernandina. In the humid season two regions of high chlorophyll (1.0 mg/m^3) were registered: a nucleus to the west of Galapagos associated with Cromwell Current and another nucleus southeast of Island San Cristobal, possibly associated with a mixture of upwelling Cromwell and Humboldt.

In the Gulf of Guayaquil some of the highest readings for the South American Pacific were recorded, with peaks ranging from 1 to 3 chlorophyll mg/m^3. The readings were highest between 0 and 30 m, the precise depth depending on the intensity of the area of mixtures of upwelling waters and warm waters. During El Niño events the chlorophyll biomass dropped to values of less than 0.2 mg/m^3, due to the discontinuity of the upwelling and/or masses of waters warm poor in nutrients. These areas of more biological productivity in chlorophyll a are associated to areas of higher catches of pelagic fishes and of tuna.

The North Sea Benthos Project: integrating biogeographical data from various sources

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The ICES Benthos Ecology Working Group is integrating recent macrobenthic infaunal data (1999-2001) available from various sources, including national monitoring surveys, in North Sea soft bottom sediments.

Data for the North Sea Benthos Project were provided by 14 marine biology institutions/research groups. Sampling was done in a quasi-standardised way, and occurred mainly in spring and early summer of 2000. A total of approximately 1500 stations was sampled, covering almost the whole North Sea from the English Channel to about 60°N, and an area northwards along the Norwegian oil fields.

Taxonomic names were checked using the database Integrated Taxonomic Information System. After excluding spelling variations, the database contained 1426 taxonomic entities, of which 814 (57%) are unique to individual datasets. The high incidence of occurrences unique to individual datasets indicates that there could be differences in interpretation of the taxonomic literature between the different data contributors.

Data were sent to VLIZ either as Excel sheets, or as structured text or Word documents. Information was then first converted into separate Access databases, taking care to preserve the information as supplied by the research groups. After an initial quality check the data were then uploaded into a central database. This database is an MS SQL server database, with a front-end developed in MS Access. Extensive meta-information (including cruise- and project information, and documentation on quality control procedures and Standard Operational Procedures) is an integral part of the database.

TISBE: Taxonomic Information System for the BElgian continental shelf

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One of the objectives of the Flanders Marine Institute (Vlaams Instituut voor de Zee, VLIZ), and of the Flanders Marine Data- and Information Centre (VMDC), which is part of VLIZ, is to offer data and information to scientists, policy makers and the interested layman. One of the databases under development is a species register for the Belgian coast and adjacent areas (including the Scheldt Estuary). The TISBE database will contain detailed taxonomic information, and information on the distribution within the area of interest. The Marine Species Database for Eastern Africa (MASDEA), maintained by VLIZ and hosted on the VLIZ web site, served as a model while developing TISBE. An effort will be made to minimize duplication of other initiatives, both those within the VLIZ (e.g. the North Sea Benthos Project in collaboration with ICES; Aphia, VLIZ's North Sea species register), and those from other institutions (e.g. the databases developed at Ghent University and the Centre for Estuarine and Coastal Ecology; the European Register of Marine Species). The TISBE database will be integrated in the other databases of VLIZ: literature, datasets, experts and institutions will be taken from the Integrated Marine Information System (IMIS).

The objective of TISBE is to become a comprehensive list of all records of species from the area, with detailed taxonomic and distribution information abstracted from scientific literature. Links with the taxonomic literature and to the original publication of the distribution record will assist in tracing the history of records. By providing a synonymised list of species records, TISBE will be a tool to assess marine biodiversity and to monitor the species composition of the ecological communities along the Belgian coast.

The structure of the data is a modification of the structure used in the International Taxonomic Information System (ITIS), and information from TISBE is easily converted to the ITIS format. Taxonomic reference numbers (TSN), the unique identifiers used in ITIS, are stored in the TISBE database, and permit immediate comparison of the two databases, checking for records that would be missing in ITIS; one of the ambitions with our application is to provide input in ITIS.

Possibilities of satellite remote sensing for monitoring coral reefs in the Red Sea

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Coral reefs are considered as one of the most spectacular marine ecosystems on earth. They are characterised by a tremendous biodiversity and, in many places like the Red Sea, by a high level of endemism.

Coral reefs need our attention because of the importance of their biodiversity and their key role in the tropical marine biosphere. But coral reefs are also very valuable as a socio-economic resource. As coral reefs are main fishing grounds and attractors of large numbers of tourists, they generate important contributions to the national income of many developing countries. Despite these natural and socio-economic advantages, many threats are posing stress on coral reefs. A few examples are: extreme pressure from tourism (anchoring damage, coral collection), irresponsible and illegal coastal development, marine and land-based pollution and, on another level, the 'Global Change'-issue.

Remote sensing from satellites can help to collect information about coral reefs in order to get a better knowledge of their current status. Some satellite sensors are especially developed for marine applications, such as the SeaWiFS-, CZCS- or MODIS-sensor. Others are not but can still be useful, for example Landsat (MSS, TM or ETM+), SPOT or ASTER. All these sensors detect visual light. The blue-green range in the visual spectrum is the most important. In optimal conditions, clear calm water, information of objects up to a depth of 25-30m can be gathered. The newest evolution in marine remote sensing applications is tending to use hyperspectral airborne data and very-high-resolution images, such as IKONOS or Quickbird.

The main advantages of using satellite images, in comparison with traditional 'on the spot' survey methods, are the possibilities to work on a multi-temporal basis and over extended areas. Remote sensing offers the opportunity to gather information over vast areas compared to traditional survey methods where only limited spatially distributed information can be collected. It is also possible to follow up the situation more cost effective in a temporal manner. In that way, remote sensing data is very useful for setting up monitoring programs for distant or intensively used coral reef areas. But of course with the constraint of limited depth penetration, gradually increasing with higher turbidity.

Remote sensing techniques can be used to derive information about the location of the coral reefs (X-, Y- and Z-coordinates), their structure, their composition and their condition. Secondly, remote sensing can also contribute in monitoring the physical, chemical and/or ecological conditions of the Red Sea.

These remote sensing based results combined with additional information concerning the coral reefs in the Red Sea, information on the conditions in the Red Sea, natural hazards and threats, possible bleaching events, different human threats posed on the coral reefs, as well as predictions, give us a wide range of thematic maps and databases which can be combined into a 'Coral Reef GIS'. As one of the outcomes, a 'near real time' risk map can be created which marks the localisation of the reefs in the Red Sea that are under potential stress due to the changing conditions. These maps and others can be used for immediate actions or as a back up for coastal planning, by government, coastal developers, environmentalists or other decision makers.

Biodiversity of Antarctic nematodes: the 'NEMASLAN' project

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Recent biodiversity research reveals that more than 50% of the free-living marine nematode species found in before unexplored environments, such as Antarctica, are new to science. Too few taxonomists remain to describe them all. Additionally, there are problems with the quality control of the identification of nematode samples since fewer labs possess all the literature (and manpower) required to verify the morphological characteristics of the animals.

NEMASLAN, software for a tree-based classification system (Access) is a methodological approach for improving identification, classification and description of specimens in difficult taxonomic groups such as free-living marine nematodes. It seeks to serve as an easy research tool for central management of information of the taxon of the nematodes, and this for people with little training in database technologies.

The program consists of four main modules: (see demonstration)

1. Module for data- entering: provides possibilities to enter geographic, morphological, ecological, and literature data on species in a record database. An additional connection between these database records and the actual digital sources (e.g. scanned literature from original descriptions and good recent publications) enlarges the scientific value of the system.
Personal metadatasets can be created, for example for the use of drawings and/or pictures of undescribed species or not yet published taxonomic papers.
2. Module for document consultation: data sources (PDF documents of original descriptions, text documents, photographs,…) and their references can be consulted.
3. Module for Quick Search: *Morphological data* from the species identification (e.g. *shape and/or position* of amphid, cuticle, buccal cavity, tail, oesophagus, caudal glands and spinneret; *feeding type*; *numerical fields* of de Man ratios, length, setae, nerve ring, excretory porus, spicule, gubernaculum, male supplements) and other information such as *type* of *biotope* and *water depth distribution* can be consulted; datasheets can be generated.
4. Search Module: The output and search within the database can be user configured (i.e. questions like 'give me all the nematode species so far described from the coastal sites with a spicule longer than 30µm and cuticular punctuations' get an answer from this database). SQL (Structured Query Language) is the formal language used to query databases. An in-depth knowledge of the fairly complex SQL language is not required.

The Windows application functions for multi-users in a local network environment (LAN). The program is distributed free of charge through a website (at present http://allserv.rug.ac.be/~tdeprez: later on through a more specified Antarctic database website) at which demonstration datasets are distributed.

NEMASLAN was applied to Antarctic nematodes. The resulting 'Biodiversity of Antarctic Nematodes' CD-ROM version includes an archive of all numerical and nominal information for each species ever described in the Southern Ocean. About 350 species have thus been digitized. There is an urgent need to develop appropriate information tools on Antarctic marine biodiversity for scientific, environmental management and conservation purposes. Therefore, the collaboration of three laboratory pioneers in Antarctic biodiversity databases (e.g. Antarctic nematodes, amphipods and echinids, see other presentations) will seek for further developments such as the construction of a common portal, common mapping applications, or links to pertinent information sources of Antarctic benthic biodiversity. The resulting 'biodiversity information system' will be made available to the scientific community. This will be done within the framework of the OSTC project on Antarctica – BIANZO (BIodiversity of three representative groups of the ANtarctic ZOobenthos). It will contribute to the DIVERSITAS, SA 2000, CoML-OBIS and GBIF initiatives.

Long-term trends of the macrobenthos of the Belgian Continental Shelf (BCS)

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The Belgian Continental Shelf (BCS) covers approximately 0.5% (surface: 2017 km²) of the total North Sea surface, but is nevertheless characterised by a high, natural diversity of marine habitats and associated fauna. The socio-economic aspects within the BCS are also important. As in most coastal areas around the North Sea many human activities take place e.g. fisheries, shipping, military exercises, dumping of dredged materials and sand/gravel extraction.

Combining the high ecological and high socio-economic values of the BCS leads in many ways to profound conflict situations between both interests. To come to a scientific sustainable management of the marine resources, the availability of the following information proves to be fundamentally important: (1) the geographic distribution of the marine fauna, (2) the structure of the communities, (3) their relation with the local physical and chemical environment, (4) the natural ecological and genetic variability and (5) the nature, magnitude and the effect of the anthropogenic influences on the ecosystem.

Macrobenthic organisms are, because of their relative immobility and their direct link with the adjacent environment (sediment, physical/chemical conditions) extremely useful within short- and long term studies covering the ecological effects of natural and anthropogenic influences on marine ecosystems.

Within the periods 1977-1986 and 1994-2000 both the Marine Biology Section (Ghent University, Department Biology) and the Department of Sea Fisheries (DvZ, Oostende) collected thousands of macrobenthos samples, covering the whole BCS. Many of the latter were already processed and analysed for the periods 1977-1983 and 1994-2000. Together, these data cover mainly the western coast and some nearby sandbank complexes. Hundreds of samples from other areas (e.g. east coast, open sea) were, although many times sampled, never analysed. Furthermore, during the period 1977-2000 approximately 30 stations (scattered over the BCS) were sampled for macrobenthos on a regular basis (3 to 7 times per year).

The general aim of this project is to deliver a substantial contribution to the knowledge of the long-term variability within the biodiversity and density patterns of the macrobenthos and its relation to anthropogenic activities. Next to the compilation of a unique dataset of the macrobenthos of the BCS (combined data from all sampled periods), the project will also provide a sound foundation for policy making for the future sustainable management of the benthic habitat of the BCS.

ANNEX

SeamountsOnline, a biogeographic information system for Seamount biology

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SeamountOnline is a project compiling existing information on the biota of seamounts globally and making it freely available through a web-based portal (http:seamounts.sdsc.edu). Seamounts (undersea peaks in the oceans floor) support unique biological communities that are of interest both as natural laboratories for studying biodiversity in the oceans and as commercially-fished habitats requiring wise management. Through this online portal researchers and managers can find the distribution of species of interest, produce species lists for seamounts of interest, and access a searchable bibliography of seamount literature. Because sampling intensities vary greatly across seamounts, with many seamounts highly undersampled, the system also reports the numbers and types of samples that have been taken in a selected area. SeamountsOnline covers a spectrum of metazoan taxa, and obtains the majority of its data from published literature and from electronic datasets donated by seamount researchers and managers. It is a member of the Ocean Biogeographic Information System (OBIS) and can also be accessed through the OBIS central data portal at http://www.iobis.org.