COASTLINE

From Data to Information

INSPIRE - a new Directive

- Understanding the concepts
- The steps required
- Learning from experience
- The future for ICZM information

EUC Coastal Union

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Foreword

The ***Data into Information*** pathway defines the route by which ***data*** (data without meaning) are turned into ***information*** (data with meaning). Indeed nearly all of us at some point in time have collected data of some sort and have, with the aid of a calculator or spreadsheet, processed it into information. Whilst some of us still require access to the raw (unprocessed) data, increasingly the coastal manager, practitioner, stakeholder requires access to the information (the processed data). It is the information rather than the data that has the most practical value in the context of environmental planning and decision-making.

Spatial data and information, collected with the aid of many different types of sensor e.g. remote sensing and GPS, are stored and processed with the aid of digital image processing and/or Geographical Information System (GIS) software, the end product most often being a product of the visualisation tools e.g. an enhanced or classified image or a map. With the Internet, and most recently Google Earth (GE), there are now many powerful desktop tools to provide greater access to spatial information and to communicate the end results of spatial data analyses to a wider audience. Widespread sharing of spatial information also relies upon the existence of spatial data Infrastructures (SDI), data models, metadata, and standards. All are essential components ensuring seamless access to coastal and marine information.

In this issue of Coastline, the data into information pathway is examined in the context of the provision of access to spatial information for coastal management in the EU. Beginning with the example of the Eurosion database and the INSPIRE initiative as a setting, the fundamentals of the data into information pathway are briefly examined, followed by some illustrative examples representing applications at different spatial scales, concluding with a consideration of the key issues facing us in the future to help maximise the benefits of being able to access and communicate spatial information for coastal and marine environments.

David R. Green,
President EUCC - The Coastal Union

Table of Contents

3 Converting data into information: understanding the concepts
4 Converting data into information: the steps required
6 The problem simply defined – the EUROSION initiative
8 The response: INSPIRE – a new Directive
10 Spatial information for ICZM
12 Learning from Experience
16 Mapping European Seabed habitats – MESH project initiative
19 Local solutions for Managing Coastal Information
22 The Future for ICZM Spatial Information
24 EUCC Germany focuses on coastal databases

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Converting data into information: understanding the concepts

Most coastal managers and professionals implementing EU and national coastal policies have to collect and use different kinds of data and information, from different sources, with different formats for very diverse activities and applications. This is often hampered by the absence of a proper harmonised information system. Though national databases and information systems are being created to assemble available public data, there is still a large amount of data and information not accessible and withheld by projects and organisations, including private companies. In an ideal world, coastal data and information would be harmonised, interoperable, and openly accessible. This is what European Directive INSPIRE wants to achieve ultimately.

Data harmonisation & interoperability

Two concepts are essential to the INSPIRE initiative: a) *data harmonisation*, which refers to the standardization of data so that they can be matched with other data and information regardless of the format, b) *interoperability*, the ability of products, systems, or business processes to work together to accomplish a common task. With respect to software, the term interoperability is used to describe the capability of different programmes to exchange data via a common set of business procedures, to read and write the same file formats or different file formats using appropriate transforms, and to use the same information exchange protocols.

While national databases normally provide access to main sources of raw data and information, the same is not true for model outputs and integrated results needed for the decision-making process. Presently, the integration of new data and processed information from other sources, including private companies is under investigation in the Dutch National Information System. This initiative aims to streamline the monitoring data collection with the needs for reporting and processed data (e.g. Water Framework Directive reporting) – not without problems. It is time consuming to assess and gather new data available from new sources, but also to combine them with existing data and process them in new (or existing) models. Agreements between institutions at different levels of governance require strong political support as well as time.

Metadata

Another important aspect of INSPIRE is related to the data itself. When we speak of data we mean data and metadata at the same time. Metadata is 'data about data' for purposes of description, administration, legal requirements, technical functionality, use and usage, and preservation.. What a person forgets about the data, or someone else from another project/organisation never knew in the first place, metadata can remember and explain. This is why metadata plays an essential role.

Although metadata creation might seem quite logical and inherent to the production of datasets, especially regarding geographical datasets, lack of metadata remains one of the main problems coastal managers frequently face. It is normally difficult to locate the data origin, the date when survey was conducted, the person/organisation that produced it and quality information about this data. The variety of data sources also hampers the work since there is no data standard exchange format applying one unified way to describe the attributes for e.g. a habitat, as identified in the framework of seabed mapping.

Standards

In terms of standards, an international standard has been developed by ISO (*the International Standardization Organization*) to provide a standard structure for describing geographical data – ISO 19115. This standard defines the schema required for describing geographic information and services. It provides information about the identification, the extent, the quality, the spatial and temporal schema, spatial reference, and distribution of digital geographic data. One can use it for the cataloguing of datasets, clearinghouse activities, and the full description of datasets such as geographic datasets, dataset series, and individual geographic features and feature properties.

Despite these considerations a major question remains - why are these underlying concepts not being applied? The answer may be easy: there is no framework setting common, unifying, data collection and production measures and a proper agreed exchange format between organisations. The other aspect is that metadata does not provide the answer to all the issues. Metadata as described by ISO19115 only accounts for data discovery enabling the user to find and make some assessment of the fitness for purpose of the data. It does not support the 'use' of the data, meaning the user will still need to unpick the actual dataset to find the content they require.

This state of affairs has been the trigger for the development of the European spatial information infrastructure initiative which has led to the INSPIRE Directive.

Maria Ferreira & Irene Lucius - EUCC - The Coastal Union

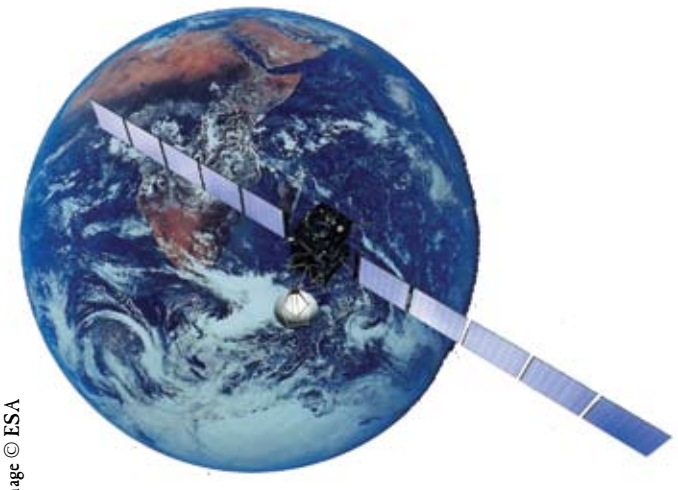


Image © ESA

Converting data into information: the steps required

A maxim in the generic Information Science community is that "Knowledge stems from Information which springs from Data", a concept that permeates every research endeavour and discipline. Some expand on this adage, which becomes "Knowledge stems from Experience in applying Information that springs from (intelligent) Analysis of Data." So how can coastal researchers best transmute their Data into Knowledge – or even meaningful Information? Focusing only on the Data-to-Information step of this Knowledge creation process still presents us with the tricky issue of "intelligent Analysis" of data.

Without reverting to a description of the basic research process, the first step in collecting meaningful data is in setting a well defined research goal. We already know that in this nebulous area called the 'coastal zone' such goals will be highly disparate due to the multidisciplinary nature of coastal research. Thus one can expect that the data requirements will likewise be highly dissimilar. Yet some data, such as the topography or geology of that physical bit of the 'coastal zone' under investigation, is a relatively invariant requirement for locating or underpinning other data attributes, if not 'invariant' physically and temporally! One giant step forward for coastal researchers would be to have a single, continuous, contiguous underpinning 'coastal infrastructure', extending from X km onshore to Y km offshore, with X and Y to be agreed by the community, onto which they could map the other data attributes specific to each research objective.

Underpinning datasets

Such underpinning datasets are absent from most of Europe, with only very few, often localised, exceptions, such as the 'Hydrospatial' data product produced by SeaZone Solutions Ltd in the UK for very select sections of the British coastline. If they did exist, then at least the researchers – and those who must act on their research results – would know that 'Project A' and 'Project B' used the same underpinning geophysical data. Absence of such datasets throws in an unknown from the very outset of the research project, as far as comparing results with other, similar projects – even those conducted by the same research team at later intervals, unless they use exactly the same procedure for creating their underpinning geographic data infrastructure every time.

The second step is identifying the types of data needed to support the analysis required to reach the goal. This is a bit iterative, since the type of data likely to be available already or at an acceptable cost, within typically limited budgets, may determine the extent to which analysis is possible and the form that the analysis will take. Conversely, if a well defined goal can only be achieved using one prescribed analytical methodology (for whatever reason), then this will determine the type of data needed, regardless of the cost – and if the cost is too high, the research may not be completed.

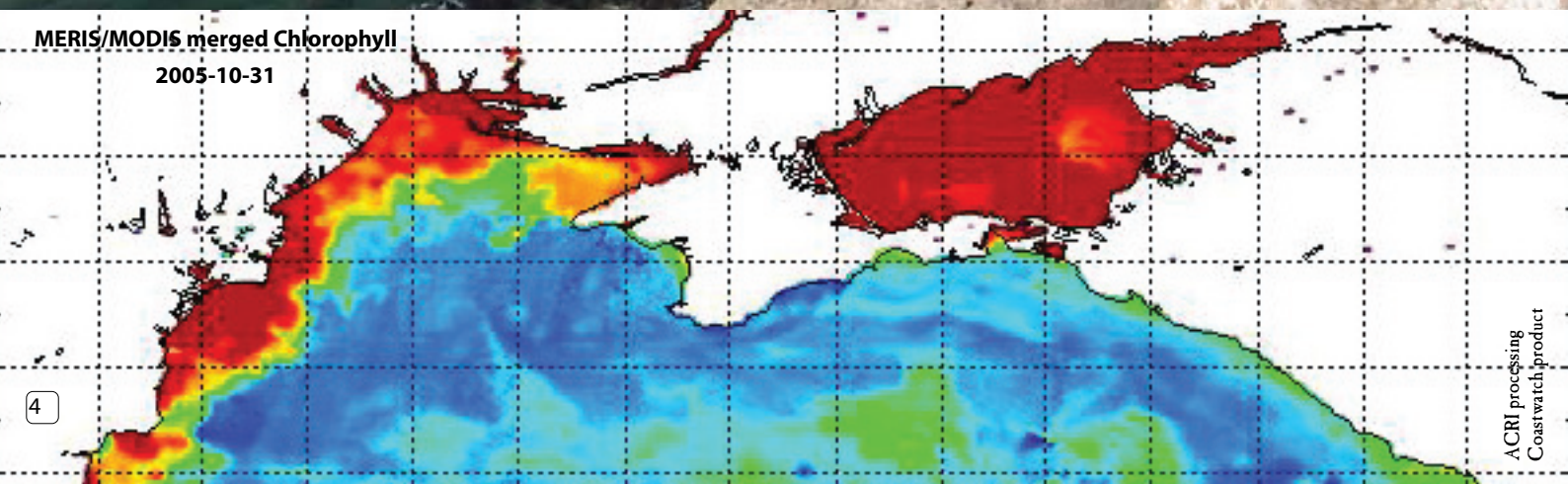
Already available?

Thus, an early question for researchers is – "Is this data already available from somewhere else?" – or at least similar data or perhaps datasets onto which we can add some new attributes, thus hopefully saving time and money in the process? This is especially important in the coastal zone, where data collection costs are typically much higher than for purely land-based investigations, especially working in highly dynamic intertidal zones. Sadly, this is seldom the case, since each investigation typically requires collection of new data or at least new attributes to existing data – either of which can be expensive. However, simply knowing what data is available already is the first hurdle, and one that initiatives such as coastal or marine spatial data infrastructures (SDIs), few though they be, are trying to help solve, typically within a larger, more generic (topographic) national SDI programme. Here is where creation and publishing of standardised metadata is of crucial importance and is a critical link in the Data-Information-Knowledge value chain.

Correct format?

Even if an existing data source is identified that could be useful, the second question is typically "Is the data in the correct format for my research goal?" Experience informs us that in many cases, it will not be, leading to the third question – "Can I transform this data into a useful, usable format for my research objective?" Here, too, creation of a common coastal/marine SDI could help by, for example, stating what format or formats different types of data should be recorded in and/or what transformation algorithms are permitted or exist for transforming one existing format to another, their provenance, their legal acceptability, etc. These are issues that some coastal and marine information research projects are now examining.

Photo Jeanine Dietz



Unified Modeling Language (UML)

Even if an existing data set is found that is of some use, either as it exists or after transformation, the data is unlikely to have all the attributes needed for the specific research project in question, if for no other reason than temporal limitations, i.e. when was the data-set created initially and is that relevant to the current research. This issue typically leads to defining what additional attributes must be added to existing data (if available) or even the collection of the same attributes but for a later time frame - and the cost of collection. In this instance, SDI principles alone will be of little use in reducing the cost for this specific research, yet the new data, if collected using standards defined in the SDI, will become that much more useful to future researchers working in similar research areas. Also, at this stage, the researcher should be creating a standardised data model and/or model describing the analytical process, using something similar to the Unified Modeling Language (UML). Experience shows that far too few researchers complete this step, until perhaps just prior to publication date, when it should be a prerequisite to applying the data analysis methodology.

Governance

However, another issue – and one that disinterests most scientific researchers and even operational managers - is that of 'governance.' What do we mean by governance? In relation to spatial data, governance relates to taking long-term responsibility for custodianship, preservation, and dissemination of data, publication of metadata, and a range of other information systems and services related issues. Without governance, spatial data collected for one project may never be available to other potential users, who then expend considerable time and money collecting the same or similar data all over again. Without governance, research budgets realize a lower return on investment than could otherwise be achieved. This is why governance is also an important principle within most SDI strategies and visions, coastal or otherwise.

Meaningful steps

Assuming that we have now located, updated and/or collected (from scratch!) the data that our analytical methodology deems necessary to continue with our research, the next step is to get on with the analysis, discuss the results with colleagues, publish, defend, justify, etc. Of course, along the way, we should have:

a. created up-to-date, standardised metadata for the data we produced (however that was achieved), preferably within the framework of an agreed SDI,

b. published that metadata on an industry standard geoportal (since the data will be inherently geospatial in nature) again using the standards set in an agreed SDI, and

c. codified and published standardised descriptive metadata describing our analytical approach (an area of metadata research that the standards community is only now focusing on) since this may further qualify the appropriateness (or not) of some other researcher using our data in a way for which it is not suited or intended, and

d. published the data model(s) developed in the earlier stages of the project.

These are all meaningful steps on the way to converting Data to Information.

Roger Longhorn
EUCC Board Information Policy Advisor, IDG (UK) Ltd

The problem simply defined - The EUROSION initiative

Photo U. Dornbush

All European coastal states are to some extent affected by coastal erosion. The prospect of further sea level rise due to climate change and the heritage of mismanagement in the past imply that coastal erosion will be a growing concern in the future. This motivated the European Parliament in 2001 to initiate the EUROSION project on developing coastal erosion policy recommendations. In order to support the definition of this set of recommendations, a Europe-wide GIS database was produced. The process of filling this database with appropriate data and information proved to be a challenge and highlighted many of the problems addressed by INSPIRE.

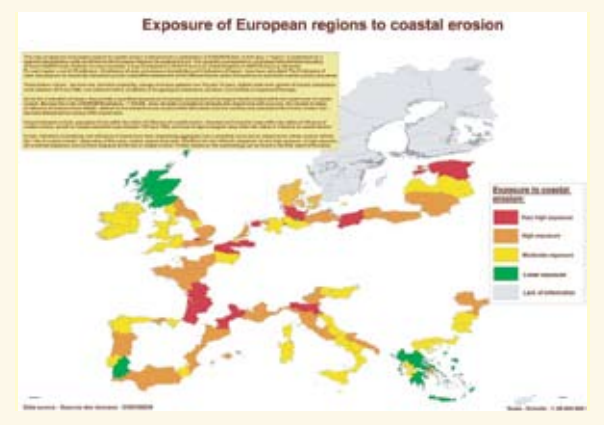
The EUROSION GIS database has a scale of 1:100,000 and can be viewed with any standard GIS software package. It contains 19 layers of information including administrative and maritime boundaries, coastal elevation and bathymetry, coastline, geology, geomorphology, coastal infrastructure, coastal defence works, erosion trends, land cover, land cover changes since 1975, wave and wind regime, sea level rise, tidal range, river sediment transport, areas of high ecological value, budget invested in coastal defence, and regional exposure to coastal erosion risk. Most of these layers are copyright-free and can be obtained from EUROSTAT, and some can be downloaded from the EEA website (http://dataservice.eea.europa.eu/dataservice/). Others are copyrighted and require the authorisation of data providers.

www.eurosion.org

The process to produce and gather this information has faced many difficulties. The main problems encountered were:

- the existence of a large variety of formats,
- many geographical gaps,
- non-harmonised reference systems,
- inconsistency of data sources,
- incompatible scales,
- lack of interoperability,
- enormous costs and access restrictions.

With an overall budget of 2 Million EUR for the development of the EUROSION database, 41% had to be spent on updating existing data (e.g. coastal erosion datasets) and/or format conversions, integration and quality control. Of the remaining budget, 28% was spent on acquisition of licensed data (e.g. elevation) and 33% on production of missing data (e.g. hydrodynamics).



EUROSION Recommendation nr. 4:
Strengthen the knowledge base of coastal erosion management and planning: The knowledge base of coastal erosion management and planning should be strengthened through the development of information governance strategies. These should be the starting point with information on 'best practice' (including learning from failures), for a proactive approach to data and information management and for an institutional leadership at the regional level.

In European Commission. Living with Coastal Erosion in Europe – Sediment and Space for Sustainability. Luxembourg: Office for Official Publications of the European Communities 2004 - 40 pp.
Available online at www.eurosion.org

Key findings

At the information management level, the key findings of the project confirmed that in spite of the availability of tremendous amounts of data, information gaps continue to exist. Practices of coastal information management – from raw data acquisition to aggregated information dissemination - suffer from major shortcomings, which may result in inadequate decisions. Unexpectedly, regional and local stakeholders almost never considered sharing and disseminating coastal data, information, knowledge and experiences. It has become clear that the use of a better knowledge base for projection of coastal development could help in reducing technical and environmental costs of human activities (including measures for coastal erosion mitigation) and anticipating future trends and risks.

Furthermore, both at European and local levels, extensive experience was gathered in the field of data collection, combination and processing. Generally speaking, the European scale of work ranges from 1:1 million to 1:3 millions, unsuitable for local or regional management. A number of applications require that data have a consistent structure and format Europe-wide.

EUROSION recommends

As a result of this study, specific recommendations were prepared for EU, national, regional, and local levels. These propose a proactive approach to coastal data and information management, promoting the institutional leadership of regional authorities in facilitating access to existing data sources, advising on future production of information and knowledge, and sharing best practice in the field of shoreline management.

One of the main conclusions of EUROSION was to recommend the establishment of a European map of coastal sediment cells which illustrates the requirement for local and regional application. By ensuring that local data fits within a specific Europe-wide structure, the opportunities for cross-combination of local data increase and the exchange of experience and methodologies becomes more efficient.

Maria Ferreira, EUCC - The Coastal Union



Photos Maria Ferreira

The response: INSPIRE - a new Directive

The INSPIRE Directive – "*Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)*" [1] - was published in The Official Journal of the European Union in April 2007, following more than 12 years of preparatory work in developing the concept for a Pan-European Spatial Data Infrastructure.

Directives are legal instruments which all EU Member States must implement in national legislation or regulations, unless they can prove to a legally constituted monitoring authority (created by the Directive) that existing legislation already covers the main objectives and principles set out in the Directive. INSPIRE came into force on 15 May 2007 and EU Member States have until May 2009 to adopt legislation enacting the Directive and the technical "Implementing Rules" that bring the various Articles of the Directive into practical application. Full implementation of all the Implementing Rules for the 34 broad spatial data themes covered by the Directive is not required until as late as 2019, in stages, depending upon the priority that has been assigned to various themes. The 34 data themes are listed in three Annexes to the Directive, grouped by priority, and many cover spatial data that is relevant to coastal research and management, whether for environmental, economic or social impacts.

The INSPIRE Directive defines spatial data infrastructure (SDI) as "infrastructure for spatial information ... covering metadata, spatial data sets and spatial data services, network services and technologies, agreements on sharing, access and use of such data, and coordination and monitoring mechanisms, processes and procedures, established, operated or made available in accordance with the Directive." INSPIRE creates a general framework for SDI primarily, but not solely, related to planning and monitoring of Community environmental policies and associated policies or activities which could have an impact on the environment. This main aim certainly has a direct impact on the coastal communities in all EU Member States with coastlines. INSPIRE Implementing Rules (IRs) will set out harmonisation principles and legally binding technical guidelines so that these dispersed datasets, within individual SDIs, can be viewed within a single technical and legal framework.

[1] *http://eur-lex.europa.eu/LexUriServ/site/en/oj/2007/l_108/l_10820070425en00010014.pdf*

Implementation rules

The Directive provides for five types of Implementing Rules (IRs), which describe how the different elements of the overall spatial information system will operate across Europe, i.e. metadata, data sharing, data specification, network services, monitoring and reporting. The Drafting Teams now working on the IRs comprise volunteer, international experts with specific domain knowledge, operating in an open consultation environment, supported by Spatial Data Interest Communities (SDICs) and Legally Mandated Organisations (LMOs). EUCC – The Coastal Union – is a registered SDIC, one of five or six representing different parts of the wider marine community.

The Directive does not require collection of new spatial data, but rather relies on increasing access to existing datasets via pre-existing SDIs within Member States, where such SDIs exist, and by promoting development of national SDIs where they do not yet exist. INSPIRE does not affect existing intellectual property rights (IPR) in ownership of geospatial data, nor does it require that all such data must be made available for free, especially not in cases of commercial exploitation of such data. The Directive is directly relevant to most public bodies that collect, use or disseminate any data with a location attribute, i.e. information that includes a reference to a two- or three-dimensional position in space as one of its attributes, not discounting the temporal aspect of such data. This broad definition is thought to encompass as much as 80% of all publicly held datasets and certainly applies to virtually all data used by the coastal research and management community.

Get inspired

The key objectives of INSPIRE are to increase wider knowledge of existence of spatial datasets collected by governments at all levels, by enhancing the ability to find such datasets via on-line searching using harmonised metadata. Potential new users can then view, access or even download the datasets of relevance to their own needs, within various limits, such as IPR considerations. Thus interoperability and data sharing are key principles covered within the Implementing Rules (IR) now being developed by the Drafting Teams, who work under guidance and coordination of the SDI Unit at the European Commission's DG Joint Research Centre, in Ispra, Italy. As a registered SDIC, EUCC – The Coastal Union – has the right – and responsibility - to provide information to the Drafting Teams that would aid their work in regard to the coastal environment and to comment officially on the conclusions and recommendations made by the teams.

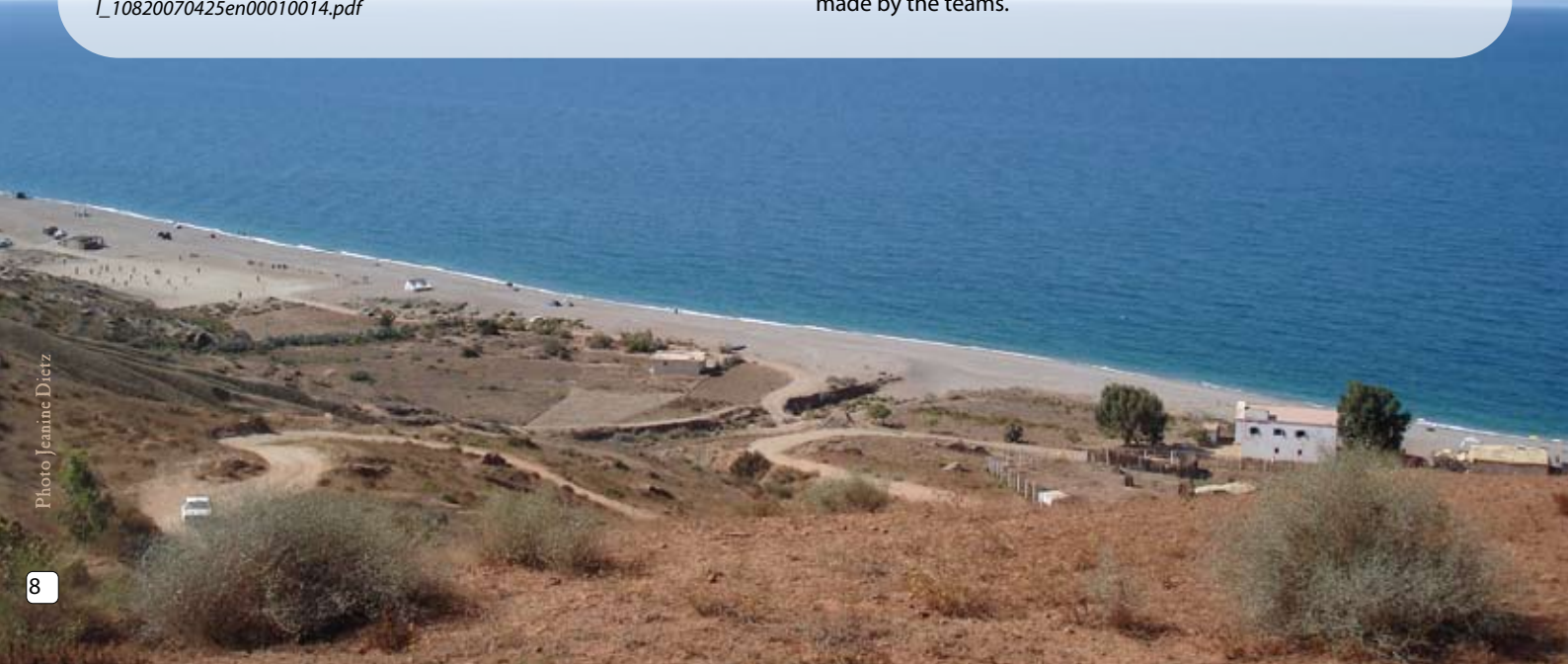


Photo Jeanine Dietz

Relevant coastal data themes listed in INSPIRE Annexes

One problem for the coastal community, in relation to monitoring and contributing to INSPIRE, is that so many of the data themes apply to one or more stakeholder groups operating in the coastal environment.

In Annex 1, which has the highest implementation priority, primary themes of interest include:

- Hydrography (marine areas, river basins and sub-basins, rivers, coastlines)
- Protected sites (areas designated by international, European Community, and national legislation aimed at achieving conservation objectives, e.g. Special Areas of Conservation etc)

Annex 2 (second highest priority) includes:

- Elevation (digital elevation models for land, ice and ocean surfaces, bathymetry and shoreline)

Annex 3 (lowest priority) includes:

- Environmental monitoring facilities
- Production and industrial facilities
- Agriculture and aquaculture facilities
- Population distribution – demography
- Area management / restriction / regulation zones and reporting units - areas managed, regulated or used for reporting at international, European, national, regional and local levels (e.g. areas for dumping of waste, prospecting and mining permit areas, river basin districts, coastal zone management areas)
- Natural risk zones (vulnerable areas such as flooding and landslide areas)
- Atmospheric conditions
- Meteorological geographical features
- Oceanographic geographical features
- Sea regions
- Bio-geographical regions
- Habitats and biotopes
- Species distribution
- Energy resources
- Mineral resources

With potential coastal interests embedded in so many different data themes, as defined by the INSPIRE Annexes, it is easy to see just how difficult it is for the coastal and wider marine community to proactively participate in the development of the all important – legally binding! – Implementing Rules.
EUCC calls on all members of the coastal community to assist in providing the Drafting Teams with as much advice as possible based on the specific requirements of their areas of interest in coastal affairs.

For up-to-date information on INSPIRE, check out these key web sites:

- The Joint Research Centre provides background and up-to-date information regarding INSPIRE at inspire.jrc.it.
- The JRC is also developing a pilot pan-European geoportal at eu-geoportal.jrc.it.

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Image © ESA - ERS 2 radar view of Strait of Messina, Italy

Spatial Information for ICZM

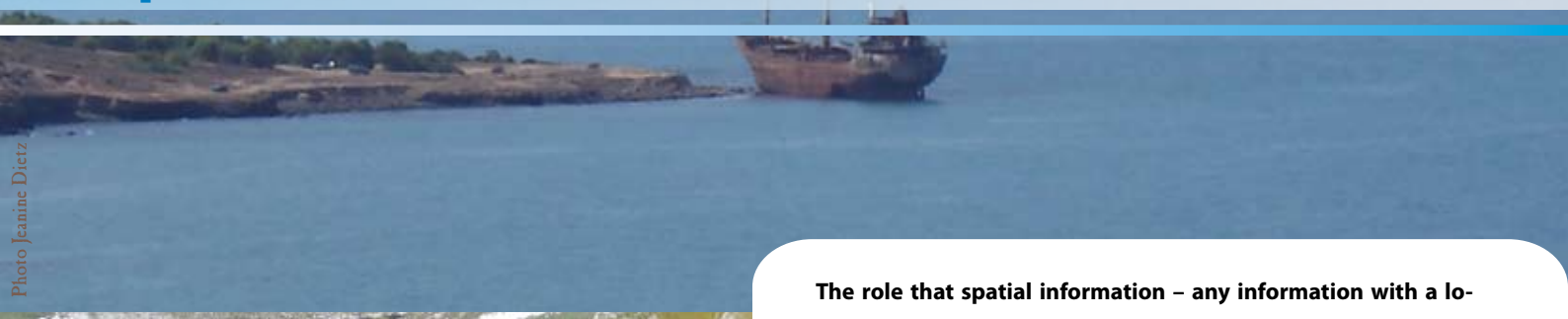


Photo Jeanine Dietz

Image © ESA

Photo Rijkswaterstaat - The Water and Beach Profiler (WESP)

The role that spatial information – any information with a location attribute – plays in Integrated Coastal Zone Management (ICZM) has been researched, tested, piloted, reviewed, standardised, harmonised, integrated and made interoperable – or not, as the case may be - for more than 20 years now in EU funded R&D, environmental and regional development programmes and in other regional and global coastal and oceanographic research initiatives and conventions.

Yet many in the marine and coastal research and environmental management community feel that we have made too little progress. Why? Buried in the excitement of their latest project, coastal researchers perhaps forget that their main output, their 'added value' to society, is the information they produce. If that information can also be used by others, then a tremendous return on investment has been achieved. If it remains locked away in proprietary data formats, lacking standardised metadata to describe it accurately and to advertise its existence, then added value is much reduced. Will initiatives such as the pan-European INSPIRE Directive make any real difference in the next 20 years? Only time will tell.

Common terminology?

One basic issue is simply terminology. One research paper in 2002 identified more than 22 legal definitions of a 'coastline' – just in the EU! Different types of 'coastal' scientific research often relate to different types of 'coast', generically, specifically and geographically. Yet this is not a terminological problem unique to coastal stakeholders. At a workshop on semantics and metadata held at the UK's National Institute for Environmental e-Science (NIEeS) in 2005, the forestry and agricultural community presented more than 27 definitions of a 'tree'! The problem lies in expressing and understanding the semantics of how the term 'tree' is being used at any one time and for what purpose. We face exactly the same issues with much of the terminology in the marine and coastal communities. It is unclear if this level of understanding of information science is being instilled in our coastal and marine research graduates, right along with the specific knowledge they need to become specialists in one of the myriad aspects of the marine and coastal environment in which they will operate.

Complexity of coastal environment

Secondly, we have the issue of the truly complex nature of the physical, geographic, geological and socio-economic 'coastal environment' - and hence of coastal research and management needs, addressing issues and problems which span a multitude of disciplines, many of which are wholly unrelated to one another. All may operate 'in the coastal zone' and their results have a direct bearing on ICZM issues, yet they can hardly be lumped into a single 'ICZM basket' when it comes to information needs, standards or data integration. This is an issue that the European Commission is facing today in attempting to define practical implementation rules and guidelines for the INSPIRE Directive in data themes so ill defined as "managed units" or "habitats" or "elevation", which exist in myriad, quite different forms on land and sea.

The coastal urban planner needs to locate, acquire, harmonise and integrate datasets covering demographics, transport systems, planning regulations and restricted areas, alternative local or regional development goals, tourism and possibly industrial and agricultural data, in order to conduct or monitor a specific development plan for a coastal region. Their data requirements will be quite dissimilar to the aquaculture researcher investigating placement of a near-shore mussel farm or dredging operator looking for a near offshore debris dumping site. Yet some of the same datasets will be needed by all, since so much of what happens on land impacts directly what happens in the sea – and vice versa. These disciplines have very little in common in terms of background, experience, terminology or objectives. How can they communicate, if and when that becomes necessary? As information systems become ever more automated, moving into the realm of multi-disciplinary modelling, widely dispersed data and computational grids, where the goal is to reduce human interaction to a minimum – how can the goal be reached when we lack common, multi-disciplinary, multi-lingual terminology that can be recognised and accurately interpreted by a machine or programme?

The need for project liaison

How are we tackling some of these basic issues? The EU has already funded projects specifically focusing on marine data, such as MERSEA, MarineXML, DISMAR and MOTIIVE, all now complete, and the more recently launched SeaDataNet, HUMBOLDT and ECOOP (European Coastal sea Operational Observing and Forecasting system). These latter projects have from 25 to 70+ partners from 20 or more countries, and multi-million euro budgets. They are addressing many of the same issues on metadata, data specifications, semantics, definitions and 'common' terminology for controlled vocabularies or thesauri (mono- or multi-lingual). Yet there is little formal cooperation between these projects and problems always exist with timing, i.e. one project begins as another is half completed and yet another has finished. How are the results of each, often (usually) arrived at independently, supposed to be incorporated into the results of the still on-going projects? Liaison is a tricky and expensive business. Yet if we do not find ways and means to better coordinate such efforts, much of this research will be less productive than desired, with resultant waste of always limited research funding.

Roger Longhorn
EUCC Board Information Policy Advisor, IDG (UK) Ltd

Image © ESA

Learning from Experience

Coastal stakeholders´ needs and practices in terms of data and information are very diversified. While they vary according to the level of influence and the specificity of the policy issue being tackled, the constraints and difficulties are common. Capitalisation of existing knowledge is the key to better understand this state of affairs. Therefore, a representation of experiences and practices of key coastal managers and professionals from national and regional governmental authorities, conservation bodies, and private companies, and findings from projects and initiatives in the European Union have been identified.

Scotland

Offshore Windfarm Siting

Geographical Information Systems (GIS) are often an ideal tool to assist in environmental siting exercises. In the past, for example, GIS has been used as the basis for the optimal siting of artificial reefs. Using a simple thematic spatial overlay approach with layers and siting criteria (e.g. site within a certain distance of a sewage outfall; outwith areas of geological fault lines) it is possible to identify one or more spatial locations that would be optimum for placing an artificial reef.

With growing interest in renewable energy sources and environmental concern over carbon emissions, GIS has also been considered as a tool to aid in examining the possible location of offshore windfarms. A number of studies have already utilized GIS to determine the best location for windfarms or windparks often in environmentally sensitive or congested coastal areas.

One such example is the AREG (Aberdeen Renewable Energy Group) (http://www.aberdeenrenewables.com/) proposal for Aberdeen Bay in Northeast Scotland. Demonstration of the potential of GIS (and the related geospatial technologies) for locating an array of wind turbines was recently explored at an ECO-IMAGINE workshop using a selection of thematic overlays from numerous different spatial data sources including those of SeaZone Solutions Limited (www.seazone.com), the Macaulay Institute (http://www.macaulay.ac.uk/) and the East Grampian Coastal Partnership (EGCP) (http://www.egcp.org.uk/), Scottish Natural Heritage (SNH) (http://www.snh.org.uk/), and others. Using an approach known as user-conflict mapping, potential sites for the location of the windfarm can easily be isolated by examining current uses. This provides the basis to explore the best location for the windfarm in areas where there is minimal conflict. GIS provides the tools to input, store, manipulate, display, visualize, and communicate the results of such an exercise. Internet-based options, such as online mapping tools, also allow for the sharing of maps and information with a wider audience through the Internet.

Additional developments provide the means to visualize the coastal environment in such a way that can involve and engage the public and the planner in such a proposal allowing for greater individual involvement in the planning exercise. In Aberdeen, Scotland, the Macaulay Institute, for example, has refined such an approach with the aid of a portable landscape visualization theatre (http://www.macaulay.ac.uk/landscapes/) that allows the theatre audience to fly through the proposed windfarm, to change the visual landscape, altering the view from a day to night view, the prevailing weather conditions, and to examine the various siting options. Further developments allow the participant to vote on various landscape views. In so doing a planning proposal can be used with different audiences to gain a better and more realistic insight into the planning process.

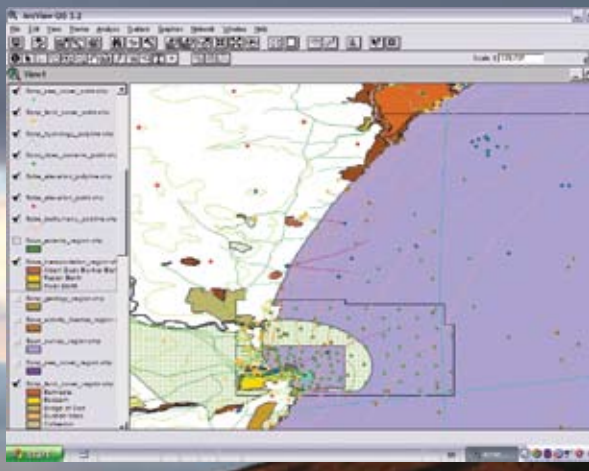
Photo coshie.co.uk

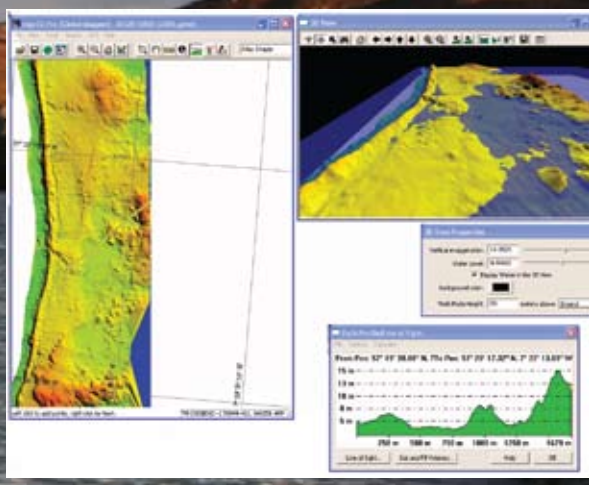
Examining Coastal Change

Growing environmental concern about the potential impacts of climate change and sea-level rise at the coast, and the frequent lack of detailed and up-to-date information, has led to the use of GIS and remote sensing to help identify coastal areas vulnerable to change over time. In Scotland, a recent SNH funded study in the Aberdeen Institute for Coastal Science and Management (AICSM) (www.abdn.ac.uk/aicsm) at the University of Aberdeen, has utilized both panchromatic and colour aerial photography and GIS as the basis for identifying areas of coastal erosion and accretion.

Focusing on a number of beach and sand dune systems around the Scottish coast, this study uses two sets of aerial ortho-photographs, separated by an approximate interval of twenty years, to derive digital elevation models (DEMs) that are subsequently analysed through a differencing technique, using ESRI's ArcGIS software, to identify areas of loss (erosion), no change (static), and gain (accretion) over time. Using a DEM also means that such changes can be quantified as volumes.

Presentation of the results of the change data analysis in the form of 2D maps, as well as maps draped over a digital elevation model, also provides a useful way to visually communicate the areas of change identified through the analysis. Generation of terrain fly-throughs for the study areas also significantly improves the opportunity to successfully communicate the results of an analysis to a wider audience, aiding audience understanding and participation.





Macro-Algal Weedmat Monitoring and Mapping in an Estuarine Environment

Combining multi-temporal aerial photographic surveys and GIS tools provides a practical basis to help monitor and map the spatial distribution and spread of macro-algal weedmats in estuarine environments. Such a study has recently been undertaken in the Ythan Estuary to the north of Aberdeen in Scotland, UK, in an attempt to establish whether or not local concern about the apparent increase in the extent of macro-algal weedmats and their potential impact on bird feeding areas over time were justified.

Both panchromatic and colour aerial photographs for the period spanning 1994-2000 were scanned for input into a desktop computer system. Using Leica's digital image processing software Erdas Imagine 8.7, the aerial imagery was geo-corrected and mosaiced for input to ESRI's ArcView 3.3. GIS software.

On-screen interpretation of the aerial imagery and digitizing of the boundaries of the weedmat units identified provided the basis for generating maps of the weedmat extent and quantitative spatial assessments of the weedmat areas for each year analysed. Photographic interpretation was aided by the use of additional thematic overlays including Ordnance Survey (OS) maps, substrate maps, and fieldwork.

The maps and imagery generated were input to Google Earth (GE) to help in communicating the results of the analysis to local coastal stakeholders .

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Germany and Poland

The Coastal GIS Oder Estuary

Coastal managers in the Oder Estuary region are faced with several challenges. They have to deal with a lot of European and national policies related to coastal issues. Furthermore, the whole system of the Oder river basin, the Oder lagoon and the Baltic Sea has to be considered in coastal management. Heavy eutrophication, for example, and water quality problems in coastal waters are consequences of the nutrient loads in the Oder river. Therefore, extremely careful consulting processes between various institutions and across the German-Polish border are necessary. Against this background, visualization of complex facts and problems is essential for coastal managers, to provide a understandable basis for dissemination and discussion.

User needs in the Oder Estuary region

The common tools to deal with spatial problems and their visualisation are GIS. But coastal practitioners are hardly using this instrument as it requires trained personnel. Furthermore, there are several problems with spatial data in Germany and the Oder estuary region. There is a lack of available information. Information is widespread and difficult to recover, there is only few accessible spatial data and it is mostly divided by the coastline or the border in separate data, which is again difficult to access. These deficits lead to great shortcomings in coastal management within the region. In order to fulfil the requirements of different policies, regional coastal actors need free and easy accessible spatial data, which should be cross-sectoral, cross-border, transparent and cost-effective.

The web based GIS Oder Estuary

The first comprehensive coastal GIS in Germany was developed within the national case study ICZM-Oder to provide integrated coastal zone management within the region. The GIS is one out of different tools integrated in the "Coastal Information System Oder Estuary". Linked information tools ensure, that information is presented in the best understandable way to improve regional communication and participation processes. The GIS Oder Estuary allows free access to regional spatial information. For the first time, multi-disciplinary spatial data are presented across borders as well as across land and sea to a large community in Germany.

The GIS contains a lot of previous project results, e.g. potential flood-prone areas and flood protection installations. Thus, the GIS can be already used for climate change and flooding questions, by visualising different flooding scenarios and comparing them with existing and planed utilizations. This is just one example of how to use the GIS for management purposes.

Lessons learned and Perspectives

The GIS Oder Estuary is increasingly used, as server statistics show. Visualisation and the overlay of different themes increase the understanding and awareness of complex problems. The web based GIS is available for everybody and it can be operated by everyone. Furthermore, the GIS can be seen as a data container, which visualizes existing results and makes them available. Although, the web based GIS cannot replace existing local GIS, which allows a more comprehensive analysis.

The GIS is hosted by a reliable coastal NGO to ensure to the future maintenance and long-term access. Integration in future regional projects as well as a link-up to other coastal related information systems is aspired for further development.

The GIS and further information you will find on www.iczm-oder.de.

Ramona Thamm
EUCC - Germany

Photo Bert Verver

Spain

Photo Pedro Fernández Bautista

Regional data & information GIS system - the Catalonia and DEDUCE project experience

The Department of Environment and Housing of Catalonia (Spain) is leading the European project DEDUCE, which deals with setting common methodologies for the calculation of sustainability indicators (27), in support of the EU Recommendation for the Implementation of Integrated Coastal Zone Management.

DEDUCE www.deduce.eu stands for "Assessment Model for the Sustainable Development of European Coastal Zones" and is financially supported by the INTERREG IIIC - South programme. It joins nine European partners, most of which representing national and regional authorities. The main goal is to improve the tools and the information systems necessary for optimum decision making about the coast, at different levels: European, national, regional, and local. For this purpose, an assessment of existing tools, in particular web-GIS and procedures on collection of data and have been developed. The definition of common methodologies for calculating the indicators (standard indicator format) and common graphical and cartographical representation of indicators have been defined. This required an assessment of each indicator in terms of data availability, accessibility, accuracy and quality. The main conclusions from this assessment are that various types of data and formats and very different visualisation tools such as GIS exist among the different partner countries/regions. There is no common information system in use. The development of such a common system has not been the goal of the project, but the common methodologies might provide the basis for such an infrastructure in the future. In order to support this process, a set of guidelines for the future use of state of the coast indicators has been developed as result of the completion of the 3-year project.

The Department of Environment and Housing of Catalonia (Spain), the lead partner of DEDUCE, collects environmental information and presents it in a GIS-based information system, freely available through their public website. The system is supported by a GIS technology – MiraMon – which is easy to use. The website www.gencat.net/mediamb/sig/sig-a.htm provides a MiraMon Map reader as download as well as the cartographical layers. The Department is presently moving its cartographical information system to the new structures based on Arc Gis. At regional level, there are no major problems gathering terrestrial data, because data exchange among relevant governmental departments is free and well established. However there are data gaps concerning the marine zone, in particular in what concerns bathymetric data.

Though the geographical information system provides a good basis for department work, it is far from being finalised. In 2002, the Cartographic Institute of Catalonia created the Catalan SDI (Spatial Data Infrastructure) framework www.geoportal-idec.net with several services. In the Catalog Services you can find more than 20.000 metadata records about data sets provided by 80 organisations and about 40 metadata describing different geo-services provided by Web Map Servers. At present, a regional law recognizes the infrastructure.

Xavier Martí
Department of the Environment and Housing,
Government of Catalonia, Spain

Mapping European Seabed Habitats - MESH project initiative

Image © ESA

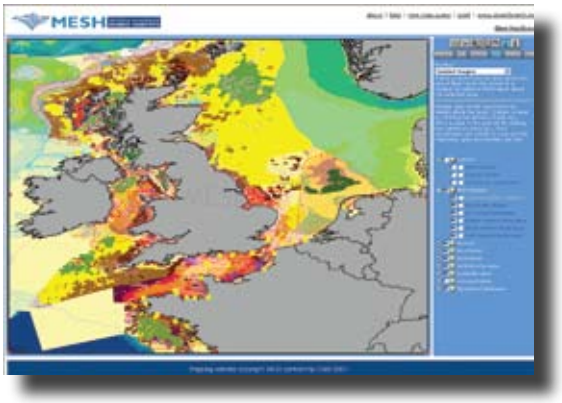
Our seas around north-west Europe support an exceptionally wide range of habitats, with associated flora and fauna having a rich biodiversity. These habitats provide important food resources (e.g. fish, shellfish) and yield valuable natural resources (e.g. oil, gas, and aggregates). Consequently the seabed is subject to increasing pressure from extraction and new developments, such as for renewable energy (e.g. wind-farms, tidal power) and coastal developments. Balancing the demands of development and our need to exploit resources with the requirement to preserve the integrity of marine ecosystems necessitates much improved sea-use management and planning, which in turn creates a substantial demand for information about seabed habitats.

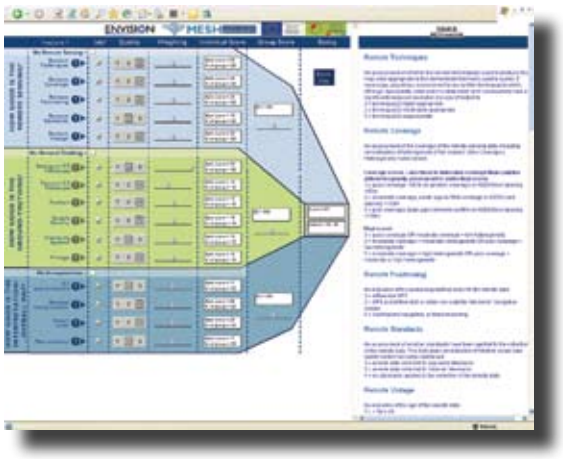
In addition to the requirement of seabed habitat information for marine management, European policy concerning access to public sector environmental information and implementation of data standards and harmonisation mean that government agencies have legal obligations to fulfil. Effective metadata collection and data standardisation, as well as dissemination of data and metadata to users, can help agencies to comply with these directives.

Guide to Seabed Habitat Mapping

MESH (Development of a framework for **M**apping **E**uropean **S**eabed **H**abitats) is an international marine habitat mapping programme comprising a consortium of 12 partners across the UK, Ireland, the Netherlands, Belgium and France. MESH gained financial support from the EU INTERREG IIIB programme. The MESH partnership has produced a harmonised seabed habitat map for the INTERREG IIIB north-west Europe area, a metadatabase of seabed mapping studies, a web-delivered geographic information system (GIS) showing the habitat maps developed, international standards and protocols for seabed mapping studies. Recently MESH has published a Guide to Seabed Habitat Mapping which covers all aspects of seabed habitat mapping, from scoping the project through data collection and interpretation, assessing confidence in maps and using maps beyond their original purpose. This guide can be found online at www.searchmesh.net/mapping-guide. The MESH project was driven by the growing pressures on the marine environment along with the increasing need for reporting and policy implementation such as the EU Maritime Green Paper, the Water Framework Directive requirement for periodic assessments of ecosystem health, the EC Habitats Directive and the OSPAR Commission requirement to designate a network of marine protected areas.

Effective management requires information on the spatial distribution and the quality of seabed habitats. These information requirements have been met by a burgeoning of seabed mapping and sampling studies in recent years, mostly in relation to specific development proposals, licence applications or the designation of protected areas. Unfortunately, this piecemeal approach has resulted in little co-ordination between studies and when combined with a lack of agreed standards for data collection prevents the drawing of regional, national or international perspectives on seabed resources to aid the process of decision-making.





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Metadata standards

Before the MESH project, seabed habitat maps in north-west Europe were held in disparate archives across five countries in a wide range of formats. The data and metadata collation work of the MESH project highlighted two technical obstacles to the goal of a unified seabed habitat map for north-west Europe. Firstly, lack of a common and practical set of terms to describe data resources, and secondly the lack of a common file format for sharing seabed habitat maps. To overcome these obstacles, MESH defined a metadata standard and a set of Data Exchange Formats (DEFs) specifically for application to seabed habitat maps. The MESH metadata standard is compliant with ISO19115. Metadata for over 1000 seabed mapping studies were collated from five countries (Belgium, France, Ireland, Netherlands and UK), and these metadata are now publicly available from the searchable MESH Online Metadata Catalogue linked to MESH webGIS (www.searchmesh.net/webGIS). The MESH Data Exchange Formats (DEFs) cover different data types, for example DEFs for habitat maps and a DEF for benthic sample data.

The process of data collation for MESH in the UK started with public organisations, particularly the UK government conservation agencies and government research bodies; these organisations hold a significant proportion of publicly available seabed habitat maps. Seabed maps from these sources served to build up a critical mass of data which encouraged usage of the MESH webGIS, as well as contribution of additional data. Consequently MESH allocated the majority of data collation effort in the UK to acquiring publicly funded data and metadata. In subsequent collation phases, NGOs and private sector data holders were contacted. Marine data held by private sector companies are a vast resource, although a relatively small proportion of these data exist as interpreted habitat maps. MESH funded the conversion to DEFs and creation of metadata for private sector data identified as valuable for environmental management, and received these data at a fraction of their original cost. MESH and the data owners established a common understanding on the quality of data and the terms for the use and dissemination: this was set out in a data agreement between the parties.

Confidence assessment system

Users need to know the quality of a habitat map if they have to base important decisions on the data presented in the map. MESH developed a confidence assessment system to give users some measure of the suitability of maps for management uses. The system developed is a multi-criteria approach which has facilitated the determination of confidence in habitat maps displayed on the MESH webGIS. The selection of maps assessed includes historical maps as well as recent maps. The partnership examined and assembled the various factors that affect confidence in a map and constructed a confidence assessment methodology. The evaluation process addresses three main questions:

1. How good is the remote sensing?
2. How good is the ground truthing?
3. How good is the interpretation?

These questions were selected because MESH promotes the creation of habitat maps through the interpretation of remote sensing data and ground truthing data. The maps are scored based on information given in the metadata catalogue for the study. The MESH Confidence Assessment Tool is available either as a template MS Excel spreadsheet, most appropriate for the assessment of multiple maps, or as a Flash tool, more appropriate for the assessment of a single map, and potentially a useful tool in the planning process. Both are available at www.searchmesh.net/confidence.

MESH webGIS

The MESH webGIS is an interactive mapping website which displays collated seabed habitat maps together with a wide range of supporting seabed mapping data. The maps were translated by the MESH partnership to a common classification scheme (EUNIS - European Nature Information Systems: http://eunis.eea.europa.eu) from a wide range of original classifications.

Photo Anne Frijsinger and Mat Vestjens

It is the first website to deliver harmonised seabed habitat maps for the INTERREG IIIB north-west Europe area. Figure 1 shows how the MESH webGIS can help inform decisions on planning applications. A common requirement for agencies responding to new infrastructure developments is to have detailed data on seabed habitats in a specific location. The agency can use the MESH webGIS to find out which habitats are present in the area and view standardised confidence assessments for the existing habitat maps in the area. Point sample data representing seabed samples and seabed photos can be overlain on the habitat maps. Several types of report are relevant in this case: a summary of habitats present in a user-selected area, and a list of the seabed mapping studies carried out in the area, containing links to their full metadata. The habitat summary report can be compiled for both polygon maps and point sample data. The metadata list is of particular use because there will be certain maps which are only accessible directly from the data owner rather than through the MESH webGIS. All the information can help the user build up a detailed view of the area in terms of seabed habitats and species to assess whether the proposed development will adversely affect the area or have an impact upon habitats or species of conservation interest.

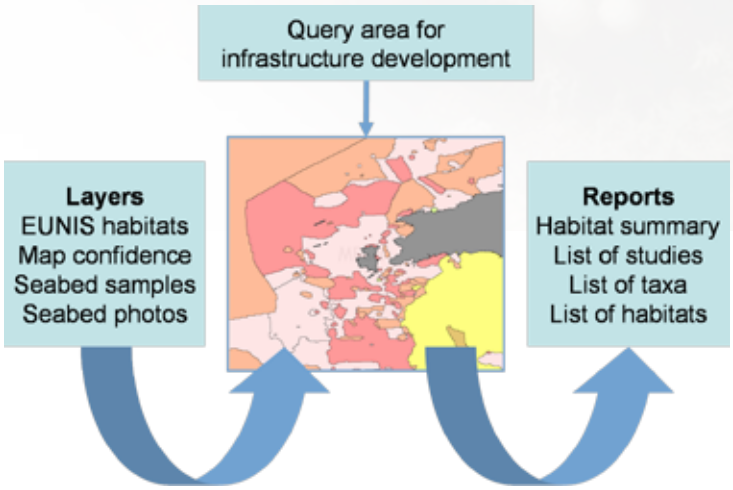
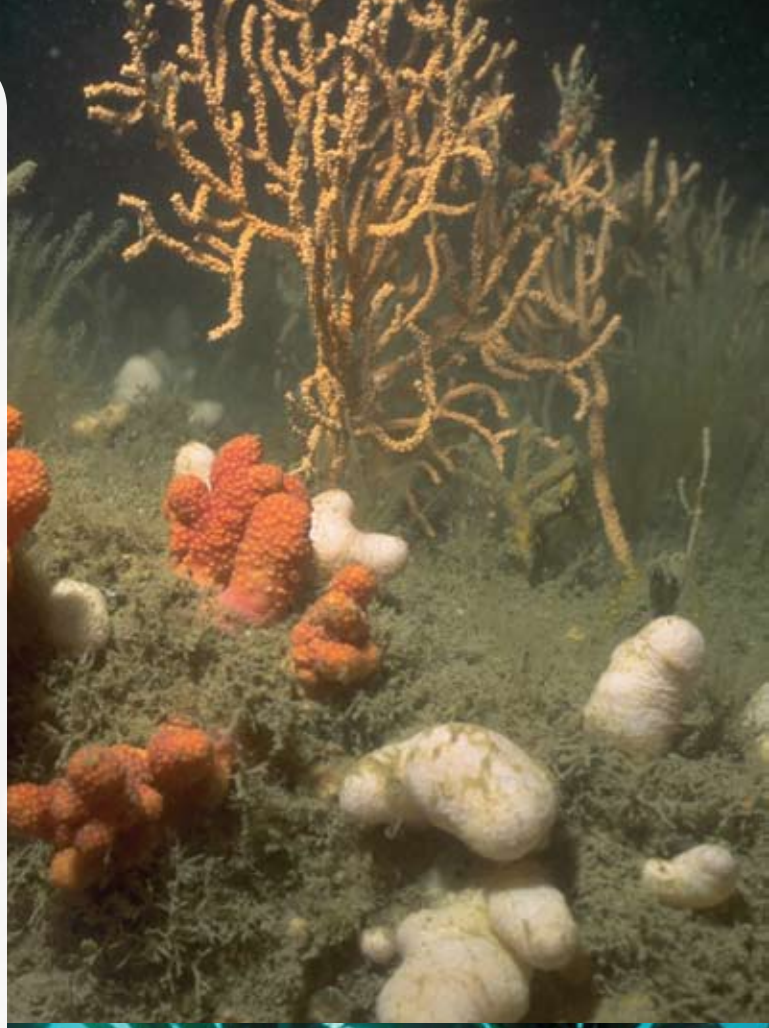


Figure 1. A schematic showing the types of layers and reports that are appropriate for a user investigating an area of a proposed development.

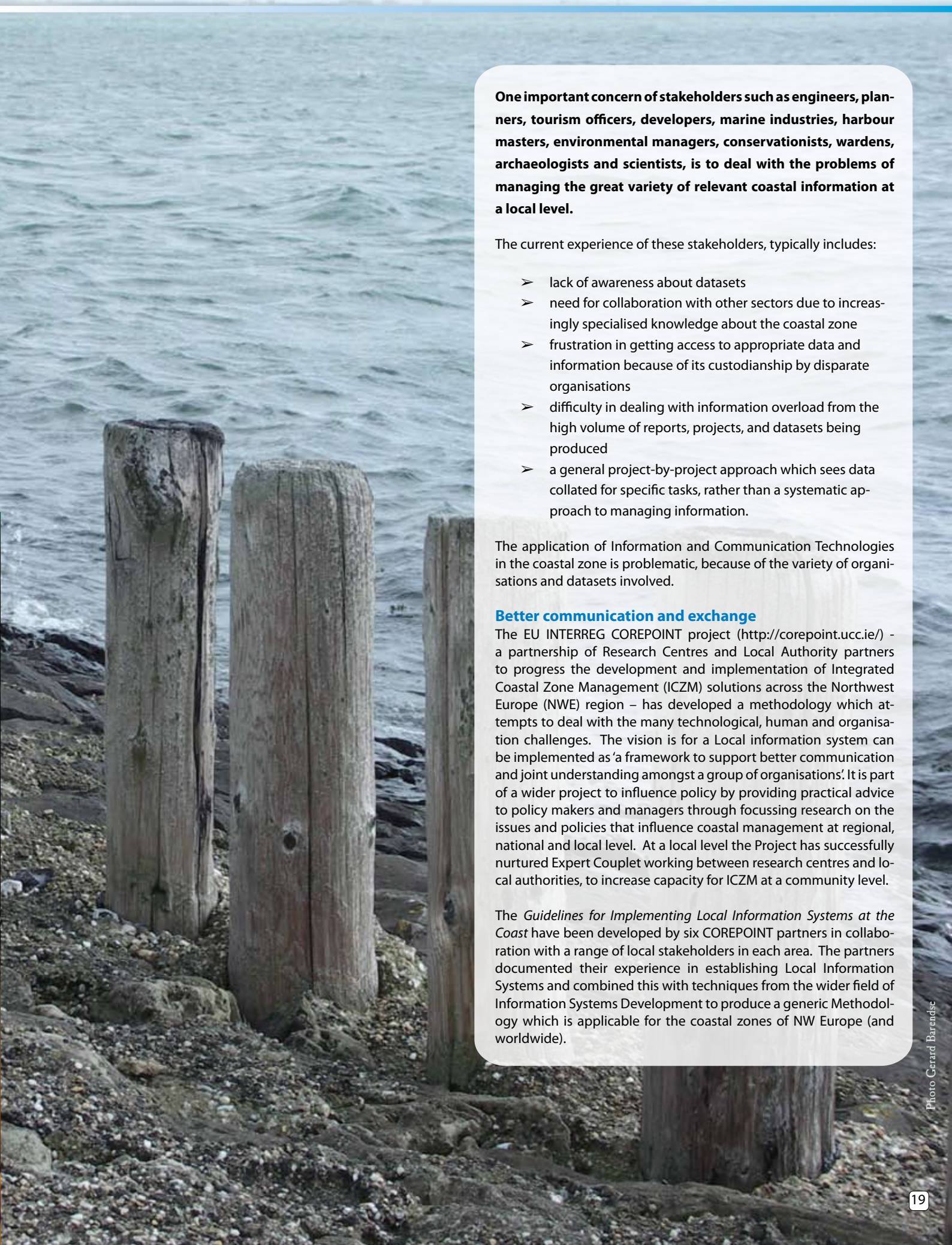
The MESH webGIS can help answer a range of questions from diverse user-groups, and the scenario described here give a flavour of one of these questions. The value of the website depends largely on achieving and maintaining a critical mass of up-to-date habitat maps. The MESH Partnership is implementing a strategy to maintain these key systems and associated guides and tools beyond the end of the project. With the ever-increasing demand for data on seabed habitats both from policy initiatives such as the EU Maritime Green Paper, and to help manage developments and activities, it is vital that organisations continue to collaborate at a national and international level to make data available to the user community.

Further information can be found at the project website: www.searchmesh.net.

Natalie Coltman, MESH Mapping Scientist,
Joint Nature Conservation Committee (JNCC), UK
Sarah Young, Marine Ecologist,
Joint Nature Conservation Committee (JNCC), UK



Local Solutions for Managing Coastal Information



One important concern of stakeholders such as engineers, planners, tourism officers, developers, marine industries, harbour masters, environmental managers, conservationists, wardens, archaeologists and scientists, is to deal with the problems of managing the great variety of relevant coastal information at a local level.

The current experience of these stakeholders, typically includes:

- lack of awareness about datasets
- need for collaboration with other sectors due to increasingly specialised knowledge about the coastal zone
- frustration in getting access to appropriate data and information because of its custodianship by disparate organisations
- difficulty in dealing with information overload from the high volume of reports, projects, and datasets being produced
- a general project-by-project approach which sees data collated for specific tasks, rather than a systematic approach to managing information.

The application of Information and Communication Technologies in the coastal zone is problematic, because of the variety of organisations and datasets involved.

Better communication and exchange

The EU INTERREG COREPOINT project (http://corepoint.ucc.ie/) - a partnership of Research Centres and Local Authority partners to progress the development and implementation of Integrated Coastal Zone Management (ICZM) solutions across the Northwest Europe (NWE) region – has developed a methodology which attempts to deal with the many technological, human and organisation challenges. The vision is for a Local information system can be implemented as 'a framework to support better communication and joint understanding amongst a group of organisations'. It is part of a wider project to influence policy by providing practical advice to policy makers and managers through focussing research on the issues and policies that influence coastal management at regional, national and local level. At a local level the Project has successfully nurtured Expert Couplet working between research centres and local authorities, to increase capacity for ICZM at a community level.

The *Guidelines for Implementing Local Information Systems at the Coast* have been developed by six COREPOINT partners in collaboration with a range of local stakeholders in each area. The partners documented their experience in establishing Local Information Systems and combined this with techniques from the wider field of Information Systems Development to produce a generic Methodology which is applicable for the coastal zones of NW Europe (and worldwide).

Photo Gerard Barendse

This "user-led", stepwise approach outlines some key points of good practice in implementing systems for the coast:

Step 1. Justify Information Systems

There are many important drivers for implementing information systems, such as the need to improve our understanding of coastal systems, better involvement of the public, and more efficient custodianship of data holdings

- Legislative drivers
- The cost of not knowing
- Good data custodianship
- Freedom of information/Access to information
- Importance of communication and engagement with public
- Benefits of group learning

Step 2. Have Clear Purposes

In order for information systems to be useful in planning and management of the coastal zone, they should clearly reflect functional goals and support managers in their daily tasks.

- Consider which functions have political or environmental currency
- Identify the key partners
- Relate your information system to the goals of management
- Think how an information system could support managers
- Consider an enabling role for ICZM initiatives

Step 3. Involve Users

Involving users in the design of information systems is crucial for their success. The technique of Soft Systems Methodology is an important approach that has been developed in the field of information systems design.

- Get users together in an Information Network
- Identify the need for an information system
- Model the process of information management (the technique of Soft Systems Methodology is particularly helpful here
- Design the system to deliver information to users at the appropriate stage of decision making

Step 4. Solve Technical Obstacles

Some obstacles which need to be solved are related to policy, such as the use of Memoranda of Understanding between two organisations to overcome the legal constraints to sharing information.

Other obstacles are more technical in nature, such as the development of standards which will allow wider use of datasets. One obstacle is the lack of standards applicable to the marine and coastal environment.

Policy Issues

- Information Policy
- Legal Constraints
- Data Supply Chains
- Cost of Data

Technical Issues

- Metadata
- Standards
- Data definitions
- Data formats
- Interoperability

Step 5. Deploy Appropriate Technology

A great variety of Information and Communication Technologies are available to help coastal practitioners to maintain their knowledge networks.

Figure 1 provides a screenshot of the development of coastal profiles for the Sefton Coast Defence Database: this data can be used to communicate an overview of Coastal Evolution to other coastal stakeholders and public groups.

Figure 2 provides an overview of possible technological applications- the key is to effectively link these to the needs of coastal practitioners and data users.

Step 6. Check for Quality Assurance

There is a requirement and avoid the rubbish-in, rubbish out syndrome.

- Establish clear links between data sources and custodians,
- Encourage users to look at in-house procedures for quality assurance
- Standardisation of records, through approaches such as metadata
- Disclosure of limitations for datasets
- Dissemination of best practice
- Peer review and rating of usefulness of data sources, utilising intelligence technologies

Step 7. Implementation and Training

Providing 'hands-on' support to individuals and organisations is a necessary part of the LIS implementation and should be factored into the costs for the project brief.

- Mechanisms such as workshops, personal visits, telephone line support, user friendly interface design and training sessions.

Photo Eng. Moisa Lopes (DRAOT-CENTRO)

Following these steps can be contrasted with other approaches which are currently prevalent. 'Data led' approaches attempt to comprehensively catalogue all data sources and can easily get overwhelmed or struggle to be relevant, and 'technology led' approaches focus on the development of a particular tool such as 'Expert Systems'. Whilst such approaches are important, the lack of a 'user led' approach has been cited as the reason for discontinuation or failure of many ICT projects on European coasts (EU Demonstration Project on ICZM, 1999). The LIS Guidelines respond to this need for a user-led approach.

The LIS Methodology will raise capacity to apply the principles of Integrated Coastal Zone Management, in particular reflecting the need for Local Specificity. *'This principle also implies a need to ensure the collection and availability to decision makers of appropriate data and relevant information, including informal traditional knowledge, concerning both the terrestrial and marine components of the coastal zone in question'.*
(EU Communication on ICZM, 2000, p26)

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Graham Lymbery, Project leader - Coastal Defence, Sefton Council.
COREPOINT Project Partners

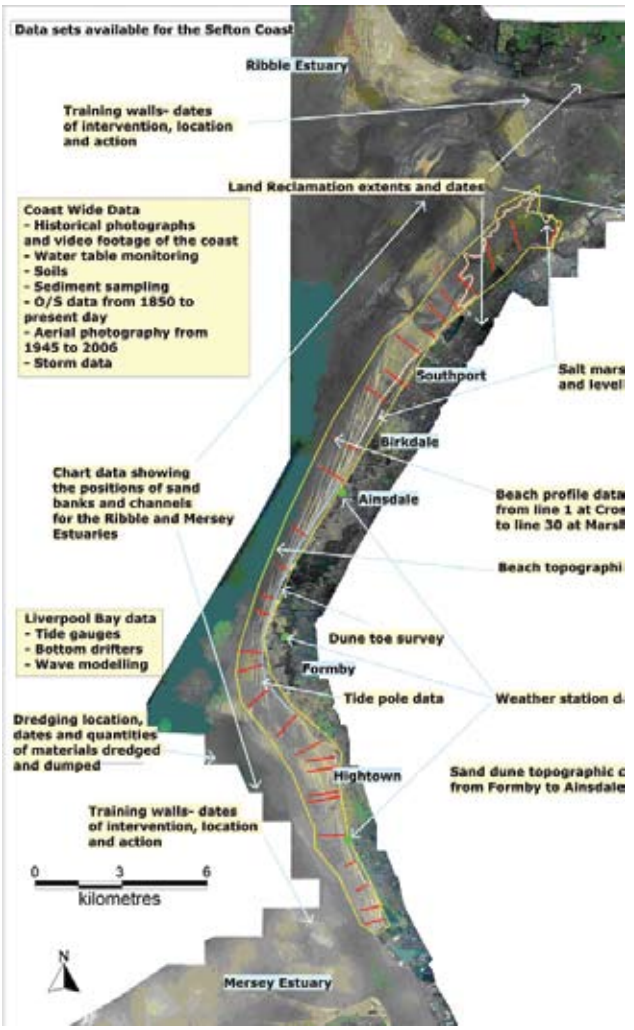
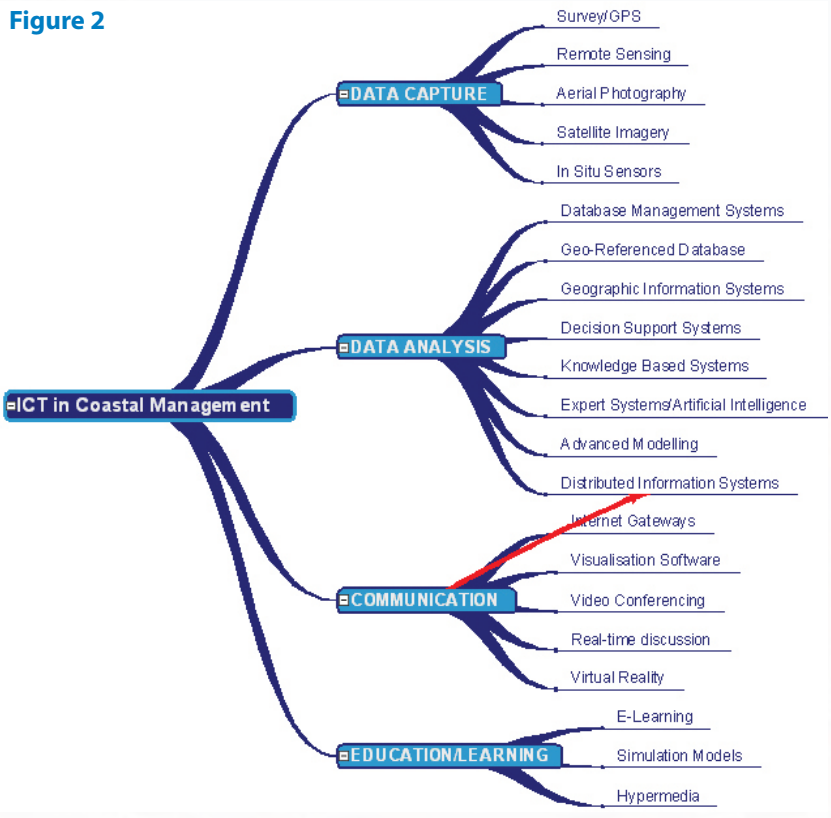


Figure 1

Figure 2



The Future for ICZM Spatial Information

Photo Dagos Mica

What does the future hold for coastal data and information, politically and technically? On the political front, two key driving forces exist – one is the INSPIRE Directive within which development of coastal/marine Spatial Data Infrastructure (SDI) will begin. The other stems from the European Commission's numerous Communications and Working papers relating to the proposed integrated maritime policy for the EU all contain specific references to the need for better marine data and improved data handling and sharing capabilities across the multitude of disciplines who work in the coastal and marine areas.

As far back as EU Demonstration Programme on Integrated Management in Coastal Zones and the 1998 Thematic Study on "Information required for Integrated Coastal Zone Management", the strategic view of information in developing the ICZM process was recognised. Recommendations from the 2004 Euroceans conference included "an urgent need to support co-ordinated and sustained collection, archiving of and ready access to, comprehensive marine datasets". [1] The Commission's 2006 Green Paper that referenced the Euroceans 2004 recommendation also officially recognised that:

> "Better understanding of the competing uses of the ocean will *require better data and information on maritime activities*, be they social, economic or recreational, as well as on their impacts on the resource base. ***Good data are also of importance for maritime economic operators.*** However, ***there are still major problems of harmonisation and reliability of data***, as well as insufficient and geographically imbalanced monitoring in EU marine regions. These gaps must be addressed if we are to devise a sound and sustainable EU Maritime Policy."

This Green Paper also proposed setting up a European Marine Observation and Data Network (EMODNET) "which would provide a sustainable focus for improving systematic observation (in situ and from space), interoperability and increasing access to data, based on robust, open and generic ICT solutions." This recommendation is now part of the October 2007 Action Plan for creating an integrated maritime policy for the EU. [2]

INSPIRE Directive

The INSPIRE Directive, creating a legally mandated pan-European SDI, already includes numerous data themes that will require input from a wide range of stakeholders in the coastal and marine communities, in all three of the priority Annexes to that Directive. Thus there is already an existing legal basis – and legal requirement - for developing the sort of data-centric systems and infrastructures that are called for in the various EU Integrated Maritime Policy documents.

One remaining issue on the political front is that of timing of initiatives, proposed work programmes and budgets. We see that the maritime policy action plan calls for creation of an EMODNET advisory group, which will, by 2009, create a new "EU action plan to make progress in this area on the basis of a road map to be published in 2008." This roadmap is to provide an overview of the

Photo Peter Heslenfeld

main data and information service categories to be covered by EMODNET and some of their sources and uses, as well as examples of "benefits and added value of better integration." By the second half of 2008, the group will propose a programme for the development of "mutually compatible and multi-dimensional mapping of seas in Member States' waters" and eventually the development of an integrated socio-economic database to support EU Maritime Policy actions. Yet while all this activity is on-going, the various INSPIRE Drafting Teams are developing the legally binding Implementing Rules that must be followed by all data creators or custodians in a parallel, but not necessarily coincident, time frame. Co-ordination between these two initiatives is crucial if work is not to be duplicated or, worse yet, work undertaken at too early a stage in one initiative (EMODNET) must then be undone to meet the legal requirements of another initiative (INSPIRE).

On the technical front, implementation of coastal/marine SDIs progresses globally, but very slowly, and Europe is no exception. It is expected that INSPIRE will drive the technical aspects of wider access to more harmonised marine data across all EU coastal Member States from about 2009 onwards. Yet that 'onwards' stretches out to 2019 – more than a decade away – and much of the data to be covered by INSPIRE towards the end of that period is of importance to coastal stakeholders already today.

On-line geoweb services

We can expect to see ever more use of the new on-line geoweb services, such as Google Earth, Microsoft's Virtual Earth or NASA's World Wind. Numerous coastal and marine applications are already being developed of the 'point and click' variety using these underpinning technologies. Although none of these systems offers today the sort of geographic analysis capabilities found in modern Geographic Information Systems (GIS), more functionality is added to these web-based services on a regular basis.

Ever more marine focused "geo-portals" are being created globally, including in Europe, where MIDA[3] – the Marine Irish Digital Atlas – is a very good example, along with the Irish programme INFOMAR[4] , which provides key baseline data to support coastal and inshore development. INFOMAR's goal is to make the vast amount of data collected available to a wide audience, "to stimulate research and development of Ireland's 220 million acres under the sea." The data offered within INFOMAR can be accessed via an interactive data delivery system hosted by the Geological Survey of Ireland, from the Irish Marine Institute's web map service and as on-line, downloadable marine datasets. These Irish initiatives are indicative of not only what can be achieved, but what is needed as 'best practice' across all EU coastal Member States. Spreading that technology, based on open source interoperability standards (developed by the Open Geospatial Consortium) and *de jure* data and metadata standards (from ISO) are key to providing wider access to important marine datasets in the future.

The Future

For the last three years, numerous papers on use of GIS for coastal projects and programmes, from planning to monitoring to execution, have been presented at the global CoastGIS conferences (Aberdeen, UK, 2005; Wollongong, Australia, 2006; Santander, Spain, 2007). Readers interested in seeing just how GIS and web technologies are being used to create important components of coastal or marine SDIs should visit the conference's permanent web site [5] at, from which proceedings of the various conferences are available.

More future forecasting? Look for ever more GIS capability to be offered by the leading on-line geoweb service providers, such as Google Earth and Microsoft Virtual Earth. For just a taste of what can already be done using Google Earth or the Google Maps API, look at Google Ocean [6] where the French firm, Magic Instinct Software, demonstrates scores of Google Maps and Google Earth visualizations for marine data. Expect much more of the same in the near future from many other sources.

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[1] COM(2006) 275 final – Green Paper: "Towards a future Maritime Policy for the Union: A European vision for the oceans and seas", Brussels, 7.6.2006.
[2] SEC (2007) 1278 of 10.10.2007 – Commission Working Document.
[3] http://mida.ucc.ie/
[4] http://www.marine.ie/home/services/surveys/seabed/
[5] http://www.coastgis.org
[6] http://www.justmagic.com/GM-GE.html

EUCC Germany focuses on coastal databases

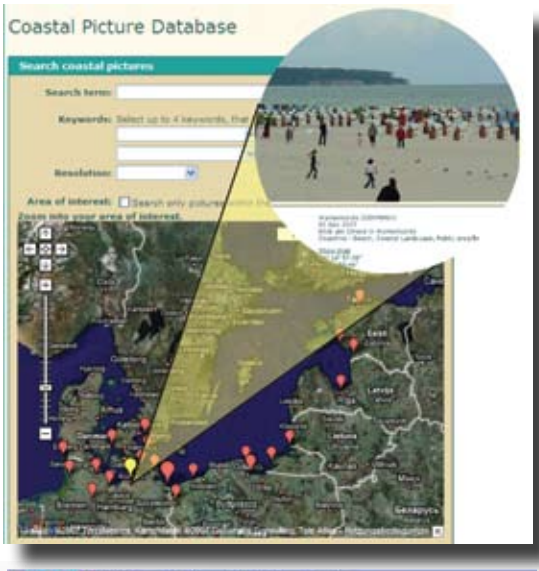
EUCC - The Coastal Union Germany offers several thematic coastal databases for projects, organisations and networks. CoPraNet, BALLOON and SPICOSA already benefit. In particular we provide the following databases:

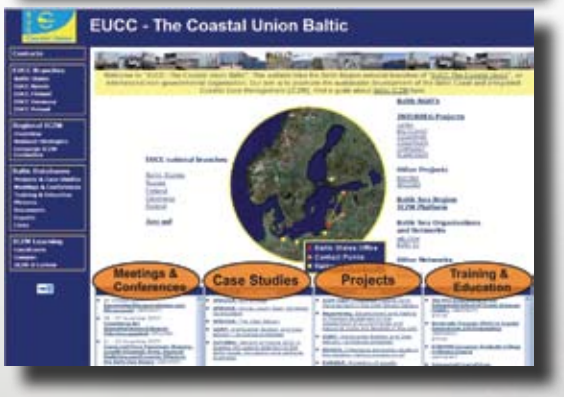
"Projects & Case Studies": Search for coastal project results and valuable contacts which enhance the exchange of experience and support the identification of needs for your future projects.

"Meetings & Conferences": Locate national and international coastal conferences and workshops which could be relevant to your actual work or for later contacts in previous events.

"Training & Education": Find information about education opportunities for graduates and young professionals dealing with coastal and marine topics.

"Coastal Pictures": Download coastal photographs from a pool of geo-referenced pictures (Google-Maps-application) for free to trim your web page, lighten up your lecture or illustrate your poster .





The World Wide Web provides a flood of information about themes related to the coast. Storage and access to this information is essential for coastal scientists and practitioners. The challenge is thus the database content. It has to be up-to-date, comprehensive and permanently available. The Internet presentation of the content has to be flexible, user-oriented and designed to reach a large international coastal community. The EUCC databases are freely accessible for everyone in order to support a wide use.

Local input – central storage – wide spread distribution

The new feature of the EUCC databases is the linkage between one central database and several web-pages of organisations and projects. The EUCC databases thus follow the principle local input – central storage – wide spread distribution. Users enter their coastal information into the EUCC database assuring the database growth. The information of the central database can be displayed in individually adapted databases for various user portals (networks, organisations, projects a.s.o.). By filtering the content of the databases regarding spatial or thematic aspects, relevant information for a specific user group is displayed. The information gets then distributed up-to-date and comprehensively to the broadest coastal audience possible, both nationally and internationally. Therefore, various existing networks are interconnected.

Network profit

Integrating the EUCC databases into your own web-page by visual adapting its layout will increase the attractiveness of your Internet presence. It ensures the dissemination of coastal information from your specialized audience towards different and large user communities. As the central database is maintained and further developed independent of a project period by the NGO EUCC – The Coastal Union Germany, a starting stock of information is available immediately and long-term operability is ensured. Currently the thematic coastal databases provide you over 300 mainly European projects and case studies, 50 future conferences worldwide and more than 600 pictures mainly from Northern Europe.

For further information feel free to contact us: eucc@eucc-d.de

Photo IKZM-Oder

Have a look at http://databases.eucc-d.de/en/ and join us!