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Report of the Working Group on Integrated Coastal Zone Management (WGICZM)

11–14 March 2008

Mallorca, Spain

ICES International Council for the Exploration of the Sea

CIEM Conseil International pour l'Exploration de la Mer

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Contents

Executive summary

The highlights for this year's Working Group on Integrated Coastal Zone Management (WGICZM) meeting were:

1) The indicator workshop, which identified the need for integrated decision making frameworks as opposed to standardised lists of indicators and the necessity of specified management objectives at an appropriate scale (ToR f).

2) The need to develop an integrated decision-making framework that can progress at different rates depending on the resources available (ToR f).

3) To consider the catchment– coast fluxes in ICZM management plans. Therefore closer collaboration with LOICZ was suggested and representatives from LOICZ will be invited to the meeting next year (ToR g).

4) To establish closer links with international organisations such as OSPAR, IOC and EU ICZM expert group (ToR a) and g).

WGICZM agreed that standardized lists of indicators may not be applicable or useful at local scales. ICZM scenarios vary considerably among ICES countries and, in this context, it is not feasible to apply a single list of indicators to all monitoring programmes. Nevertheless, it was proposed that coherent and coordinated methods of selecting and implementing indicators, selecting comparable measures wherever applicable were essential.

The discussions ascertained that a lot of resources and time have been dedicated to detailing the specifics of indicators themselves. This included research aimed at defining indicators and associated methods used to monitor specific impacts. While the importance of such research is recognized, it was considered that too much focus on these aspects may overshadow the important issue of the process by which actual indicators may be selected within different local and political regimes. WGICZM believes that the development of an integrated decision-making framework will facilitate effective implementation of ICZM in ICES countries and considers this to be the main priority of the group's future work.

The country reports did not include information on the integration of management of the coastal zone, and it seems that the governance systems in the reporting countries are still largely uncoordinated, fragmented and ad hoc (ToR b).

1 Opening of the meeting

The Chair, Beatriz Morales-Nin, ES, opened the meeting at 9:00 hrs on Tuesday, 11 March 2008, welcomed the participants and made some announcements regarding domestic arrangements.

Nine ICES countries: Spain, Denmark, Germany, Ireland, Norway, The Netherlands, Belgium, UK and Canada were represented at the 2008 meeting. France provided a country report. An observer from the EUCC Coastal Union attended the meeting.

A list of participants is included in Annex 1.

Clare Greathead, UK, Amy Diedrich, ES, Oisin Naughton, IR, Roland Cormier, CA, Erlend Mokness, NO, Andreas Kannen, DE, and Josianne Strottrup, DK, kindly agreed to draft parts of the report. Clare Greathead, UK, kindly agreed to act as general editor of the report.

2 Adoption of the agenda

A draft agenda was circulated in advance of the meeting which was adopted without changes. The adopted agenda is presented in Annex 2.

3 Terms of reference

The Terms of Reference for the group were presented to the members in advance of the meeting and are presented below. Responsibility for compiling the information for each ToR was delegated to different WG members prior to the meeting.

a) update and report on activities of relevant ICES Working and Study groups to identify information pertaining to coastal zone and evaluate this information relative to ICZM needs and review progress from the EU and IOC;

b) update and report on ICZM activities in different ICES countries including information on monitoring of recreational fishing and other coastal monitoring programmes.

c) revise and update a list of tools, data products and research needs;

d) continue to monitor and report results generated from larger projects that are directly relevant to ICZM needs;

e) continue to report on the effects of thermal, chemical and saline pollution produced by desalinisation and power plants;

f) explore the utility of adopting standardised methods for the selection of indicators that are applicable and relevant at a local scale;

g) further identify ICES' role in the application of the WFD, Habitat Directive, Maritime Policy (Green paper), Marine Strategy (proposed), and EU ICZM Recommendation 2002, in the coastal zone

WGICZM will report by 7 April 2008 for the attention of the Marine Habitat Committee.

3.1 Update and report on activities of relevant ICES Working and Study groups to identify information pertaining to coastal zone and evaluate this information relative to ICZM needs and review progress from the EU and IOC (ToR a)

The 2007 ICES WG reports that were available on the ICES website were reviewed. Due to the timing of the meeting, only the 2007 reports were available. This means that some of the comments or identified needs for information may already have been taken up and considered by a group during 2007/2008, but would not be registered in this report. Due to time constraints only reports that were identified as relevant in the previous two years were reviewed and discussed.

The figure below (Figure 3.1.1) shows the role of this working group within ICES and the identification of different ICES Working Groups with respect to information on human activities or issues relevant to ICZM. A summary of relevant ICZM information from these WG is presented below.

WGBEC: This WG is working on characterising potential indicators. The group reported that OSPAR/ICES WKIMON had produced of a number of background documents on biological effects responses. Examples of how biological effects methods are applied were reviewed. The ICON project was reported upon. This project aims to assess the health of the North Sea ecosystems and aims to integrate chemical and biological effects methods. This work was considered important for future work within the forthcoming EU Marine Strategy Directive.

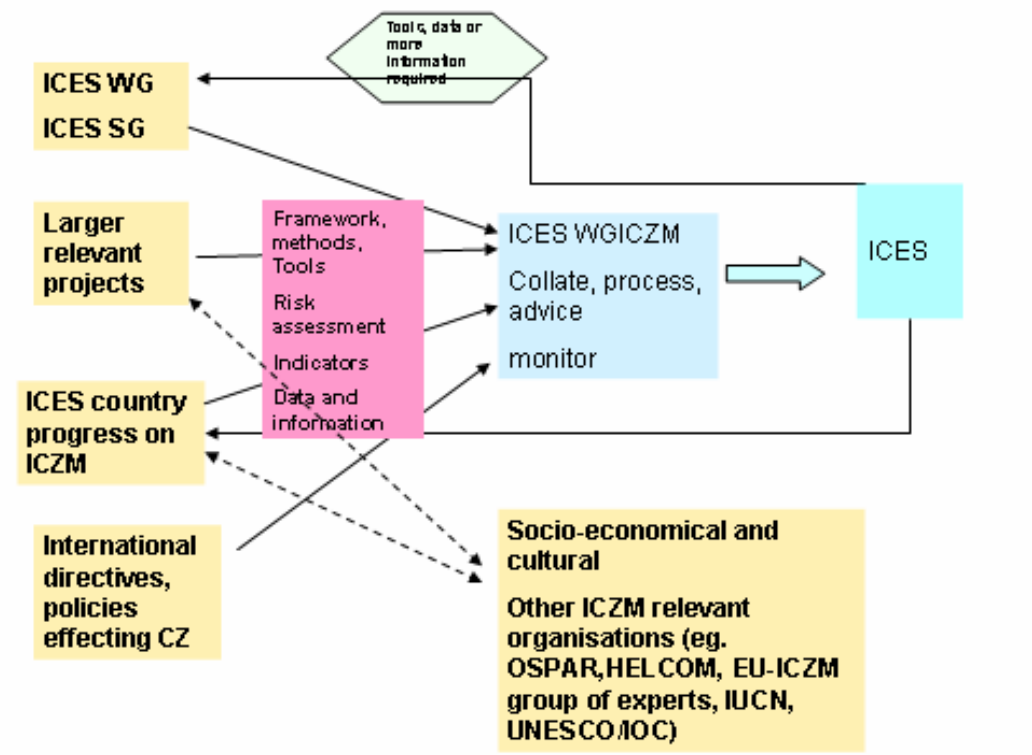


Figure 3.1.1. The role of WGICZM within ICES.

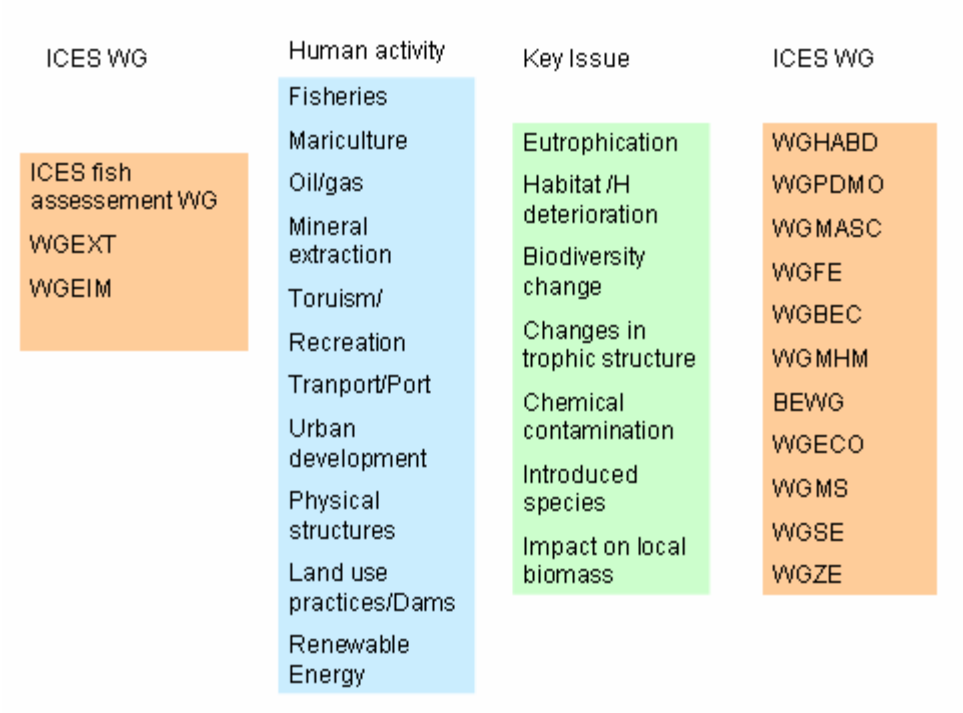


Figure 3.1.2. The identification of different ICES Working Groups with respect to information on human activities or issues relevant to ICZM.

The group also considered monitoring requirements under WFD and recommended the use of bio-assays to partially replace chemical analyses of priority pollutants, reduce monitoring costs and generate more comprehensive assessment of chemical water quality. Since indicators are important tools in ICZM this work is valuable for integrated ocean and coastal management.

WGHAB: This group reported that there was no convincing evidence on links between eutrophication and HABs. This WG aims to monitor the occurrence of HABs and to develop models for the prediction of HABs. The WGIZCM found that for ICZM purposes it was very useful and necessary to monitor the frequency of occurrences of HABs as an ecosystem health indicator.

WGECO: This WG is considering the draft EU Marine Strategy Directive and anticipating the requirements for achieving good ecological status throughout the marine environment. They reported on progress in developing a set of pan-European indicators for the assessment of the state of European seas. Since the set of indicators may be regional or area specific, WGICZM recommends that the development of an assessment tool that allows for a flexible use of a set of indicators relevant for each specific system would be more appropriate.

WGEIM: This group continues to review the applicability of sustainability indicators (SI) for aquaculture. They reviewed progress made to date on the development of SIs proposed for mariculture activities. A number of shortcomings of many SIs were identified and approaches to develop SI continue to be identified by the group. Broad definitions of SI include social and economic elements which are not covered in the deliberations of WGEIM, due to lack of relevant expertise. The question of scale was identified as critically important when considering sustainability. Future deliberations of the group will consider SIs from the aspect of scale ranging from farm-level to global indicators.

WGICZM finds the development of mariculture SIs a valuable input for ICZM.

BEWG: This group has considered decision support systems (DSS) for sustainable marine management. They identified the need to include social and economic as well as ecological aspects. They reported on the project on marine biological valuation, which aims at establishing a protocol to provide an integrated view on nature's intrinsic value. Based on the results from a workshop, criteria for biological valuation were defined and a strategy described. The valuation model was applied and tested in the Belgian part of the North Sea. For all valuation criteria and organizational levels of biodiversity assessment questions were described, leading to a protocol for biological valuation. The results were separate maps representing separate assessments, which would need to be combined for a marine biological valuation.

The protocol is being tested within MarBEF and Encora projects in different sites to examine applicability.

The group also discussed ongoing projects concerning WFD matters. Benthos is still the major component for WFD investigations and assessments. Phytobenthos is only used in a few countries.

WGICZM considers the development of marine biological valuation maps useful within DSS and these are important for the integrated decision making framework for the coastal zone.

WGFE has examined issues regarding Essential Fish Habitat (EFH) for several years now. In 2007, the group had a new set of ToR related to habitat mapping for different life stages of pelagic and demersal life stages. These maps included aspects such as the functional coupling between fish and their biotic and abiotic environment to identify the characteristics of essential habitats for fish species (and life-history stages) of interest or to identify those ecological, physiological and behavioural components that may affect the distribution of fish. New maps were produced in addition to those produced in previous years and these GIS based information are valuable for the ICZM process.

WGMHM; This group reviewed habitat mapping programmes and addressed the issue of data accuracy in habitat maps. The group identified a potential weakness in that there is limited internationally-agreed guidance available on techniques to be used for producing maps. The MESH project that is developing guidance for map production is being monitored by WGMHM.

WGMHM has started to outline a paper on the role of habitat mapping in an ecosystem-based context recognising the importance of habitat mapping to a wide range of marine management and policy contexts, including ecosystem functioning, coastal zone management, fisheries, protected areas and spatial planning.

The products from this WG are important tools for the ICZM process as they provide basic information useful in spatial planning.

WGMASC reviewed concepts and desirable features of environmental indictors, existing indicator frameworks, classes of indicators and selection criteria. A preliminary list of benthic and pelagic indicators specific to shellfish culture is provided along with a discussion of operational management thresholds. Environmental conservation and protection legislations in place within ICES countries are important considerations for the selection of ecological status/performance indicators, and particularly for the setting of management triggers/thresholds.

WGSE: this group reviewed the current approaches on how to identify and delineate protected areas for seabirds. This topic has become an important issue during recent years as most ICES member states are involved in designating Special Protection Areas, following the EU Birds Directive, and Important Birds Areas, according to Birdlife International.

WGZE encourages micro-zooplankton to be included in time series monitoring within the ICES area since changes in recruitment of several fish of commercial interest and in seabird breeding productivity in some regions may be associated with changes in plankton biomass and in the seasonal timing of plankton production. WGICZM encourages exploring this measure as an indicator for coastal ecosystem function.

Review progress on EU and IOC.

Towards a future Maritime Policy for the Union, the Aberdeen Declaration of the 22 June 2007 was adopted supporting a holistic and coherent cross-sectoral and multidisciplinary approach.

The preparation of a European Atlas of the Seas has been initiated and provides a basis for marine and coastal spatial planning, for business and nature conservation purposes and as an educational and promotional tool.

The Maritime Policy Blue paper aims to launch a Communication of the commission on a "Marine and maritime related research strategy", which also will enhance research and integration of sciences relevant for ICZM.

The EU ICZM expert group is still continuing its work and WGICZM will seek to link with the EU ICZM group, for example through observer status at their meeting, and reporting back to this WG.

Within IOC there is ongoing work on spatial planning through workshops. The latest report on Marine Spatial Planning is dated 2006. Within IOC, expert groups were formed to work on Coastal Hazards Awareness and Mitigation and a handbook on Indicators for Coastal and Ocean Management was released (also 2006).

Recommendation:

The WGICZM recommends continuing to update and report on activities of relevant ICES working and studying groups to identify information pertaining to the coastal zone and evaluate this information relative to ICZM needs and to monitor progress within the EU and IOC.

3.2 Update and report on ICZM activities in different ICES countries including information on monitoring of recreational fishing and other coastal monitoring programmes (ToR b)

After reviewing the country updates it is evident that there is still limited development of ICZM in many European countries. The primary reasons for this are:

- Fragmented responsibilities for legislation and policies among authorities,
- Lack of a legal framework to support ICZM nationally and internationally,
- Lack of compatibility among legislations at the national and eco-region (ICES) levels,
- Inefficient collection, communication, dissemination, and limited compatibility of available data sets.

The countries represented in this report could be said to cover more than 60% of the European coastline, and the Atlantic coast of Canada. This meant that there were contributions from a broad range of countries and sectors in all the topics discussed at the meeting. The available country updates are presented in full in Annex 5. The table in Annex 5 (Table A5.1) is an overview and comparison of a number of issues relevant to integrated coastal zone management for different countries. In summary, since last year there are no changes in the number of countries that have completed an ICZM stock take and produced an ICZM strategy document.

Many of the countries had key issues in common, most of which related to highly or over exploited terrestrial and marine areas of the coastal zone, which lead to conflicts of interest between sectors. Many also highlighted the use of GIS in the coastal planning process to map and evaluate resource use. This is picked up and discussed further in ToR c. The country reports did not include information on the integration of management of the coastal zone, and it seems that the governance systems in the reporting countries are still largely uncoordinated, fragmented and ad hoc. As a consequence, the information requested for the Country reports will be updated for the 2009 meeting.

All countries have ongoing programmes for the designation of sites for aquatic and terrestrial nature conservation, either under the Habitat and Birds Directives or, as in the case of Canada, in relation to integrated ocean and coastal management initiatives. In Europe, the coastal and ocean interactions are largely not being addressed. Progress towards implementation of the Water Framework Directive is continuing in all countries; most countries have finished the classification stage, and some have monitoring programmes in place. With regards to the Maritime Policy and Marine Strategy Framework Directive, which are still under development; work towards preparation or response to these, will need to be included in next year's report. This can be seen by the large number of ICZM projects relating to management and data coordination, some of which are described in detail in the full country reports (Annex 5) and ToRs c) and d).

Recommendation:

WGICZM recommends continuing to update and report on ICZM activities in different ICES countries including updates on initiatives towards responses to the future Marine Strategy Framework Directive and activities to coordinate national management objectives within the coastal zone.

3.3 Revise and update a list of tools, data products and research needs (ToR c)

A strong theme throughout the EU Maritime Blue Paper is that of an integrated approach to governance but also to the development of technological approaches and in the sharing of pan-European datasets and mapping resources.

Top down legislative approaches are necessary to provide a generic, over-arching policy framework which endorses the concepts of ecosystem based management, precautionary principles and holistic approaches to management of our marine resources. The legislative context is set in Canada and the United States, for example, through the Oceans Act and CZM Acts, respectively, which endorse these principles and support their ocean management strategies. The proposed Marine Bill in the UK similarly provides a legislative context for marine spatial planning as a tool to deliver on integrated approaches to sustainable resource development and to provide for local specificity.

The Maritime Blue Paper suggests the use of marine spatial planning as a tool to deliver sustainable development of our coastal regions. Marine Spatial Planning (MSP) effectively involves technological approaches to predicting areas for suitable development and areas in need of protection. This must be based on best available data and scientific evidence, stakeholder involvement and socio-economic influences. Marine Spatial Planning is best achieved by first developing the technological approaches, to first "know your resource". This is achieved through seabed mapping programmes, hydrographic modelling and from baseline datasets derived through various national monitoring programmes.

Filling in these knowledge gaps provides for better informed management decisions. Once the resource maps are created and spatial needs identified, the datasets can be integrated into GIS. As well as utilising the resource maps, forward planning must incorporate socio-economic components and be driven by priority needs for the region. This involves public consultation and ensures local specificity.

Not all aspects of the management approaches can be displayed on maps however. Many behavioural and methodological aspects will be controlled through Technical Control Measures (TCM) and codes of practice. What is important is that each sector develops their management plans within an Integrated Coastal Zone Management context, where they provide for integrated datasets, consider other users in the region, adopt the ecosystem management approach and consider the long term effects.

Monitoring is another significant component of ICZM, both in terms of environment monitoring programmes and in the ICZM sustainability and progress indicator context. Environmental monitoring is necessary to meet statutory obligations and to validate coastal plans. Socio-economic components are strongly integrated through the use of sustainability and progress indicators.

Indicators and the frameworks used to select them are discussed in more detail in ToR f).

The key steps in the marine spatial planning approach and the important research areas are as follows:

- Data collection standards must be applied internationally and provide for integration of national datasets as well as providing for integration with other datasets in GIS.

- Involvement of industry in sampling, for example, traditional fishing information from inshore fishermen to provide resource maps for spatial planning.
- Continued application of seabed mapping and acoustic surveys to identify ecologically important areas, for example, fish nursery and spawning areas.
- Continued development of hydrographic modelling for predictive capacities for pro-active designation of areas, for example, larval settlement areas, spawning areas, harmful algal blooms, etc.
- Provide for the spatial planning approach i.e. the resource maps should be developed at an appropriate regional scale.
- Temporal issues and behavioural issues need to be addressed by Technical Control Measures, Codes Of Practice (COPs), etc, and be published as part of a the wider Coastal Plan.
- Public consultation is needed for local communities to identify important traditional activities and activities important to sustaining local communities. For example the fishing industry should engage in existing coastal fora such as Regional Advisory Councils, C.L.A.M.S., and Coastal Development Plans public consultation. All sectors must ensure that relevant information is included in relevant socio-economic analysis, which will be a key driver in coastal planning.
- Monitoring programmes will need to be redefined to validate Marine Spatial Plans, particularly in relation to water quality. Where possible there should be an integrated approach to monitoring relative to the defined resource use.
- There should be compatibility between monitoring under the WFD and the proposed Marine Strategy Directive. This applies to monitoring programmes, sensor development programmes (currently under way to meet WFD requirements), administrative structures, etc. This is to ensure no arbitrary boundaries are established and to ensure compliance with the ecosystem based management concept.
- ICZM is specific to regions and influenced by local economic, environmental and social needs. Influences and pressures will change over time. A set of progress and sustainability indicators must be established to assess the level of ICZM achieved in a particular region and to assess to influences of socio-economic factors on planning needs.

As tools are a key part of the integrated-decision-making framework discussed mainly under ToR f), in next year's WG they will be discussed in the new ToR d).

3.3.1 Canadian Coastal Tools Initiative

Economic, environmental and demographic pressures are converging sharply in the coastal regions, creating a complex situation that presents a multi-dimensional challenge to their effective and sustainable management and governance from the social, economic, cultural and environment perspective. In Canada, the development of coastal management tools are presently being sought to effectively and equitably manage the spatial and temporal use of these areas. Tools are needed to effectively assist in the decision making processes given that traditional users and interests are now being joined in the coastal area by new industries, recreational opportunities and development interests.

With the implementation of ecosystem-based approach to integrated management of the aquatic environment, risk analysis decision-making tools and processes are being developed with the aim of assessing human activity against ecosystem component vulnerabilities. Using classical risk analysis processes, these tools will provide a systematic way of gathering, evaluating, recording and disseminating information leading to recommendations for management consideration in response to an identified ecosystem vulnerabilities.

The initial phase of the project is focusing on the risk characterization phase of the process designed to connect ecosystem health vulnerabilities and coastal community viability. The process is using the DPSIR definitions in the development of the framework. The following are the initial conceptual framework and models that will be subject to validation and pilot exercises.

Integrated ecosystem-based planning framework: This framework takes into account the ecological, social, cultural and economic elements of the holistic LOMA approach and integrates the bottom up incremental elements of coastal planning. It is also designed to incorporate coastal planning into existing regional coastal management federal/provincial governance structures.

Drivers, Pressures Impact Model (DPI Model): This model defines the pathways of effect from anthropogenic activities to specific coastal ecosystem components vulnerabilities. These models also include key Drivers, Pressures and Impact indicators for approximately 12 anthropogenic activities including upland activities.

Community Viability Ecosystem Dependency Model (CVED Model: This model connects the coastal community to their respective watershed/coastal aquatic ecosystem. The model connects risk to the viability of coastal communities in relation to the ecosystem health risks caused by their own economic activities; thus providing the basis for integrated planning at the coastal level and subsequent integrated management.

Bayesian Risk Characterization: The Community Economic Viability Dependency Model is presently being used to identify potential Bayesian approaches using the DPSIR indicators to characterise and identify risk priorities during the assessment phase of the process. Given that the Bayesian model can incorporate both qualitative and quantitative knowledge, the process and requirements for a computer application is being developed to allow additional factors to be added as new knowledge is generated. Such an application would harmonise and assist the characterization of risks.

3.3.2 The Systems Approach Framework

The EU SPICOSA project aims at integrating science and policy through a Systems Approach Framework that allows the assessment of different policy alternatives. Based on a system approach, a multidisciplinary assessment framework is being developed with a balanced consideration of the Ecological, Social and Economic sectors (ESE) of Coastal Systems. This System Approach Framework (SAF) will be used to explore the dynamics of Coastal-Zone Systems and potential consequences of alternative policy scenarios. Achieving this objective will require a restructuring of the science needed to understand the interactions between complex natural and social systems at different spatial and temporal scales including the overall economic evaluation of alternative policies. The SAF is organized into four major Steps, Design, Formulations, Appraisal and Output. At each Step, the SAF is implemented in 18 Study Sites, and feedback is provided towards developing a generic SAF. The

EXTEND software will be applied that allows model components to be arranged in a hierarchy, which adds clarity to the conceptual model that describes the particular Issue identified.

SPICOSA's objective may also be seen as the improvement of the Coastal Zone System Feedback Loop as shown in Figure 3.3.2.1 below.

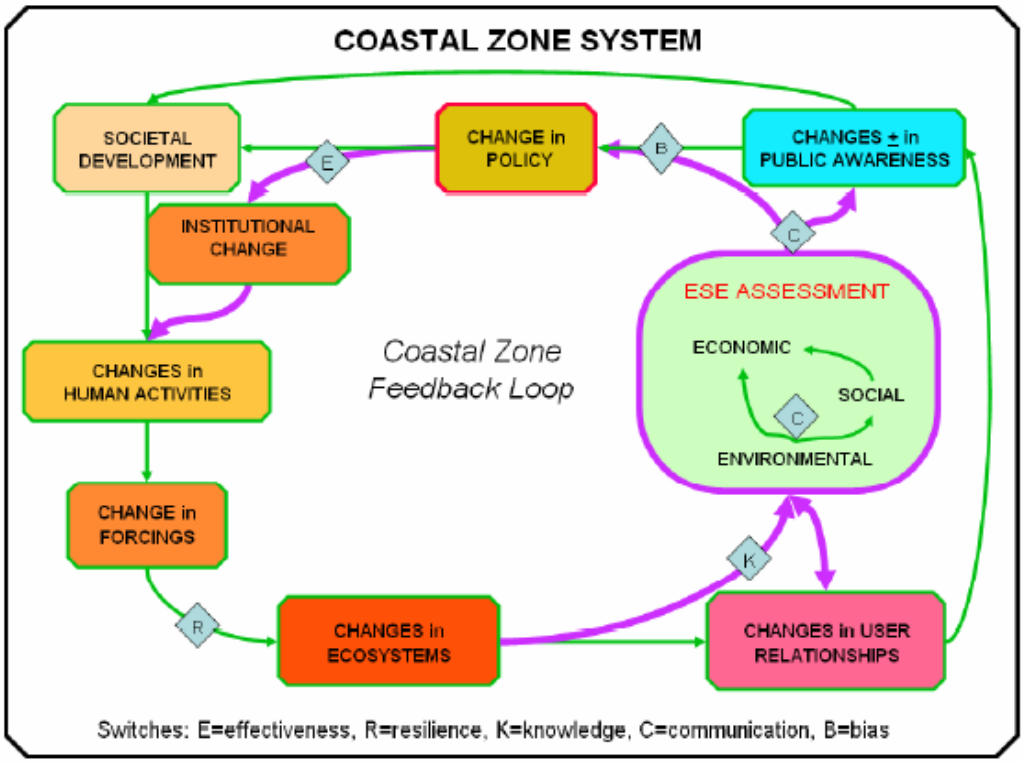


Figure 3.3.2.1. The SPICOSA Coastal Zone System Feedback Loop. The Ecological-Social-Economic (ESE) Assessment box represents the central activity of SPICOSA. The small diamond boxes represent critical threshold constraints on the interactions between components of the system. These constraints need to be understood if the effects of various policy scenarios are to be accurately forecast, and distinguished. For more information see www.spicosa.org

3.3.3 AquaReg CZM Project

AquaReg is a cooperation between the regions of Galicia in Spain represented by the CETMAR Foundation, Border, Midland and Western (BMW) in Ireland represented by The Marine Institute and Trøndelag in Norway represented by joint forces of the South Trøndelag and North Trøndelag counties. The overall objective of AquaReg is to provide opportunities and design strategies for sustainable development of peripheral coastal communities by promotion of interregional cooperation in aquaculture and fisheries.

The pilot studies under the AquaReg CZM project looked at the application of seabed mapping to coastal management and the development of Geodatabases for the pilot areas. Much of the impetus came from the recently completed HASUT programme in Norway and various national seabed surveys, which developed thematic maps showing the suitability of areas for aquaculture production, fishing activities, special conservation areas and other resource uses.

In the AquaReg pilot studies, seabed maps were produced for the pilot areas giving bathymetry data, sediment distinction, locations of marine features and shipwrecks, slopes and elevation. Thematic maps were produced showing nursery grounds for commercial fish species (based on historical fishing data), suitable areas for anchoring fish cages, oxygen depletion zones, and water current patterns. This information was then layered into GIS. Geo-referenced information on current activities in the pilot regions was layered into the databases to provide a spatial planning tool for coastal planners. These datasets included: the location of aquaculture units; traditional fishing grounds; shore and boat angling; natural shellfish beds; habitat types and protected areas (SACs, SPAs, etc.); piers and slips; shipping routes/navigational channels; monitoring stations; industrial discharge points; surrounding land use; coastal population structure; freshwater catchments; inter-tidal zones; and political boundaries such as WFD coastal water bodies, nautical mile limits, etc. Some thematic maps from the three databases can be seen below:

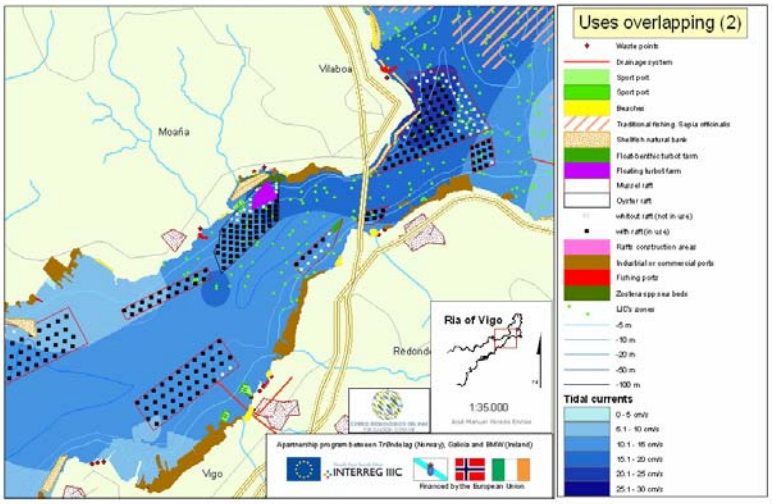


Figure 3.3.1. The use of GIS as a spatial visualisation tool in the coastal planning context, from the pilot study in the Ria of Vigo, Galicia, Spain. Here potential overlapping/conflicting uses can be visualised.

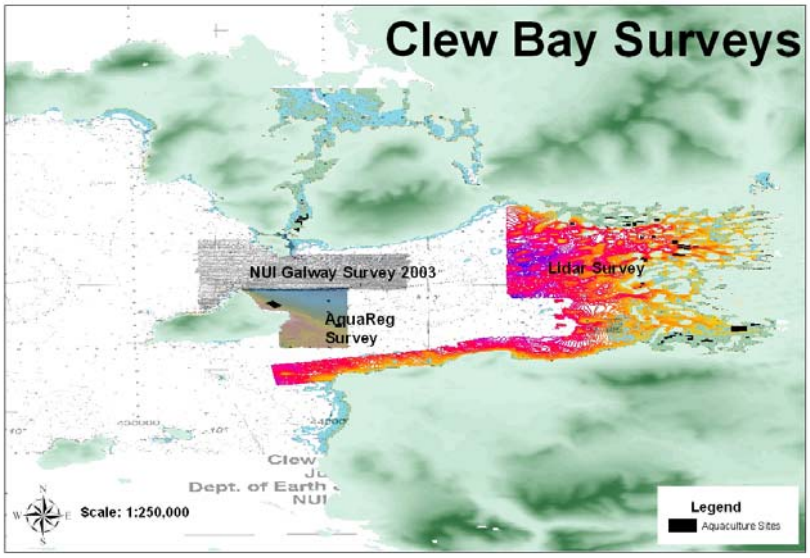
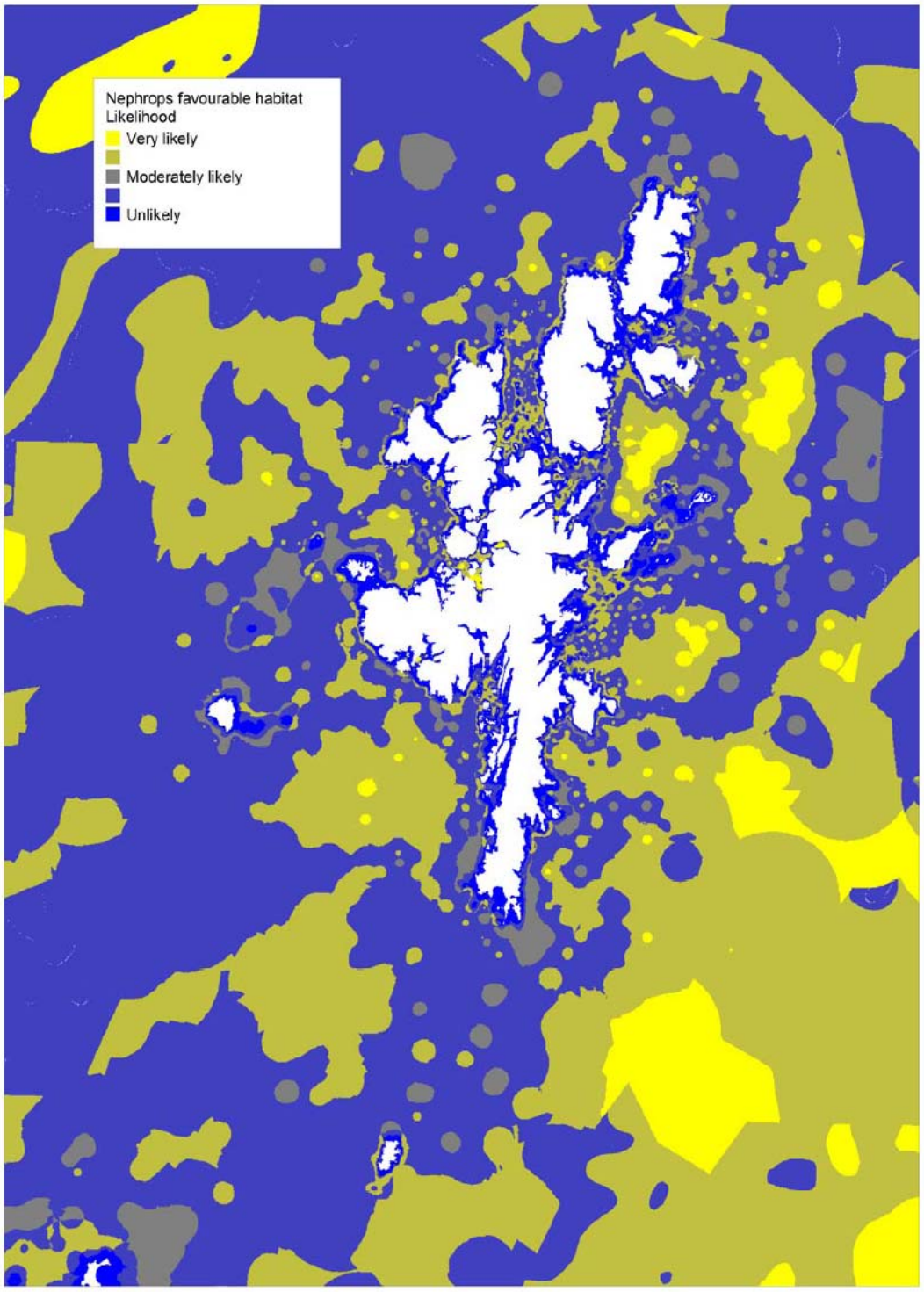


Figure 3.3.2. Seabed mapping surveys carried out in Clew Bay, Ireland. Information from these surveys were loaded into the Clew Bay Geodatabase, Ireland under the AquaReg project.

Figure 3.3.3. Combined map with depth, sediments and bottom types to indicate where there are strong currents abundant oxygen rich waters (AquaReg CZM project Trondelag, Norway). This is important information for the identification of suitable sites for fish farms.

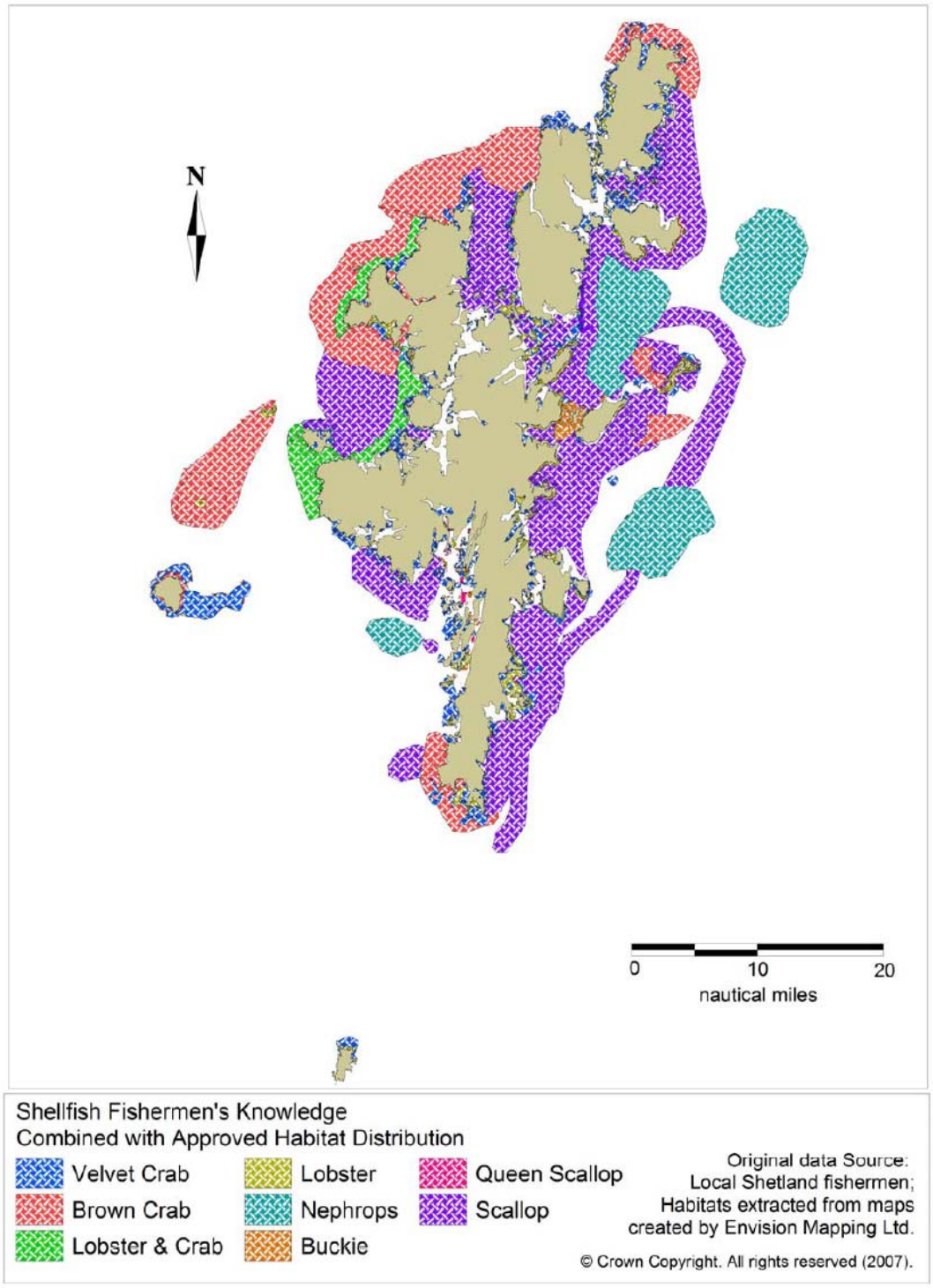
3.3.4 Scottish Sustainable Marine Environment Initiative (SSMEI)

The Scottish Sustainable Marine Environment Initiative (SSMEI) was initiated by the Scottish Government to inform future marine policy and test new management framework options for Scotland's marine and coastal environment. Four pilot projects have been set up across Scotland, located in the Firth of Clyde, the Sound of Mull, Berwickshire and Shetland. Each of these pilots is testing different approaches to developing a management framework.



Map 1: An example of a habitat map of Nephrops.

Figure 3.3.4.1. Example of a fish habitat area that has been mapped by Envision Mapping Ltd using known locations of physical characteristics, cross-referenced with fish habitat preference information.



Map 2: Shellfish fishermen's knowledge combined with approved habitat distribution.

Figure 3.3.4.2. Example of a habitat map for key shellfish species scrutinised initially by the Shetland Shellfish Management Organisation and combined with the shellfish fishing grounds mapped by the fishermen.

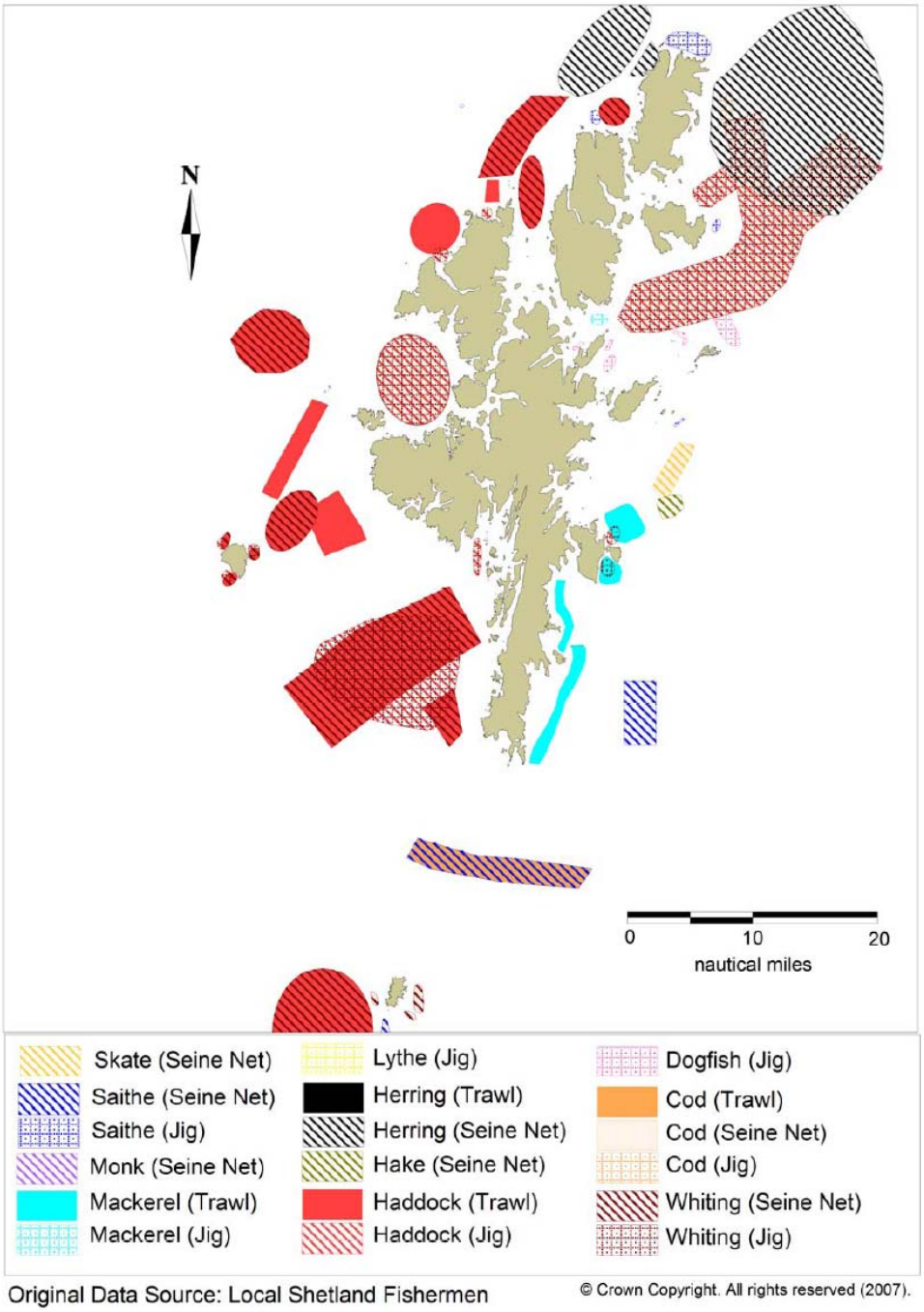


Figure 3.3.4.3. Example of the whitefish grounds mapped solely by the fishermen.

The Shetland SSMEI project has developed a marine spatial planning framework with local partner agencies and marine users. The project has used the most authoritative data available to map what is currently occurring where and when, which has subsequently used to inform policy on where a development or activity should not occur.

The Shetland Marine Spatial Plan is currently out for consultation (www.nafc.ac.uk/SSMEI.aspx) and consists of two documents, a Policy Framework and a Marine Atlas (which includes a CD of data for use with GIS and Google

Earth™). Examples of maps displaying the Fishing Grounds and Habitat Data Used in the Shetland Marine Spatial Plan Mapping (out to 12 nm) are shown below, and show the distribution of important fishing grounds, using two sources (fishermen and habitat areas). These maps will be used by developers and planners to ensure that there are appropriate safeguards against developments that remove the opportunity for fishing.

The fish habitat areas have been mapped by Envision Mapping Ltd using known locations of physical characteristics (such as seabed sediments, depth, temperature, salinity, known seabed habitat types), cross-referenced with fish habitat preference information; an example is shown in Figure 3.3.4.1(Map 1).

The habitat maps for key shellfish species have been scrutinised initially by the Shetland Shellfish Management Organisation (SSMO). Where the information has been approved by fishermen, this information was extracted and combined with the shellfish fishing grounds that were mapped by the fishermen (Figure 3.3.4.2, Map 2). It has been agreed by a local Small Boat Committee that further scrutiny workshops will be established to build on the knowledge collated so far.

So far only the whitefish grounds mapped by the fishermen have been used in the Marine Spatial Plan (shown in Figure 3.3.4.3, Map 3). Methods of scrutinising the whitefish habitats will be explored and then included. When the whitefish habitat maps have been reviewed, nursery and spawning grounds will then be mapped.

3.4 Continue to monitor and report results generated from larger projects that are directly relevant to ICZM needs (ToR d)

This ToR reported on several large projects that are relevant to ICZM needs. Key information about the projects is summarised in Table 3.4.1 below, with further details available in Annex 6.

Recommendation:

WGICZM recommends that it continues to monitor and report on the results generated from larger projects that are directly relevant to ICZM needs.

3.5 Continue to report on the effects of thermal, chemical and saline pollution produced by desalinisation and power plants (ToR e)

Due to the few reports regarding this ToR, and the difficulties on updating the information, it was agreed to include these aspects on the country reports for this and future reports.

Table 3.4.1. Summary of larger multinational projects that are directly relevant to ICZM needs.

Large ICZM Initiatives	DATES	Area	Key issues	Website	Contact person
AQUA REG	2005–2008	Europe	To provide opportunities and design strategies for sustainable development of peripheral coastal communities by promotion of inter-regional cooperation in aquaculture and fisheries. Application of seabed mapping to coastal management and the development of Geodatabases for the pilot areas	www.aquareg.com	Gabriel de Labra Chas, Galacia (e-mail: glabra@cetmar.org) Sigurd Bjørgo, Norway (e-mail: sigurd.bjorgo@stfk.no) Alan Drumm, Ireland (e-mail: alan.drumm@marine.ie)
SPICOSA	2007–2011	Europe	integrating science and policy through a Systems Approach Framework that allows the assessment of different policy alternatives	www.spicosa.org	Daniel Roy (Spicosa Project Manager), IFREMER Centre de Brest Technopole Brest Iroise BP 70, 29280 Plouzané, France
LOICZ	1993–2012	Global	Biogeochemical fluxes, ecosystem governance, social-ecological systems analysis	www.loicz.org	Hartwig Kremer (Chief Executive Officer), hartwig.kremer@loicz.org
ACZISC	Est. 1992	Atlantic coast	Foster cooperation in Atlantic Canada with regards to Integrated Coastal and Ocean Management (ICOM), coastal mapping and geomatics.	http://aczisc.dal.ca/	Michael J.A. Butler (Director) michael.butler@dal.ca
BALANCE	2005–2007	Baltic	Identify and collate relevant and available marine data in the Baltic Sea, Kattegat and Skagerrak area. Define Baltic Sea marine landscapes and develop habitat maps, the latter in 4 pilot areas. Assess the existing Baltic Sea Marine Protected Areas network and develop a "blue corridor" concept. Develop Baltic marine zoning plans in 2 pilot areas (pilot area 2 and 3). Communicate with stakeholders and disseminate the results to partners, stakeholders and the public.	http://www.balance-eu.org/	E-mail: balance@sns.dk

Large ICZM Initiatives	DATES	Area	Key issues	Website	Contact person
COREPOINT	2004–2008	NW Europe	Aims 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.	http://corepoint.ucc.ie/	v.cummins@ucc.ie Coastal and Marine Resources Centre (CMRC) University of Cork, Ireland
IMCORE	2008–2011	NW Europe	promote transnational, innovative and sustainable approach to reducing the Ecological Social and Economic impacts of climate change on coastal resources		v.cummins@ucc.ie CMRC, University of Cork, Ireland
DEDUCE	2004–2007	Europe	To assess the usefulness, viability and necessity of an integrated approach to inform management by means of environmental and socio-economic indicators for measuring the degree of sustainable development in the European Coastal zones	www.deduce.eu	Xavier Marti Department of Environment and Housing of Catalonia, Barcelona wxmarti@gencat.net
ENCORA	2006–2008	Europe and N Africa	To overcome existing fragmentation of knowledge and experience within ICZM by facilitating access to local networks.	www.encora.org	www.encora.org
PROTECT	2005–2008	Europe	"Marine protected areas as a tool for ecosystem conservation and fisheries management" (PROTECT) is an interdisciplinary research project involving 17 European institutions. It aims to strengthen the decision basis regarding potential use, selection, development and management of MPAs in Europe	www.mpa-eu.net.	Scientific Coordinator: Erik Hoffmann info@mpa-eu.net
COASTATLANTIC	2003–2006	European Atlantic Area	Thematic actions: Coastal Access, Natural heritage, Cultural heritage, Urban/ Rural inter-dependencies Cross-cutting actions: Geographic information systems, Stakeholders involvement, Governance Dissemination, Coastal Access, Natural heritage, Cultural heritage, Urban/Rural inter-dependencies	www.coastatlantic.org	www.coastatlantic.org
MESH	2004–2007	Europe	Habitat mapping	www.searchmesh.net	info@searchmesh.net

Large ICZM Initiatives	DATES	Area	Key issues	Website	Contact person
COMCOAST	2004–2007	North Sea	European project that developed and demonstrated innovative solutions for flood protection in coastal areas. created multifunctional flood management schemes with a more gradual transition from sea to land	www.comcoast.org	frans.hamer@rws.nl

3.6 Explore the utility of adopting standardised methods for the selection of indicators that are applicable and relevant at a local scale (ToR f)

This Tor was formulated as a result of discussions among members of the WGICZM in 2007. The ToR was carried out as a Workshop convened on 13 March 2008 in IMEDEA in order to explore the utility of adopting standardized methods for the selection of indicators that are applicable and relevant at a local scale. In addition, it was emphasized that, in order for an indicator system to be effective it must be comprehensive, including environmental, socio-cultural, economic and governance measures.

From the discussions during the workshop, it was agreed that standardized lists of indicators may not be applicable or useful at local scales. ICZM scenarios vary considerably among ICES countries and, in this context, it is not feasible to apply a single list of indicators to all monitoring programmes. None the less, it was proposed that coherent and coordinated methods of selecting and implementing indicators and selecting comparable measures wherever applicable are essential.

Discussions were structured around 9 presentations which were presented by invited participants and some members of the WGICZM. Summaries can be found in Annex 7.

3.6.1 General themes of the discussion

It was decided at the outset of the discussion that the name of this Tor should be changed to "Progress in the development of an integrated decision making framework for ICZM". The reasons for this are, first, the word *standardized* is considered too restrictive if one takes into account the diversity of management systems existing at different locations. Second, indicator systems may be applied at *multiple scales*, all of which may have different objectives and institutional arrangements. Simply referring to local scales would not take this into consideration.

A number of important issues were discussed and highlighted that includes:

a) The process for indicator selection and the resulting indicators are of equal importance.

It was ascertained during the discussions that a lot of resources and time have been dedicated to detailing the specificities of indicators themselves. This included research aimed at defining indicators and associated methods that can be used to monitor specific impacts, particularly in the environmental field. Where the importance of such research is recognised, it was considered that too much focus on these aspects may be overshadowing the important issue of the process by which actual indicators may be selected within different local and political realities. The latter is equally, if not more important, to ensure the ultimate implementation and success of monitoring programmes. The importance of placing more emphasis on the process of selecting indicators that monitor the anthropogenic *cause* of the problem, aiming at addressing associated objectives, as opposed to simply monitoring the resulting impact, was also highlighted.

b) The importance of developing indicators within the context of a management framework.

A large number of indicators have been developed outside the context of management objectives. The group recognized that indicators can not be effective in the absence of a suitable management framework that enforces their implementation.

The management framework consists of (a) identification of policy issues leading to locally relevant objectives and (b) definition of the boundaries (scope) of the system. In this context, it is considered important that indicator systems be developed within the context and in conjunction with management frameworks that will ensure their implementation. In order for this to occur, decision-makers at all levels must be involved at all stages of the process.

An indicator is a dynamic part of an overall scheme that is understandable and compelling to its intended user community. A successful indicator should reduce the number of measures that would normally be required for an exact representation of a situation, and simplify the process of communication to managers, stakeholders and communities. However, to be useful, an indicator should be incorporated into a sound and practical management process.

When working with indicators two approaches can be identified: (a) the creation of indicator data warehousing libraries, and (b) the selection of the appropriate indicators for ICZM, which can vary among issues, governance scenarios and locations. Indicators should be able to measure the effectiveness of management plans to achieve the defined objectives as well as the efficiency of management plan implementation.

c) The achievement of objectives of ICZM plans is more important than the standardization of indicators.

Although a standardized set of indicators would be preferable in order to facilitate comparison (e.g. EC WG-ID, IMAGINE, Inspire Directive), these may not always be useful or applicable across ICES member countries given multiple spatial scales and national governance structures. Furthermore, the group wishes to emphasize that the achievement of objectives of ICZM plans is more important than the standardization of indicators.

The presentation on Risk Characterization highlighted the importance of decision-making frameworks in the selection or identification of relevant indicators. Risk characterization is only one step in a decision-making process for integrated management. Classic risk analysis decision-making includes:

1) Setting management objectives based on spatial/temporal social, cultural, economic, regulatory and ecosystem profiles and consultations;

2) Identifying and characterizing the risk to both ecosystem and social components to set priorities for management;

3) Formulating the assessment scope, which includes setting indicators and identifying data sources;

4) Conducting the assessment of the identifies taking into account the management objectives so as to provide options for management consideration;

5) Developing management plans based on options provided in consultation with key stakeholders and regulatory agencies;

6) Implementing management plans where indicators are then used for monitoring the performance of the management plans in effectively achieving the initial management objectives;

7) Communicating to stakeholders, regulatory agencies and the coastal communities from the perspective of developing stewardship.

The risk characterization approach is extremely useful for communicating priorities to local actors. However, selecting indicators is also important for engaging stakeholders and ensuring that indicators fully reflect local objectives and regimes. WGICZM recognizes the need to integrate the two approaches, i.e. Risk Characterization and Indicator Characterization because it will lead to an integrated decision-making framework.

Recommendation:

Following the discussion it was recognised that the WGICZM members have the necessary background and expertise to explore the essential aspects required for ICZM and indicator development that were highlighted previously. Each country is currently working on a specific aspect and approach and, therefore, there is a need for closer collaboration. In this context, it was felt necessary to bring together these elements. Therefore, WGICZM suggests the development of a joint proposal to FP7. Specifically, in the interim period, it is recommended that the WGICZM work towards:

- Bringing together the risk characterisation and the indicator characterisation approaches within an integrated decision-making framework.
- Developing a general framework for the indicator selection process for ICES countries. Within that framework should be the clear definition of objectives and the integration of the indicator system into the overall management process.
- Exploring the possibility of putting together a proposal developing the integrated decision making framework for ICZM.

3.7 Further identify ICES' role in the application of the WFD, Habitat Directive, Maritime Policy (Blue paper), Marine Strategy (proposed), and EU ICZM Recommendation 2002, in the coastal zone (ToR g)

Within the context of ICZM a range of existing and upcoming European policies and directives need to be considered. Similar policies exist in other ICES countries like Canada. These form an overall framework in which the work of ICES needs to be incorporated (Figure 3.7.1). These policies and directives include:

- Habitats and Birds directives;
- EU Water Framework Directive;
- EU Marine Strategy Directive;
- EU ICZM Recommendations;
- EU Maritime Policy (Blue Paper).

In ToR a) several contributions from other ICES WGs relating to ICZM from their specific aspects are discussed, while in ToR f), the WGICZM identified indicators as key focal points for linking science and policy. Indicators are effective tools for assessing and monitoring ICZM efforts and for communicating results and arising issues to decision makers in government, the private sector and the civil society. On the other hand, as stated under ToR f), indicators and their reference conditions need to be related to objectives at local, regional, national or international levels and be selected in a process which is appropriate to that level including involvement of relevant decision making bodies and stakeholders.

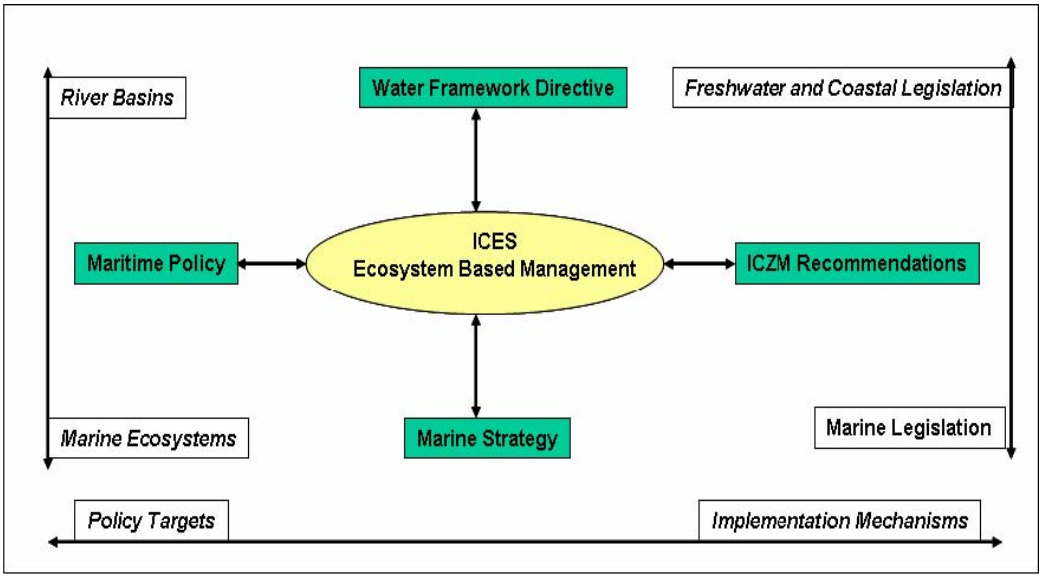


Figure 3.7.1. ICES position within ecosystems and EU legislation framework.

Obviously, ICZM needs to be seen in relation to the interactions between human activities and the ecological, economic, socio-cultural and institutional context, which has to be reflected in evaluation and assessment frameworks. An example of research on assessing interactions between ecological, economic, social and governance aspects of ICZM is the German BMBF funded research project "Coastal Futures", which aims to develop an integrated assessment approach for coastal and marine changes by using offshore wind farms as a case study for changing spatial structures. Based on the notion of socio-ecological systems, the application of the Driver-Pressure-State-Impact-Response (DPSIR) approach and the concept of ecosystem services (Figure 3.7.2), the cluster focuses on risks and opportunities associated with offshore wind farms in the German North Sea as an example for sea use change. Key activities include:

- Discussing future sea use patterns using a scenario approach;
- Modelling and assessing impacts of offshore wind energy on specific ecosystem services;
- Modelling and assessing economic impacts of offshore wind energy at local and regional scale;
- Analysing social values, problem perceptions, institutional networks and communication;
- Analysing and assessing related policies and governance structures;

In the Canadian government a framework following a similar approach is being developed and tested. This Canadian approach links DPSIR structured assessment of human activities and their impact on ecosystem services within a decision-making framework, the latter being based on concepts of risk analysis and vulnerabilities of coastal systems. This Community Viability Ecosystem Dependency Model (CVED Model) connects the coastal community to their respective catchment and coastal aquatic ecosystem. The CVED model connects the risks of coastal communities' viability to their dependant ecosystem services, which are susceptible to the health of the ecosystem and the stressors of the same coastal community (Figures 3.7.3 and 3.7.4). The model provides the basis for integrated planning at the coastal level and subsequent integrated management.

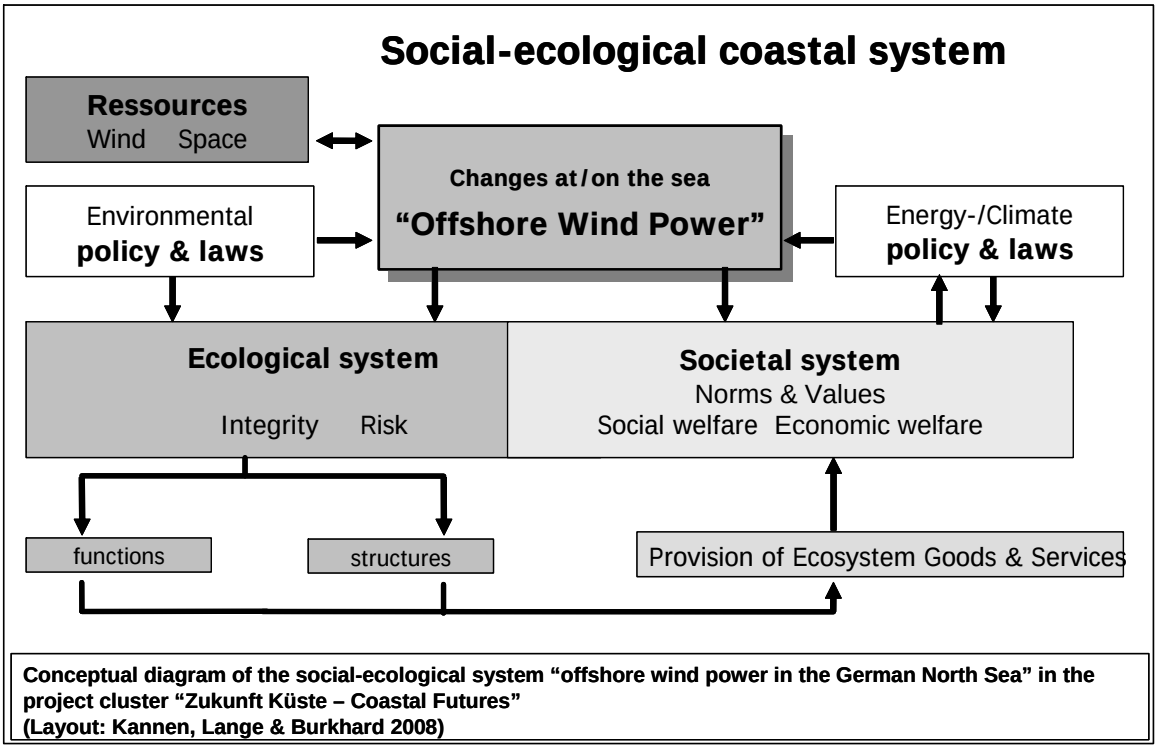


Figure 3.7.2. Approach for assessment of human activities used within the Coastal Futures project (submitted for publication in Kannen and Burkhard in GAIA 2008).

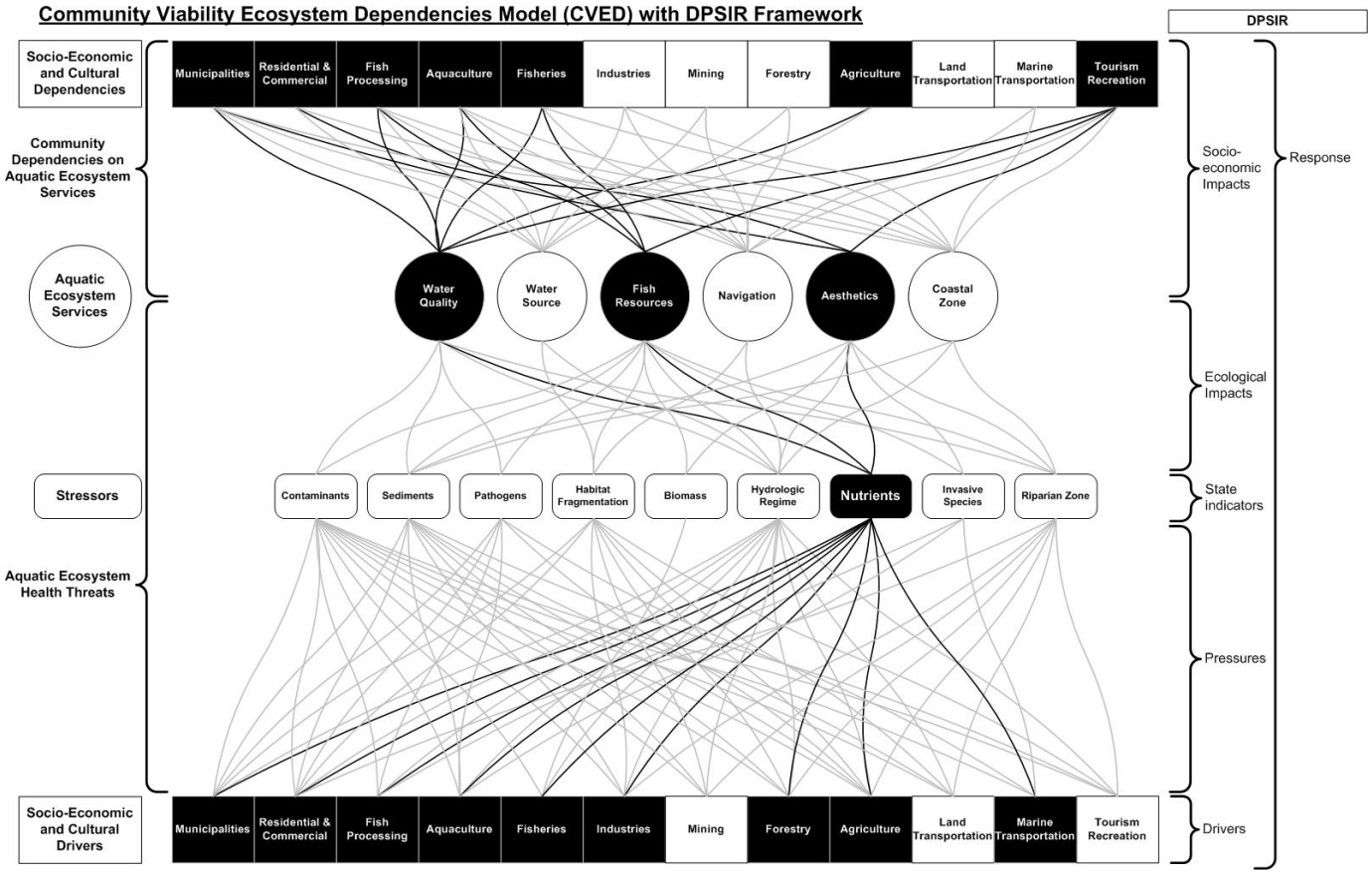


Figure 3.7.3. CVED Model tested in Canada for coastal assessment (developed by R. Cormier, 2007).

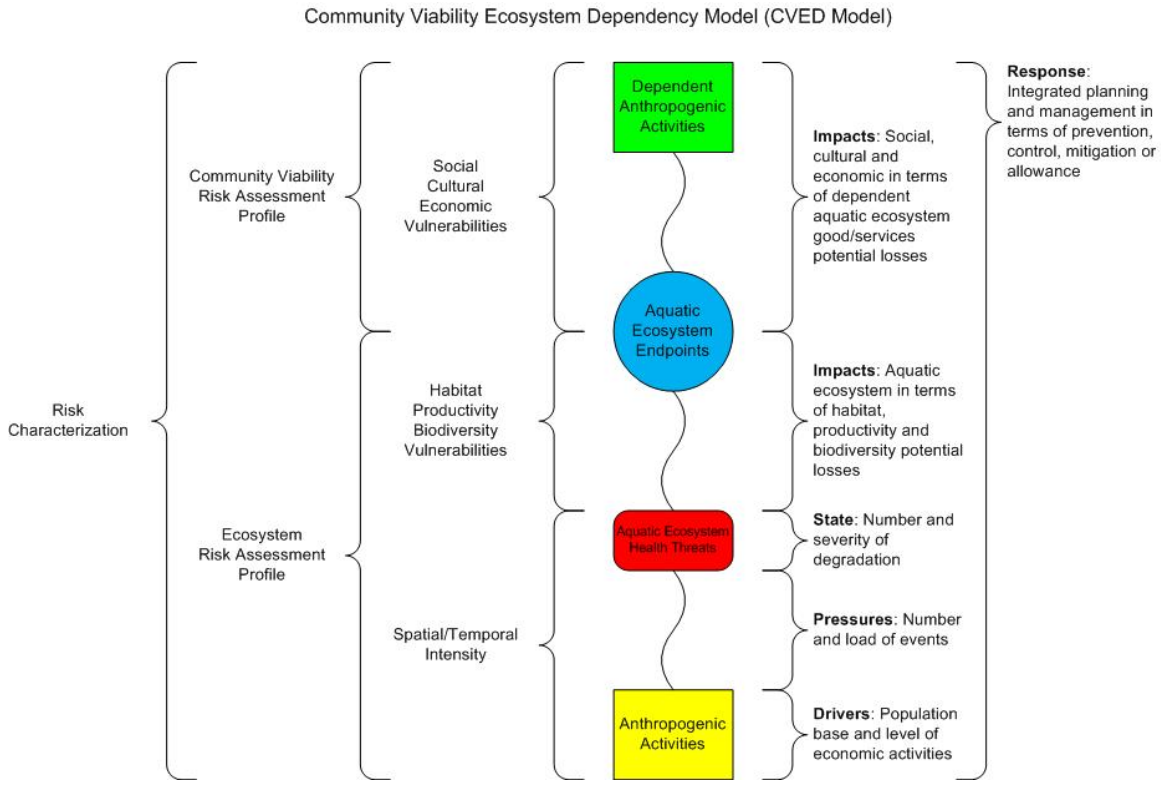


Figure 3.7.4. Elements in and structure of the CVED Model (developed by R. Cormier, 2007).

The approaches mentioned here together form a base for an evaluation framework. Similar tools for system analysis being developed in SPICOSA can be linked to this framework as well. In any case, the evaluation framework needs to relate to decision making in management and policy, considering the multilevel, multi-goal characteristics of coastal (including terrestrial parts of the coastal zone) and marine governance in agreement with the Draft ICES Science Plan (5.3.2 and 5.3.4).

From the perspective of WGICZM the WFD, which forms a legislative driver to look at river basins and coastal environments in a comprehensive way, can be tackled using the integrated approach described above. The EU Water Framework Directive (WFD) has the following aims that relate to coastal waters, including transitional waters (from Article 1):

- Prevent further deterioration and protect and enhance the status of aquatic ecosystems;
- Promote sustainable water use based on a long-term protection of available resources;
- Enhanced protection and improvement of the aquatic environment, inter alia, through specific measures for the progressive reduction of discharges, emissions and losses of priority substances and the cessation or phasing-out of discharges, emissions and losses of the priority hazardous substances;
- Contribute to mitigating effects of floods and droughts and thereby contribute to protection of marine waters and achieving the objectives of relevant international agreements, including those which aim to prevent and eliminate pollution of the marine environment, with the ultimate aim of achieving concentrations in the marine environment near the background values for naturally occurring substances and close to zero for man-made synthetic substances.

To address these aims, the implementation of the WFD includes the characterisation of river basin districts, the review of environmental impacts of human activities, establishing coastal water types using a common typology; divide the coastal waters into surface water bodies according to the typology and assessment of ecological status of all these water bodies.

In the assessment of the ecological status of coastal water specific biological quality elements are considered (phytoplankton, macro algae and angiosperms, benthic invertebrate fauna), as well as hydro-morphological quality elements (tidal regime, morphological conditions) and physio-chemical quality elements (temperature, oxygen, transparency, nutrients, specific synthetic pollutants, specific non-synthetic pollutants).

To obtain high ecological status the values of the specific biological quality elements and physio-chemical quality elements of a water body should be close to reference values, which are undisturbed (pristine) conditions.

The role of ICES in the application of the WFD in the coastal zone

The focus of the WFD on aquatic ecosystems is in line with the ecosystem approach adopted by ICES. ICES has, on request, given advice to the EU on appropriate eco-regions in European waters, and on ecosystem based management, see http://www.ices.dk/advice/marineeco.asp. In addition, the ICES community (committees, working groups, study groups, workshops), by responding to specific

terms of reference, have contributed, and can contribute in the future, with scientific assessments and advices of relevance for the implementation of the EU WFD, but also the EU MSD and other directives like the Habitats and Birds directives, which involve most of the ICES-member countries. So far the contributions from ICES to the implementation of the WFD has been spread among many working– and study groups and often not very specifically communicated. Much of the WFD-relevant work by the ICES community has been done by assisting OSPAR, HELCOM or other commissions.

ICES should identify and further improve coordination of the WFD and MSD related work done by its various WGs with a view to achieving ICZM or better contributing to ICZM as a tool for implementation of specifically the MSD and the EU Maritime Policy.

From the perspective of WGICZM the WFD can be tackled using the integrated approach described above. The importance of interactions between river basins/catchments and coastal habitats was noted as a driver of matter and energy fluxes. Most available information and expertise for catchment-coast interactions are found outside ICES, recognising that within the Earth System Science Partnership (ESSP), LOICZ in particular has performed a considerable amount of work in dealing with this issue. Several programmes under the UN umbrella deal also with this issue. In the context of non-EU countries, attention needs to be given to similar policy approaches, for example the Canadian Oceans Act and ICZM implementation in Canada, in order to strengthen cooperative approaches for managing the catchment-coast-ocean interactions.

Recommendations:

Out of the discussions concerning assessment frameworks, WGICZM proposes the following recommendations:

a) investigate the usefulness of assessing ecosystem goods and services as a tool to link the ecosystem approach to management, the assessment of human impacts and subsequent decision making.

b) investigate how the type of integrated assessment processes described in this ToR can be included in "Ecosystem-based Management" and thus also be included in a decision making framework for ocean and coastal management.

Based on the discussions about catchment-coast-ocean interactions, WGICZM recommends that this WG works towards exploring cooperation with LOICZ and invite LOICZ representatives to the next meeting of WGICZM with the aim of having a joint half day session exploring river-coast-ocean interactions.

4 Other items

The meeting next year will be held at GKSS Research Center, Geesthacht, Germany from 24 to 27 March 2009.

Recommendation:

WGICZM recommends having a Theme Session in the 2010 Annual Science Conference on decision making frameworks for ICZM, including the land-ocean interactions

WGICZM supports the Second International Symposium on ICZM to be held in Glasgow, UK in June 2009. The WG recommends that ICES sponsor this conference.

Annex 1: List of participants

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Annex 2: Agenda

Tuesday, 11 March

09.00	Welcome. Beatriz Morales Nin (Chair). House keeping and support arrangements. Introduction of participants. Agenda approval.
09.15	ICES Science plan.
09.30	Review of Terms of Reference, Designation of Reporters, Report layout (chair + members).
10.00	Coffee Break
10.15	Tor d) different participants present status and progress within different larger projects relevant to ICZM.
13.00	Lunch
14.30	Status and progress regarding ToR c): revise and update a list of tools, data products and research needs
15.45	Status and progress regarding ToR e): Each country should present their reports on coastal activities regarding continue to report on the effects of thermal, chemical and saline pollution produced by desalinisation and power plants.
16.45	Collate different inputs into the report.

Wednesday, 12 March

09.00–16.00	Miniworksop on indicators (ToR f) B. Morales-Nin Rafael Sarda Gotzon Basterretxea C. Greathead Hannelore Malfait Roland Carnier Amy Dietrich Javier Franco Andreas Kannen Grete Elisabeth Dinesen
16.00–18.00	Round table on selecting indicators applicable and relevant at local scale

Thursday, 13 March

09.00	ToR b) Each country or organization presents his/her report.
10.15	Coffee Break
10.30	ToR g): Update discussion on "draft on the development of a framework for integrated evaluation of human impacts in the coastal zone and how to integrate this information for CZM, identifying ICES' role in the application of the WFD in the coastal zone

13.00	Lunch
14.30	Progress and update on ToR a): update and report on activities of relevant ICES Working and Study groups to identify information pertaining to coastal zone and evaluate this information relative to ICZM needs and review progress from the EU and IOC
16.30	Collate different inputs into the report.
17.30	Days Progress distributed for reading.

Friday, 14 March

09.00	Rapporteurs of the different ToR pass draft recommendations and 2009 ToR proposals to be discussed in forum.
10.15	Coffee Break
13.00	Lunch
14.30	Work in drafting groups
16.00	Collate the report and print out Draft 2 and distribute for reading.
17.00	Convene to discuss the draft report.
18.00	Final modifications of draft.
	Next year venue and dates.
	End of 2008 meeting.

Annex 3: Terms of Reference for 2009

The **Working Group on Integrated Coastal Zone Management** [WGICZM] (Chair: B. Morales-Nin, Spain) will meet at GKSS Research Center, Geesthacht, Germany from 24 –27 March 2009 to:

a) update and report on activities of relevant ICES Working and Study groups to identify information pertaining to coastal zone and evaluate this information relative to ICZM needs and review progress from the EU and IOC;

b) update and report on ICZM activities in different ICES countries including information on initiatives towards integrated governance on the CZ;

c) continue to monitor and report results generated from larger projects that are directly relevant to ICZM needs;

d) progress the development of an integrated decision making framework for ICZM;

e) evaluate the usefulness of assessing ecosystem goods and services in ICZM;

f) report on progress on catchment-coast fluxes in the ICZM management plans of ICES countries.

WGICZM will report by 30 April 2009 for the attention of the Marine Habitat Committee and ACOM.

Supporting Information

Priority:	In order to maintain and improve the quality of ICES advice, the specific requirements for scientific advice in support of client initiatives on ICZM need to be evaluated. In response to demands for ecosystem-based advice, ICES has adopted an ecosystem-based approach. Including the coastal zone would allow ICES to provide better holistic advice. Consequently these activities have high priority.
Scientific justification and relation to action plan:	All ToRs also relate to Action Plan 1.9, 2.2, 2.3, 2.9, 2.11, 2.12, 2.13, 3.3, 4.7, 4.8, 4.14. Many ICES Study and Working groups address specific coastal zone issues. Others do not include coastal zone issues in their work, but have the expertise to, or could, with added expertise, address these issues. All the information being generated needs to be compiled and analysed to ensure consistent and integrated advice. The ecosystem based approach to the management of human activities as the leading principle for integrated coastal zone management implies that knowledge on the key ecosystem processes and properties in the coastal zone will be the core of the information ICES will be able to add into the process of ICZM. Important components include the valuation of coastal ecological niches, specific habitats, identification of essential and critical species and habitats particular to coastal areas, and development of EcoQOs specifically for the coastal zone. This work will contribute directly to the applications of emerging and present coastal directives (e.g. EU-WFD; EU-ICZM, Marine Strategy) and other local or trans-boundary management issues within ICES Member Countries.
Resource requirements:	New experts have been recruited during the past two years and there is a need to engage experts from USA and other ICES countries involved in ICZM and not participating actively within the WG.

Participants:	ICES Member Countries working with coastal zone issues and 1–2 socio-economic experts also involved with ICZM.The Group is normally attended by some 10–14 members and guests.
Secretariat facilities:	None.
Financial:	No financial implications.
Linkages to advisory committees:	There are obvious direct linkages with ACOM.
Linkages to other committees or groups:	MHC, MARC and several Working Groups within these committees.
Linkages to other organizations:	EU, OSPAR, HELCOM.

Annex 4: Recommendations

1) WGICZM to continue to update and report on the activities of relevant ICES working and study groups to identify information pertaining to coastal zone and evaluate this information relative to ICZM needs and to monitor progress within the EU and IOC.

2) WGICZM to continue to update and report on ICZM activities in different ICES countries including updates on initiatives towards responses to the future Marine Strategy Framework Directive and activities to coordinate national management objectives within the coastal zone.

3) WGICZM recommends that it continues to monitor and report on the results generated from larger projects that are directly relevant to ICZM needs.

4) Following the discussion it is recognized that the WGICZM members have the necessary background and expertise to explore the essential aspects required for ICZM and indicator development which were highlighted previously. Each country is currently working on a specific aspect and approach and, therefore, there is a need for closer collaboration. In this context, it is felt necessary to bring together these elements. Therefore, WGICZM suggests the development of a joint proposal to FP7. Specifically, in the interim period, it is recommended that the WGICZM work towards:

   i) Bringing together the risk characterization and the indicator characterization approaches within an integrated decision making framework.

   ii) Developing a general framework for the indicator selection process for ICES countries. Within that framework should be the clear definition of objectives and the integration of the indicator system into the overall management process

   iii) Exploring the possibility of putting together a proposal developing the integrated decision making framework for ICZM.

5) Out of the discussions concerning assessment frameworks, WGICZM proposes the following recommendations:

   i) investigate the usefulness of assessing ecosystem goods and services as a tool to link the ecosystem approach to management, the assessment of human impacts and subsequent decision making.

   ii) investigate how the type of integrated assessment processes described in this ToR can be included in "Ecosystem-based Management" and thus also be included in a decision making framework for ocean and coastal management.

6) Based on the discussions about catchment-coast-ocean interactions, WGICZM recommends that this WG works towards exploring cooperation with LOICZ and invite LOICZ representatives to the next meeting of WGICZM with the aim of having a joint half day session exploring river-coast-ocean interactions.

7) WGICZM recommends having a Theme Session in the 2010 Annual Science Conference on decision making frameworks for ICZM, including the land-ocean interactions

8) WGICZM supports the Second International Symposium on ICZM to be held in Glasgow, UK in June 2009. The WG recommends that ICES should sponsor this conference.

Annex 5: Current ICZM activities and progress in different ICES Member Countries (ToR b)

Issue	Canada	Denmark	Germany	Ireland	Netherlands	Norway	Poland	Spain	Sweden	UK
Coastline length	Longest marine coastline in the world 243,792 km	7,000 km	3,379 km 1,300 km North Sea 2,000 km Baltic Sea	7,100 km	432 km 82% of which is sandy shores	Mainland without fjords: 2,650 km Mainland including fjords: 21,000 km The coastline including islets and islands: 85,000 km	500 km	6600.4 km including the autonomous cities of Ceuta and Melilla on the Moroccan coast	7,600 km	19488 km
Has the coastal zone been defined for management?	Between low water mark and 12 nautical mile line	3 km inland 6 m depth or 1 nm seaward	No, Entire German Continental Shelf is considered	No, coastal boundaries defined by WFD, EEZ, ICES areas	The coastal sea, limited to the -20 metre bathymetric line, beach, dunes, sea dikes and the strip to landward of them which bears some functional or cultural relationship to the coast	No The EU WFD definition of 'coastal water': 1 nautical mile off the baseline is adopted	Not reported	The EU WFD definition of 'coastal water': 1 nautical mile off the baseline of interior waters is adopted	No	Informal 5 m inland in England only but in process of being decided

Issue	Canada	Denmark	Germany	Ireland	Netherlands	Norway	Poland	Spain	Sweden	UK
Competent authority for coastal zone use	Department of Fisheries and Oceans	Sea: Two ministries and three authorities. Land: One ministry via the Forest and Nature Agency. In 2007, 78 new coastal municipalities will be responsible for CZM.	Land and coastal waters (12 sm): Sectoral responsibilities, EEZ: Federal Ministry of Transport, Building and Urban Development (Federal Maritime and Hydrographic Agency BSH)	Department of Agriculture Fisheries & Food. Department of Environment (and local authorities) for planning and development on terrestrial side. (Departments restructured in 2007)	Many management authorities. The policy and management are organised in a number of different networks, some sectoral, others area-based	Several ministries and directorates. Counties and municipalities. Municipalities are leading the planning of their areas, both on land and in the sea (from land to the baseline)	Not reported	There are 3 levels of management, at the Estate level: Directorate General of Coasts(Direccion General de Costas),; at the regional level (federal governments) Regional Autonomous Authorities:	12 authorities have on a sectoral basis competence in relation to the use of the coastal zone. The municipalities lead the physical planning out to 12 nm.	Scotland: Scottish Executive - Marine Branch England and Wales: Department for the Environment Food and Rural Affairs (DEFRA) - Marine Environment Division
with a consultation process involved through	Integrated management plans, rules governing oceans and fisheries, new oceans governance arrangements, ecosystem science	Consultation with sectors and stakeholders	Consultation with sectors and stakeholders	Depending on the issue but normally with other Departments, Governments Agencies, NGO and stakeholders.	Other than National Spatial Strategy (2005), The Third Policy Document on Coastal Areas (2000) is the most important policy document in relation to the coast. Consultations within networks with sectors and stakeholders	Consultation with sectors and stakeholders	Not reported	Master Plan for Coastal Sustainability (POL in Cantabria, POLA in Asturias, PDUSC in Catalonia, PTSL in the Basque Country); Territorial sectorial plan of the littoral zone; and the city level	The local communities and resource users through the process of municipal planning and hearings; The sectoral authorities; user's organizations; the Co-management groups, where these exist.	Inter-governmental cooperation Coastal Fora Stakeholder involvement

Issue	Canada	Denmark	Germany	Ireland	Netherlands	Norway	Poland	Spain	Sweden	UK
Responsible authority ICZM (EU Recommendation)	Department of Fisheries and Oceans in collaboration with Provincial and Territorial Government Departments	Ministry of Environment	Federal Ministry of Environment	Department of Agriculture, Fisheries & Food. (CZM section)	Multiple management authorities.	Not reported	Not reported	Directorate General of Coasts of the Ministry of Environment; for inland fisheries the Regional Governments and for coastal zones the Fisheries Directorate General from the Ministry of Agriculture and Fisheries	The National Board of housing, building and planning (NBHBP)	Scottish Executive and Defra
EU ICZM Stock-take [1]	Non-EU yes	Ministry of Environment. Two reports. No decisions as yet on how to proceed.	Finished	In progress	Yes (2005)	Not reported	No	Yes	In progress	Yes
EU ICZM Strategy [2]	Non-EU yes	No strategy formed as yet.	Yes	Stocktake drafted. No formal strategy since 1997 Draft ICZM Policy	Yes	Not reported	No	Yes	In progress	Yes
Key Activities	1. Fishing 2. Oil and gas exploration 3. Aquaculture, 4. High coastal population, 5.Transportation 6. Marine energy 7. Tourism 8. Coastal defense	1.Coastal marine wind farms, 2. Aquaculture, 3. Coastal protection, 4. Nature rehabilitation, 5. House boats, 6. Mineral extractions, 7. Pipelines, 8. Mussel farming and dredging,	1. Offshore wind-farms, 2. Marine aggregate extraction activities, 3. Fishing, 4. Nature conservation areas, 5. Development of ports and harbours, 6. Tourism, 7. Coastal defence strategies, 8. Aquaculture,	1. Shipping and maritime transport, 2. marine energy, 3. Aquaculture, 4. Marine tourism, 5. Fishing, 6. Nature conservation,	1.Coastal defence 2.Sand nourishment 3.Urban and industrial development 4.Nature conservation 5.Fishing 6.Shellfish farming 7.Recreational activities 8Gas extraction 9.Wind farming 10.Dredging	1.Marine resource exploitation, 2. Fishing, 3. Carrying capacity, 4. Introduced species, 5. Aquaculture,	1. Seasonal tourism, 2. Coastal urbanisation, 3. Coastal industries, 4. Comercial and fishery ports, 5. Land reclaim for agriculture,	1.Urban and mass tourism development, 2. Coastal occupation, 3. Recreational marinas, 4. Recreational fisheries, 5. Intensive aquaculture, 6. Fishing,	1. Fishing, 2. Recreational fishing, 3. Tourism, 4. Marine resource exploitation,	1. Large coastal population, 2. Coastal development, 3. Coastal defence, 4. Coastal manufacturing industries, 5. Marine resource exploitation 6. Fishing, 7. Aquaculture 8. Marine renewables

Issue	Canada	Denmark	Germany	Ireland	Netherlands	Norway	Poland	Spain	Sweden	UK
Key issues identified	1. Over exploited fsh stocks, 2. Spatial competition and un quantified environmental impacts, 3. Spatial competition and eutrophication, 4. pollution near urban areas,	1. Spatial competition and un quantified environmental impacts, 2. Spatial competition and eutrophication, 3. Habitat loss flooding and erosion, 4. Spatial competition, 5. Spatial competition, 6. Habitat loss 7. Environmetal impacts and spatial competition, 8. Habitat loss and spatial competition	1. Spatial competition and un quantified environmental impacts, 2. Habitat loss, Spatial competition and environmental impacts, 3. Over exploited fsh stocks, 4. Spatial competition, 5. Spatial competition and habitat loss, 6. Coastal pollution and carrying capacity issues, 7. Habitat loss flooding and erosion, 8. Spatial competition and eutrophication	1. Spatial competition, 2. Eutrophication & Environmental impacts, 3. Improve knowledge gap on resource use 4. Carrying capacity issue 5. Over exploited fsh stocks 6. Real time monitoring and better knowledge of marine events.	1.Coastal erosion 2.Coastal squeeze 3.Nature conservation 4.habitat loss 5.Wind-farming 6.Dredging 7.Fishing 8.Shelfishculture 9.Sandnourishment 10.Gas extraction 11.Recreational activities 12.Mitigation compensation	1.Limited knowledge of coastal species and processes, 2. Over exploited fsh stocks, 3. Pollution 4. Competition for habitat, 5. Spatial competition and eutrophication	1. Coastal pollution and carrying capacity issues, 2. Coastal pollution, 3. coastal pollution, 4. Habitat loss and spatial competition, 5. Habitat loss	1. Habitat loss 2. Coastal pollution and carrying capacity issues, 3. hydro-morphological alteration, 4. Over-exploitation of natural resources, 5. Eutrophication, ecosystem changes (jellyfish blooms, biodiversity changes, habitat destruction), water quality 6. Over exploitation of fish stocks	1. Poor economy in the commercial fisheries and over exploitation of fish stocks, 2. Local over-fishing, 3. Coastal pollution and carrying capacity issues, 4. Conflicts between stakeholders Increased use of marine resources	1. Coastal pollution and carrying capacity issues, 2. Habitat loss and pollution, 3. Habitat loss flooding and erosion, 4. Habitat loss and pollution, 5. Spatial competition and depletion of resources, 6. Over exploitation of fish stocks, 7. Spatial competition and eutrophication 8. Spatial competition and un quantified environmental impacts

Issue	Canada	Denmark	Germany	Ireland	Netherlands	Norway	Poland	Spain	Sweden	UK
ICZM relevant Legislation	Oceans Act, Fisheries Act, Species at Risk Act , Canadian Environmental Assessment Act	System of laws Protection of Nature Act (1992) Planning Act (2000)	Nature Conservation Act Federal Building Act Planning jurisdiction to MHW	Planning jurisdiction to HW Foreshore Act between HW and territorial limit- licences for marine works, Local Government Planning & Development Acts – planning on the terrestrial side. Sea Fisheries Acts – regulation of sea fishing. Foreshore Acts – licensing for aquaculture. Water Quality & pollution legislation. Transposition of EU Legislation on WFD, BWD, HD, Shellfish Water Dir.	Several relevant laws including planning, management, fisheries, aquaculture pollution, nature conservation, recreation, navigation etc.	More than 13 relevant laws including planning, management, fisheries, aquaculture pollution, nature conservation, recreation, navigation etc.	Not reported	The Shores Act = Ley de COSTAS (22/1988, July 28th), Law on Evaluation of Plans and Programmes (Ley de Evaluación de Planes y Programas) (application of the Strategic Environmental Assessment Directive); EU Framework Directives: Water, Habitat, Flows, Marine Strategy	The planning and building Act (1987) The Environmental Code (1999) The Fisheries Act (2003)	Planning jurisdiction to MLWS. Crown estate lease required to 12 nm Licences required for coastal and marine works (FEPA), other discharges and aquaculture also require a licence (CAR)
Precautionary approach applied?	yes	yes	Not reported	Yes – in the decision making process	Mostly only in theory	yes		Not reported	Yes, to a certain extent on a sectoral basis and in the municipal planning process.	Yes
National ICZM projects, consortia or networks	integrated management pilot programs	GIS mapping. MariNet formed	Zukunft Küste (Coastal Futures) ICZM-Odra	I-CoNet initiative. AquaReg CZM. Corepoint.	COPRANET INTERREG IIIB/IVB ENCORA	GIS Maps of marine nature for use with ICZ planning and Management		HISPACOSTA INCOME Mallorca ICZM project EKOLURRAL-DEA (Basque Country)	ENCORA/ SENCORE Regional and local projects	Local Coastal forums/Partnerships. Regional schemes e.g. Irish Sea Pilot and SSMEI.

Issue	Canada	Denmark	Germany	Ireland	Netherlands	Norway	Poland	Spain	Sweden	UK
Integrated data management initiatives	Not reported	Through MariNet	information system CONTIS (Continental Shelf Information System), NOKIS and other projects on environmental data and/or meta data	National Sea Bed Survey. http://www.gsiseabed.ie/ Marine Data Repository Smartcoast. Smartbay. Aquareg CZM.	Not reported	Not reported		In development an Integrated Data management system for the Director Plan on the Sustainable Coastal management (http://www.gisig.it/eco-imagine/presppt/Nice/	Ongoing process. Models for integrating data on recreational fisheries are being designed.	Integrated Coastal Hydrography project, MDIP/ MEDAG, UKSEAMAP UKDMOS, MCCIP, UKMMAS
Environmental national research initiatives relevant to ICZM	Ecosystem overview and assessment report (EOAR), map of ecological and biological significant areas (EBSA), Ecosystem Research Initiative (ERI)	Interreg programmes: BERNET, BALANCE. Baltic Sea Breeze, WATERSCETCH, Safety at Sea, Comrisk, comcoast, lancewadplan, Wadden Sea Forum, POWER, FSII,	RETRO, IMPULSE, EU-INTERREG: BaltCoast project POWER project	National Sea Bed Survey, Review of Marine Environmental Indicators. Smartcoast	Not reported	GIS Maps of Marine nature MAREANO Project on the ecological impact of introduced King Crab.		There are 33 ongoing R&D National Funded Projects with a wide range of objectives from GIS to biodiversity including socioeconomic aspects, EU Funded initiatives (SPICOSA); Interreg projects (ENPLAN, DEDUCE, BEACHMED) and Regional funded projects (EUGIZC)	Swedish EPA is supporting many research initiatives of relevance. Major programs such SUCOZOMA and WASTRA are now completed. Sweden is involved in EU-projects of relevance such as Interreg.	Review of Marine Nature Conservation and the Habitat Classification Scheme Irish Sea Pilot State of the Seas Report MarClim MECN Seabed Indicators Species database and report (SNH) Marine National Park Project SSMEI

Issue	Canada	Denmark	Germany	Ireland	Netherlands	Norway	Poland	Spain	Sweden	UK
Socio-economic information	Yes, human use atlas	GIS with overview of the different usages – not integrated, within different counties	spatial plans dealing with human activities	National Spatial Strategy County Development Plans	Several data-bases are available, but not integrated	Municipalities plans for their coastal zones, Statistics from fisheries and aquaculture		There are several initiatives at Regional level in development, the States main source of information is the Statistics National Institute (Instituto Nacional de Estadistica) where a GIS at municipality level is available	Conventional socio-economic data is used in planning.	Not reported
Marine coastal protected areas	6 Marine Protected Areas, 4 Areas of Interest	254 habitats protected including bird protection zones, 27 solely marine; coastal protection zone exists	Habitat and Bird protected areas proposed, 100 m inland in Schleswig-Holstein 200 m inland and seaward in Mecklenbug-Vorpommen a whale sanctuary, Wadden Sea is a National park	158 marine sites 4,196 km^2 All Natura 2000 sites	Habitat and Bird protected areas, both marine, estuarine and terrestrial	Coral reefs protected, Bird areas protected, A new national plan for protection of marine areas is in preparation		Natura 2000 and Bird Protected areas defined, 2 National Parks with land-sea domain (Islas Atlanticas and Cabrera), Coastal Biosphere Reserves and Regional protected areas (PEIN in Catalunya, Marine Biotopes in the Basque Country)	0–6 m fringe, fishing trawling line, Natura 2000 sites, HELCOM and OSPAR protected areas, World Heritage areas, marine reserves, birds/seals/fish spawning areas. A first Marine National Park is under planning	382 marine Natura sites 1 Offshore SAC 1 Marine SPA- further ones and extensions to terrestrial ones are being considered 7 MEHRAs identified OSPAR MPAs (Natura sites)

Issue	Canada	Denmark	Germany	Ireland	Netherlands	Norway	Poland	Spain	Sweden	UK
Water Framework Directive Position	Not relevant	Local municipalities responsible to elaborate and implement plans for the quality and use of coastal waters, based on environmental quality objectives. Suggestions for formation of 12 water districts being considered.	On "Länder" (county) level	Transposed to Irish legislation. Established 8 RBD. Characterisation of sites. Irish WFD Monitoring Programme operational in Dec 2006.	WFD-objectives are set, with exeption of macrofauna. A monitoring programm will start and several projects will be executed.	The first characterisation and classification performed is to be evaluated by the regional WFD authorities		At national level it has been enforced in 2001. For the Basque Country: characterisation finished the rest must be finished in 2008 (http://hispagua.cedex.es)	Five watershed authorities each governed by a board are working with the preparation of action plans.	Transposed to devolved country legislation Monitoring programme fully operational in December 2006

5a. BELGIUM (updated in 2008)

In the context of ICZM, a flexible definition of the zone which compromises both sides of the Belgian coastline: sea and land, is often used. The coast comprises the territory of the coastal and polder (hinterland) municipalities and is demarcated on the seaward side by the 12 mile zone. In the context of legislation, the line between land and sea is formed by the baseline or the average low water line. The Belgian Coast is a densely populated area with important economic and tourist activities. The coastline comprises broad sandy beaches that are mostly connected to a narrow dune belt. Inland, there lies a flat and vast polder landscape. The extensive road system provides easy and efficient access to the coast from a vast hinterland comprising cities. The built-up shoreline and linear traffic infrastructure makes the coast resemble a narrow, unbroken, conurbation, only sparsely interrupted by empty spaces. On the seaward side of the coastal zone, the Belgian part of the North Sea, has a maximum width of about 65 km and extends about 87 km from the coast. Despite its small size, the North Sea of the Belgian coast is characterised by several valuable habitats. This in part has to do with the presence of a complex system of sandbanks.

ICZM Policy Activities

In Belgium there is no specific strategy for ICZM, but Belgium tries to integrate the ICZM approach in the existence instruments. A first governmental structure, which was important for realization of a sustainable and integrated management of the coast, was the Technical Commission North Sea (1990). It main objective was the preparation and the implementation of decisions, that were taking in international treaties concerning the marine environment. Under the impulse of several NGOs, the Flemish minister for environment set up an inter-ministerial cooperation in 1994. This was a first attempt for co-ordination and consultation of sector crossing activities with regard to the coastal zone. The co-ordination structure for International environmental policy (CCIM) was set up in 1995. The technical commission North Sea was reformed into the steering group North Sea and oceans and is a part of the CCIM-structure, which has a permanent character. As a sequel of the TERRA-Coastal zone project, the Coordination Centre for integrated coastal zone management (ICZM) was established in 2001. The partners of the Coordination Centre are the Province of West Flanders, acting on the basis of its decretal task to target specific zones; the Flemish authorities, two departments of which act as partners in the Coordination Centre. (1) the Department of Mobility and Public Works, Agency for Maritime and Coastal Services, Coastal Division; (2) the Department of the Environment, Nature and Energy, Agency for Nature and Forests, Coastal zone service and the Flanders Marine Institute (VLIZ). In September 2007, these partners signed a cooperation protocol at the Coordination Centre. By doing so, they confirm that they will use the Coordination Centre as their primary instrument for accomplishing sound coastal management. The global goal is to stimulate and promote the sustainable and integrated management of the Belgian coastal zone. The Coordination Centre is the prime point of contact for everyone in the coastal zone that is involved in cross-sector issues. To accomplish this mission, the Coordination Centre is to pursue three strategic objectives:

1) Cooperating in implementing the Recommendation of the European Parliament and the Council of 30 May 2002 concerning the implementation of integrated coastal zone management in Europe;

2) promoting the integration of planning and policy in the coastal zone;

3) creating a basis for integrated coastal zone management.

In order to realize the three strategic objectives, the Coordination Centre will take the following actions:

1) communicating on and enhancing awareness of integrated coastal zone management:
   - realizing concrete actions within the framework of integrated coastal zone management with a view to creating a basis of support;
   - publishing in print (brochures, folders, posters, articles) and on websites concerning specific coast-related sector-transcending issues, or contributing to other relevant publications;
   - organizing or co-organizing workshops, symposia and conferences;
   - participating in public events, workshops, symposia and conferences;

2) acting as the point of contact for integrated coastal zone management:
   - setting up an information counter for the coastal zone and providing objective information to policy makers, teachers, students, interested citizens etc., from home and abroad;
   - providing information from and to the relevant international forums, on request and on our own initiative;
   - participating in the relevant European and international projects and networking on sustainable coastal management.

3) offering a platform for consultation on integrated coastal zone management:
   - assuring the secretariat for specific integrated consultative structures;
   - offering a (temporary) platform when specific, topical problems arise;
   - participating in relevant steering committees and consultative structures in order to develop a clear image of new policy developments and future plans and to make the facilitator's role known.

4) assuring the follow-up of the sustainability indicators in the coastal zone:
   - stimulating the use of coastal zone indicators as an instrument in policy development;
   - developing the website on indicators and contributing to relevant publications.

5) cooperating in the realization of the European Recommendation regarding the implementation of an integrated coastal zone management in Europe:
   - cooperating in the national implementation of an integrated coastal zone management in Belgium;
   - attending to the international cooperation within the framework of this Recommendation.

While implementing the objectives, the Coordination Centre will never take up the place of the competent authorities. The activities are determined and approved annually in consultation with all partners. Since 2003, Belgium appointed a minister for the North Sea. This minister has the responsibility for the political coordination between the different actors that are involved in the management of the Belgian marine area. For a better coordination of the actions of the Belgian state on sea, in 2003 the "Coastwatch" was established. In a later stadium (2005), the Flemish

government participated in the Coastwatch as an equal partner. In 2003, the minister of the North Sea had an objective to install a plan for a sustainable management of the North Sea. In a first phase, new rules for the sand extraction and electricity-production were implemented. In a second phase, 5 marine areas were protected in the framework of the habitat and bird directives. Three Bird Directive areas and Two Habitat Directive areas are being designated. By these measures, the EU Bird– and Habitat Directive have been fully implemented.

Water Framework Directive

The Water Framework Directive aims at the protection of all water bodies (including coastal waters) in Europe and must have achieved a 'good ecological status' in 2005. According with the EU Water Framework Directive, Flanders is divided into 11 basins. The filling-in of river basin plans goes by an equally process for the 11 basins but coastal areas are not included in these river basin plans. The project REFCOAST, aims to derive a typology, reference condition and classification system for the Belgian coastal waters in the framework of the objectives set by the European Water Framework Directive (WFD). For every determined surface water type (including coastal waters), a 'biological' reference condition needs to be determined. This reference should be based on a good ecological status of the surface waters, categorized by their biological, hydro-morphological and physico-chemical condition. The project combines a general overview of the Belgian coastal and marine jurisdiction and the status concerning the implementation of the WFD with a study of the availability of data and the delimitation of a typology, reference condition and classification of the coastal waters. The results of the project will be of direct importance to policy makers in charge of the implementation of the WFD for Belgium.

5b. CANADA (updated in 2008)

Canada has the longest marine coastline in the world with almost one-quarter of its population living in coastal communities. The area of its territorial seas is two-thirds of the landmass.

Key Issues for ICZM in Canada:

- Impacts on the economies of coastal communities
- Residential development and recreational and tourism use of the coastal zone are often in conflict with mariculture and traditional fishing uses.
- Land-based sources of pollution (e.g. nutrients and contaminants) and land use practices (e.g. forestry and agriculture) affecting the coastal zone
- Impact of offshore oil and gas exploration, development and production activity
- Energy extraction, wind and tide
- Sea-level rise, erosion, flooding
- Invasive species
- Marine transport and infrastructure
- There are a number of obligations resulting from international agreements with respect to biodiversity and endangered species that are common to all ICES member countries.

ICZM Policy Activities

Canada's Oceans Act, passed in 1997, gave the minister of the Department of Fisheries and Oceans (DFO) the authority to facilitate an integrated approach to the management of activities in the oceans and along our coasts. This means incorporating ecosystem-based, social, economic, and cultural considerations into decision-making processes through collaborations with affected and relevant interests.

Activities relating to integrated management in Canada were given a higher priority in March 2005 when the government committed "to move forward on its Oceans Action Plan (OAP) by maximizing the use and development of oceans technology, establishing a network of marine protected areas, implementing integrated management plans, and enhancing the enforcement of rules governing oceans and fisheries, including rules governing straddling stocks." The OAP articulates a government-wide approach to reach sustainable development. Fundamental to this initiative are new oceans governance arrangements, including integrated management, as wells as ecosystem science to improve the management of the marine environment. The main goal for oceans and coastal zone management in Canada continues to be the sustainable use of aquatic resources through a sustainable fisheries management framework. However, the application of the precautionary approach and integrated ecosystem-based planning are presently at the forefront with a number of current management and advisory issues as they relate to the coast.

The establishment of five priority Large Ocean Management Areas (LOMAs), within which DFO is applying an integrated approach to management, represents a significant step forward in achieving Canada's objective of improved oceans and coastal zone management. This initiative was in response to Phase I of the OAP and the LOMAs represent high-priority management areas within Canada's territorial waters: Pacific North Coast, Beaufort Sea, Gulf of St. Lawrence, Eastern Scotian Shelf and Placentia Bay/Grand Banks (Canadian Science Advisory Secretariat (CSAS) SAR 2007/010; http://www.dfo-mpo.gc.ca/csas/Csas/status/2007/SAR-AS2007_010_E.pdf). The establishment of these LOMAS included a number of scientific assessments and the development of approaches to formulate objectives against which ecosystem status and management success can be measured. The LOMA initiative included producing the following elements:

- Ecosystem Overview and Assessment Reports (EOARs) which are comprehensive descriptions of the knowledge base which present the current scientific understanding of the structure and function of the ecosystem.
- Lists of the Ecologically and Biologically Significant Areas (EBSAs) and Ecologically Significant Species and Ecologically Significant Community Properties (ESS/ESCPs) which represent a high ecological or biological significance and require a greater-than-usual degree of risk aversion in management of activities which can affect them.
- Conservation Objectives (COs) which are science-based objectives related to the status of the non-human components of the ecosystem (CSAS PS 2007/001;
- http://www.dfo-mpo.gc.ca/csas/Csas/Proceedings/2007/PRO2007_001_B .pdf).

Canada is committed to moving forward on the next steps the OAP and is active on a number of initiatives relating to coastal zone management. There is recognition of the need to adapt the approaches and knowledge from the LOMA initiative to the finer

scale of coastal and inshore areas. EOARs have already been completed for specific priority coastal areas and Coastal Management Area (CMA) pilot projects are being considered (CSAS PS 2007/025). This task is a challenge for both science and management given the extent and diversity of human activities in the coastal environment as well as the overlapping jurisdictions of municipal, provincial and federal governments. Ecosystem Research Initiatives (ERI) have been designated in coastal areas (e.g. Northumberland Strait and Strait of Georgia) to develop ecosystem-based advice for integrated management based on strategic scientific research. The development of ecosystem indicators and reference points is ongoing and considered essential to setting and achieving the goals and objectives. These indicators are tied to the identification of EBSAs/ESS/ESCPs and Species-at-Risk, where the intent is to provide for the overall ecosystem function and structure by protecting key ecosystem components. The renewed emphasis on ecosystem-based science and the identification of vulnerable components is expected to provide guidance in establishing monitoring approaches and scientific priorities (CSAS PS 2006/003; http://www.dfo-mpo.gc.ca/csas/Csas/Proceedings /2006/PRO2006_003_E.pdf).

Priorities also include the establishment of a Center of Expertise on Coastal Zone Management to develop national tools and approaches for integrated coastal management via a consortium of regional, national and international partners. The approach will focus on developing risk analysis decision making processes and governance by drawing on existing international practices, concepts and frameworks. DFO is drawing on the Driver Pressure State Impact Response (DPSIR) standards as well as the Pathway of Effects (PoE) approaches for risk characterization, decision-making and priority setting approaches through its Coastal Tools initiative. DFO is facilitating the development of Social, Economic, and Cultural Overviews and Assessments (SECOAs) to complement the EOARs. Stakeholder groups will be engaged in a structured process to match human activities with conservation objectives, indicators and reference points.

5c. DENMARK (Updated in 2008)

The Danish coastline length is approximately 7,000 km and is an important spawning and nursery ground for both commercial and non-commercial local and open sea fish and shellfish species. Spawning grounds for local herring stocks are found both in the fjords and along the open coasts together with spawning sites for a large number of non commercial species. The Danish Wadden Sea as well as sandy coastal areas in the inner Danish waters are important nursery grounds for many flatfish species. Small cod are found on gravel bottom interspersed with eelgrass and macro algal meadows and the ecological quality of these areas is essential for the survival and later recruitment to the fishery. Unlike many other countries, Denmark has defined a dividing line (the mean low-water line) between the sea and the land when dealing with management. The sea is managed by several ministries and by the 7 Environmental Centres under the Ministry of Environment, while coastal land areas are managed by the 7 Environmental Centres and the municipalities. Denmark has therefore not formally adopted a clear definition of the coastal zone or a defined integrated coastal zone management system (ICZM). However, the ICZM-principles have been applied through a system of laws and regulations, coordination among sectors and a high degree of public participation, which has developed over several years. Denmark has undertaken an ICZM stock take, but as yet has not produced a strategy for implementing ICZM.

Key issues

- Coastal marine wind farms
- Marine aquaculture (fish, mussels, oysters)
- The severe decline in coastal fish populations of both commercial and non-commercial species
- Coastal protection
- Nature rehabilitation
- House boats
- Mineral extractions
- Pipelines
- Mussel dredging
- Shipping
- Policy activities

A major structural reform of the Danish regional and local government structure decided upon in 2003 was implemented in 2007. Because of this no comprehensive Danish ICZM National Strategy has been formulated. A stock take on the state of coastal zone management was undertaken and reported to the EU Commission by the Forest and Nature Agency, Danish Ministry of the Environment. As part of the stock taking exercise, two reports were completed: "The report on county planning in the coastal zone" and "The analysis of administration of the coastal zone in Denmark". Both reports provided recommendations for ICZM. The Agency for Spatial and Environment planning and the Danish Coastal Authority, the two main authorities for the coastal zone, have not yet decided on how to proceed with the recommendations.

Data projects

- MariNet

Research projects

Interreg programmes: BERNET, BALANCE. Other projects include Baltic Sea Breeze, WATERSCETCH, Safety at Sea, Comrisk, comcoast, lancewadplan, Wadden Sea Forum, POWER, FSII, PROTECT and SPICOSA (www.spicosa.org). A number of smaller national projects were also identified. These represent case studies where GIS tools are implemented for the sustainable management of the exploitation of a local resource (shellfish).

Natura 2000 position

The Danish Ministry of the Environment through the Agency for Spatial and Environment planning is responsible for nature conservation. This Agency also administers raw material extraction at sea. The Ministry for Transport deals with transportation and infrastructure of the sea territory via the Danish Coastal Authority. The Ministry of Climate and Energy deals with matters related to exploitation of natural resources via the Danish Energy Agency. Fisheries and aquaculture are managed by the Ministry of Food, Agriculture and Fisheries through the Directorate of Fisheries. The planning process for both the terrestrial and marine zone will require coordination between these authorities in order to administer Natura 2000 directives appropriately. Consequence investigations have to be conducted before new activities (e.g. establishing of wind mill farms, mussel

aquaculture, and mussel fishery) can be performed in or nearby an international protected Natura 2000 site. The effect and consequence for the ecosystem in relation to both protected nature types and flora and fauna has to be evaluated for each separate species and fishing gear applied in the fishery. Denmark is currently elaborating Natura 2000 plans for each designated Natura 2000 site. Regulation of fishery activities can be relevant within the coming years in relation to especially structures leaking gas (the so called bubble reefs) and reefs in designated sites.

A number of government authorities and research institutes are engaged in tasks relating to management of the national marine area and the coastal zone have formed a network MariNet. Work within this network concerns different issues related to the marine environment such as:

- Development of strategies at a national scale
- National and international legal framework
- Characterisation of the marine sites
- Coordination of infrastructure to manage these sites.
- 254 habitats protected including bird protection zones, 27 solely marine; coastal protection zone exists

Water Framework Directive position

In Denmark the Ministry of the Environmental is responsible for preparing plan for quality of coastal waters and for programmes of measures to fulfil these quality objectives according to the WFD. Denmark is divided into 4 Water Districts and the Ministry of Environment is the Water Authority for all districts.

The local municipalities shall carry out the programmes of measures, including measures for point sources and diffuse sources.

Recreational fishery

As it is stated in Commission Regulation (EC) No 1581/2004, member states are obliged to assess catch figures (in weight) regarding the unaccounted catches in the non-commercial fishery especially for cod (*Gadus morhua*). In Denmark no official documentation on the magnitude of the recreational fisheries exists. Therefore, the present pilot survey on the recreational fisheries is not based on detailed official recorded data. In 1994 the Danish Institute for Fisheries Research (DIFRES) made a report on the Danish fishery in the Sound (ICES Subdivision 23). Furthermore, in 2005 a report on recreational fisheries catches in gillnet and trap-net in the period 2002–2004 (Støttrup *et al*., 2005). As the bulk of the Danish recreational– and angling fishing for cod takes place in the Sound it was decided that the present pilot survey should be made for this area. The survey was mainly focused on the organised recreational– and angling fishing in the area in 2006. Another reason for choosing the Sound is the relative large concentrations of adult cod compared to other Danish marine waters (Figure 1). In this report the Sound is defined as the area south of a line Gilleleje (DK)/Kullen (SE) and north of a line Stevns (DK)/Falsterbo (SE).

The fishery in the Sound can be divided into the following groups:

- Commercial– and sideline fishery
- Commercial angling boats
- Angling fishing club boats
- Trolling boats

- Recreational fishermen using gillnets and trap-nets
- Angling using small private boats
- Angling from the coastline

In the Sound area 61 Danish commercial fishermen are registered (all harbours from Hornbæk in the north to Bøgeskoven in the south). The fishery carried out from the commercial angling boats has been investigated in detail and it has been possible to give a total estimate of the cod catches. The total number of angling club boats is recorded and it is therefore possible to give an estimate of total effort and total catch of cod. For the trolling fleet we have estimated the number of days at sea, but unfortunately only a guest is possible for the number of cod caught in this fishery. The total numbers of recreational fishermen that use gillnet and trap net in the Sound is around 210, and we assess their catches of cod to an insignificant amount. For angling from small privately owned boats there is no estimate of the catches. Catches from rod and line fishery directly from the coast, we assess to have very minor effect on the total catch of in the Sound. It should be mentioned that many of the employees at DIFRES, living in the Sound region, through many years fishing in Sound, have a good understanding of what is happing in the fishery year abound. The pilot study set up by Denmark and the conclusions made for subdivision 23 are presented below.

From information gathers from colleges, retailers of fishing tackle and sport fishers magazines for the area we conclude that the major part of the recreational catch in the Sounds is taken by around 22 larger vessels that work with organised trips with anglers. We have conducted phone interviews with all the Danish vessels that organise trips all year. On the basis of their information regarding effort in 2006, in number of persons and the number of fishing days that cover 100% of the vessels we have calculated the total effort for the angling vessels. Further we have selected three vessels as reference vessels, and obtained detailed information regarding their effort and catches in 2006. The information from these reference vessels have been used to estimate the total catch for the whole fleet. The remaining part of the recreational fishery with smaller boats has been quantified by conducting investigation in all the Danish harbours in the Sound, to estimate the number and types of boats. Finally we have conducted phone interviews with a number of angling clubs to get an estimate of their member's effort and catches.

The fleet of commercial angling boats in the Sound consist of around 22 vessels that sail from the harbours of Kastrup, Copenhagen, Vedbæk, Rungsted, Nivå and Helsingør. The highest number of vessels sails from Helsingør and Copenhagen, but the numbers of vessels in the different harbours varies a lot with fishery and season. The vessels are of different sizes and can carry between 20 and 50 angers. On average the vessels has room for 25 to 30 passages. The fishing is pursued with a casting rod or by jig fishing from a drifting boat, and is mostly conducted in the northern part of the Sound, in the area around the island of Hven, and in the vicinity of Helsingør. The vessels conducts day trips lasting 7 to 8 hours, or half day trips with duration of 4 to 5 hours. In general the fishery in the first three month of the year is targeting bigger cod in spawning aggregation or on spawning migration. The catches are not great in number of individuals caught. In the spring the fishery is a transition fishery where smaller cod is targeted together with flatfish until the good summer fishery starts. From June to August/September a high number of smaller and medium size cod is caught. By fall and in the early winter, herring is targeted, and to a lesser degree cod, but cod are difficult to catch, due to the high concentration of herring. The winter fishery attracts many anglers from Denmark and also from northern

Europe. Partly because of wind and weather conditions in this season, this fishery does not contribute to the bulk of the recreational catches of cod in the Sound. During the winter fishery there are many days with small or no catches at all. On the contrary the summer fishery is very rewarding for the anglers, and there are few days without cod to all anglers. The fleet of Angling fishing club boats consist of 25 to 30 smaller boats, that often are at sea and catches there share of cod. The boats have room for three to ten anglers and are equipped with echo sounder and GPS. The trolling fleet consist of a high number of small boats, that lies in or are launch from harbours in the whole Sound area. All these vessels are equipped with echo sounders and GPS, and many of then are quit powerful and effective fishing boats. A greater part of these boats targets trout and salmon and gets cod as a bycatch. In the winter months many of the boats fish exclusive for cod. Recreational fishermen fishing with gillnet or traps have around 210 smaller boats, fishing with a small number of nets or traps. They mainly fish for flatfish, cod and eel. Recreational fishery from other small privately owned boats is conducted from an unknown number of very different types of vessels, and is mostly conducted during the summer month targeting cod, flatfish, garfish and mackerel. Angling form the coast is conducted year round from harbours and the beach targeting all the fish species in the area.

There are approximately 61 commercial fishermen registered in the harbours of the Sound. According to the Danish Directorate for Fishery the commercial catch of cod is 1.985 tons (live weight) in 2006. A part of this catch is taken by vessels from harbours outside the Sound. The fleet of commercial angling boats consist of 22 charter vessels that sails in the Sound. From this pilot studies we conclude that there in 2006 were fished in around 3200 days. In all around 75.000 recreational anglers took part in this fishery, and they caught an estimated 320 tons of cod, giving around 4.27 kg cod pr person pr daytrip. The angling club boats we have estimated to a total of 25 to 30 boats. From the catch information given during the interviews with the angling clubs, we have calculated that they have spent around 2500 fishing days at the Sound. Their catch is estimated to be 25 tons in all. The trolling fleet is a relative efficient fishing fleet, and due to their often big engines they can cover all of the Sound. We have estimated that the trolling boats in 2006 have spent 6000 days at sea. The total catch of cod for this fleet component is approximated to be around 100 tons. The recreational fishermen using gillnets and traps has around 210 vessels and operate a small number of nets or traps. They fish for flatfish, cod and eel. We have no calculation of either their effort or their catches. According the DIFRES report: "Registreringer af fangster i indre danske farvande 2002, 2003 og 2004" (in Danish) the fishermen often catch cod in the nets and traps. In our interviews with harbours masters in all the harbours of the Sound shows that these fishermen due not spent a lot of days at sea, and that there catches of cod is assumed to be of minor quantities. Recreational fishery from other small privately owned boats is conducted from an unknown number of very different vessels types. We have no calculations of either their effort or their catches. Angling form the coast gives very small cod catches and is regarded as having very limited influence on the stock. Overall it can be said that the part of recreational fishery that we have investigated have a total catch of cod of around 445 tons in 2006, and to this figure should be added at least a couple of hundred tons from the fishery where we have no information.

We are certain that the recreational fishery in the Sound is the most important Danish recreational fishery after cod in any Danish area, and that the Sound therefore has been the right place to conduct a pilot study of the recreational fishery for cod. We are also convinced that the method of making contact to all the commercial angler

boats, and thereafter selecting a number of reference vessels, where a closer collaboration have been established, is the right method to quantify these vessels catches of cod effective and reasonably accurate. The commercial angling vessels, including the reference vessels, do unfortunately not keep a record of the weight of the catches, and therefore this method it is not as appropriate for calculating the exact amount of the overall catch in kg. The method also has the weakness of giving no information regarding length/age/weight relationships, and can not expose the assumed small discard problems. We have good figures for effort on the boats owned by the Angling fishing clubs, but unfortunately the catch journals that have been fill in by club members, are not in a sufficient number to reflect the total catches of cod. The pilot study further has the weakness that we have been unable to calculate the effort spent by the trolling fleet. The effort figures are estimated by collecting information from angling fishing clubs, harbours masters and tackle shops. The estimated catch of 100 tons of cod is estimated from our knowledge of the fishery that mainly targeted trout and salmon. The recreational fishery with gillnet and traps have previously been investigated. We know the size of the fleet, but do not have adequate information regarding effort or the catch. Recreational fishery from other small boats and angling from the coast have not been investigated in this pilot study and therefore no estimate of the catches has been given. DIFRES's previous investigations of the recreational fisheries in the Sounds in the period 1988–1992, among them an interview investigation among recreational fishermen show the they in this five year period caught between 120 and 330 tons of cod pr year. The present study from 2006 gives an estimated catch of 445 tons plus an estimated two hundred tons extra from the fisheries with limited information. In our judgement the figures given in this study on the catches from commercial angling vessels is more realistic and higher that the study made in 1994. This difference also account for most of the difference found between the two studies. In addition the trolling fishery has increased considerably from the period 1988–1992 to 2006.

Following the discussion given above, we will also in the future limit the studies of the recreational fishery in the Sound, and we will try to improve the method. For the commercial angling vessels we will improve the contact the whole fleet and thereby get a better estimate of the total number of anglers that participate yearly in this fishery. To get better and more precise information from the reference vessels, we plan in 2007 to have at least one monthly visit at one of the reference vessels to discuss the fishery and collect the catch reports that have been fill in daily. And thereby get continues update on the catches from the Sound. At these visits we also plan to collect information on the length/age/weight distribution of the catch, in order to be able to estimate the size and age distribution of the catch from these vessels. Smaller privately owned boats and the boats owned by the angling fishing clubs: In the studies for 2007 it is our intention to investigate this fishery more closely and better than were done in this pilot study. We intend to make an organised interview or questionnaire studies, to get a more precise estimate of the overall number of fish caught by this fleet. The collected information on length/age/weight data from the reference fleet from the commercial angling vessels can also be used for the catches taken by the smaller boats. The trolling fleet: We will attempt to get in better contact with clubs organising these boat owners and get contact with more of the anglers to gather data on effort and catch amount.

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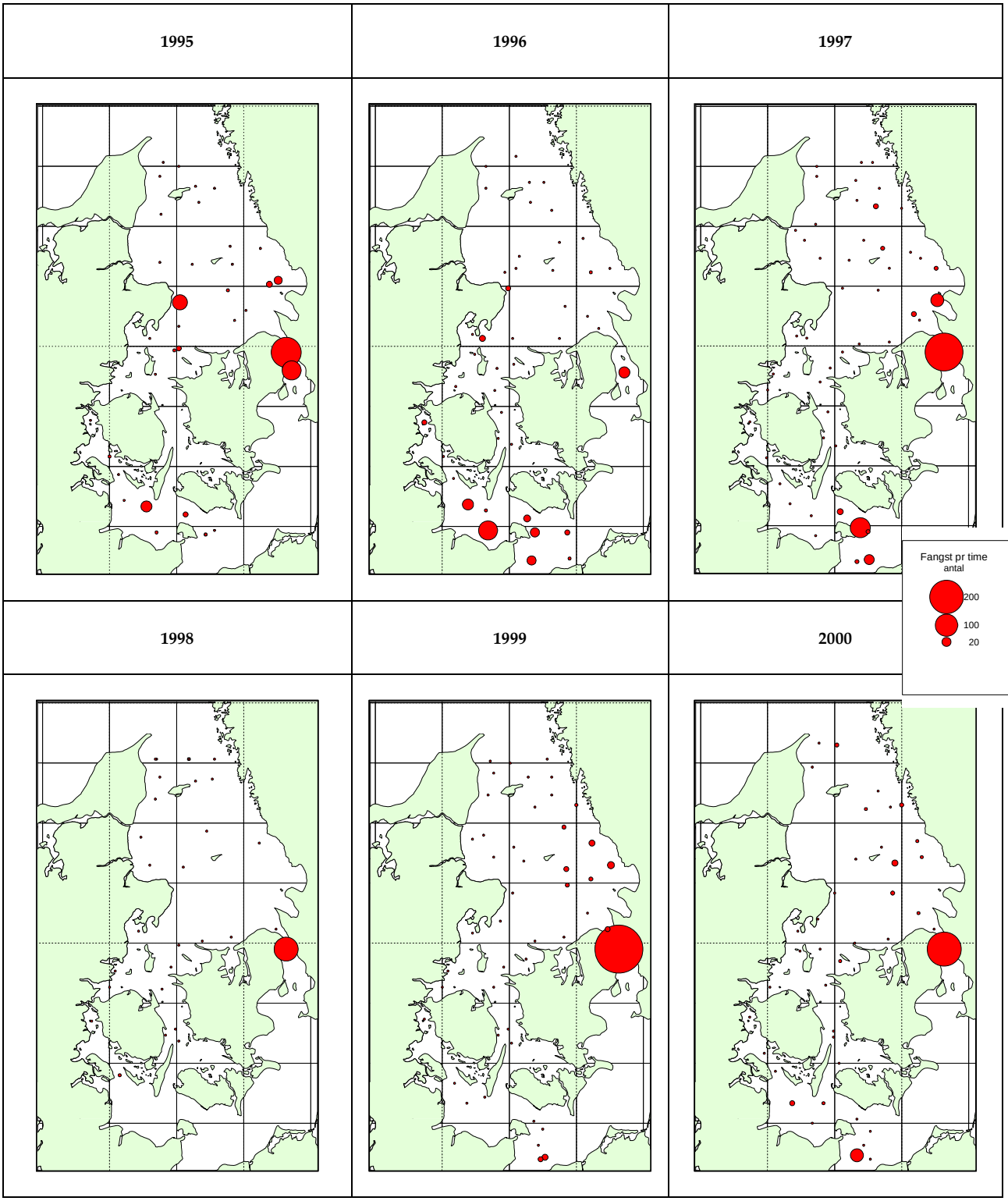

Figure A5.1. The number of cod older than 2 years caught with the Danish research ship "Havfisken" from 1995–2006 on its fall cruise.

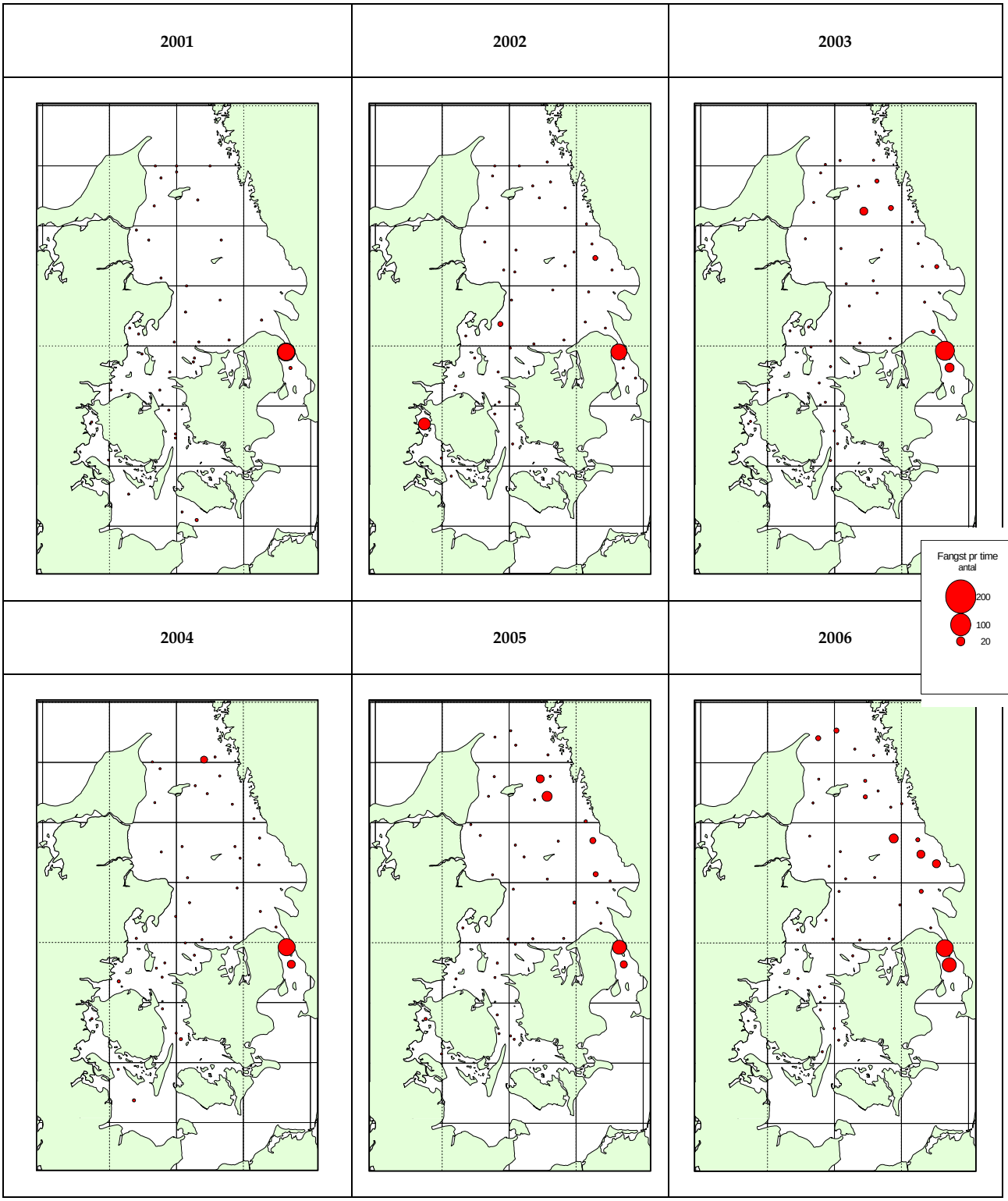

Figure A5.1 continued.

5d. FRANCE (Updated in 2008)

To fulfill the one of these public interest missions of Ifremer, aiming at the identification, evaluation, understanding, forecasting and promotion of sustainable exploitation of marine resources, the Fisheries Information System of Ifremer (FIS) has been developed in strong collaboration with the French Ministry of Agriculture and Fisheries. The FIS aims to build an **operational** and **multidisciplinary** monitoring network for scientific purposes, allowing a comprehensive view of fishery systems including their biological, technical, environmental and economical components. Thereby, the general objectives of the FIS are:

1) To provide the specifications and methodologies for the collection, storage and processing of fisheries data, with the constant concern to harmonise all these procedures on a national scale.

2) To improve data management system. This entails not only ensuring storage in data bases and validation of fisheries data, but also improvement of access to centralized data bases.

3) To supply the data to the researchers. Thus, the FIS provides support for fisheries research projects, advice and evaluation on marine living resource.

4) To elaborate indicators and products for a widespread public (from our laboratories and partners, to the fishermen, administration and general public), including bio-economic diagnostics of the fisheries, and assessment of the short and long-term impacts of fisheries management scenario and measures.

To reach these objectives, the FIS has been structured in 5 interacted sub-programs, collecting different kinds of data by different processes:

- Fisheries statistics (landings, through log books) and surveys on activity of the fleet
- Economics data, collected by survey
- Biological sampling of landings
- Biological sampling of catches (landings and discards) aboard fishing vessels
- Scientific survey data collected by the oceanographic research vessels

To further an integrated analysis of the fishery systems, the FIS computer engineers have built a single data management system, based on a relational data base with geographical facilities to allow direct interface with Geographical Information Systems (GIS). While the data are inherently wide-ranging – including acoustic surveys of water columns, biological in-situ observations, environmental observations, as well as fishing efforts and landings –, the database is completely integrated. Indeed, all five components previously quoted are linked to common referential data, and some data fields are common to different components.

The objective of the FIS is to take into account all the entire "fishing system". A network of observers has been set up along the French coasts and collects data in strong relationship with the fishermen and the fishing sector according to standards and national methodologies. The FIS covers all the coasts, including overseas territories, and is one of the rare information systems in Europe considering the whole fishing fleet (whatever the length of the vessels, the gear used, the target species or the fishing sector), including the small coastal fleet (two-thirds of the fleet

in France, as well as in Europe) and gradually the recreational fisheries. For example, we can quote different data collections:

- **The comprehensive survey of activity calendars:** The starting point of the method consists of a comprehensive characterization of the French national fleet, based on official and administrative data, supplied by the French Ministry of Fisheries. These official data include administrative data related to the vessels (i.e. technical characteristics, official number of crewmembers) and the owners. Other official data, declarative landing statistics, are made available by the French Ministry of Fisheries, but are incomplete. Therefore, in order to palliate the lack of complete information regarding activity of the vessels, Ifremer has carried out a comprehensive survey consisting of an exhaustive collection of annual activity calendars. This consists of a follow up of the different "métier" practiced by the vessel per month. The "métier" is defined by the use of gear, to target one or several species, in a given fishing area. This method is carried out for the entire fleet, and allows having the minimum but exhaustive information and completing description of the activity of the fleet in terms of gears, target species and main fishing areas, especially for the fleets whose official data are incomplete or low quality, that is to say the coastal fleets. This comprehensive data allows then to build sampling plans for the collection of other data, such as economic or catches data.
- **Bioeconomic survey of commercial trip upon landing:** In the areas where no "declarative system" exists (no log-books), a new survey is currently set up to assess the catches and economic information. It concerns the overseas territories (Guadeloupe, Martinique, La Réunion, Guyane), and the Mediterranean coast. The survey consists in interviewing the fisherman when he goes back from the trip, asking him to assess the catches and effort par species (per gear used and per fishing areas if possible) and revenues and costs of the trip. The sampling plan is built using data from the comprehensive activity calendars survey.
- **Recreational fisheries:** Ifremer, in coordination with the Ministry of Fisheries and the help of a specialized polling institute, have implemented a national survey to study the whole recreational fishery (by boat, by foot, sea harvest, spear fishing) in France (including mainland and overseas territories). The aim of this study is an evaluation of the impact of this activity on marine resources and on the economic sector. This two-part survey covers 2 years: a first survey was made by phone in 2006, and then an on-site survey may precise catches and expenditures. This second part has begun in July 2007 and will end in May 2008. The phone survey consisted in interviewing 15 000 households all along the year from every département of France. The survey targeted only citizens over 15 years old. This first part already gave some interesting results that allowed organising the on-site sampling plan.
  For the on-site survey, 1500 interviews may be carried out on site to precise the catches data and expenditures. The sampling plan is stratified by coast, season and fishing mode. It has been set up to complete the phone survey data and to allow on-site data extrapolation. 150 sites have been chosen all over the country.

5e. IRELAND (Updated in 2008)

Ireland's coastline is 7,100 km long and with recent strong economic growth, greater pressure has been placed on coastal areas through increased competition for resources. The recreational value of the coast has improved in this economic climate and as a result greater challenges have been faced from the coastal planning context. The most important factors driving this growth include EU membership, low corporation taxes, the presence of a large number of multinational companies, low unemployment rates, increasing participation by females in the labour force, inward migration, investment in education and training, coordinated social partnership and stable public finances. The major influences on ICZM in Ireland revolve around Local Government and Planning Acts, Foreshore & Fisheries Acts and a variety of EU Directives on areas of conservation and human and animal health protection. Although there may still be a relatively strong marine-terrestrial divide in terms of planning and development in Ireland, recent initiatives have tried to redress these issues through education, data integration and integrated monitoring. The need for the development of a National Integrated Coastal Zone Management Strategy for Ireland will be examined in the context of our response to the European Parliament and Council Recommendation concerning the implementation of Integrated Coastal Zone Management in Europe. The then 15 Member States adopted this Recommendation in 2002. This called on Member States to conduct a stock take to identify the major actors, laws and institutions that influence the management of their coastal zone. Ireland is in the process of finalizing its National stocktaking report under the Recommendation. The Recommendation also called on Member States, based on the results of the stocktaking, to develop a national strategy or strategies to implement the principles for integrated management of the coastal zone. Following the completion of the stock take the need for an Irish ICZM strategy will be assessed. Integrated Coastal Zone Management (ICZM) provides a holistic approach to the interactions between sectors, agencies and legal codes. ICZM is seen as a possible tool in ensuring that the coastal zone is used to the best advantage of the Irish People from an economic, leisure, social and environmental perspective.

Key Issues:

- Coastal areas provide a scenically attractive environment that is biologically highly productive and diverse. At the same time, this environment accommodates a wide range of economic activities and recreational uses.
- It is estimated that approximately 80% of the population of *circa* 4 million live in coastal counties.
- Over the past decade Ireland has experienced unprecedented economic growth, of which the contribution of the ocean economy to the overall Irish Economy is estimated to be in the order of €3 billion Euro or approximately 2% of the GDP for 2004.
- The contribution of the various sectors to the ocean economy is estimated as Shipping and Maritime Transport (42%), Water-based Tourism (14%), Fish Processing (12%), Fishing (7%), Marine Energy and Resources (7%), Marine Manufacturing (3%), Aquaculture (3%) and others account for 12%.

ICZM Policy Activities

In the Republic of Ireland land use planning is the responsibility of the Local Authorities through powers invested in them by the Planning and Development Acts

2000 to 2002. The jurisdiction of the various Local Authorities is defined by statute in the Boundary Survey (Ireland) Act 1854. In effect, the Local Authority has jurisdiction to the mean high water mark. The power to grant licenses and leases of the foreshore (i.e. the bed and shore of the sea between the high water mark of ordinary or medium tides and the limit of the territorial seas) is vested in the Minister for Agriculture, Food & Fisheries under the Foreshore Act 1933 as amended. In1997 a report on a Draft ICZM Policy for Ireland (Brady-Shipman-Martin Report) was commissioned by the then Department of Marine & Natural Resources, Department of Environment & Local Government and the Department of Arts, Heritage, Gaeltacht and the Islands. This looked at the legislative context for ICZM (the planning and conservation legislation) and catalogued the resource use and marine resource development. It compared best practice in a European context at coastal resource management and made recommendations for a National Coastal Zone Management Policy for Ireland. The principle departments responsible for Coastal Zone Management in Ireland are the Department of Agriculture, Food and Fisheries and the Department of Environment & Local Government (DoE). Previously, the remit fell with the Department of Communications, Marine & Natural Resources (DCMNR). In 2007 a National Working Group on ICZM, set up under the aegis of the DCMNR and DoE, was established to complete the ICZM stock take required under the 2002 EU ICZM Recommendation. The stock take is currently in the final editing stages and will provide a useful inventory of key agencies/institutions, the current legislative and regulatory framework, current coastal management initiatives in Ireland and it will highlight useful technology tools and resources available in the coastal planning context. Coastal policy in Ireland has laterally been dictated by environmental and conservation directives from the EU. Most significant amongst these is the Water Framework Directive (WFD). This aims to improve or sustain European water bodies at a satisfactory quality based on a serious of guideline environmental parameters. It primarily covers freshwater catchments but extends to the one nautical mile limit. In Ireland the WFD has been very significant in improving cross-agency cooperation, the establishment of defined River Basin Management Districts, defining remits in terms of monitoring. The effects have been more integrated approaches to data handling and management and private-public investment in developing tools to meet these monitoring needs. The Smartcoast project in Ireland has looked at developing robust sensors and data integration infrastructure to meet the requirement of the WFD and to provide for remote and real-time access to data. The drafting of the EU Marine Strategy Directive (pending) will extend the requirements of the WFD to the wider marine area. It will be important that both directives don't establish any arbitrary boundaries but serve to promote the principles of ecosystem management through the integration of the infrastructure already in place under the WFD. Other significant legislation in the context of ICZM is the Habitats Directive, Birds Directive, Bathing Waters Directive and Shellfish Water Classification Directives. These provide for various levels of zoning or designation in the coastal zone in terms of areas in need of protection, suitable recreation areas and closure areas for shellfish consumption.

Natura 2000

The Habitats Directive was transposed into Irish legislation by the European Communities (Natural Habitats) Regulations, 1997 S.I. No. 94 of 1997. These regulations also cover the Birds Directive.

The Minister for the Environment, Heritage and Local Government is currently coordinating the development of Ireland's 2nd National Biodiversity Plan. The

preparation and implementation of the Plan will be the responsibility of a range of Government Departments and Agencies. The production of national biodiversity strategies is an obligation under the Convention on Biological Diversity, which Ireland ratified in 1996. Ireland produced the National Biodiversity Plan in 2002, to meet this commitment and the new Plan will seek to build on the progress achieved since 2002.

The principal biodiversity related legislation is that concerned with nature conservation. The most important such legislation is the Wildlife Act, 1976 as amended by the Wildlife (Amendment) Act, 2000, and the European Communities (Natural Habitats) regulations, 1997. While the Wildlife Act, 1976 provided a fairly adequate legislative base for nature conservation, it has been considerably strengthened by the Wildlife (Amendment) Act, 2000, which was enacted in December 2000.

Ireland has selected 544 Natura 2000 sites and of these 158 has a marine element noted in their selection. A total of 4,196 km² of Ireland marine area is designated part of the Natura 2000 network. All proposed marine SAC under the Habitats Directive will be put forward as Marine Protected Areas within OSPAR. GIS files and Site Synopsis for the Irish Natura 2000 Sites are available from the Department of the Environment, Heritage and Local Government website at http://www.heritagedata.ie/en/ParksAndWildlife/. There are no fishing restrictions within Natura 2000 sites. Within Natura 2000 Sites, all activities that require a licensing, permit or permission and that are not directly connected with, or necessary to the management of, the site but likely to have a significant effect thereon either individually or in combination with other developments, shall be subject to an appropriate assessment of the implications for the site in view of the site's conservation objectives in accordance with the *European Communities (Natural Habitats) Regulations 1997*.

Water Framework Directive

The Water Framework Directive has been transposed into Irish legislation by the European Communities (Water Policy) Regulations 2003. Eight River Basin Districts (RBDs) have been established. The delineation of RBDs has been developed in consultation with authorities in Northern Ireland and interested parties generally. The Regulations identify the seven RBDs established in relation to areas in the South, including cross-border areas. One further RBD is wholly internal to Northern Ireland.

The Environmental Protection Agency (EPA), Department of the Environment, Heritage and Local Government, local authorities and associated consultancies prepared the Characterization Report for the Irish River Basin Districts. This was submitted to Brussels in November 2004. The objective of this study was to identify areas most at risk of falling below standards required under the WFD by 2015. In this characterization study the impacts of a range of pressures were assessed including diffuse and point pollution, water abstraction and morphological pressures (e.g. water regulation structures). Measures to address and alleviate these pressures are to be included in a formal programme of measures to be submitted to the European Commission by 2009. The report provides a comprehensive outline of Ireland's water resources, an assessment of the risks of failing to meet the objectives of the WFD plus an economic analysis of water resources.

The EPA published the first draft of the Irish Water Framework Directive Monitoring Programme in June 2006 and an update following public comment in October 2006.

The monitoring programme became operational on 22 December 2006, with reporting sheets on the monitoring programme design sent to Brussels by 22 March 2007. A Smartcoast project in Ireland is looking at technological solutions to meet the monitoring requirements of the WFD. It involves the development and testing of a suite of water quality monitoring sensors which can be strategically placed in a catchment to fulfill various monitoring programmes requirements. Smartcoast involves development of the IT infrastructure to support the sensors, record at required intervals and to provide real time data to relevant agencies.

All waters have been grouped into types (e.g. different types of lakes) and further divided into individual management units called water bodies. The identified range of individual water bodies includes 757 groundwater, 4,468 river, 210 lake (above 50 hectares), 196 transitional and 113 coastal water bodies.

The status of waters will be determined by water pollution indicators plus a wide range of new criteria based on pressures and impacts arising from aspects such as abstractions, hydromorphological alterations (e.g. navigations, hydropower, and flood control), commercial marine fishing activities and invasive aquatic alien species. The assessment identified those waters which, by reference to present circumstances and based on the best information currently available, might not meet all of the new criteria being established for good status. These waters are assessed as being at risk *i.e.* they may not comply with all the criteria for good status by 2015 unless measures are taken in the meantime. The water bodies identified by the initial characterisation as being at risk include (by number): 5% of groundwater bodies, 29% of river water bodies, 18% of lake water bodies, 30% of transitional water bodies and 12% of coastal water bodies. Management measures will be implemented for these water bodies. Water bodies identified as being probably at risk include: 56% of groundwater bodies, 35% of river water bodies, 20% of lake water bodies, 23% of transitional water bodies and 15% of coastal water bodies. Further characterization will be focused on these water bodies to confirm risk.

5f. GERMANY (Updated in 2008)

A lot of positive aspects and achievements of ICZM in Germany are mentioned in literature (see BBR, 2007; EUCC, 2007; Glaeser *et al*., 2004; Rupprecht Consult and International Ocean Institute, 2006). However, in order to answer research questions (see research questions), it is necessary to concentrate on gaps of the ICZM process in Germany. Therefore, the following central question was posed: What are the gaps or problems of the ICZM process in Germany? At first, it was tried to answer this question by literature research of relevant and most up-to-date documents on ICZM for Germany. Then, the question was posed within the frame of semi-structured interviews with German ICZM key-experts of various levels (national, federal state, regional/local) and sectors (politics, research, and consultancy). Finally, after preparation of the results, an expert validation of the results of the gap analysis was conducted in order to review the internal validity of the analysis (see methodology gap analysis).

Gaps of the German ICZM process

The most relevant literature in order to figure out the main gaps of the German ICZM process is the German ICZM strategy. Therein the authors distinguish four main deficits, which are sustainable development, integration, participation and communication as well as experience transfer (BMU, 2006). Furthermore, the authors recognize that an optimization is necessary, especially in the fields of formal

implementation, definition of responsibilities and coordination of activities (ibid.). Fichtner (2006) strengthen this statement by saying: "*The questions remain unanswered as to who organizes ICZM processes, who is responsible for ICZM and which tools can be used for execution and how ICZM can be integrated in other sectors*". Concerning interviews, each of the ten participants defined between three and five gaps of the German ICZM process. These gaps were assembled and clustered into groups according to similarities. Finally, each gap was allocated to one specific group (see appendix). By the number of nominations, a ranking of importance of the gaps could be derived (see Figure A.5.2). It shows that ICZM experts identified two main gaps of the German ICZM process, which are (1) Fuzziness concerning formal implementation of ICZM (ten nominations), and (2) Lack of knowledge concerning execution of regional/local ICZM projects (nine nominations). For that reason and because the results of the interviews are in line with the gaps mentioned in literature, the study at hand concentrates mainly on these two gaps. However, it also tried to incorporate additional gaps (see appendix) if they are closely connected with the first mentioned.

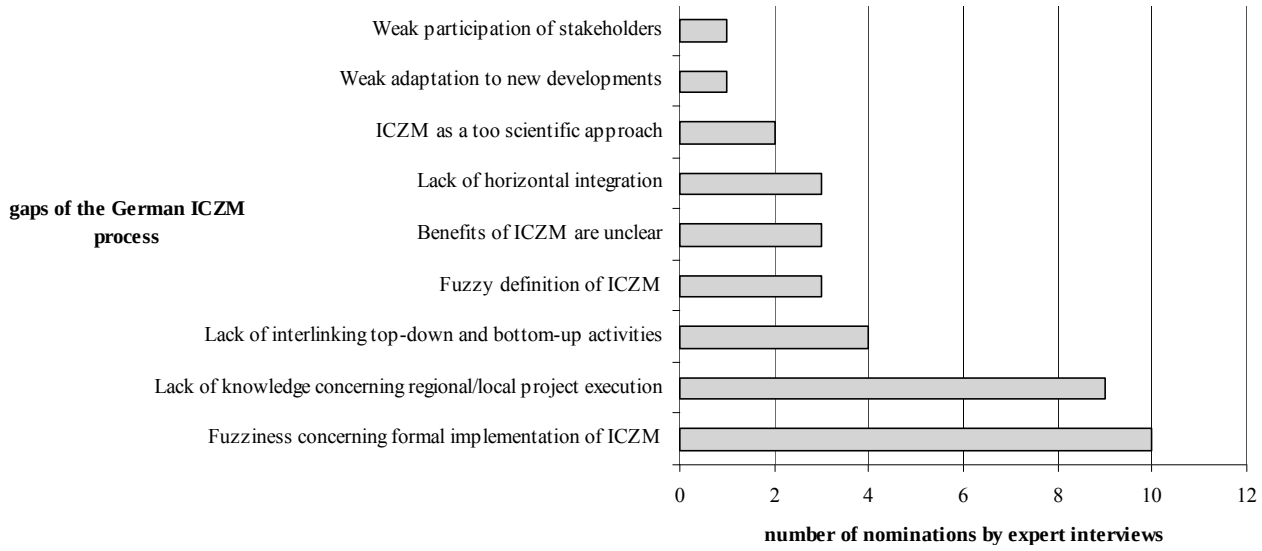

Figure A5.2. Gaps of the German ICZM process and their number of nominations by expert interviews. Following, the results of the gap analysis are presented in detail according to the main two gaps, which are (1) Fuzziness concerning formal implementation of ICZM, and (2) Lack of knowledge concerning execution of regional/local ICZM projects.

Gap 1: Fuzziness concerning formal implementation of ICZM

The ICZM strategy of Germany clarifies, that the principles of ICZM should be implemented in the existing legal system, and that ICZM is "*not aiming in being an independent planning and decision-making tool*" (BMU, 2006). This so called 'soft' implementation implicates some difficulties. Essentially ICZM is consequently non-binding (Schernewski, 2008). It should be implemented voluntarily. Therewith, it is partly dependent on political and individual moods. Wenk (2007) assumes that most municipal institutions only undertake action if they are directed from above, which refers to a legal regulation from national or federal state level, but not on voluntary basis. Fichtner (2008) confirms this statement by going as far as to suppose that the "*targets of ICZM (such as consolidation of coastal sectors) are too far reaching for a soft*

implementation". Considering all expert opinions, it stays questionable, to which extent all ICZM principles can be implemented in a 'soft' and informal way.

Rupprecht Consult and International Ocean Institute (2006) document that spatial planning instruments in place already, interact at various levels and that there are already suitable instruments for horizontal, vertical, territorial, and temporal integration in the German ICZM process. But nevertheless, a "*clearer allocation of responsibilities at national and federal state level is required*" (ibid.). Thus, the issue of responsibilities for ICZM is not adequately clarified in Germany. Fichtner (2008) stresses that responsibilities for all ICZM implementation levels (national, federal, regional) are not sufficiently addressed. The question stays open on which institutions on national, federal state and regional/local level are responsible for ICZM issues. Furthermore, it is not clarified what tasks ICZM relevant institutions should perform. In that context, especially the proposed ICZM secretariat is worth mentioning. BMU (2006) proposes an ICZM secretariat in order to coordinate the German ICZM process on national, federal state and regional/local levels. This office should assume various functions, such as knowledge transfer, coordination, cooperation and long-term planning (ibid.). Even though some experts support an establishment of an ICZM secretariat (see ARL *et al*., 2007; Dickow, 2007; Janßen, 2008; Krause, 2008), it is not defined yet, which precise tasks should be undertaken by the office. Furthermore, there exist different opinions on which institutional level such a secretariat should be organised. BMU (2006) supposed one ICZM secretariat at national level. Within the 'Joint declaration on ICZM' three ICZM secretariats are recommended, one for each coastal federal state (ARL *et al*., 2007). However, Fichtner (2007) expressed his concerns that an ICZM secretariat at federal state level is too far away from ICZM practices on local level. He favours ICZM contact points at regional level. A general difficulty of formal implementation of ICZM can be seen in the complex German federal structure (Schernewski, 2008). It holds the risk that all federal states develop their own uncoordinated ICZM strategies (Krause, 2008). In order to avoid an unmanageable patchwork of ICZM measures, tools and visions, a multitude of research institutes and administrations work on sustainability indicators for the coast (see Hoffmann, 2006). However, BMU (2006) is missing a simple indicator system in order to describe the progress and state of sustainability for the coast of Germany.

A striking point of implementing ICZM is its integrative approach. It is intended to consolidate the most relevant sectors of Germany's coastal zones (BMU, 2006). However, Janßen (2008) sees a lack of horizontal integration of various sectors. Ahlhorn (2008) emphasises strong sectoral proceedings in coastal–, conservation– and economic planning. Especially economic and social sectors seem to be poorly integrated in ICZM (Krause, 2008). Furthermore, the legislative division of land, coastal waters and Exclusive Economic Zone (EEZ) avoids integrative implementation (ibid.). Even Germany's spatial planning partly fails in terms of integrating different sectors (Ahlhorn, 2008).

The formal implementation of ICZM is characterized by two approaches. On the one hand, it is tried to implement the principles of the German ICZM strategy by a top-down approach, which means that national and federal state legislations are responsible for a further ICZM process. On the other hand, ICZM is seen as a bottom-up approach. The regions and municipalities are expected to develop their own ICZM projects (BMU, 2006). It is strived to optimize these two opposed approaches, which seems to be not succeeded yet. Kannen (2008) assesses this failure as an important gap (see appendix). He refers to it as a lack of interlinking top-down

(abstract, strategic and political papers) and bottom-up (precise wishes of local stakeholder) approaches (ibid.).

Lack of knowledge concerning execution of regional/local ICZM projects

The ICZM recommendations of the EU reveal that ICZM activities basically should take place at local and regional level (European Parliament and Council, 2002). Considering this, the German ICZM strategy derives that a "*emphasis of ICZM execution activities in Germany is placed on regional and local level*" (BMU, 2006). Furthermore, the strategy envisages four areas where further steps should be pursued. One of them calls for gaining experiences in best-practice projects (ibid.). The last statement indicates a lack of knowledge and experience concerning ICZM executions at regional and local level. Schernewski (2008) confirms this by stressing that the German ICZM process is "*lacking local and regional best-practice experiences*". This lack of local and regional best-practice experience refers to various aspects. It is of particular importance that the German ICZM is not an applicable management approach for practitioners since it lacks exemplary descriptions of project executions (Fichtner, 2008). Ahlhorn (2008) stresses that there are insufficient tools and instruments to execute ICZM aspects (such as participation and integration) in practice. Furthermore, there does not exist any elaborated instructions or guidelines for practitioners at regional and local level. (Schernewski, 2008). Consequently, the majority of regional and local practitioners do not know how to execute ICZM activities at Germany's coast. According to Liebrenz (2007) many people are motivated to execute ICZM activities, but do not know how to set them into practice. They simply miss a practical approach, especially a field manual with instructions (ibid.).

Funding possibilities play an important role for local and regional ICZM. For Schuchardt (2007) it is unclear where regional ICZM initiators can get funding for the execution of ICZM projects. There is no organized support or contact point for ICZM funding possibilities in Germany. In literature, several funding possibilities are discussed, whereas funding via Regional Agenda 21 or the European INTERREG program seem to be most appropriate (Schernewski, 2004). However, there is little knowledge available for ICZM initiators how to fund successfully local and regional ICZM projects. Since local and regional ICZM activities are poorly connected and coordinated with each other (Haese, 2008), there is little experience and knowledge transfer amongst them. According to Haese (ibid.) a central coordination point is absent where ICZM experiences and knowledge converge. In this regard, some interview participants see another gap of the German ICZM process, namely ICZM as a too scientific approach (see appendix). Dickow (2008) states that the information which is made available to the wide public is often too scientific. Hamann (2008) is of the opinion that the interlinkage of best-practice and science is poor. According to him it is questionable to what extent scientific studies are relevant for local and regional practitioners (ibid.).

The lack of best-practice experiences and knowledge transfer redounds to the gap that benefits of ICZM are unclear to local and regional stakeholders (see appendix). So far, the strengths and benefits of ICZM do not get across to local stakeholder (Janßen, 2008), which results in a lack of local and regional acceptance for ICZM (Fichtner, 2008). According to Liebrenz (2007) that has the consequence that hardly anyone see a need in participating in ICZM processes and set them into practice. Furthermore, it seems to be difficult to communicate the term ICZM with public

stakeholder (Schernewski, 2007). The definition of ICZM is not clear to them. Fuzzy definitions of ICZM lead to various interpretations on various levels (Ahlhorn, 2008).

Intermediate conclusion

At the beginning of this chapter the question was posed, what are the gaps or problems of the ICZM process in Germany? To conclude, the German ICZM process has two main gaps. The first gap corresponds to fuzziness of formal implementation. The responsibilities for all ICZM implementation levels (national, federal, regional) are not sufficiently addressed. Furthermore, it is not becoming apparent what tasks ICZM relevant institutions should perform. The establishment of an ICZM secretariat is extensively discussed in Germany since it could make an important contribution to bridge this gap. However, it is not defined yet, on which institutional level such a secretariat should be organised and which precise tasks should be undertaken by the office.

The second gap is a lack of local and regional best-practice experience. In Germany, no elaborated instructions or guidelines for practitioners at regional and local level do exist. Consequently, the majority of regional and local practitioners do not know how to execute ICZM activities at Germany's coast. Moreover, these two gaps are closely connected to other gaps. First, a lack of interlinking top-down (abstract, strategic and political papers) and bottom-up (precise wishes of local stakeholder) approaches. Second, the absence of awareness for benefits of ICZM on local and regional level. And third, the failure of an unambiguous and practicable definition of ICZM for national, federal state and local level.

Table A5.1. Result of the expert interviews showing ICZM gaps in Germany (left column), their associated group (middle column), and their total number of nominations within the interviews (right column).

GAPS ACCORDING TO EXPERT INTERVIEWS	GAP GROUP	NR.
• Responsibilities and tasks for ICZM implementation levels (national, federal, regional) are not sufficiently addressed (Fichtner, 2008) • The targets of ICZM (such as consolidation of coastal sectors) are too far reaching for an informal implementation (Fichtner, 2008) • Missing of an integrative ICZM responsibility on national and federal state level (Janßen, 2008) • Legal bodies are poorly coordinated in terms of formal implementation of ICZM (Janßen, 2008) • Federal structure of Germany holds the risk that all federal states develop their own uncoordinated ICZM strategies (Krause, 2008) • Legislative division of land, coastal waters and Exclusive Economic Zone (EEZ) avoids integrative implementation (Krause, 2008) • ICZM is formally non-binding (Schernewski, 2008) • Lack of formal structures (Schernewski, 2008) • Difficulties of formal implementation and competencies because of complex German federal structure (Schernewski, 2008) • Hierarchy, structure and responsibilities are poorly defined for ICZM in Germany (Wenk, 2008)	Fuzziness concerning formal implementation of ICZM	10
• Too little tools and instruments to execute ICZM aspects (such as participation, integration) in practice (Ahlhorn, 2008) • Little practical experience of ICZM project execution (Dickow, 2008) • ICZM is not an applicable management approach, but a policy target. ICZM lacks exemplary descriptions of project executions (Fichtner, 2008) • Missing of best-practice experiences, available for the wide public (Haese, 2008) • Fuzzy definition and poor classification of ICZM executions (Haese, 2008) • Little collaboration of horizontal sectors (Haese, 2008) Unclear how participation according to ICZM principles works in practice (Krause, 2008) • Missing of applicable guidelines for the execution of ICZM projects (Schernewski, 2008) • Lack of local/regional best-practice experiences, by what the benefits of ICZM are unknown (Schernewski, 2008)	Lack of knowledge concerning execution of regional/local ICZM projects	9

GAPS ACCORDING TO EXPERT INTERVIEWS	GAP GROUP	NR.
• ICZM activities are poorly connected and coordinated with each other. A Coordination Point is missing (Haese, 2008) • Poor interlinkage of science and best-practice (Hamann, 2008) • Lack of interlinking top-down (abstract, strategic and political papers) and bottom-up (precise wishes of local stakeholder) approaches (Kannen, 2008) • Poor cooperation of vertical operational levels (Kannen, 2008)	Lack of interlinking top-down and bottom-up activities	4
• Fuzzy definitions of ICZM lead to various interpretations (Ahlhorn, 2008) • Current definition of ICZM according to BMU is not adequate to establish ICZM in coastal zones (Fichtner, 2008) • Heterogeneous definitions of ICZM lead to barriers for project execution and formal implementation (Janßen, 2008)	Fuzzy definition of ICZM	3
• The local level is little aware of ICZM's benefits (Dickow, 2008) • Benefits of ICZM are unclear to local and regional stakeholder, which lead to a lack of acceptance (Fichtner, 2008) • Strengths and benefits of ICZM do not get across to local stakeholder (Janßen, 2008)	Benefits of ICZM are unclear	3
• ICZM process is lacking integrative approaches. Sectoral approaches by all professional plannings (Ahlhorn, 2008) • Lack of horizontal integration of various sectors (Janßen, 2008) • Missing integration of economic and social sectors (Krause, 2008)	Lack of horizontal integration	3
• Available information on ICZM are often too scientific (Dickow, 2008) • ICZM process in Germany is too much driven and affected science, and therewith far away from practice (Hamann, 2008)	ICZM as a too scientific approach	2
• Missing adaptation of ICZM towards new developments, such as climate change (Kannen, 2008)	Weak adaptation to new developments	1
• Missing participation of stakeholder (especially from the economic sector) in local/regional ICZM activities (Kannen, 2008)	Weak participation of stakeholders	1

5g. NORWAY (Updated in 2008)

In Norway the coastal zone (equal to the definition in the EU Water Framework Directive) covers an area of about 100,000 km^2 and extends about 85,000 km (including islets and islands). It has a complex topography with many deep and sheltered fjords, often with sills toward a more exposed sherry or an open coast. Rocky shores and many basins with relatively large depths are common features along the Norwegian coast. The fisheries along the coast, and in more recent years fish-farming, are important to the Norwegian community, its welfare and economy in a long-term perspective. Crucial conditions for these industries are the maintenance of high, natural production and biodiversity and good water quality along the coast, which call for sustainable management of human activities and exploitation of

resources. The utilization and production of marine, renewable resources cannot be sustained where the functional integrity of coastal systems is degraded.

The coastal zone is the key area for many marine species. The areas where the large oceanic stocks spawn are important both for the stocks, the coastal ecosystem, the fishermen, and for the people living or recreating along the coast. These spawning areas should be treated as sacred and every necessary measure to secure these areas for spawning also in the future should be taken. The threats from anthropogenic activities to the fishery resources, to the health status and to the biodiversity of the coastal ecosystems in general are much the same. Negative influences may be due to inputs of nutrients, toxic substances, and habitat-alteration from physical encroachment, oil exploitation and transport, and from introduction of alien species. In addition, the fishery itself may overexploit the resources and use methods such as trawling that may damage bottom-ecosystems such as coral reefs and soft bottom habitats. Non-sustainable fisheries may thereby be a threat both to optimal utilization of the resources and to conservation of the nature and biodiversity. Several of the largest oceanic fish stocks in the North-East Atlantic region migrate to the Norwegian coast to spawn. These stocks thereby transform and transport the vast oceanic plankton production from the Norwegian and the Barents Seas to the coast. Their spawning products, eggs and larvae, are prey for local fish, mammals and birds and are consequently of vital importance to the sustainability of the coastal ecosystem. The large oceanic fish stocks are the basis for important fisheries that together with aquaculture support people living along the Norwegian coast. Therefore it is important to manage the fish stocks so they remain strong and sustainable, and can support the coastal communities both now and in the future. Advanced genetic studies have recently demonstrated the existence of local stocks of the common species Atlantic cod along our coast, and such populations may have difference in age– and size at maturity, survival rates and growth rates. The size of these local stocks is considered crucial for recruitment and future fisheries. This new knowledge calls for careful and sustainable management, both from a resource and biodiversity point of view. These local stocks use local spawning areas and are also dependent on nursery grounds in the vicinity. It is important to protect the spawning areas and nursery grounds from habitat-destruction, and to assess the size of local stocks in order to prevent over-exploitation. Because local stocks of cod are very small compared to the North-Sea and the Norwegian Arctic stocks, they are easily neglected by the management authorities. Local populations are, however, valuable resources to the local public for leisure– and recreation-fishery, and may also attract tourists.

Key questions and issues for sustainable ICZM are:

- Limited knowledge about coastal ecosystems structure and function, and effects of intervention. An important part of this is knowledge about life history of marine organisms
- What are the threats against maintenance of rich and clean coastal ecosystems
- How do oceanic stocks affect the coast and what is the significance of the coast for the oceanic stocks
- Species-demand on the environment including suitability and their vulnerability with respect to chemical pollutants and eutrophication.
- Population structure and size of local fish stocks, for example of coastal cod and herring, as well as of other fauna (invertebrates) and flora.

- Sustainable exploitation of living, marine resources in coastal waters. (Who is harvesting what?)
- Need for monitoring programs to quantify and characterize recreational fishing effort and catches of commercially important species
- Need for marine protected areas in coastal areas and expected benefits
- Mapping and monitoring of biodiversity, including marine nature and habitats
- Carrying capacity of coastal ecosystems for aquaculture and other human activities
- Interaction between wild and reared organisms
- Benefits and drawbacks with sea ranching
- Non-indigenous marine species in the coastal waters
- Rehabilitation of strained environments, ex. polluted sediments

Projects and activities of relevance to ICZM

In two recent projects knowledge on the coastal zone are made available to managers and stakeholders. As the first municipality in Norway, Tvedestrand along the southern coast of Norway has got GIS-based maps of their marine nature. The information is open to everyone (www.tvedestrand.kommune.no/kartdata) and has so far been very useful in ICZ-planning and management. The other project aims to make information on how and where relevant knowledge on the coastal zone can be found and information on how to use it, available on the Internet (http://www.kystsone.no/). A new GIS-system for the whole coast is established by the Fisheries Directorate (www.kart.fiskeridir.no/adaptive/). The first version combines sea maps, land maps, satellite photos and orto photo that can be displayed with official data on aquaculture, spawning grounds, kelp dredging plans etc. We are also developing tools and guidelines for mapping of marine biodiversity in the municipalities along the coast. Models for predicting bottom habitats and marine nature, as kelp forests and eel grass, as tested. In another project called MAREANO (http://www.mareano.no/) we map the sea bottom using multi-beam echo sounder. A relative extensive monitoring along the Norwegian coast including many different parameters generates useful information both for short-term and long-term purposes. The Norwegian Food Safety Authority organize a surveillance of algal toxins in mussels to advice the public if it safe or not to pick and consume wild mussels (http://matportalen.no/Matportalen/Blaaskjell/blaaskjell). The Institute of Marine Research produces weekly information on the algae-situation along the coast (http://algeinfo.imr.no/). In addition there are monitoring of hydrophysical and hydrochemical parameters at many stations along coast, and surveillance of kelp-trawling and effects of emissions from fish-farming. A large project on possible ecological effects of the introduced Red king crab will be finished in 2010.

Recreational fishery

The Institute of Marine Research (IMR) is now developing survey methods to provide estimates of total number and weight of commercially important species caught by tourists in Norwegian coastal waters. The project will contribute to increases knowledge of the coastal fisheries resources to support sound management advice that help secure sustainable fisheries. A pilot study that involves more than 40 businesses is being conducted to test field data collection methods including the use of catch logbooks for recording catches and effort by tourists. Data on the variation in

daily effort and catches from the pilot study will form the basis for developing methods that can be used in a National survey of the tourist fishery. In order to obtain better and continuous samples from the coastal fishing fleet, knowledge about fleet behaviour and technical developments influencing efficiency and effort, 18 coastal fishing vessels (the Coastal reference fleet) have been contracted. The fleet will probably be expanded during 2008. The vessels are from 9–15 m, and the crew members are trained to conduct self-sampling. Biological samples (length, otoliths, genetic samples, stomachs etc) and logbook data are delivered according to contract, which secure a proper statistical coverage for a number of species in time and area. The observations of rare species are also most valuable information from the fleet, together with continuous information about species that are hardly accessible by research vessels, and observations of sea mammals, sea birds, crabs etc. Further, such trust based cooperation between fishermen and scientist seems to reduce controversies and rather build a common understanding and ownership of improved stock assessments and fisheries management.

MPA

A group at Flødevigen Marine Research Station, IMR, is testing marine reserves (MPAs) as a potential management tool for European lobster (*Homarus gammarus*) in Skagerrak. Catch per unit effort sampling and mark-recapture is conducted annually in three experimental lobster reserves and adjacent control areas along the Skagerrak coastline. The research is carried out according to a BACIP (Before After Control Impact Pairs) design. The reserves were implemented in September 2006, but pre-selection sampling and collection of 'before-data' was conducted in three years prior to the area closure. The project is preliminarily given a 10 year horizon, which is considered sufficient time to yield information on the effect of protection. The IMR MPA-project has attracted funding for two additional projects from the Research Council of Norway 'Havet and Kysten' programme. The first project (*Marine Protected Areas in coastal Skagerrak: a model system for understanding lobster demography and successful introduction of MPAs in temperate waters*) uses existing mark-recapture data, telemetry and archival tagging in order to understand lobster demography and behaviour in relation to shape and size of reserves. The second project (*An integrated study of stakeholders and living resources in relation to the potential effectiveness of MPAs as a management tool*) focuses on socioeconomic aspects linked to the establishment of the existing experimental reserves as well as future implementation of coastal MPAs with a special emphasis on lobster and cod (*Gadus morhua*). IMR is thus seeking to take a holistic approach whilst generating knowledge on MPA performance (biology) and establishment (socioeconomics).

Water Framework Directive

The implementation of the EU Water Framework Directive in Norway is now to a large extent brought forward by 9 new regional WFD-authorities. Guidelines for this work and information about the progress can be found at the wep-page: http://www.vannportalen.no/hoved.aspx?m=31139. In addition national authorities (Directorate for Nature Management and State Pollution Authorities) organize national and international cooperation on inter-calibration exercises and development of classification systems for ecological status.

5h. POLAND (Updated in 2007)

5i. SPAIN (updated in 2008)

The National Shores Act, *Ley de Costas (Ley 22/1988),* defines the coastal zone (Maritime-Terrestrial Public Domain, MTPD) as the area between the landward limit of coastal dynamics influence and the limit of the external continental shelf or of the Exclusive Economic Zone (EEZ). This law, which focuses on the protection of the public use of the coastline, also defines a protection zone that extends 100 meters landward from the limit of the MTPD (or 20 m for zones occupied by urbanizations before 1988), where housing is forbidden and an area of influence that extends 500 m landwards where urban planning can be informed. However, coastal management based on this law has not been entirely effective, particularly in relation to the regulation of construction in the 100 m protection zone, due to lack of accurate data delimiting management zones. In 2006, the Coastal Directorate initiated the Master Plan for Sustainability of the Coasts, finally renamed Coastal Sustainability Strategy, with the objective of protecting the MTPD and promoting sustainable use of coastal resources through integrated planning and management. This Strategy is described in more detail in the following sub-section. The Territorial Sea extends from the sea side of the coastal zone to a distance of 12 nautical miles. The coastal zone, the territorial sea and the Economic Exclusive Zone as defined by international treaties, are part of the MTPD, can not be owned by private parties and for all activities and developments temporary permits have to be issued, licenses that are granted by the different levels of the Government. Free, open access exists to the public domain of the coastal zone.

Key Issues for ICZM in Spain:

- Urban development affected 5% of the surface of a 10 km-wide area along the coastline in 1990, and 40% of the human population lived in coastal municipalities in 2005.
- Most (65%) of the Spanish industrial production is located in the coastal zone.
- 90% of the imports and 80% of the exports are done by maritime transport.
- Nearly 70% of the 48 million foreign visitors to Spain have the coastal zone as their destination.
- Coastal aquaculture is a fast-growing sector of Spanish economy and contributed 24% of the total national fish production in 1998.
- Coastal erosion.
- Pollution.
- Overexploitation of fisheries.
- Overall, more than 10% of the gross national product is generated by economic activities performed in the coastal zone; this percentage can increase up to 65%–90% in some regions (i.e. the Balearic Islands).

ICZM Policy Activities

There is no nation-wide legislation specific for coastal zone management. The 1978 Constitution transferred most components of environmental and territorial planning to the regional governments, "Comunidades Autónomas". Municipalities are

responsible for producing land-use plans. Jurisdiction overlaps are common among national, regional and local governments. ICZM is acknowledged as a desirable goal by the different government levels but there is no standard approach and the degree of implementation varies widely between the different regions. Each region can produce its own environmental legislation. The Spanish Government is currently elaborating the Spanish Strategy for Sustainable Development (EEDS), which adopts ICZM as a key element to assure the sustainable development of the coastal zone, and declares the cooperation among all levels of the Government and the private sector in the design of integrated strategies for sustainable development as a main goal.

As a part of this Strategy, the Coastal Sustainability Strategy, which was mentioned previously, is being promoted by the Spanish Government as an instrument for the Implementation of ICZM at the Spanish national level. This instrument is based on a framework for the integration of coastal administrations at national, regional and local level, which was achieved through a strong public participation mechanism. In addition to generating research to accurately delimit the coastal areas specified in the National Shores Act, the plan is intended to facilitate appropriate coastal planning, based on the principles of sustainable development and knowledge-based decision-making. This is achieved through the development of integrated tools and techniques for the assessment of environmental and socio-economic issues, using spatial database technologies and numerical modeling of coastal processes.

A strong effort was also made to answer to the Recommendation 413/2002/EC on ICZM. The Spanish report was finalized in 2006 and included a stocktaking of actors, laws and institutions which have a relation with the coastal zone and the Coastal Sustainability Strategy as the main instrument for ICZM implementation in Spain. Following the EU Directive of 1992, Spain issued the 1997/1995 Directive for the identification and management of the protected areas. All the previously protected spaces for birds (SPAs included in the Bird Directive 79/409) were included in the Nature 2000 network. The Spanish Government approves the SACs, which are included in the Nature 2000 network. These have a wide ecological variation from terrestrial to marine ecosystems. The Regional Governments propose the areas to be identified as SACs and manages them, implementing the regional normative and protection measures. In a recent revision of the state of the implementation of the Habitat Directive at Mediterranean level, the delay in the identification of the SACs and on their protection was manifest.

A new strategic action towards sustainable water use and preservation and restoration of associated ecosystems, including coastal ecosystems, is being developed to be applied from 2004 to 2008 (Programme A.G.U.A. Ministry of Environment, http://www.mma.es/agua/informes.htm). An urgent action on the Mediterranean littoral (RDL 2/2004) is addressing the sustainable management of the water resources and will implement numerous water desalination plants along the coasts. Measures to protect the *Posidonia* meadows are foreseen.

The Spanish scientific community works in the field of coastal ecology, both on applied (coastal management, environmental conservation, and biological monitoring) and basic aspects (biodiversity, benthic ecology, and productivity), with efforts on Integrated Coastal Zone Management (ICZM) studies and applications to fulfill the EC Recommendation on the application of ICZM (EC-30 May 2002). Spain is a part of the ICZM group of ELOISE (European Land Ocean Interaction Studies). Additionally, Spain is building up a network of researchers and institutions interested in Integrated Coastal Zone Management (HISPACOSTA) as an active part

of the European Network for Coastal Research Coordination Action (http://www.encora.org) and is involved in the INCOME Integrated Project and Research Consortium, an Integrated Project on ICZM issued under the FP6 programme of the European Commission. Also, Spain has participated in international agreements on Coastal Zone Management and Research such as the second Euro-Med Forum of the High Representatives of Euro-Med RTD Public Institutions as a tool for the development of the Euro-Mediterranean Partnership held in Antalya (Turkey) in 2002. Moreover, there is participation in the analysis of European environmental policy and their interaction with national and regional policies, including a specific analysis of the potential links between the forthcoming Directive on the management of wastes in the extractive industries, and the Water Framework Directive, Habitats and Bird Directives (documents are available at: http:// www.minewater.net/ermite/) and a number of case studies of estuarine systems affected by mine water pollution. The increasing demand for sustainability and for the improvement of the use of coastal resources, in the long-term based on scientific knowledge, is the main driver for the development of both basic and applied research in the Spanish scientific community. The problems of land-use, tourism, overfishing, and pollution are main concerns on the Spanish coastal zone. As an answer to the concern in these issues, the Autonomous Government of the Balearic Islands (W Mediterranean) and CSIC have funded in 2005 a research unit on the sustainability of the coastal zone at medium and long term. Financed by the Basque Government, an ICZM project Eko-Lurraldea has recently started, which aims at developing new emphases, models, methods and tools, from an integrated perspective, to support decision making and its posterior follow-up, by the decision makers as well as the users of a region and based on the environmental (physical, ecological) and socio-economical knowledge of the region and its interactions.

Finally, in the framework of the Barcelona Convention (Mediterranean Action Plan, MAP), Spain hosted and signed the Protocol on Integrated Coastal Zone Management in Madrid, together with fourteen Contracting Parties to the Barcelona Convention, in January 2008. This is the 7th Protocol in the framework of the Barcelona Convention and all the Parties are convinced that this Protocol is a crucial milestone in the history of MAP, which will allow the countries to better manage their coastal zones, as well as to deal with the emerging coastal environmental challenges, such as the climate change.

Local Initiatives

An extensive list of all the initiatives happening in Spain at the local level is outside the scope of this report. Some examples from the Balearic Islands include oceanographic observation services being provided by IMEDEA through the real-time data being collected by gliders, ocean buoys, satellites, and beach monitoring cameras. Additional monitoring programs are in effect, among others, for Harmful Algal Blooms (IMEDEA), contaminant concentrations in mussels (IMEDEA), and beach clean up activities (Ministry of the Environment). All of these data are currently being transferred to a public GIS data base (http://www.imedea.uib.es/gis/). On 19 December 2007, the Economic and Social Council of the Balearic Islands (Consell Econòmic i Social de les Illes Balears, CES), an advisory body to the autonomous regional government intended to represent societal needs, published an official mandate for the implementation of a system of indicators for ICZM in the Balearic Islands (*Dictamen* 5/2007). The system of indicators was developed through a collaborative process between IMEDEA and CES from November 2006 – 2007. The final document contains a comprehensive panel of 54

indicators (environmental, governance and socio-economic) and associated implementation plan, intended to respond to the objectives of ICZM in the Balearic Islands, with the overall goal of achieving sustainability in the coastal zone. The document may be found online at:

(www.caib.es/sacmicrofront/archivopub.do?ctrl=MCRST16ZI16639&id=16639)

Recreational fisheries

Marine recreational fishing is a cause of exploitation of the coastal zone, since angling is a popular activity around the world. In the Mediterranean a total of 2 million anglers and 300,000 recreational fishing boats have been estimated. Consequently, a sector of great economic and social value has risen. The continuity of this sector depends on the ability of the ecosystems to provide sufficient biomass (Post *et al*., 2002). Recreational fishing is basically an open access activity, since fishing permits are very affordable and there is no limitation on the number of licenses granted. Recreational fishing regulations include daily bag limits, minimum catch sizes, closed seasons and the prohibition of artisanal methods. Although the sale of fish is prohibited, it is common knowledge that it happens occasionally. Usually recreational fisheries are considered different from professional/commercial fisheries because they are not subject to the market economic forces.

Along the coast of Majorca catch volumes for recreational fishing have been placed in 1209 t/year, nearly 60% of the total catches declared by the artisanal fishing (Morales *et al*., 2005). On the other hand, spearfishing, with apical predators being its primary catches, has a considerable effect, as the gradual shift on the species catch composition in Majorca clearly shows (Coll *et al*., 2004). Additionally, recreational fishing has been shown to affect the growth and reproduction of coastal species (Coll *et al*., 1999, Palmer *et al*., in press). According to this data it is clear that recreational fishing has important ecological consequences. However, there is a lack of global studies on the economical return that this sector generates, although data from recreational fishing from boats indicates that in Gerona, Barcelona and the Balearic Islands this sector produces 4 times more the added value of professional fishing (TRAGSATEC, 2004).

Therefore, coastal fishing resources are shared between a regulated professional activity and an open access recreational activity. In a recent study, some artisanal fisherman from Majorca reported considering some anglers as a threat (Merino *et al*., submitted). Clearly, the large recreational activity and the artisanal fishing overlap and compete for a common resource. Managing these shared resources should take into account the size of the resource, its uses, the corresponding rights, the impacts by each kind of fishing and the economical benefits generated, as well as the right of the population to fish as a source of healthy food (Kearney, 2001).

Besides the interest in coastal biodiversity conservation and health, it is important to consider that recreational fishing represents an important side economic activity (fishing gears, lure, boats, moorings, charters) that has not been completely evaluated yet and whose existence is dependant on the state of the resources and the marine environment as a whole. Interestingly, the CGPM (organ dependent on the FAO) in his 31st meeting celebrated in Rome in January 2007 emphasized the need to include recreational and sport fishing for the correct monitoring of the fish trade and the market flows. Additionally, the compilation and later examination of data from the recreational and sport fishing is suggested.

Recently (September 2006) the First Congress Mediterranean Sea Recreational Fisheries, organized by SGPM and the Balearic Island Government, was celebrated in Majorca. As stated in its conclusions (Grau, 2007) "knowledge should be the source of the decision-making process, and collaboration among scientists and anglers will result, on the medium and long run, on the understanding of poorly known aspects of both the biology of marine species and the effects of the various fishing methods on the conservation of resources".

In Spain data from the various studies on recreational fishing are not coordinated by any official management organization. Most data are gathered by affiliations, federations or fishing clubs, although in the Balearic Islands the Dirección General de Pesca (D.G.Pesca) collects systematically the results of competitions from 1998, having been partially analyzed and published in Coll *et al*. (2004). Therefore most data correspond to short term study projects or to partiall monitoring of some activities. The interest in the Balearic Islands for this relevant activity is supported through research projects carried out by IMEDEA funded since 2002 by the D.G.Pesca and the Ministry of Education and Science. As a first step the evaluation of the relevance of the recreational fisheries was undertaken (Morales-Nin *et al*., 2005), the current study (www.roquer.org) is implementing a GIS to describe the fishing distribution effort (Figure 1), the effects of fishing on the population parameters, fish mobility (Figure 2) and gear selectivity.

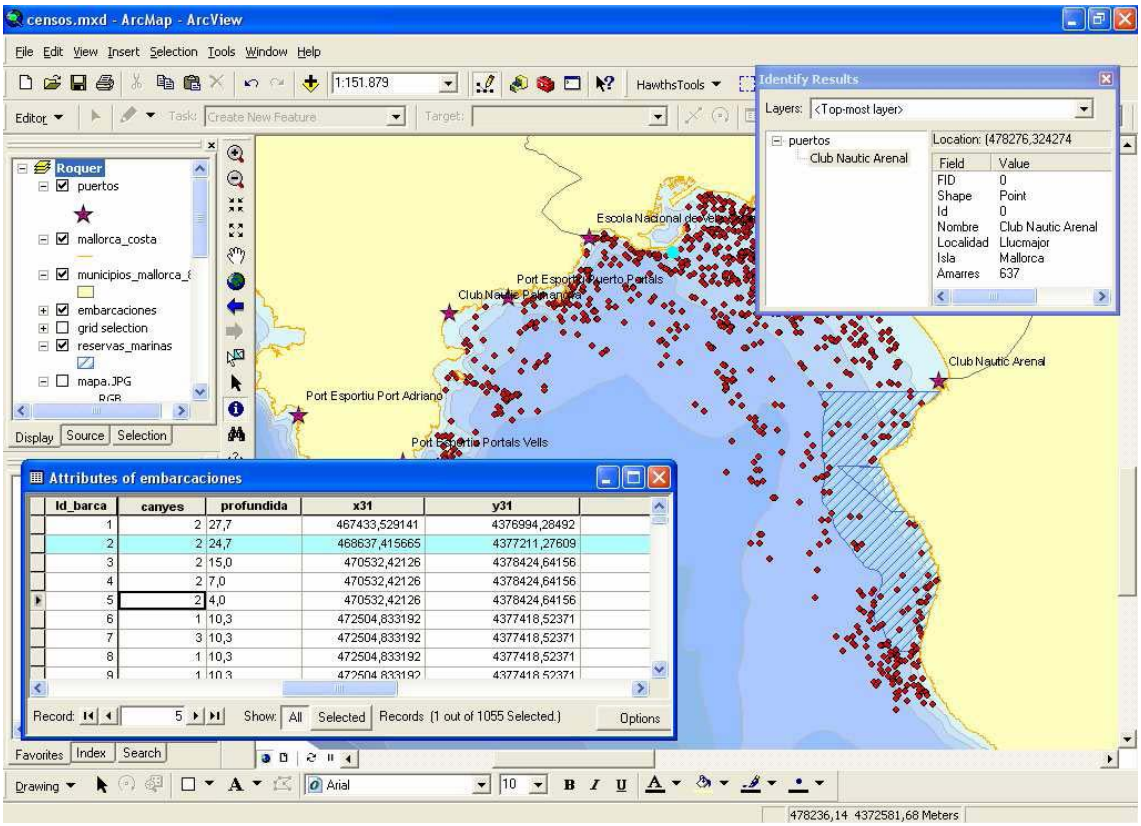

Figure A5.3. An example of the GIS implemented at IMEDEA showing the recreational fishing effort in Palma Bay.

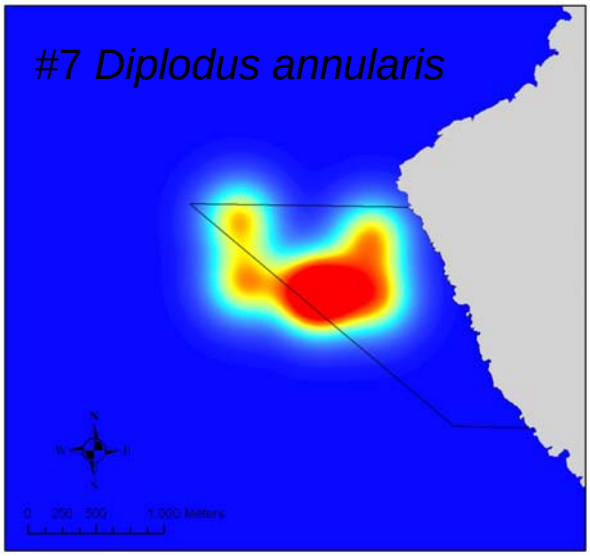

Figure A5.4. Home range of one of the target species for recreational fisheries determined by acoustic telemetry (courtesy of David March, IMEDEA). The line corresponds to the boundaries of a Marine Protected Area.

Effects of thermal, chemical and saline pollution produced by desalinisation and power plants

The chronic lack of fresh water in some parts of Spain has motivated the use of desalination plants since the 70's. The improvement on the technology and the reduction of costs with the public support to them have resulted in around 900 desalination plants on 2004 with a capacity of 1,45 10^9 l/day representing a 30% increase from 2001. These plants correspond to two modalities the plants treating sea water (47%) and brackish water (53%). The budget allocated to desalinisation plants building was on 2004 360 M€, with an increase of 9% since 2003. Thus Spain, with 7% of the worldwide capacity, is the largest producer in Europe: about 70% of the Spanish plants are located on the Mediterranean coast and the Balearic Islands, and the rest on the Canary Islands. The production of desalted water by regions on 2004 is as follows: Canary Islands 38%, 14.5% Andalucía, 14% Comunidad Valenciana, 13.5% Murcia and 10% in the Balearic Islands.

The main process in Spain is reverse osmosis (RO) with 95% of all plants. The brine produced has a high salinity (43–90 ups) and contains high levels of chemicals used in the plant and filters maintenance. Concern over the potential adverse effects to marine resources of desalination plant discharges is tempered by the following factors: the total volume of brine being released; the constituents of the brine discharge; and the amount of dilution prior to release.

The constituents of discharges of particular concern for marine organisms include biocides, high metal concentrations, and low oxygen levels. Not all desalination plant discharges contain these constituents; however, where detected, these constituents should be removed or neutralized to acceptable levels before discharge or else adequately diluted in the ocean. The high salt concentration of the discharge water and fluctuations in salinity levels may kill organisms near the outfall that can not tolerate either high salinity levels or fluctuations in the levels (similarly, if a temporary desalination plant is shut down, the organisms that have become accustomed to high salinity levels and/or salinity fluctuations may be killed). In addition, discharges from desalination plants will be denser than seawater and could

sink to the bottom, potentially causing adverse impacts to benthic communities. These effects may be significantly reduced if desalination plant discharges are combined with sewage treatment plant discharges (which are less dense than seawater) or are diluted by mixing with power plant cooling water discharges. At this time, there is considerable uncertainty about how well desalination plant discharges, either alone or combined with other discharges, will be diluted in seawater. The metals may become concentrated in the upper few micrometers of the ocean (the microlayer), which would be toxic to fish eggs, plankton, and larvae that are located there. Toxic constituents of the plume could be driven by wind or currents to become concentrated in the intertidal zone. Discharge of brine water with high salt concentration, particularly if combined with sewage effluent, may also cause sewage contaminants and other particulates to aggregate in particles of different sizes than they would otherwise. This effect influences rates of sedimentation, and is highly important for determining the well-being of benthic organisms that may be buried or burdened by an increase in deposition of unstable and/or finely suspended materials. If the particles are smaller and stay in suspension, they could interfere with transference of light in the ocean, which would diminish the productivity of kelp beds and phytoplankton. In addition, redistribution of trace metals (e.g. iron, nitrogen, and phosphorus) could change the phytoplankton community to one that is unappetizing to fish and may also be toxic (for example, by increasing the possibility or prolonging the occurrence of a "red tide" condition). Larval fish that feed on the phytoplankton could be forced beyond near shore waters, where they may not survive (Cooley *et al*., 2006).

Two key historical barriers for wider implementation of seawater desalination are water production costs and environmental impact of the plant concentrate. Both the economics of seawater desalination and desalination plant discharge impact on the environment could be improved significantly by co-location of membrane desalination plants with existing power generation stations. Co-location provides a direct connection of the membrane desalination plant intake and discharge facilities to the discharge outfall of an adjacently located once-through coastal power generation plant. This configuration allows using power plant cooling water as source water for the desalination plant and as blending water to reduce salinity of desalination plant concentrate prior to discharge to the ocean.

A desalination plant with the intake connected to the discharge outfall of a power plant usually doesn't require construction of a separate intake structure, intake pipeline and screening facilities (barracks and coarse screens). Since the cost of a new surface water intake for a desalination plant is typically 5–20% of total plant construction costs, power plant co-location yields significant savings. Sharing intake infrastructure also has environmental benefits because it avoids the need for new construction in the ocean and seashore area near the desalination plant. Building a separate new open intake structure and pipeline for the plant can cause significant disturbance of benthic marine organisms on the ocean floor. Use of intake beach wells instead of open intakes has similar negative environmental impact on these marine organisms during beach well construction. Under a co-location configuration, power plant discharge serves both as an intake and discharge to the desalination plant. Four key benefits stem from this arrangement: 1) it avoids construction of a separate desalination plant outfall structure, decreasing desalination costs by 5–20%; 2) salinity of the desalination plant discharge is reduced as a result of mixing and dilution of membrane concentrate with power plant discharge, which has seawater salinity; 3) because a portion of the discharge is converted to potable water, total

quantity of the power plant thermal discharge is reduced, which lessens negative effects of the power plant thermal discharge on the aquatic environment; 4) blending of desalination plant and power plant discharges results in dissipation of both salinity and thermal discharges.

One key additional advantage of co-location is the overall reduction of desalination plant power demand and associated costs of water production as a result of warmer source water. Source water of the RO plant is typically 5–15°C higher than the temperature of ambient ocean water. This is of significant benefit, especially for desalination plants with cold source seawater (such as ocean water in Northern California), because the RO membrane separation of 10°C of warmer seawater requires about 5–8% lower feed pressure, and, therefore, proportionally lower energy use for seawater desalination. Since power costs are about 20–40% of total costs for production of desalinated water, use of warmer source water has a measurable beneficial effect on overall water production costs (Voutchkov, 2007).

The new combined cycle thermal plants, using natural gas, are now under development in Spain. In some cases a new desalination plant has been associated to an existing thermal plant. This was the case with the largest desalination plant in Spain (Carboneras, in Almería), where the brine from the desalination plant is mixed with the effluent of the thermal plant before discharge to the sea.

The marine habitats have different degrees of sensitivity to desalination plants (Table 1) In the Mediterranean coasts of Spain there are five kinds of angiosperms marine prairies, and the most abundant is the *Posidonia oceanica* endemicity. *P. oceanica* has experienced a remarkable regression in the last decades; reason why at the moment is an species protected by law in the autonomous communities of Balearic Islands, Catalonia and Valencia, and is classified as a high-priority habitat by the European Union Directive (Marbá *et al*., 1996). Other sea grass prairies on the sandy sea beds (generally associations of two species: *Cymodocea nodosa* and *Caulerpa prolifera*) of great biological importance are both present in the Mediterranean and Canary islands. The grass prairies contribute to fix and to stabilize sandy deposits; also they can permit algae association communities' development. Finally they are an important marine habitat to different fishes and invertebrate communities.

Sensitivities of marine habitats to desalination plants from Hopner and Windelberg (1996).

1) High-energy oceanic coasts, rocky or sandy, with coast-parallel current
2) Exposed rocky coast
3) Mature shoreline (sediment mobility)
4) Coastal upwelling
5) High-energy soft tidal coast
6) Estuaries and estuary-similar
7) Low energy sand–, mud–, and beach rocks-flats
8) Coastal sabkhas
9) Fjords
10) Shallow low-energy bay and
11) semi-enclosed lagoon
12) Algal (cyanobacterial) mats
13) Seaweed bay and shallows

14) Coral reefs

15) Salt marsh

16) Mangal (mangrove flats)

In Spain, environmental impact assessment was established on 1986 as a basic regulation in environmental matters with Royal Decree 1302/1986 of 28th June, in agreement with European Directive 85/337, concerning the evaluation of the incidences of certain private and public projects. Later on further regulations were issued, such as including the Environmental Impact Assessment Decree (EIA), which includes a list of those activities where an environmental impact assessment is mandatory. One of these activities is water desalination whenever new or additional capacities become larger than 3,000 m3/day. Nevertheless this EIA Decree is only the basic regulation for Spain, since the different regions (Autonomous Communities) are entitled to produce their own procedures, including the capability to issue their own screening and scoping procedures (establishing the activities subject to environment impact assessment and the terms of reference for the assessments themselves).

The thermal pollution is controlled by legal normative, which generally restricts the cooling-water effluent temperature. For instance, in Spain the limits are 8ºC above inflow water and is preceptive/mandatory that the environmental temperature does not increase above a mean of 3ºC at a distance of 200 m from the outflow pipe. The total water temperature must not reach over 30ºC. An environmental impact study is perceptive before a new plant is installed.

A host of associations are related to desalinization in Spain: the Association for the Use of Water (http://hispagua.cedex.es/), Canary Islands Water Association (http://www.fcca.es/) and the Spanish Association for water Desalination and Reuse (http://www.fcca.es/) are the main ones. At international level IDA (http://www.idadesal.org/) and the European Desalination Society (http://www.edsoc.com/home.htm) are promoting technological developments and best practices. It is interesting to mention that in their web pages the impacts of the effluents are not considered.

Very little information is available on the impacts of desalination plants on the marine environment. For example, few monitoring studies have been conducted on the marine resource impacts of discharges from plants operating in the Mediterranean and in Canary islands. Most of them are related to environmental impacts, mainly generated by the discharge into the sea of the brine produced, which can affect marine benthic communities.

The extent of the environmental impacts of reverse osmosis desalination reduction when brackish groundwater is used instead of sea water, was assessed using the Life-Cycle Assessment (LCA) methodology, on two water production plants: the brackish groundwater scenario based on a plant located in Almería (southern Spain), while the sea water scenario is based on literature data. The results of Muñoz and Rodríguez Fernández-Alba (2007) show that the key life-cycle issue of brackish groundwater desalination is electricity consumption, and since this is substantially reduced with regard to using sea water, the life-cycle impacts are found to be almost 50% lower. Potential local impacts provoked by brine discharge are also found to be lower, due to a reduced content of salts.

Regarding impacts on benthic communities several studies deal with the *Posidonia* meadows, which are very sensitive to salinity increases (García and Ballesteros, 2001; Buceta *et al*., 2003, Fernandez-Torquemada *et al*., 2004). Laboratory and field

experiments showed significant effects on seagrass structure and vitality at salinities of 39.1 and 38.4, respectively. Due to this high sensitivity of *P. oceanica* to salinity increases, it is recommend to avoid design and construction of brine discharges in areas where these ecosystems or others that are potentially sensitive occur. However, when this option is not possible, it was suggested not to exceed neither 38.5 psu of salinity in any point of the meadow for more than 25% of the observations (on an annual basis) nor 40 psu of salinity in any point of the meadow for more than 5% of those observations (Sánchez-Lizaso *et al*., 2008).

In the Canary Islands brine reject is always the main environmental problem, and his discharge is usually done jointly with the discharge of waste water treatment, thus diluting it. There are some marine species affected by the salinity of the brine discharged into the sea, as grass prairies or red algae (*Rissoella Verruculosa*) (Sadhwani *et al*., 2005).

Monitoring of the effects of the Alicante desalination plant showed brine dilution lower than what was foreseen. Near the discharge point dilution is very strong but a layer of high density water expands over the bottom at a distance of several kilometres. Echinoderms, osmoconformer organisms, disappeared on the area of brine influence as well as *Posidonia* vitality was affected after one year plant functioning (Fernández-Torquemada *et al*., 2004, 2005). Other plants on the area seem to cause less damage when the environmental impact is taken into account during planning (Malfeito *et al*., 2005).

Intake of water directly from the ocean usually results in loss of marine species as a result of impingement and entrainment. Impingement is when species collide with screens at the intake; entrainment occurs when species are taken into the plant with the feedwater and killed during plant processes. These effects have not been considered in the impact assessments carried out in Spain.

A holistic view of the effects of desalination is seldom undertaken. In a recent study of the management of Mar Menor (Murcia) (Martínez-Paz *et al*., 2005) it was shown the implications of the desalination effluents on the complex environmental scenarios (Figure 3). Moreover according to the IPCC rainfall patterns with experiment changes over the next decades with an increase of frequency and intensity of droughts. That may result in increases in desalinization and of its impacts.

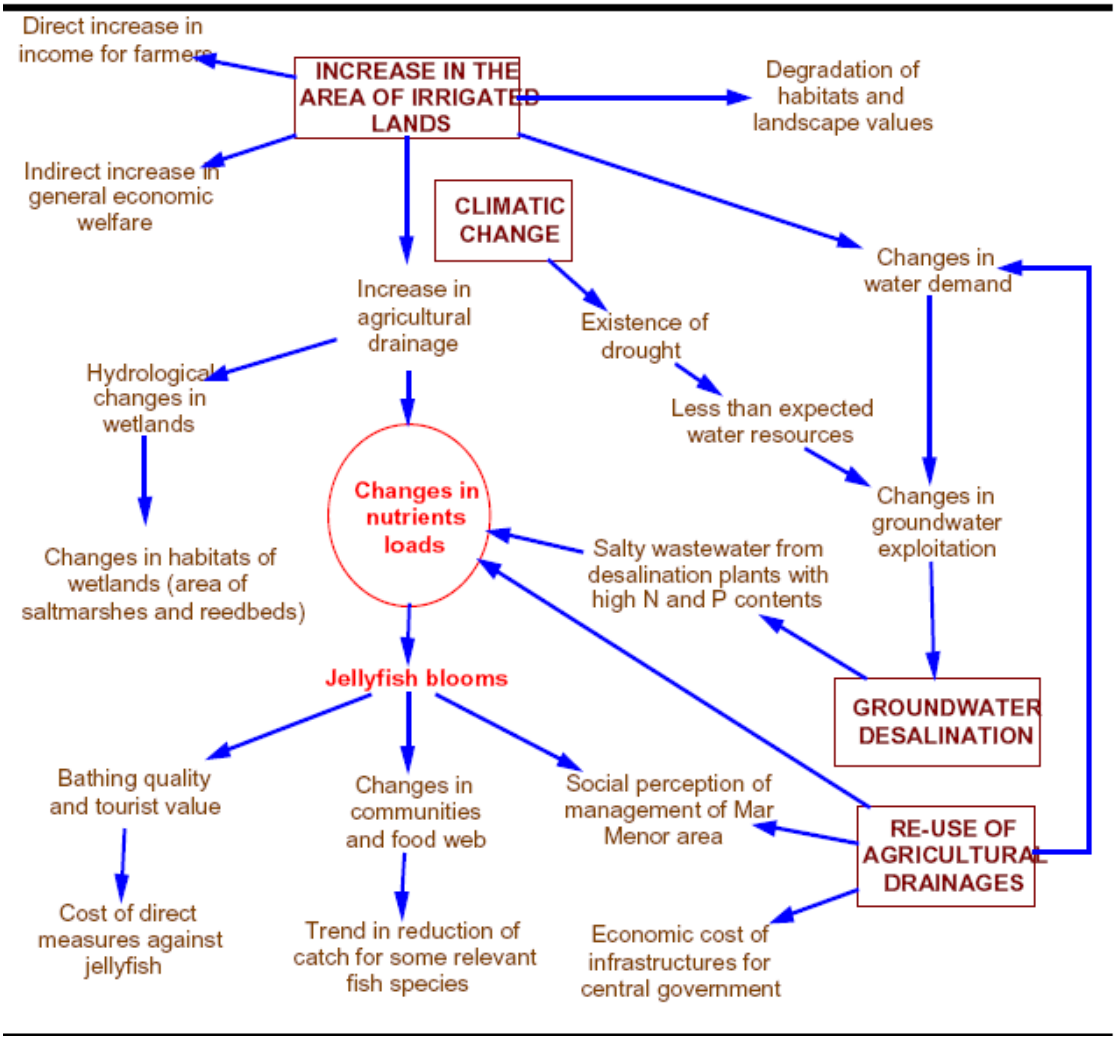

Figure A5.5. Environmental and human impacts associations in Mar Menor Lagoon (from Martínez-Paz *et al.*, 2005).

Routine monitoring update

Routine monitoring is an essential component of successful management of coastal and marine areas. This section is intended to summarize the main activities related to monitoring in Spain. The majority of these initiatives are in response to requirements stipulated by European and national level environmental legislation.

Natura 2000 Network

A map of LICs (Lugares de Importancia Comunitarias) designated under the Natura 2000 network is available online at the Spanish Ministry of Environment's webpage (http://www.mma.es/portal/secciones/biodiversidad/rednatura2000/). There are currently 1.381 LICs listed on the website, categorized at the level of autonomous communities, including links to text files with information (characterization, vulnerability, quality etc.) pertinent to each area. In accordance with the regulations stipulated by the Natura 2000 Network, each region is required to submit a status report to the EC of habitats and habitats of species designated as LICs every six years.

The information on the 27 marine protected areas is available on http://www.faocopemed.org/es/activ/research/mpas.htm#part5 and

http://www.wwf.es/red_amp_espana.php. These are managed by the regional governments including the two national Maritime-Terrestial Parks (Islas Atlánticas in Galicia and Cabrera in the Balearic Islands).

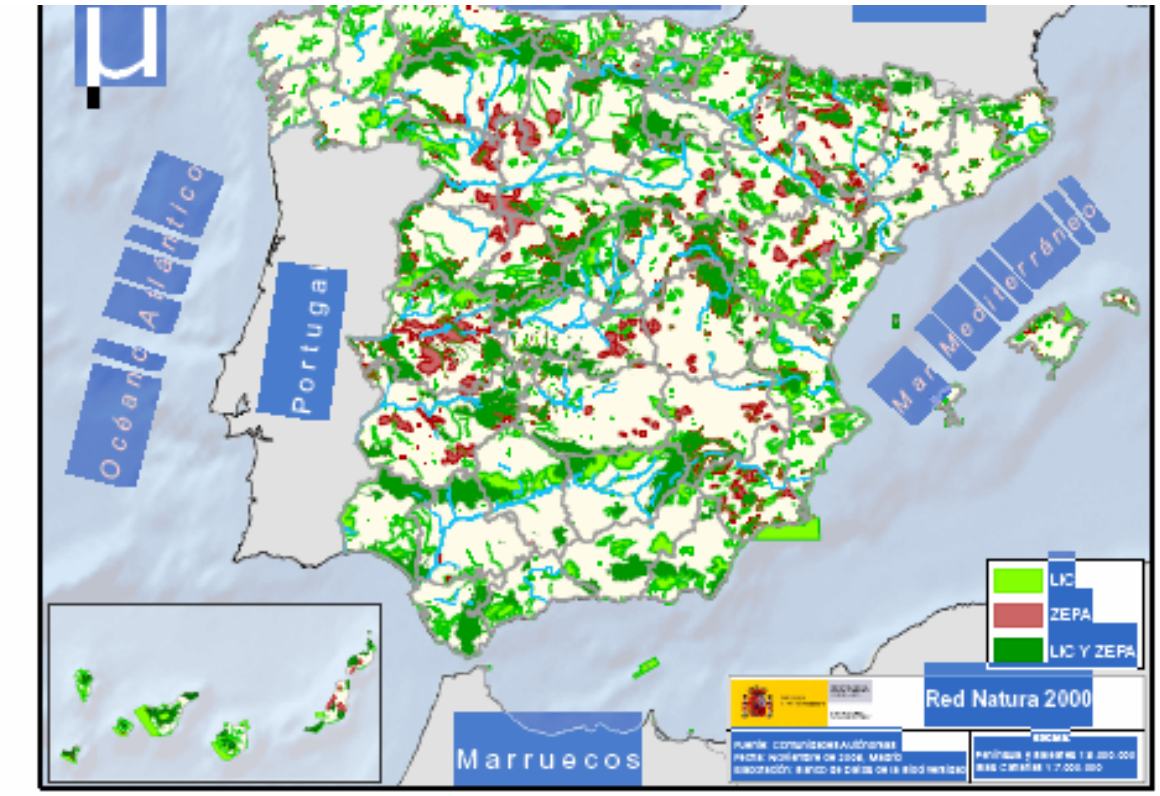

Figure A5.6. Spanish Natura 2000 sites.

Pais Vasco (AZTI and Basque Meteorological Agency)

This service provides real-time oceanographic (currents, tides, waves, sea temperature) and meteorological data (air temperature and pressure, winds, radiation, visibility) through a network of seven buoys located in the main ports of the basque Country, since 2003 (http://www.euskalmet.euskadi.net/s07-5853x/es/meteorologia/selest.apl?e=5) and (http://www.azti.es/estaciones2005/pasaia/index.asp). In addition, data on sea temperature are collected daily in San Sebastián since 1946.

Water Framework Directive

The methodologies for establishing the quality status sensu the Water Framework Directive are still under development in some transitional and coastal areas of Spain. At the same time, the intercalibration process is being carried on at national and international levels. The monitoring programmes are in operation in almost all the Spanish regions. Spain is participating in the international intercalibration process; at this moment this has been almost finished for the coastal areas. In the next two years this will be carried out for the transitional waters. An example of available data on line is provided by the Basque Water Agency. The classification of the quality status

of the transitional and coastal waters in the Basque Country, as well as the complete reports of the monitoring programme for the WFD, is accessible on line (http://www.uragentzia.euskadi.net/u81-0003/es/contenidos/informe_estudio/red_masas_agua_superficial/es_red_agua/indice.html).

Shellfish Waters Directive

The monitoring of the shellfish harvesting areas (bivalves, gastropods, echinoderms and tunicates) takes into account the parameters and frequencies described in the National and European Legislation together with Guidelines proposed by EU Working Group. Thus, this monitoring takes into account: (i) microbiological status, (ii) chemical status, (iii) presence of biotoxines, (iv) presence of toxic phytoplankton and (v) hydrographical characteristics. These monitoring programmes are in operation in almost all the Spanish coastal regions (with the exception of those without shellfish harvesting areas). As an example, the results obtained by the Galician monitoring net can be consulted in: http://www.intecmar.org/Informacion/Default.aspx. The laboratories to perform the analyses must be accredited, therefore several intercalibration processes have been carried out.

http://www.idadesal.org/

http://www.fcca.es/

http://www.fcca.es/

http://hispagua.cedex.es/

http://www.imedea.uib.es/gis/

www.caib.es/sacmicrofront/archivopub.do?ctrl=MCRST16ZI16639&id=16639

5j. SWEDEN (Updated in 2007)

5k. THE NETHERLANDS (Updated in 2008)

The Dutch coast is largely the product of the natural processes occurring in this delta area. It was not until the 20th century that man began to control the morphology and the position of the coastline. In the north, the coast is composed of the Wadden Islands, the intertidal area inshore of them and the diked coast of the mainland. Southwards, the provinces of North and South Holland have a coast consisting largely of areas of dunes punctuated by coastal settlements, dikes and harbours. Still further south, the coast of Zeeland is composed of dunes and dikes and so heavily influenced by the Delta Works that virtually all tidal inlets have now been closed off by dams or semi-open barriers.

Key issues

Given that much of the hinterland lies below sea level, a major function of the coast is to act as a flood defence. Tourism is prominent along its entire length, but ports and harbours, shipping, oil and gas extraction, horticulture under glass, drinking water collection and fishing are also important functions. The coastal zone also includes nature conservation areas, both marine and terrestrial. The coastal zone system is an

integrated complex of marine coast and land sub-systems. The coast-subsystem includes the foreshore, the beach area and natural coastal protection systems such as dunes. Natural ecological processes on the one hand, and socio-economical and political processes on the other hand, act on different temporal and spatial scales. Human activities as for instance dredging, sand-nourishment and recreation have there implications on a short term scale of days to several years or even decades, while for instance habitat alteration and climate change have effects or larger time scales of decades to centuries. Local authorities are responsible for coastal defence and recreation, while fishing management is carried out within a European framework, and global warming for instance should be addressed on a global scale. An important question now arises on what temporal- and spatial scales information is needed on ecological processes, entities to play a role in integrated coastal zone management.

Policy activities

The Dutch government has developed by the end of 2002 the contours for integrated coastal zone policy. In accordance with the European recommendation a national strategy was ready in 2005. This policy document, "Towards an Integrated Coastal Zone Policy – policy agenda for the coast", examines subjects of imminent importance, giving priority to safety policy. A number of safety and risk problems in the near future must be faced. Topping the policy agenda are the weak links in the coastal defences, which must be mitigated in time to continue to guarantee the safety of the hinterland. In addition to the weak links, risk management and quality boosts present a challenge for coastal towns. The coastal foundation zone concept illustrates the philosophy that sand is the basis of Dutch coastal defences and other functions in the coastal zone. Another duty of the national government is to ensure effective coastal zone policy and administration. With regard to communication and education the policy agenda takes consideration of the storm surge awareness. A very important new aspect is the integration of nature conservation (Natura 2000 and WFD) with coastal defence aspects. In October 2001, the European Environment Council made recommendations for integrated coastal zone management, stressing the strategic importance of coastal areas as residential areas and links in the trade and transport chain. Attention was drawn to the fact that these areas contain ecologically valuable habitats and are favourite holiday spots. However, a number of serious problems can be identified. Habitats are threatened and the coast is eroding. On the basis of the three basic qualities of the Dutch coast, resilience, cohesion and horizon, the Dutch vision of the coastal zone includes the following with respect to ecosystems:

- To protect existing ecosystems, there should be sufficient space for natural processes (resilience) in the coastal area. The aim with respect to estuaries is to restore the natural freshwater/saltwater interfaces (cohesion). Human activities, such as fishing should be carried out in a sustainable manner. Given the connection between the coast and the sea, the (ecological) quality must be ensured. An example is the development of a marine reserve to compensate for the loss of nature resulting from the development of an offshore industrial site in the North Sea.
- Space for the development of human activities is limited in the coastal areas. This requires special attention to spatial planning. Therefore, a growing search for space is thought to be found in the marine part of the coastal zone, for instance the planning of an artificial island to be used as a

new airport and locations for wind turbine parks. A major concern is the minimal amount of ecological knowledge of the near shore coastal areas, i.e. the sandy shores and surf-zone area, as well as the lack of instruments to integrate this ecological knowledge into integrated coastal zone management. The different temporal- and spatial-scales acting in both the natural environment and in the political and socio-economical planning need special attention.

Nature conservation Natura2000 and WFD

The protection of species according to the EU Bird– and Habitat Directive has been fully implemented in the Netherlands since 2002 (Flora en Fauna Wet). Special protected zones have already been put forward to the EC, according to Natura 2000. These areas are, however, not yet fully implemented. The Voordelta and the Wadden Sea including the part of the North Sea coastal zone will be implemented according to the B&H Directive as an adjustment of the Natuurbeschermingwet (1998). There is only very limited protecting of specific species and habitats in the sandy shores in the coastal zone in the Netherlands, other than some birds and sea mammals. This has partly to do with the lack of knowledge on the ecology of sandy shores in the Netherlands. Therefore it is also unknown how vulnerable and valuable the species and habitats of the coastal zone are. The Water Framework Directive aims at the protection of all water bodies (including coastal waters) in Europe and must have achieved a "good ecological status" in 2015. Coastal areas will be part of river basin plans (Rijn, Schelde, Maas and Eems). The ecological status will be judged using chemical and biological quality elements (phytoplankton, macrofauna, macrophytes and fish). The Ems-Dollard estuary, as transitional waters, will be judged on all four biological elements. The Wadden Sea and other coastal areas, being coastal waters, don't have to be judged on the presence of fish.

Monitoring / assessment

A first inventory of the European sustainability indicators for coastal zones in the Netherlands was published in 2006. This was done on the basis of data from several scattered monitoring programmes.

Monitoring of human activities e.g. fisheries, recreation, coastal defence, gas-extraction etc. and ecosystem properties e.g. geo-morphological, hydrological, chemical and biological aspects (e.g. WFD and Natura2000 monitoring) etc. are for the most separate programmes, not yet part of an integrated programme.

5l. UNITED KINGDOM (Updated in 2008)

The boundaries involved with the UK coastal zone management are not clearly defined however the Crown Estate manages the marine areas below Mean Low Water Springs (MLWS) out to 12nm. For planning purposes the Local Authority boundaries seaward limit is generally the MLWS mark. There is no statutory planning offshore; however the recent Water Environment and Water Services (Scotland) Act 2003 extended marine fish farming to local authority control in terms of planning permission out to 3 nm, and is now fully implemented. There is no official development setback line policy or protected zone for the coast. Recently, however, there have been several instances where an informal 5-metre contour line has been recognized in England, specifically in relation to dealing with coastal erosion and flood defence. The coastline around UK is highly variable with rocky cliffs, firths and beaches, creating a large inshore area (within 12 miles of the coast).

The diverse habitats in the inshore zone are vital to the UK's fisheries as they provide important spawning and nursery grounds for white fish and flat fish as well as rich feeding areas to several bird colonies. The clean productive seas of Scotland are also essential for the continued development of aquaculture. In the UK, but especially Scotland the network of Local Coastal Partnerships are key to implementing ICZM (Figures A5.7 and A5.8).

A UK ICZM stock take was published in April 2004 and subsequently ICZM strategies were then published for England and the devolved administrations during 2006.

Coastline length: The UK has a long coastline, totalling 19488 km. This can be broken up into: Scotland (mainland) 6482 km, 33.3% of total; Scotland (islands) 5295 km, 27% of total; Wales 1592 km and N. Ireland 650 km.

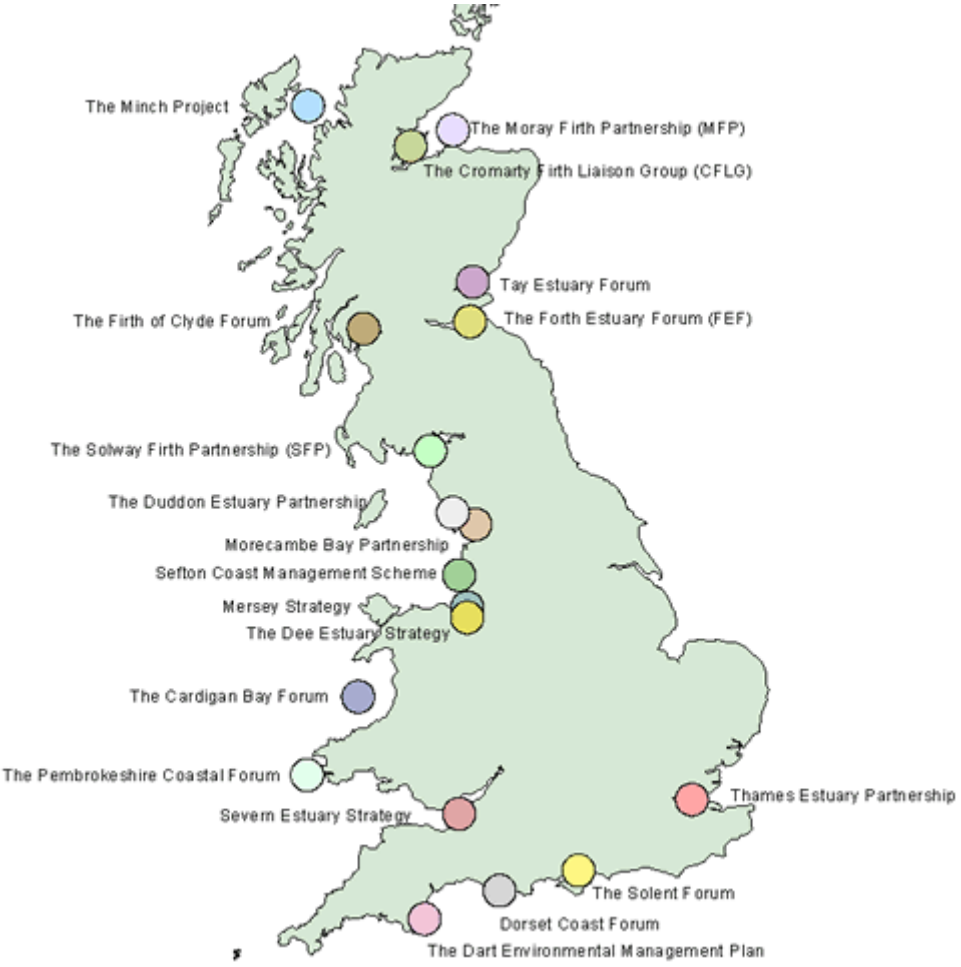

Figure A5.7. Some UK Coastal and Estuary Partnerships, Management Groups and Fora.

Key issues:

- Economic contribution of activities in the marine area as per the latest available figures was GBP 67 B, which is made up of: oil and gas – GBP 22.3 B; tourism and recreation – GBP 16 B; strategic – GBP 6.5 B; shipbuilding and repairs – GBP 3 B; ports – GBP 1.6 B; and fisheries – GBP0.5 B.
- The development of urban infrastructure, ports and harbours and the substantial areas of tidal land that has been converted to agriculture through enclosure. This has been particularly intense around the major estuaries.
- A significant percentage (31%) of the coastline is already developed in industrial, commercial, residential and recreational terms. Economic pressure for further expansion of these facilities is likely to increase in the future.
- Approximately 40% of UK manufacturing industry is situated on or near the coast. Much of this industry, along with major cities, is located around large estuaries.
- Most of the Scottish population lives within a few miles of the coast and on its many islands.
- Spatial issues regarding the distribution of resource exploitation in the coastal zone by inshore fisheries, shellfish gathering, aquaculture, game fishing, offshore oil and gas, shipping, recreation, tourism and small scale agriculture.
- Cumulative impacts of coastal and marine developments.
- Flooding and erosion threat resulting from climate change, sea level rise and isostatic sinking are an issue around the south and east of England, requiring coastal defence.
- Decline in inshore fish stocks due to over-fishing and habitat damage.
- Decline in runs of wild salmon and sea trout in many rivers.
- Fish farming (spatial reclamation, benthic impact, disease, escapes, algae blooms).
- Coastal water pollution threatening the collection and farming of shellfish and the local wildlife.
- Offshore energy development

Policy activities (UK)

The UK Government has stated it's commitment to adopting an integrated approach to the coastal zone management in general, in the first Marine Stewardship Report "Safeguarding our Seas", published in May 2002. After the launch of the EU recommendation on ICZM in 2002, Member States were asked to report back to the Commission on their experience in implementing the Recommendation. The UK Government report to the Commission was published in March 2006. Major developments for ICZM in the UK include the new Marine Bill, which completed its consultation phase in June 2007.This Bill outlines many proposals that will affect the coastal zone and the implementation of ICZM. The key elements of the proposed UK Marine Bill are a new system of Marine Spatial Planning; licensing reform, merging some disparate regimes for development consents (but not oil and gas licensing which DTI has ring-fenced); new nature conservation measures in territorial and

offshore waters to implement marine protected areas (called Marine Conservation Areas); the creation of a Marine Management Organisation to deliver some or all of the above, together with some existing functions; and changes to inshore fisheries' management in England. The responses to the consultation were generally in agreement with all these proposals and the Marine Bill will now be presented to the UK Parliament in November 2007.

UK-wide Marine Monitoring and Assessment Strategy (UKMMAS): Two UK reports, Safeguarding our Seas (2002) Charting Progress (2005) and the Scottish equivalent Seas the Opportunity (2005) specified the need for an integrated assessment of our seas. The overarching aim of the UKMMAS is to make most efficient use of UK resources by: investigating and reporting on objectives for the marine environment; preparation of an integrated assessment framework for multiple use (e.g. future UK Charting progress reports, OSPAR QSRs, Water Framework Directive and Marine Strategy Directive); preparation of Protocols and Monitoring Manual; efficient data archiving; and three evidence groups to collate data and reports. To date an assessment matrix has been produced, based on the OSPAR framework, comprising ecosystem components and anthropogenic pressures. Future monitoring and subsequently indicators will be driven by the assessments within this matrix i.e. monitoring and research efforts will be targeted where there is a significant pressure linked to an ecosystem component.

http://www.defra.gov.uk/environment/water/marine/uk/science/monitoring.htm
http://www.defra.gov.uk/environment/water/marine/uk/science/pdf/ukmmas-strategy.pdf

Shoreline Management Plans (SMPs): An SMP is a "document which sets out a strategy for coastal defence for a specified length of coast, taking account of natural coastal processes and other environmental influences and needs" (MAFF 1999). In the last 10 years we have made significant progress in understanding and mapping coastal processes through the first generation of SMPs which cover the 6000 kilometres of coast in England and Wales. SMPs provide a large-scale assessment of the risks associated with coastal processes and present a long term policy framework to reduce these risks to people and the developed, historic and natural environment in a sustainable manner. An SMP is a high level document that forms an important element of the strategy for flood and coastal erosion risk management. Coastal groups, made up primarily of coastal district authorities and other bodies with coastal defence responsibilities, provide a forum for discussion and cooperation and play an important part in the development of SMPs for their area.

Policy activities (Scotland)

The Scottish Coastal Forum (SCF): SCF plays an important role in gathering information about approaches to coastal management and disseminating good practice. The SCF encourages debate on coastal issues at national level and seeks opportunities for better coordination of development opportunities, avoiding conflict and safeguarding natural assets. TheSCF also developed the ICZM Strategy for Scotland.

Scottish Sustainable Marine Environment Initiative (SSMEI): This project is now in phase three, and the four pilot projects (Sound of Mull, St Abbs, The Clyde and Shetland) are up and running and have each been designed to investigate different aspects of Sustainable Marine Management. Topics included are spatial planning, habitat mapping and conflict resolution. The Shetland Pilot has produced maps,

using GIS layers, and a policy review, which are both currently out for consultation. The map layers include fish habitat and resource maps, of which further details are included below.

Advisory Group on Marine and Coastal Strategy (AGMACS): This was set up to advice Scottish Ministers on delivering the vision and objectives outlined in Scotland's marine and coastal strategy (Seas the Opportunity – a Strategy for the Long Term Sustainability of Scotland's Coasts and Seas). The final report was published in March 2007, which covered four main work streams: Science, Research and Performance Indicators; Conflict Resolution and Integrated Coastal Zone Management; Marine Spatial Planning and Marine Nature Conservation. With regard to ICZM the main recommendation was that Scotland should have its own Marine Management Organization for national coordination of ICZM and MSP. The report can be found at http://www.scotland.gov.uk/Publications/2007/03/08103826/0.

Coastal and marine national park. In June 2005, the Scottish Executive announced their intention to create Scotland's first coastal and marine National Park during 2008. The Scottish Executive have now launched a consultation (October 20096) on the possible areas for Park status and also on how a Park could operate. Scottish Natural Heritage has identified 10 areas as potential candidates for Park status.

State of Scotlands Seas Report: As part of the UK-wide process for reporting the status of UK seas (Charting Progress 2), Scotland has produced its own report on the status of Scotland's seas, which is to be published in spring 2008.

Data projects (UK)

United Kingdom Directory of Marine Observing Systems (UKDMOS): This will support the requirements of the UKMMAS and provide a discovery resource for legislation such as the Water Framework Directive (WFD). There are also a number of other ongoing initiatives that require metadata from monitoring programmes such as the European Global Ocean Observing System (EuroGOOS), and the Environmental Research Funders Forum (ERFF). This information is also required as part of the UK contributions to EU-wide monitoring methods and systems of surveillance for species and habitats of Community interest (EUMON), and the Global Climate Observing System (GCOS). It is proposed that UKDMOS will become a single application that will meet all of these requirements.

UKMMAS– marine protocols manual: The Marine Monitoring Protocols Manual is a searchable web-based tool that provides information on the protocols and standards used to generate data for UK marine monitoring programmes. The Manual supports the UK Marine Monitoring and Assessment Strategy (UKMMAS) and complements the United Kingdom Directory of Marine Observing Systems (UKDMOS) by cataloguing information for over 250 monitoring programmes across all scientific disciplines. Specifically, the Manual identifies the parameters measured by each monitoring programme, provides signposts to the protocols used to generate a reportable data point for each parameter, and presents information on relevant data quality standards. http://www.wrcplc.co.uk/marineprotocols/

Research projects (UK and Scotland)

Marine Trophic Index Project: The UK Government have commissioned this work to look at high level indicators that will be long term, robust and give a comprehensive overview of ecosystem integrity. The indicators proposed are based on fish data, as datasets on different trophic levels is available for fish. Fish stomach contents data

have been investigated as has $\delta^{15}N$ isotope accumulation in flesh of fish, this is greater for organisms that consume higher up the trophic pyramid and as such have accumulation of the isotope through many trophic levels. The size of fish has also been considered e.g. the OSPAR EcoQO re proportion of fish >40cm. Threat indicators are another approach e.g. decline rate – % change over 3 generations; size spectrums re lengths and abundance. This project will run until October 2008, with a workshop in March 2008.

SSMEI: The Scottish Sustainable Marine Environment Initiative (SSMEI) was initiated by the Scottish Government to inform future marine policy and test new management framework options for Scotland's marine and coastal environment. Four pilot projects have been set up across Scotland, located in the Firth of Clyde, the Sound of Mull, Berwickshire and Shetland.

UKSEAMAP Final report January 2007. The outputs provide a fundamental spatial information layer to support more effective management of marine resources and also support the implementation of existing international commitments and targets. A primary output of the project is an interactive web based mapping system giving access to the datasets used and maps created by the project. The project is closely linked with a wider habitat mapping initiative 'Mapping European Seabed Habitats' (MESH).

Carrying capacity of coastal waters for aquaculture – improved physical and ecosystem management modelling.

Environmental sustainability indicators for aquaculture: to develop indicators of the environmental sustainability of Scottish aquaculture that will include: benthic enrichment; nutrient release; feed materials; disease control; space requirements and biomass fragmentation. By setting aspirational targets an assessment of the trend of the aquaculture industry towards or away from sustainability will be possible. The scope for the expansion of aquaculture within the current legislative regime and technical capabilities will be studied, and an assessment of the effect this expansion will have on the environment will also be made.

Application of carrying capacity models to support aquaculture

- Physical and biological models to predict the effects of nutrient discharges from fish farms on water quality parameters
- Models have been tested in two sea lochs
- Future work aims to gather data to test these models elsewhere and identify areas where growth of shellfish may be limiting
- Models will ultimately be applied to regulation of the aquaculture industry

Natura 2000 position (Scotland)

SACs in Scottish territorial waters out to 12 nautical miles are designated under the Conservation (Natural Habitats, etc.) Regulations 1994 (as amended). All candidate SACs in Scotland were approved by the European Commission as SCIs on 7 December 2004. Scottish Ministers then formally designated all these sites as Special Areas of Conservation on 17 March 2005. As at 1 April 2005, a total of 34 sites with marine interest have been designated as SACs. In Scotland, 6 of the 34 marine SACs have purely intertidal marine interests and are fully underpinned by the SSSI mechanism. For these sites, the duties imposed on SNH by Regulation 33 are discharged by SSSI protective measures and notifications. The remaining 28 sites contain significant subtidal areas (i.e. lying below Mean Low Water Springs) cannot

be notified under the SSSI system. Documents containing the Regulation 33 advice for each of these 28 European marine sites are all now available. Marine areas beyond 12 nautical miles (offshore waters) are under UK jurisdiction and managed by the Joint Nature Conservation Committee (JNCC). So far, one site has been formally identified as a possible SAC in offshore waters. This area is known as the Darwin Mounds and is proposed for its cold water coral reefs. Several other sites in offshore waters are under consideration as draft SACs.

Water Framework Directive position (Scotland)

The WFD is implemented in Scotland through the Water Environment and water services (Scotland) Act 2003. To control discharges from point sources the Water Environment (Controlled Activities) (Scotland) Regulations 2005 have been introduced to deliver WFD objectives and became fully operational in April 2006 and the new point source, impounding, abstraction and engineering regimes also started then. In December 2006 the monitoring programme became operational and has been reported to the EU (see below).

National report on coastal recreational fisheries (Scotland)

There is no government led system for the collection of data from recreational fisheries, although it is acknowledged that there is a need for it, if only to exclude these catches from the DCR.

The National Federation of Recreational Sea Anglers (NFSA) has produced two reports for the UK government on the scope and commercial value of recreational sea angling (RSA) to the UK economy. There are approximately one million people who participate in RSA in the UK spending some £1Bill each year and creating 19,000 jobs. About 65% of this activity is in England and Wales.

Report on national time-series coastal monitoring programmes (Scotland)

The Fisheries Research Services (FRS) Coastal Long Term Monitoring project was set up in 1999 to monitor water quality parameters at 10 sampling sites around Scotland (Figure A5.7). The measurements taken as part of this monitoring are used to create a continuous time series of the variation in key properties of the sea. This time series data set will enable us to study the impact of climate change on Scottish coastal waters, as well as giving us information on typical background conditions. Parameters measured include water temperature, salinity, nutrients (such as phosphate, silicate, nitrate and ammonia) and phytoplankton. Another scheme, the Stonehaven and Loch Ewe Ecosystem monitoring, covers one site on the East Coast (Stonehaven) and two sites on the West Coast (Loch Ewe). Weekly samples are taken (weather permitting) with the present and long-term objective to monitor and assess the state of the ecosystem in the eastern, coastal waters of Scotland from the Stonehaven site and in contrasting waters of the Scottish west coast from Loch Ewe.

WFD: The Scottish Environment Protection Agency (SEPA) and other responsible organisations in Scotland have developed a new monitoring and classification system to deliver the WFD in Scotland. The bulk of the monitoring work is operational monitoring, targeted on 66 of the 81 water bodies at risk. The objective of this work is to establish the status of those bodies and help inform the targeting of any measures that may be needed. 'Not at risk' water bodies have been grouped within coastal sediment transport cells (a relevant geographical unit for marine ecosystems) and then by the pressure profile which may be acting on the water bodies. 5–10% of these water bodies are monitored and the classification extrapolated across the group.

In Marine (coastal and transitional) waters there are 300 physico-chemistry sites and 270 biology sites for operational monitoring. The surveillance network consists of 35 transitional and 140 coastal sites and has built on the long established UK National Marine Monitoring Pprogramme (NMMP), which in turn has been amalgamate into the new UK Monitoring and Assessment Strategy (see below). Although surveillance monitoring will be at a frequency of 4 times per year it will be ongoing; consequently within a RBMP period 24 samples will have been taken.

In order to help deliver these new monitoring requirements, SEPA has developed a Scottish Monitoring Strategy with partners such as SNH, Scottish Water, British Waterways and Fisheries Research Services.

Report on national time-series coastal monitoring programmes (UK)

Two UK reports, Safeguarding our Seas (2002) Charting Progress (2005) and the Scottish equivalent Seas the Opportunity (2005) specified the need for an integrated assessment of our seas. The overarching aim of the UKMMAS is to make most efficient use of UK resources by: investigating and reporting on objectives for the marine environment; preparation of an integrated assessment framework for multiple use (e.g. future UK Charting progress reports, OSPAR QSRs, Water Framework Directive and Marine Strategy Directive); preparation of Protocols and Monitoring Manual; efficient data archiving; and three evidence groups to collate data and reports.

To date an assessment matrix has been produced, based on the OSPAR framework, comprising ecosystem components and anthropogenic pressures. Future monitoring and subsequently indicators will be driven by the assessments within this matrix i.e. monitoring and research efforts will be targeted where there is a significant pressure linked to an ecosystem component.
http://www.defra.gov.uk/environment/water/marine/uk/science/monitoring.htm
http://www.defra.gov.uk/environment/water/marine/uk/science/pdf/ukmmas-strategy.pdf

United Kingdom Directory of Marine Observing Systems (UKDMOS): This will support the requirements of the UKMMAS and provide a discovery resource for legislation such as the Water Framework Directive (WFD). There are also a number of other ongoing initiatives that require metadata from monitoring programmes such as the European Global Ocean Observing System (EuroGOOS), and the Environmental Research Funders Forum (ERFF). This information is also required as part of the UK contributions to EU-wide monitoring methods and systems of surveillance for species and habitats of Community interest (EUMON), and the Global Climate Observing System (GCOS). It is proposed that UKDMOS will become a single application that will meet all of these requirements.

UK Marine Environmental Change Network (MECN). This is a collaboration between organisations in England, Scotland, Wales and Northern Ireland collecting long-term time series information for UK marine waters. It is coordinated by the Marine Biological Association of the UK (MBA) and is funded by the Department of the Environment, Food and Rural Affairs (DEFRA). The goal of the network is to use long-term marine environmental data from around the British Isles and Ireland to separate natural fluctuations from global, regional and local anthropogenic (human) impacts. Currently, the MECN is working with the Marine Climate Change Impacts Partnership (MCCIP) in the production of an annual report card on the issue of climate.

Annex 6: Status of large EU funded projects relevant to ICZM (ToR d)

AquaReg

AquaReg is a cooperation between the regions of Galicia in Spain represented by the CETMAR Foundation, Border, Midland and Western (BMW) in Ireland represented by The Marine Institute and Trøndelag in Norway represented by joint forces of the South Trøndelag and North Trøndelag counties. The overall objective of AquaReg is to provide opportunities and design strategies for sustainable development of peripheral coastal communities by promotion of interregional cooperation in aquaculture and fisheries. The AquaReg CZM Project is primarily looking at reviewing best practice in aquaculture and inshore fisheries management and producing guidelines of best practice for use by these industries. The consultation stage, however, involved representatives from a variety of different sectors and resource uses, through workshops and questionnaires. This focused on highlighting issues relating to: administration; licensing; monitoring programmes; availability of results and data processing; technological approaches to management; current management fora and representative participation. Currently, pilot studies in each of the three regions are looking at the application of seabed mapping to aquaculture and inshore fishing and at the establishment of a Geo-database (GIS) in each of the pilot study regions. The application of seabed mapping involves the production of thematic maps looking at sediment types, exposure, biota and areas for special protection and nursery areas for wild fish species. The Geo-databases comprises of: bathymetry data; fixed station temperature data; hydrography for surrounding catchment; marine boundaries; quays and piers; political boundaries; aquaculture site locations and inshore fisheries activities. The information gathered in these pilot studies will form the basis for developing a marine spatial plan for the area. For this the relevant agencies will be brought on board and additional survey material incorporated into the database. www.aquareg.com

Atlantic Coastal Zone Information Steering Committee (ACZISC)

The ACZISC (http://aczisc.dal.ca) was established in 1992 to promote regional cooperation in Atlantic Canada with regard to Integrated Coastal and Ocean Management, coastal mapping and geomatics. The ACZISC is multi-disciplinary and multi-sectoral with representation from ten Canadian federal departments, four Atlantic provincial governments, community organizations, academia and the private sector. A free monthly newsletter is available via email and the website provides links to, for example, mapping programmes, websites, workshops and organisations concerned with ICZM. The information portal contains metadata records or search by subject, coverage or product type to find, evaluate, visualize and access geospatial data.

BALANCE

The project is partly financed by the European Union (European Regional Development Fund) within the BSR INTERREG III B Programme. The project started in August 2005 and runs for 2.5 years. The BALANCE partnership consists of 19 partners and 8 consultants from the all countries surrounding the Baltic Sea except Russia, but incl. Norway. The aims of BALANCE are to:

• develop trans-national marine spatial planning tools and an agreed template for marine management planning and decision-making. Four trans-national pilot areas

are used to demonstrate the economical and environmental value of habitat maps and marine spatial planning. The tools and zoning plans integrate biological, geological, oceanographic and socio-economic data with local knowledge from stakeholders;

- develop the "blue corridor" concept and promote "blue corridors" between protected sites adding spatial development dimensions to the implementation of EC Directives;
- assess if the Baltic marine MPA network is ecological coherent and adequately represents and protects a continuum of habitats;
- develop a communication strategy for stakeholder involvement to ensure that objectives and decisions address local stakeholders needs and that products is used and understood by the end of project;
- disseminate project outputs to key users and public through various media, including a project web site, enhancing awareness of the marine natural heritage and the benefits of sustainable resource use.

The planned results are an agreed approach to identification and mapping of Baltic Sea marine landscapes and habitats through development and production of maps. In areas with little biological information habitat predictive models will be developed and validated.

For more information see www.balance-eu.org. For using, sharing or distributing marine data for the Baltic Sea, please see the BALANCE Data Portal at Http://maps.sgu.se/Portal

Sustainable development based on an ecosystem-based approach to management requires:

- Cross-sectoral marine spatial planning
- Transnational cooperation
- Public data access
- Standardized data collection and presentation
- One characterization of the marine ecosystem, not a one nation-one approach
- Stakeholder involvement

Corepoint

Funded under the INTERREG IIIB programme, Corepoint is a €4.2m project with 12 Partners from Ireland, UK, France, Netherlands and Belgium and is led by the Coastal & Marine Resources Centre in University College Cork. The Project will utilise the expertise within the project consortium to attempt to progress the development and implementation of Integrated Coastal Zone Management (ICZM) solutions across the Northwest Europe (NWE) region.

It aims to achieve this through:

- Building European and local capacity to implement integrated coastal management programmes
- Providing concrete solutions for current problems in the Northwest region using current best practice approaches and identify models for sustaining ICZM initiatives
- Promoting social and political responsibility for coastal environment

- Developing an integrated coastal information management system for Northwest Europe. Corepoint also aims 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. This three-pronged approach adopted by the Project has already yielded results with Corepoint being referenced both in Europe and also across the international arena. www.corepoint.ucc.ie

ENCORA

This EU Network is formed by the institutes coordinating national networks within 18 European countries. It aims to overcome existing fragmentation of knowledge and experience within ICZM by facilitating access to local networks. The national networks include: Sencore, Dancore, Russian Coastal network, Cozone, I-CoNet, NCK, Bencore, GCN, Inet, Ukranian Coastal Network, RFRC, PoCoast, HispaCosta, RIC, Hencore and Regional North African Coastal network (3 countries). More information on this project can be found in www.encora.org.

MARINET

MARINET is a newly established Danish national forum with the purpose of optimizing the mapping of the Danish marine areas as well as the use of existing information based on a common coordination between relevant authorities. The members come from broad spectrum of authorities, research institutes and private companies. The common initiatives include calibration of existing multibeam datasets with geological and biological data development of a national habitat classification system.

PROTECT

The international project "Marine protected areas as a tool for ecosystem conservation and fisheries management" (PROTECT) is an interdisciplinary research project involving 17 European institutions. It aims to strengthen the decision basis regarding potential use, selection, development and management of MPAs in Europe as part of an ecosystem-based approach to fisheries management. The project is running from January 2005 to June 2008 with support from the EU 6th Framework Programme.

The main scientific objectives of PROTECT are:

- To evaluate the potential of MPAs as a tool to protect sensitive and endangered species, habitats and ecosystems from the effects of fishing in the context of EU fisheries and marine environmental policies.
- To outline and develop a suite of monitoring, assessment and management tools for MPAs. These methods are intended to assist managers in assessing (i) the fisheries impact on the ecosystem or ecosystem components to be protected, (ii) the impact of introducing MPAs with varying level of protection on the protection target, and (iii) the impact of MPAs on the fishery and related socioeconomic effects.
- To improve the linkage between science and management when designing and introducing future MPAs, including guidance on (i) timing and level of stakeholder involvement required to achieve legitimacy and to ensure that the best knowledge is applied and (ii) follow-up actions after the

implementation of MPAs, ensuring achievement of objectives or introduction of necessary modifications. An important outcome so far in the project is the report: "Review of Marine Protected Areas as a Tool for Ecosystem Conservation and Fisheries Management". This report can be downloaded from the project web-page: www.mpa-eu.net.

SPICOSA

The project "Science and Policy Integration for Coastal Systems Assessment" (SPICOSA) is funded by the EU 6th Framework Programme. It started in February 2007 and will run for 4 years. A total of 54 partners from 22 different countries are involved in the project.

The overall objective of SPICOSA is to develop a self-evolving, holistic research approach and support tools for the assessment of policy options for sustainable management, through a balanced consideration of the ecological, social and economic sectors of Coastal Zone (CZ) Systems. The specific objectives of the project are to:

1) Create an operational Systems Approach Framework (SAF) for assessments of policy alternatives in Coastal Zone Systems;
2) Create a working science-policy interface and attempt to qualify and quantify complex systems;
3) Implement and test the SAF over 18 diverse Study Site Applications throughout the European region;
4) Generate SAF Portfolio consisting of generic assessment methodologies, decision support tools, models and new knowledge useful for ICZM, in a manner that is user friendly and updateable;
5) Improve the communication and integration among the main actors and infrastructures of CZ Systems;
6) Generate new opportunities for academic and professional training in ICZM.

The project has only one central focus, that of demonstrating the practicality of systems thinking into the research and management of Coastal Zones. Given that this experience will be a learning curve for all involved, it is expected that the level of achievement would not be maximal. On the other hand, requiring that several hundred researchers collectively experience and contribute to the first objective; that of creating the SAF protocol, it will certainly stimulate the evolutionary process required to develop appropriate strategies in support of Sustainable Development.

The project has just completed its first year. The SAF is divided into four steps: Design Step, Formulation Step, Appraisal Step and Output Step. The Design Step has been successfully completed by all 18 Study Sites and the Formulations Step is just starting. A manual for each step is being produced or revised throughout the project. The EXTEND model will be implemented by all study sites for the SAF. This allows exchange of generic model blocks and the build up of a model library.

For more details about this project refer to the project website on: www.spicosa.org

Land-Ocean Interactions in the Coastal Zone (LOICZ)

The LOICZ Project is one of six programme elements of the IGBP and one of five of the IHDP, and focuses on the interface of the Earth system where land, ocean and atmosphere meet and interact. The overall goal of this project is to determine at

regional and global scales a) the nature of that dynamic interaction, b) how changes in various components of the Earth system are affecting coastal zones and altering their role in global cycles, c) to assess how future changes in these areas will affect their use by people and d) to provide a sound scientific basis for future integrated management of coastal areas on a sustainable basis.

LOICZ has developed scientific knowledge and tools that address global change in the coastal zone, focusing on material flux and human dimensions at regional and global scales. For LOICZ purposes, the coastal zone incorporates the domain extending from river catchments through the land-sea interface and coastal shelf, to the shelf margins. Globally LOICZ has established regional coastal projects addressing natural and socio-economic knowledge and tools development for material flux from river catchments to the coastal shelf. LOICZ' central database of affiliated projects is online providing basic information, search tools and regular updates to the wider community. Other services included the set up of an advanced computer server for a coastal typology data base.

Focusing on three Priority Topics, 1) Linking social and ecological systems in the coastal zone, 2) Assessing and predicting impacts of environmental change on coastal ecosystems, 3) Linking governance and science in coastal regions, LOICZ organizes the biochemical, geophysical and human dimensions of coastal change and provides information enabling future scenarios of socio ecological system scale.

LOICZ International Project Office

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ComCoast

ComCoast **was** a European project that developed and demonstrated innovative solutions for flood protection in coastal areas. Shortly: COMbined functions in COASTal defence zones. ComCoast created multifunctional flood management schemes with a more gradual transition from sea to land, which benefits the wider coastal community and environment whilst offering economically sound options. The ComCoast concept focused on coastal areas comprising embankments. ComCoast did run from 1 April 2004 to 31 December 2007.

Website: www.comcoast.org

IMCORE

Aim: To promote a transnational, innovative and sustainable approach to reducing the Ecological Social and Economic impacts of climate change on the coastal resources of NWE.

To achieve:

A demonstration of how the innovative expert couplet approach, (i.e. collaboration between coastal practitioners and scientists using the principles of sustainability science), can help with the effective implementation of adaptive management strategies for coastal resources.

The identification of impacts of a range of specified climate change scenarios on coastal sectors and the development of a response in the form of strategies for adaptive management.

Contact. Val Cummins, CMRC, University of Cork, Ireland

Annex 7: Summary of presentations given in the mini workshop on indicators (Tor f)

Basque Coastal Area, Javier Franco, AZTI – Tecnalia / Unidad de Investigación Marina Herrera Kaia, Pasaia (Gipuzkoa)

For the Basque Coastal Area (Bay of Biscay, Northern Spain) a proposal of marine environment indicators has been carried out by Azti-Tecnalia. In this area, the main strategic documents regarding environment issues are the Basque Environment Strategy for Sustainable Development (2002–2020) and the Basque Environment Framework Program (2007–2010). These programs establish the main goals, objectives and compromises regarding environment issues in the Basque Country. A set of indicators was proposed.

The proposal of marine environment indicators included some of the basic set of indicators as well as some others more specific for the marine environment. The proposed list contains 29 indicators. A suitability-feasibility classification of these indicators was performed. This list should be completed with indicators of the socio-economic and governance component of sustainability.

Risk Characterization in Canada, Roland Cormier, Oceans and Habitat Division Gulf Region, Fisheries and Oceans Canada

Risk characterization is but one step of a decision-making process for integrated management generally. Classic risk analysis decision-making includes:

1) Setting of management objectives based on spatial/temporal social, cultural, economic, regulatory and ecosystem profiles and consultations;

2) Identifying and characterizing the risk to both ecosystem and social components to set priorities for management;

3) Formulating of the assessment scope which includes setting indicators and identifying data sources;

4) Conducting the assessment of the identifies taking into account the management objectives so to provide options for management consideration;

5) Developing management plans based on options provided in consultation with key stakeholders and regulatory agencies;

6) Implementing management plans where indicators are then used for monitoring the performance of the management plans in effectively achieving the initial management objectives;

7) Communicating to stakeholders, regulatory agencies and the coastal communities from the perspective of developing stewardship.

Qualitative risk characterization can prove useful in communicating priorities to coastal or regional communities and management as well as identifying science knowledge gaps. In addition facilitating of setting priorities, such approach also provides a framework to identify indicators and formulate the scientific and technical assessment. Risk characterization coupled with GIS tools plays a key role in spatial planning and management.

Indicators as guides for Integrated Coastal Zone Management, Hannelore Maelfait, Coordination centre on ICZM, Belgium

Indicators for the Coastal zone

The final goal is a sustainable management of our coast. A management that not only places importance to the needs of the tourist sector but also takes other economical interests into account, where social concerns and a pleasant environment are appreciated and the unique nature and cultural patrimony are safeguarded. To achieve this goal, common future perspectives, operating the development and sustaining the formulation of the long-term strategic objectives, are needed. The development of a set of indicators is one of the ways to control and to support such a complex matter as sustainable coastal management. To pursue effective policies for the coast, a wide variety of high-quality information and data is needed. Decision taking and good governance requires a sound scientific base in order to assess effects of policies at ecological, environmental and socio-economic level. The set of sustainability indicators (SI) can provide an answer in a format that is useful for policymakers. An indicator is a measured or observed parameter that provides information about a system. It is supposed to make certain phenomena perceptible that are not –at least not immediately– detectable. This means that an indicator has a significance extending beyond what is directly obtained from observations [1]. Indicators provide an extremely useful way to improve communication, transparency, effectiveness and accountability. They are a tool that helps make clear assessments of and comparisons between management measures through time. They also can be used to simplify the description of the extent to which the objectives for the management programs are being achieved.

The Belgian approach to the use of indicators within integrated coastal zone management

The coastal area: finding the right balance

At the European level, Belgium has pioneered the development and implementation of a set of 20 sustainability indicators for the coast, as an initiative of the Coordination Centre for Integrated Coastal Zone Management (ICZM)-Belgium. The process to draw up a set of indicators for the Belgium coast started in 2000, under the impulse of the Flemish government and the province of West-Flanders. In a preliminary study, the Centre for Sustainable Development (CDO, University of Ghent, 2001) suggested an outline for what long-lasting management for the coastal area could mean and proposed a list of indicators which would be useful and efficient to check whether the area is indeed evolving in the desired direction. For this purpose dozens of civil servants both from provincial and Flemish administrations entered into intensive talks and were involved in a series of workshops [2]. The goal, in the second phase was to obtain an elaborated list of more or less 20 indicators [3]. The extensive list was the object of critical analysis by civil servants and representatives of coastal actors gathered in two workshops (7 June 2002 and 20 January 2003). The results of these workshops were decisive for the final set of indicators. Finally the participants drew up a list of 50 indicators that, in their opinion, can be used to observe in an efficient way the future perspective of the coastal zone. For the top 20 – the 20 most representative – exhaustive filing cards have been set up and data, where possible over several years, have been gathered. These 20 indicators are brought together in the website: www.kustbeheer.be/indicatoren.

Interactions between Belgian and European set of indicators for the coastal zone

Coastal Indicators at a European level

Several international partnerships also underline the importance of indicators. For instance, the SAIL (Schéma d'Aménagement Intégré du Littoral) partnership uses a set of 27 indicators and 45 measurements to visualise the state of the coast of the Southern North Sea. This set was developed and calculated by Flanders Marine Institute (VLIZ). (www.vliz.be/projects/SAIL) [6].

This set of indicators also served as a blueprint to the list of indicators as approved in November 2004 by the Working Group on Indicators and Data, of the EU ICZM Expert group. The Recommendation concerning the implementation of Integrated Coastal Zone Management, (2002), calls for an integrated approach to monitoring and measuring the sustainable development of the coastal zone. The EU ICZM Expert Group established a Working Group on Indicators and Data (WG-ID) in 2002 to advise it on ways in which Member States can assess whether they are moving further towards, or away from, a more sustainable future for their coastal zones, and at what pace and to propose a method for measuring the extent to which ICZM is being implemented.

The WG-ID, led by the European Topic Centre on the Terrestrial Environment, subsequently drew up two indicator sets:

- an indicator measuring progress in implementing ICZM (the 'progress indicator')
- a set of 27 indicators of sustainable development of the coastal zone (the 'SD indicators')

Used together, the two sets should reveal the degree to which implementation of ICZM can be correlated with a more sustainable coast. That is, decisions using an integrated approach should see a positive improvement in the state of the coast with concomitant progress towards sustainable development. The indicators measuring progress in achieving sustainable development of the coast will in turn feed back to give policymakers an indication of the need for further action in ICZM. The EU-indicators support member states in the evaluation of sustainability in their coastal zones and in developing and reporting on Coastal Strategies (February 2006).

The coordination centre on ICZM, works together with 9 partners in the DEDUCE project. DEDUCE or the Développement Durable des Zones Côtières Européennes, was a transnational project, supported by the Interreg III-south Community Initiative Programme. Its main objective is to evaluate the utility of indicators for optimal decision making on the coast following the principles of the EU Recommendation on Integrated Coastal Zone Management. Nine partners from six countries (Poland, Spain, Malta, France, Latvia and Belgium) are calculating, testing and validating the 27 indicators of sustainable development as agreed in the

EU expert groep [7]. The main objective of DEDUCE was to improve the tools and the information systems necessary for optimal decision making about the coast, at all levels: European, national, regional and local. According to DEDUCE this can be divided into five specific objectives:

- calculate and compare the 27 sustainability indicators and one progress indicator agreed;

- evaluate and compare the geographical information systems (GIS) for the analysis and viewing of the state of the environment of each of the coastal areas and the methodologies based on the use of the GIS through a website;
- establish a common model for reporting the state of sustainability of the coast, in which the effects of human activities and their impacts are evaluated and monitored;
- compose a guide for the use of the indicators of sustainability for examining the development of the state of the coast;
- study the possibility of setting a European regional information observatory.

Indicators of ICZM as a tool for Sustainable Regional Development, Rafael Sardá Borroy, CEAB (CSIC), Spain

This presentation focused on the development of an environmental information system for the Catalan Coast. Using the Tourism Industry as the main pressuring driver and the municipality as the territorial unit, we compiled a vast amount of information that it was converted into an information platform for the general public, politicians, and public administrators. Working in close cooperation with the planning authorities of the Generalitat of Catalonia, we developed decision support tools as a methodological approach for coastal management. The system was composed by: a) the development of an environmental indicator-based report, b) the use of a Geographical Information System (GIS), and c) the incorporation of different types of graphical packages. These tools were applied to the seventy municipalities of the Catalan Coast and an specific development of the system was carried out in the region of La Selva, municipalities of Blanes, Lloret de Mar, and Tossa de Mar (Southern Costa Brava). The system was designed to help coastal managers in Catalonia, and used in the process of developing the National Strategy for Integrated Coastal Zone Management (ICZM) of the Catalan Coast following the EC Recommendation (COM/00/545).

Emphasis was placed on the basic principles of developing an indicator system, in particular, the need for them to be integrated into a sound and practical management process, as well as their utility as a tool for assessment, planning and monitoring. The use of indicators inside ICZM processes as a tool for the Sustainable Development of the coast and the possibility of using aggregated indicators such as IPAT was also reflected.

Developing a Panel of Indicators for ICZM in the Balearic Islands, Amy Diedrich, IMEDEA (CSIC-UIB), Baleares, Spain

The purpose of the project, which was conducted by IMEDEA in collaboration with the Economic and Social Council of the Balearic Islands (CES) from November 2006 – November 2007, was to develop a list of indicators to monitor and assess ICZM in the Balearic Islands, with the overall objective of achieving sustainability in the coastal zone of the islands. The motivation for collaborating with the CES, which is an advisory body to the regional government intended to reflect the needs of Balearic society, was to ensure the resulting indicators were locally relevant and, ultimately, to generate an official mandate to implement the resulting indicators thus closing the gap between science and policy. By collaborating with the CES, IMEDEA faced the challenge of finding the balance between scientific need (the quest for the "perfect"

set of indicators) with institutional/political reality (cost, accessibility of data, technological capacity, relevance) in order to ensure implementation.

The resulting indicator panel was developed through a two step process. First, through an in-depth evaluation of international scientific standards and protocols for indicator development and, second, through a participatory, collaborative process CES in order to tailor such standards to the environmental-socio-economic reality of the Islands. The result was an official mandate from CES to the Government of the Balearic Islands which included the proposed list of indicators and an associated implementation plan. Document online at: http://www.costabalearsostenible.es/PDFs/CES.pdf .

The Role of Indicators in the UKMMAS, Clare Greathead, Fisheries Research Services Marine Laboratory, Aberdeen, Scotland

Two UK reports, Safeguarding our Seas (2002) and Charting progress (2005) specified the need for an integrated assessment of our seas, as Charting Progress identified that information shortfalls were evident, coordination was a problem, effective indicators and detailed objectives didn't exist. It was recommended that a UK Marine Monitoring and Assessment Strategy (UKMMAS) be developed.

The overarching aim of the UKMMAS is to make most efficient use of UK resources, in terms of all existing obligations and to be prepared for emerging requirements, e.g. the EU Marine Strategy Directive. The presentation concentrated on the development of an effective Assessment Framework, specifically the assessment matrix, the assessment of pressures and impacts and the review of the available indicators.

To date an assessment matrix has been produced, based on the OSPAR framework, comprising ecosystem components and anthropogenic pressures. This framework also incorporates an initial assessment on the level of impact of the pressure on the ecosystem components and possible indicators. A separate project has developed a methodology to consistently assess the degree of impact across all pressures and for each pressure an assessment of the degree of impact on each ecosystem component. Both a priority matrix and a confidence matrix have been developed, where the Priority score is a function of exposure, resistance and resilience and the Confidence score is either low or high based on predefined criteria.

Future monitoring and indicators will be driven by the assessments within this matrix i.e. monitoring and research efforts will be targeted where there is a significant pressure linked to an ecosystem component.

The presentation also outlined a project starting in April 2008 to develop sustainability indicators for aquaculture covering benthic enrichment, nutrient release, feed materials, disease control and requirement for space. By setting aspirational targets i.e. pristine conditions it will be possible to assess the trend of aquaculture towards or away from sustainability.

The HELCOM Eutrophication Assessment Tool (HEAT), Grete Dinesen,Technical University of Denmark, National Institute for Aquatic Resources (DTU Aqua), Denmark

The HELCOM Eutrophication Assessment Tool (HEAT) developed by DHI, was presented (see details at heat.dhigroup.com). The overall objective of HEAT is to assess the eutrophication status in the whole Baltic Sea based on a harmonised approach, for evaluation of whether the goals of the WFD are fulfilled.

HEAT comprises of the four quality elements, "phytoplankton", "submerged vegetation", "benthic invertebrate fauna" and "physio-chemical factors". Different indicators are assigned to each element, and indicators can be added as appropriate, thus making the tool highly flexible towards differences between regions. Assigned to each indicator is a reference condition (RefCon), and an acceptable deviation (AcDev), the latter being between 15 and 53%. Results are expressed as an ecological quality ratio (EQR), the ratio between the RefCon and observed value. The element evaluation results are expressed using five classes, high, good, moderate, poor or bad, of which the latter three are not acceptable. The overall evaluation is based on the principle *sensu* the WFD, of "one out all out".

Similar assessment tools concerning the status of biodiversity and ecosystem functioning (BEAT) and hazardous substances are currently under development.

The possibility of developing such assessment tools also for social, cultural and economic issues for ICZM purposes should be investigated.