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

19–21 April 2006

ICES Headquarters, Copenhagen

International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

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Executive summary

The increasing demands on the coastal zone introduce new and mounting pressures on the limited available resources. The resulting conflicts will require first and foremost the recognition of the coastal zone as a distinct and valuable resource in its own right, as well as the integration of information and management to ensure the sustainable utilisation of this valuable resource.

Most ICES Working Groups do not have a direct focus on coastal zone issues. Mariculture and fisheries are the main human activities addressed within ICES Working Groups, and there is a need to address impacts from other human activities on the coastal zone such as tourism, coastal protection and urban development. ICES address eutrophication and chemical pollution, relevant to several human activities but other issues such as habitat destruction are only addressed relative to a small number of human activities (e.g. fishing and mariculture and not coastal protection or tourism). ICES Working groups can work towards collating relevant information, intercalibration of methods or examining impacts of particular activities.

The process of implementing ICZM in the different Member Country differs. Common to most countries is the fragmented management and sporadic information flow. Where there are trans-boundary issues, added problems may arise due to lack of data compatibility and confusion with the different administrative systems within each country. ICES could have a role in trans-national coordination of nature conservation in Coastal Areas and Regional Seas. Progress towards the implementation of the Water Framework Directive is continuing in all Member Countries. A number of projects are currently in progress working directly with ICZM issues, aiming either at communication and exchange of information and experience or at developing tools and methodologies for resolving integration of information. It is expected that more projects will be needed towards developing this field and that dissemination of basic information, methodologies and tools will be an import feature of future projects. In particular the interface between the different sciences (natural, social and economic) and between science and policy needs to be addressed.

As more information on ICZM is generated, awareness has shifted towards the need for comprehensive coastal programs designed to resolve conflicting demands on the use of coastal resources, maintain coastal biodiversity and ensure long-term economic sustainability of the resources. Research needs on sectoral problems are important as there is a need to understand the external forcing processes that cause constant changes in the ecosystem. Even more important is research on assessing interactions between different coastal uses, and particularly considering human interchanges with the coastal ecosystem. This includes the valuation of coastal resources, potential negative impacts on these resources using risk and vulnerability analysis, social science tools such as assessments on public perception on the environment, the sea and specific human activities. In addition, tools from ecological economics can help to identify priorities and conflicts. Some of the ICES Working and Study groups have embarked on the process of integrating biological, ecological and environmental information emerging from the different sectoral ICES groups but more focus should be given to coastal ecosystems. This could be processed as vulnerability maps and interaction matrices and developed further to impact scenarios in the medium term. These would be powerful tools for coastal managers and it is here ICES could play a proactive role.

Within the EU, the ICZM Recommendation has been adopted and it provides a set of eight elements, based upon which EU coastal Member States should draw up a national report for implementing ICZM following a stock-take process. Towards the implementation of the ICZM Recommendation, two sets of indicators have been developed:

- “progress indicators” that allow the evaluation of the progress for implementing ICZM;

- "Sustainable Development (SD) indicators that allow the evaluation of the results from the implementation.

ICES can contribute passively by simply monitoring this progress or proactively by constantly monitoring the information and research requirements for this process and mobilising the relevant Working or Study groups to provide the necessary information or analyses.

The ecosystem based approach adopted by ICES is suitable for addressing ecosystem responses to different human activities and ICES could be operative in providing scientific assessments and advice with focus on coastal issues and human activities. These could be directly relevant for the implementation of the EU WFD, OSPAR, etc., and include further development of ecological quality objectives and indicators, establishment of reference values, definitions of scientifically based limits for ecological status and advice on monitoring programmes and methods. ICES work could include developing models for assessing the vulnerability of coastal ecosystems to changes related to human activities and in the next step to integrate the vulnerability assessment with risks associated to human activities. Finally ICES could explore the interplay between effects of climate change, natural variability and cyclical events and pressure due to human activity.

WGICZM addressed two specific issues this year:

- national attempts at monitoring recreational fisheries; and
- the effects of hypersaline waters produced by desalinisation plants.

Coastal fish stocks play an important social and economic role and their sustainable management is important. More attention is anticipated towards recreational fisheries partly due to increasing conflicts with the commercial fisheries caused by the general declines in most commercially valuable fish stocks. Registering all catches from the recreational fishery may provide important data on rare, endangered and protected species. There is a need to monitor shellfish stocks since these have multiple roles in the coastal zone, depending on species and ecology. Blue mussel beds play for example an important role in protecting coastline from erosion or, when harvested in an environmentally friendly way may serve to mitigate impacts from eutrophication in fjords and enclosed bays.

About one-third of the world's population lives in countries with moderate to high water stress. It is anticipated that the declining state of the world's freshwater resources in terms of quality and quantity will be a major issue in the near future. A solution in some countries, especially warm-dry climate countries, is to desalinate saltwater. The plants produce liquid waste in the form of brine which is discharged into the environment and also other wastes containing biocides or heavy metals or low oxygen water. Since the discharge is denser than the surrounding seawater, this may sink to the bottom with negative impacts to the local benthic community. These problems are local but the management of wastewater from desalinisation plants or other plants such as power plants, may benefit from the development of common recommendations and standard international impact assessments and policies.

1 Opening of the meeting

The Chair, J. Støttrup (Denmark) opened the 2006 meeting of the Working Group on Integrated Coastal Zone Management at the ICES Headquarters, Copenhagen, Denmark. This year's meeting, from 19–21 April, was the first meeting of the group since it reformed from the Study Group on Information needs for Coastal Zone Management (SGINC), which had completed its study in 2004.

During the interim year, the newly-formed group worked by correspondence and produced the Working Group's first report: ICES WGICZM Report 2005/E:09.

The group was also welcomed by V. Piil, ICES Secretariat, who described the working facilities with detailed instructions and advice on the arrangements made for the group.

2 Adoption of the agenda

A draft agenda was circulated in advance of the meeting and was accepted by the group. 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 also 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;

b) update and report on ICZM activities in different ICES countries, and in different international organisations;

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

d) monitor and report results generated from larger EU funded projects (PROTECT, MESH, etc) that are directly relevant to ICZM needs;

e) report on different national attempts at monitoring recreational fisheries and evaluate the progress;

f) report on the effects of hypersaline waters produced by desalinisation plants;

g) report on progress in valuable component or management tools;

h) revise and develop the 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.

WGICZM will report by 5 May 2006 for the attention of the Marine Habitat Committee, ACME and ACE.

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 (ToR a)

Most of the ICES WG/SG reports were reviewed for this process but due to the timing of the meeting, only the 2005 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 2006 but would not be registered in this report. The fisheries assessment reports are not included in this analysis.

The information for this ToR is compiled in Annex 5, Table A5.1. Several WG/SGs have taken on a sector approach, compiling information on ecosystem effects of a human activity such as mariculture or mineral extraction, whereas others focus on Key Issues that may be relevant to a number of human activities such as eutrophication or chemical contamination.

We decided to use the Sector approach for this ToR and built on Table 5.1 of the SGINC report (ICES CM 2004/E:08). However it should be kept in mind that ICZM attempts to overcome single-sector management and to overcome compartmentalized approaches. The different reports were reviewed for information on coastal impacts of Natural influences such as climate change and Human Activities such as:

- Mariculture;
- Fisheries;
- Oil and Gas;
- Marine Aggregate Extraction;
- Tourism/Recreation;
- Transport/Port;
- Residential/Urban development;
- Physical structures/renewable energy/plants; and
- Land use Practices/Dams.

For each Human Activity a number of Key Issues were also listed, so the WG/SG information was listed according to Key Issue under each Human Activity or Natural Influence. A few WGs have a regional focus (e.g. Baltic Sea, North Sea) and their task is not unlike that of this WG; with a major difference that this WG does not compile data. A disadvantage to this approach is that several Key Issues are common to a number of human activities and the generic approach of the WG made the information relevant to several Human Activities, which resulted in some repetition.

With a few exceptions, there is a need for ICES WGs/SGs to recognise the coastal zone as a distinct and valuable resource in its own right. There is need for a focus on collating information pertaining to the coastal zone that is essential for comprehensive management. Marine impacts from terrestrial activity are highest in the coastal zone.

There is evidence of ICES focus on a number of human activities, while the impacts of several other activities are largely unexamined. These include tourism, coastal protection, transport, urban development and land use practices. Much of the information compiled for key issues such as eutrophication and chemical contamination is relevant to different human activities, whereas the issue of e.g. habitat destruction needs to be related to the different human activity and how these may impact negatively different habitats.

Based on the review and the ensuing discussion the WGICZM identified gaps in knowledge of relevant to the ICES CZ, in particular concerning coastal fish, coastal fisheries and physical alterations of the coast and therefore make the following **recommendations** for future ICES work:

- There is a need for focus on genetic identification of locally adapted coastal fish stocks (e.g. coastal cod in Norway);
- Maps on coastal Essential Fish Habitats for target and non-target species during different life-stages should be drawn up;
- There is a need to compile information on coastal fish communities and coastal fisheries;
- Coastal fish monitoring methods on sandy bottom need to be intercalibrated and there is a need to develop “standard” coastal fish monitoring techniques on other sea bottom types as well as intertidal zone sampling techniques;

- There is a need to examine the effect of fishing gear, when used in coastal areas, on the marine coastal habitats;
- Zooplankton seem sensitive to environmental changes, and these may be useful indicators for climate change or other impacts. In addition jellyfish occurrences and distribution should be monitored;
- Data on shore nourishment, amounts and spatial and temporal information need to be compiled as well as the impact of this activity and other coastal alteration on coastal ecosystems;
- Spatial and temporal data and information on shore/beach nourishment needs to be compiled so as to quantify the impact of this and other coastal alteration on coastal ecosystems;
- Need to examine the effects of noise from both over water sources (catamaran ferries, small fast boats, near-shore installations) and underwater sources (geophysical mapping techniques) on coastal marine fish, birds and sea mammals.

3.2 Update and report on ICZM activities in different ICES Member Countries (ToR b)

The different coastal zone of the countries represented here range from 65 km in Belgium to the very extensive and complicated coastlines of Sweden and Norway. This is matched by equally wide variation in topography and uses of the coastal zone. However many of the key issues stated by each country are similar. For example all countries have a large proportion of their population and industry in the coastal zone (25–80%); are concerned about the sustainable exploitation of their marine resources, especially fish stocks; conflicts between nature conservation and recreation, tourism and industry; the development of marine energy renewables such as wind farms; and for some countries coastal protection/erosion is a key issue. Other issues are specific to one region and may be very local, e.g., desalination in the Mediterranean. Many ICZM projects tend to be short-term and have limited core funding from Government. The individual country reports are appended in Annex 6. An overview on the country ICZM information is provided in Table 3.2.1 below.

The process of implementing ICZM in each country does vary considerably according to the set up of Government departments, Legislation and historical issues. However there is recognition of the fact that the process of managing activities in the coastal zone is fragmented and requires integration. Many countries are making progress towards more integrated management of coastal zones, which is indicated by the large number of ICZM projects e.g. Coastal Futures in Germany and the UKSeaMap in the UK; the identification of specific regions for developing management plans e.g. the Wadden Sea, Limfjord, Baltic Sea, Irish Sea and the Georges Bank - Bay of Fundy; and the setting up of bodies to co-ordinate ICZM, for example the Co-ordination Centre for ICZM in Belgium. Where there are trans- boundary issues, added problems may arise due to lack of data compatibility and confusion with the different administration systems.

All countries have ongoing programmes for the designation of sites for marine nature conservation, either under the Habitats and Birds Directives or, as in the case of Canada, Marine Protected Areas under the Oceans Action Plan. ICZM could have a role in trans-national coordination of nature conservation in coastal areas and Regional Seas.

Progress towards the implementation of the Water Framework Directive is continuing in all countries; most countries are at the classification stage, although the actual processes are different. In the UK each devolved administration has a designated agency to steer the implementation, whereas in other countries like Sweden and Denmark each water district has its own plan.

The following table is a first attempt to make an overview and comparison of a number of issues relevant to integrated coastal zone management for different countries. The table is compiled with the information that was available at the meeting, given in Annex 6, and needs to be further elaborated and completed in the future meetings.

Table 3.2.1. Summary of country activities relevant for ICZM.

ISSUE	CANADA	DENMARK	GERMANY	IRELAND	NORWAY	SPAIN	SWEDEN	UK
Coastline length	Longest marine coastline in the world	7,000 km	3,379 km 1,300 km North Sea 2,000 km Baltic Sea	7,100 km	Mainland without fjords: 2,650 km. Mainland including fjords: 21,000 km. The coastline including islets and islands: 85,000 km.	4,964 km	7,600 km	18,838 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	No The EU WFD definition of 'coastal water': 1 nautical mile off the baseline is adopted	No, 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
Competent authority for coastal zone use	Department of Fisheries and Oceans	Sea: several ministries and counties Land: counties and municipalities	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 Communications, Marine and Natural Resources	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)	Directorate General of Coasts (Direccion General de Costas)	The municipalities are responsible for physical planning inland as well as out to 12 nm	Scotland: Scottish Executive England and Wales: Department for the Environment Fisheries and Rural Affairs (Defra)
Consultation process involved	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, Goverments Agencies, NGO and stakeholders.	Consultation with sectors and stakeholders	Master Plan for Coastal Sustainability; Territorial sectoral plan of the littoral zone	Consultation with sectors and stakeholders	Intergovern-mental co-operation Coastal Fora Stakeholder involvement
Responsible authority ICZM (EU recommendation)	Not reported	Not reported	Federal Ministry of Environment	Department of Communications, Marine and Natural Resources	Not reported	Directorate General of Coasts of the Ministry of Environment	The National Board of housing, building and planning	Scottish Executive and Defra

ISSUE	CANADA	DENMARK	GERMANY	IRELAND	NORWAY	SPAIN	SWEDEN	UK
EU ICZM Stock-take [1]	Non-EU yes	No info?	Finished	In progress	Not reported	Yes	In progress	Yes
EU ICZM Strategy [2]	Non-EU yes	No info?	Yes	No	Not reported	Yes	In progress	Yes
Key issues identified	Ground fishing, oil and gas exploration, aquaculture, pollution near urban areas	Coastal fish populations Marine aquaculture Mussel dredging Eutrophication Shore nourishment Marine aggregate extraction	Offshore wind-farms Marine aggregate extraction activities Fish stocks Nature conservation areas Development of ports and harbours Tourism Coastal defence strategies Aquaculture	Ocean Economy is very important particularly to peripheral communities Shipping and maritime transport Marine energy Marine manufacturing Aquaculture, Fishing and nature conservation.	Marine resource exploitation Limited knowledge of coastal species and processes Fish stocks Carrying capacity Introduced species Aquaculture	Urban development and tourism, coastal erosion, pollution and overexploitation of fisheries	Local over-fishing Recreational fishing and tourism Conflicts between stakeholders Poor economy in the commercial fisheries Increased use of marine resources	Large % of pop in coastal areas. 31% coast developed 40% manu-facturing industry in coastal area. Spatial issues Marine resource exploitation Flooding and erosion Fish stocks Aquaculture Marine renewables
ICZM relevant Legislation	Oceans Act 1997	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 Fisheries Act-licences for aquaculture	More than 13 relevant laws including planning, management, fisheries, aquaculture pollution, nature conservation, recreation, navigation, etc.	The Shores Act = Ley de COSTAS (22/1988, July 28th)	The planning and building Act (1987)	Planning jurisdiction to MLWS. Crown estate lease required to 12 nm. Licences required for coastal and marine works (FEPA), other discharges and aqua-culture also require a licence (CAR)
Precautionary approach applied?	Yes	yes	Not reported	Yes – in the decision making process	yes	Not reported	Not reported	Yes

ISSUE	CANADA	DENMARK	GERMANY	IRELAND	NORWAY	SPAIN	SWEDEN	UK
National ICZM projects, consortia or networks	integrated management pilot programs	GIS mapping	Zukunft Küste (Coastal Futures) ICZM-Odra	I-CoNet initiative to promote good practice in coastal management	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.
Integrated data management initiatives	Not reported	Not reported	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/	Not reported	Not reported	Not reported	Integrated Coastal Hydrography project, MDIP/MEDAG, SEABED Map
Environmental national research initiatives relevant to ICZM	ecosystem overview and assessment report (EOAR), map of ecological and biological significant areas (EBSA)	Not reported	RETRO, IMPULSE, EU-INTERREG: BaltCoast project POWER project	National Sea Bed Survey, Review of Marine Environmental Indicators.	GIS Maps of Marine nature MAREANO Project on the ecological impact of introduced King Crab.	Not reported	The program Sustainable Coastal Zone Management (SUCOZOMA). The program is now completed.	UKSeaMap Review of Marine Nature Conservation and the Habitat Classification Scheme Irish Sea Pilot State of the Seas Report MarClim MECN Seabed Indicators Species databse and report Marine National Park Project SSMEI

ISSUE	CANADA	DENMARK	GERMANY	IRELAND	NORWAY	SPAIN	SWEDEN	UK
Socio-economic information	Yes, human use atlas	GIS with overview of the different usages	spatial plans dealing with human activities	National Spatial Strategy	Municipalities plans for their coastal zones, Statistics from fisheries and aquaculture	Not reported	Each Municipality plans for their own coastal zone. The different sectors contribute with information	Not reported
Marine coastal protected areas	Not reported	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 Nationalpark	158 marine sites 4,196 km^2 All Natura 2000 sites	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	Natura 200 sites, HELCOM and OPSAR protected areas, World Heritage areas, marine reserves and protected areas, protected areas for birds/seals/fish spawning	382 marine Natura sites 1 Marine SPA-further ones and extensions to terrestrial ones are being considered 7 MEHRAs identified OSPAR MPAs (Natura sites)
Water Framework Directive Position	Not relevant	county councils responsible to elaborate and implement plans for the quality and use of coastal waters, based on environmental quality objectives, 12 water districts	On “Länder” (county) level	Transposed to Irish legislation Characterisation finished 8 river basin districts	The first characterisation and classification performed is to be evaluated by the regional WFD authorities	For the Basque Country: characterisation finished	Sweden is divided into five regional water authorities that are each governed by a committee or a board. Each authority has developed environmental quality objectives.	Transposed to devolved country legislation Characterisation in process, assessment tools and monitoring regime in process

(1) EU ICZM Stock-take: this issue indicates if the stock-take process has been finished, to be followed to draw up a national rapport to implement ICZM according to the EU ICZM Recommendation

(2) EU ICZM National Strategy according to the EU ICZM Recommendation or an additional action instead

(3) Marine protected coastal areas: Natura 2000, OSPAR Marine Protected areas, Habitat and Bird Directive protected areas, World Heritage areas or others

ICZM progress within EU

Evolution on indicators

On 30 May 2002, the European Parliament and the Council adopted the Recommendation concerning the implementation of Integrated Coastal Zone Management with the aim of fostering the development of integrated management strategies to guide the European coastal zones towards more sustainable scenarios.

The EU ICZM Recommendation is the main policy instrument to promote wide-spread implementation of ICZM in Europe (http://europa.eu.int/comm/environment/iczm/ home.htm). The Recommendation sets out common strategic issues facing Europe's coastal zones and provides a set of eight principles, defining the essential characteristics of ICZM. Based on these elements, coastal Member States are invited to draw up by the end of February 2006 national rapport to implement ICZM, following a stock-take process.

The European environmental agency (EEA), is also working on a paper to inform the European Commission (DG ENV) about the progress and first results with the EEA's work undertaken for assessing the sustainable spatial development of coastal regions of Europe. The specific objective of this work is to contribute to the review by the European Commission, in 2006, of the EU ICZM Recommendations, which requires information on the effects of the policies and financial instruments directed to coastal management. The EEA intends, to the extent of information capacities, to contribute to the review by promoting spatial analysis and enhancing the integration of relevant environmental data with related socio-economical data.

(http://europa.eu.int/comm/environment/iczm/pdf/state_coasts_europe.pdf).

In the framework of implementing the EU Recommendation, the European Commission created an Expert Group on Integrated Coastal Zone Management (ICZM), which established a Working Group on Indicators and Data (WG-ID). The purpose of the WG-ID is to give advice on ways in which Member States, and the EU as a whole, can assess whether they are moving further towards, or away from, a more sustainable future for their coastal zones, and at what pace. And because it is an axiom of the Recommendation that greater sustainability is directly related to the penetration of ICZM at all spatial scales, the Expert Group asked the WG-ID to propose a method for measuring the extent to which ICZM is being implemented around Europe.

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') (http://www.im.gda.pl/deduce/SUMMARY_DEDUCE_EN.htm) or (http://www.deduce.eu).

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. At its meeting of 22 April 2004, the Expert Group (with the exception of Sweden) accepted both sets of indicators but suggested further testing of the progress indicator and calculation of some of the SD indicators.

Towards this purpose, the Interreg IIIC-South DEDUCE project (Développement Durable des Zones Côtières Européennes was formed. The WG-ID has responded to the request of the Expert Group and has begun calculating the indicators at different spatial scales. Attention has

focused primarily on developing a common blueprint for creating an inventory of datasets, using GIS to manipulate and demonstrate spatial data, building a metadata profile, and so on.

The key challenge of DEDUCE is to prove the usefulness, viability and necessity of an integrated approach to information management by means of environmental and socio-economic indicators for measuring the degree of sustainable development of the European coastal zones.

Main action lines of DEDUCE:

- Testing the results of calculating the 27 indicators of sustainable development in coastal zones (WG-ID);
- Usefulness of a Geographical Information System (GIS) for the coastal zones;
- Standard indicator-based report on sustainable development in coastal zones;
- Basis for an interregional coastal observatory.

The thematic strategy on marine environment

The European Commission has proposed an ambitious strategy to protect more effectively the marine environment across Europe. The Thematic Strategy on the Protection and Conservation of the Marine Environment aims to achieve good environmental status of the EU's marine waters by 2021 and to protect the resource base upon which marine-related economic and social activities depend. The Marine Strategy will constitute the environmental pillar of the future maritime policy the European Commission is working on, designed to achieve the full economic potential of oceans and seas in harmony with the marine environment.

The thematic strategy for the protection of the marine environment aims to provide, for the first time, a European-wide coordinated effort for a comprehensive protection and conservation of the marine environment (http://europa.eu.int/comm/environment/water/marine.htm). The thematic strategy, adopted by the Commission on 25 October 2005, is not a single document, but a package. The communication of the Commission sets out the rationale and is making the case for the Strategy. The Marine Strategy Directive is the legal instrument or the hard core of the strategy. Also an extended impact assessment was published for assessing costs and benefits of different options considered.

There are several reasons why the European Commission and the legislator decided to include the development of a Marine Strategy in the 6th environmental action programme. The relatively poor state of the environment, the need to give a boost to addressing the knowledge gaps and the too fragmented governance are the three main reasons for the proposed proposal.

This strategy will make such coordinated approach more urgent and makes a requirement to use the existing international bodies for co-ordination. These international bodies would also be invited to contribute to a regionally coordinated approach, including with countries outside the Union.

The overall objective

The overall objective in the Strategy is to achieve good environmental status of the EU's marine waters by 2021. This is consistent with the water framework directive from 2000 which requires that surface freshwater and ground water bodies (lakes, streams, rivers, estuaries, coastal waters…) achieve a good ecological status by 2015 and that the first review of the River Basin Management Plan should take place in 2021.

Marine Strategy Directive will establish European Marine Regions on the basis of geographical and environmental criteria. Each Member State, in close cooperation with the

relevant other Member States and third countries within a Marine Region, will be required to develop Marine Strategies for its marine waters.

The Marine Strategies will contain a detailed assessment of the state of the environment, a definition of "good environmental status" at regional level and the establishment of clear environmental targets and monitoring programmes.

Good environmental status is the emblematic concept that will need to be filled in operationally. The Strategy will not prescribe in all detail what good environmental status is but will develop generic descriptors, the dimensions, on which to judge it. The regional level will be important for formulating the expression of good environmental status.

The approach

The approach of the strategy tries to balance a common European approach with subsidiarity. There will be common principles for problems shared by the different regions and a regionalised approach based on Marine Regions to capture specific problems.

The proposal provides a framework within which a sustainable development of marine areas can take place. The marine strategy directive will not contain the management measures required to improve environmental quality of the seas. It provides the mechanisms by which such measures can be prepared on a sound regional basis and within European dimensions.

The Strategies need to be devised building upon existing programmes and activities developed in the framework of international agreements, e.g. regional seas conventions. The existing regional seas conventions, such as OSPAR for the North-East Atlantic will be essential platforms and actors for ensuring regional cooperation and coordination.

The provisions regarding implementation is slightly similar from the model of the Water Framework Directive, but taking account of the more open nature of the marine environment. Regional marine strategies will progressively be developed and implemented by the Member States through a succession of these steps.

Timing

Marine Strategies to be progressively developed and implemented on the basis of these elements:

- Description and assessment of current environmental status including the environmental impact of human activities – four years after entry into force at the latest;
- Determination of good environmental status – four years after entry into force;
- Establishment of environmental targets – five years after entry into force at the latest;
- Monitoring programme – six years after entry into force at the latest;
- Programme of measures towards good environmental status – by 2016 at the latest;
- Entry into operation of programmes of measures – by 2018 at the latest;
- Relation with future EU Maritime Policy.

Towards a future Maritime Policy for the European Union: A vision for the oceans and seas

The European Commission decided to launch a consultation process on a future maritime policy for the Union. The Strategic Objectives of the Commission for 2005-2009 noted "the particular need for an all-embracing maritime policy aimed at developing a thriving maritime economy and the full potential of sea-based activity in an environmentally sustainable manner".

A Green Paper on a future EU Maritime Policy, to be adopted by the Commission in the first half of 2006, will constitute a first step towards the establishment of an all embracing EU Maritime Policy, in line with the Commission's strategic objectives.

The Communication establishes the Maritime Policy Task Force that will bring this process forward and takes note of the decision of the President to create a Steering Group of Commissionaires that will direct its work. The Marine Strategy will deliver the environmental pillar of the future EU Maritime Policy.

The WGICZM **recommends** continuing to update and report on ICZM activities in different ICES countries using the new ICES ICZM reporting format which was established during the 2006 meeting. The report should include progress on ICZM issues reported in the EU country report (http://europa.eu.int/comm/environment/iczm/) and highlight particular problems raised within these reports. WGICZM also recommends reporting on activities by different international organisations (e.g. EU, OSPAR).

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

The ecosystem based approach to the management of human activities as the leading principle for integrated coastal zone management implies that knowledge on the critical ecosystem processes and properties in the coastal zone will be the core business of the information ICES will be able to add into the process of ICZM. The 'value' of ecological niches, particular habitats, etc. needs to be addressed as part of the input. The identification of Essential and Critical Species Habitats are important components together with valuable management tools such as GIS, Protected Areas and Spatial Planning. An important feature of the ecosystem approach is that it calls for strong stakeholder participation, which places a spotlight on human behaviour as the central management dimension. Also of some significance is that the ecosystem approach recognises that in order to develop a coherent policy for addressing the impacts of multiple human uses of marine ecosystems it is necessary to consider how impacts occur in space and over time, as well as how different factors interrelate (complexity).

The ICES WG must help on the process of creation of new convincing arguments to help in the implementation of sustainable policies and plans; due to the fact that decisions taken on coastal development are often irreversible and engage life support conditions for many future generations.

A list of research/expertise needs identified is given below:

a) Expertise in taxonomy is required for the assessment of biodiversity and ecosystem dynamics in the coastal zone

b) There is a need for collating information on macrophyte systems focused on macroalgae as a resource and as habitat for other species, such as fish, in order to provide sustainable advice on macrophytes.

c) There is a need for further information on fish spawning, nursery and feeding areas and fish migratory corridors in the coastal zone. No ICES WG addresses this issue at the moment.

d) There is a need for information on coastal zone habitat requirements of different life stages of (epi-) benthic organisms, birds and mammals.

e) There is a need to map the different habitats in marine shallow waters, the intertidal zone and near-sea zone. For example MESH (www.searchmesh.net) is an international marine habitat mapping programme that started in spring 2004 and will last for three years. A consortium of 12 partners across the UK, Ireland, the Netherlands, Belgium and France has been established.

f) There is an increasing need for demarcation and effective monitoring of coastal and off-shore commercial fisheries.

g) There is a need to develop a suite of monitoring, assessment and management tools for MPAs. This is being picked up in a newly-started EU project, PROTECT.

h) There is a need to examine the use and utility of MPAs that include both terrestrial and marine systems.

i) There is a need for harmonising coastal ecosystem EcoQ's with those of the Bird and Habitat Directives, the Water Framework Directive and the EcoQ's presently developed by several ICES Working Groups for OSPAR

j) There is a need for data and information on the recreational fishery.

k) k) Further guidelines for monitoring and assessment programmes for impacts of human activities related to coastal zone management should be developed where necessary

l) There is a need for the standardisation of monitoring methods and tools for environmental assessment, which need to be acceptable to all other users of the coastal area. (A major problem is that most developments (ports, marine barriers, beach promenades) act as a barrier to bio-physical fluxes, resulting in erosion and instability of the coastal zone. These complex interactions must be studied to guarantee sustainability and to find adequate management tools).

m) Revise the restoration ecology of estuarine systems, with emphasis on the ecology of brackish water macrophytes.

n) Revise the activities taken in relation of harmful algae proliferations (HABs) in the coastal zone, with special emphasis of the relationships with oceanography and eutrophication

o) Analysis of European Environmental Policy and the 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, Habitats and Bird Directives (documents are available at: http://www.minewater.net/ermite/) and there is a number of case studies of estuarine systems affected by mine water pollution. Special attention should be given to the EU Marine Strategy and the forthcoming EU Maritime Policy.

p) Information on the status and progress of ICZM sustainability indicators is important. Indicators are necessary to show how ICZM works and raise awareness. Indicators can increase the perception in the affected society but also by the stakeholders and decision-makers. Without the knowledge on the progress, the people may not cooperate within the ICZM process.

q) Provision of a cross-border map-server. Map-servers are more and more upcoming on country, regional or thematic level, but there are no transboundary map-servers e.g. for the North Sea or Baltic Sea. This Map-server should show the utilization (including nature protected areas), the ecology and social-economic indicators in the coastal zone (land and seaside). This information should be available for the public, i.e., for registered stakeholders, decision-makers or the research society. Original data need not be available; only the thematic and georeferenced maps. With this information it is possible to overlay different thematic map without using the original data.

r) Ecological, social and economical data should be made compatible within and between ICES/EU countries. Environmental and socio-economic data should be standardised and quality assured in all ICES/EU member states. Some indicators are problematic in their application, because there are no or not compatible data available. In this area much research is necessary.

s) The following research areas were identified as being valuable for integrated coastal zone management:

- citical ecological processes; the ecosystem interactions between the chemical, physical and biological environment in the coastal zone; time and space scales in coastal ecosystems relationship between marine and terrestrial coastal ecosystems thresholds of nutrient and contaminant inputs for the sustainability of coastal ecosystems. This is being assessed within

the framework of the project TRESHOLDS (http://www.thresholds-eu.org);

- effects of alien species on the littoral communities, changes in the fauna and effects upon the trophic structure of the ecosystem importance of macroalgae in the biodiversity and sustainability of the phototrophic littoral algae;
- abundance, productivity and spatial fragmentation of angiosperm meadows in relation to human impacts;
- impact of both off-shore and terrestrial human uses on the coastal ecosystem EcoQ-elements and EcoQ-objectives that best represent the coastal ecosystem;
- Develop methods for assessing the impact of spatial planning and development policies in coastal development plans across scales from local, regional, European and global. In many ways, different policies have high direct impacts on economic activities and thus indirect impacts on marine and coastal resources;
- develop quantitative methods for monitoring the recreational fishery.

3.4 Monitor and report results generated from larger EU funded projects (PROTECT, MESH, etc) that are directly relevant to ICZM needs (ToR d)

A number of projects are currently in progress working directly with ICZM issues, aiming either at communication and exchange of information and experience or at developing tools and methodologies for resolving integration of information. The project descriptions were compiled in a specific format to elucidate the links with ICZM, the results achieved so far of relevance to this area and the usefulness for the further development of ICZM. These are attached in Annex 7. A number of larger EU projects aim at building networks and exchange of information and experience between disciplines, sectors and states. At least six larger EU network projects were identified and described by the WG (Coastal Practice Network (CoPraNet) www.coastalpractice.net; European Network on Coastal Research (ENCORA) www.encora.org.; Coastal Communities Network (CoCoNet) http://coconet.ucc.ie.; Coastal Zone Management Network (CZM-Net) http://coconet.ucc.ie.; Corepoint http://corepoint.ucc.ie/index.php; AquaReg www.aquareg.com). The network projects aim at identifying urgent coastal issues and collating and developing ICZM tools and techniques. Some projects also collate data to provide knowledge on the status of the quality or of conditions in the coastal zone or for informed management. A number of projects include case studies using spatial planning and dealing with typical coastal zone conflicts. Some projects aim at raising public awareness on the problems related to coastal issues, and the coastal marine environment to facilitate integrated management. A number of websites are already available containing information pertinent to ICZM (See Annex 7).

Three larger EU projects deal with specific tools relevant for ICZM . One deals with the use of Marine Protected Areas as a tool for fisheries management and for marine environmental protection (PROTECT, www.mpa-eu.net). The results from this project may be useful in developing the ecosystem approach to managing the coastal zone and in particular fisheries and aquaculture activities within this zone. Spatial planning is an essential tool for ICZM and 2 larger EU projects were identified working with implementing GIS information in management (BALANCE and Mapping European Seabed Habitats (MESH) http://www.searchmesh.net/). Marine mapping may be a useful tool in the physical planning process and the multiple layering enable integrated management.

A number of other projects were also identified as being relevant to ICZM although not directly focused on this field. These include projects aimed at estimating the local/regional

carrying capacity for shellfish farming, developing forecasting models for climate change impacts on the coastline, information on and evaluation of socio-economic importance of marine biodiversity. Also a project linking scientists working in river catchments with those working in coastal and marine environment to model material flows from catchments to coastal waters is very relevant to ICZM, as is a project on monitoring invasive alien species. (KEYZONES, http://www.keyzones.com/intro.html; Predictive Irish Sea Models – PRISM; Marine Biodiversity and Ecosystem Functioning (MarBEF) www.marbef.org; EuroCAT; Delivering Alien Invasive Species Inventories for Europe, DAISIE. http://www.daisie.se/; Managing Fisheries to Conserve Groundfish and Benthic Invertebrate Species (MAFCONS) http://www.mafcons.org/)

WGICZM **recommends** continuing the monitoring and reporting on the progress and developments from larger and/or relevant EU ICZM projects.

3.5 Reporting on different national attempts at monitoring recreational fisheries and evaluate the progress (ToR e)

Background

Reports were submitted by Denmark, Ireland, Sweden, Spain (see Annex 8) and for Norway by personal communication. In addition, the report on the Assessment of Coastal Fish in the Baltic Sea prepared for the Helsinki Commission and available from www.helcom.fi, was also reviewed.

It was considered useful to establish a definition for '*recreational fisheries*' and the WG were of the view that any fishing activity that is '*non commercial'* should be defined as recreational fisheries.

Based on the information supplied to the WG there is ample evidence to suggest that coastal fisheries are overexploited. In Denmark, Ireland, Norway the Spanish Mediterranean area monitoring programs have been initiated because of concerns with respect to lack of information on coastal fish stocks and the impact of recreational fisheries on these stocks.

Monitoring Programmes

In Denmark, as a result of a long running coastal monitoring programme, a catch registration project (2002–2004) was undertaken to document and register recreational fish catches. This project was refined by the selection of key fishermen who, on a voluntary basis, fish on fixed positions using nets or traps, during a particular period every month – temperature data is also recorded. In Ireland an ongoing long-term tag and release programme for a number of important recreational fishery species has provided valuable information on the fish caught and the migration pattern of selected species. This is also carried out on a voluntary basis by recreational fishing skippers and over 30,000 fish have been tagged with a return rate for different species of between 3.25% for blue shark and 18.3% for monkfish. In Norway plans are in place to characterise the various coastal societies and industries and to provide managers with relevant biological information on the coastal recreational fishery. In Spain the importance of including recreational fisheries into a comprehensive coastal management strategy is considered essential and a number of studies are currently underway. The Swedish Board of Fisheries has conducted surveys of recreational fishing every five years since 1990 and a questionnaire study was commissioned in 2005

Landings

In Norway, for example, it has been estimated that annually between 6,000 and 15,000 tons of fish are caught by tourists fishing and, as all Norwegian citizens have a legal right to fish for household consumption, a further 48,000 tons is caught annually for household consumption. This has lead to the consideration been given to assigning part of the Norwegian commercial quota to tourist fishing companies. In Majorca, conservative estimates show that the

recreational fishery lands 1,209 tonnes or approximately 27% of the commercial catch per year. Each country that submitted information identified the lack of accurate data on the landings from recreation fisheries as a serious problem for the management and sustainable use of the coastal fish resource. The Swedish recreational fisheries is estimated to be approximately 10 million kg landed from coastal fisheries.

Effort

Uncertainty surrounding catch data is confounded by the uncertainty in relation to recreational fishing effort. In Spain's Balearic Islands catch and effort records of spear fishing competitions since 1975 showed a decreasing trend over time for the mean CPUE (kg fisherman^{-1} h^{-1}) and for some key species the number of larger species captured have decreased significantly. It is estimated that at least 37,000 people are involved in recreationally fishery. Norway will include data collection on the average catch rate per completed fishing trip and the total fishing effort independently and use these to calculate catch per unit effort. Most fish landed in the Danish recreational fishery are considered small in size and the CPUE relatively low for most species and in most areas although the precision of CPUE is also low. Recreational boat fishing totalled in excess of 38,000 rod angling days during 2000 in Ireland. In Sweden around three million persons expressed some interest in fishing and a total number of fishing days was estimated at 22 million during 2004.

Licences

It is not necessary to have a licence to fish recreationally in Norway, however in the other countries for which information was available; a licence for recreational fishing in coastal waters is a requirement.

Gear

The fishing equipment used includes rod, net, longline with multiple hooks and trap and in some instances equipment is adopted to suit local conditions. Recreational fishing takes place both from the shore, from boats and underwater spear fishing. Fishing with nets, traps, pots, etc are restricted and by number and size in several countries or in some instances forbidden.

Social/Economic

In Norway it has been estimated that the economic worth generated by a fish caught by a tourist is ten times higher than when caught by a commercial fisher. Ireland has estimated that sea angling tourism revenue is worth about 30 million Euro annually to the Irish Economy. In Spain, efforts to establish the level of participation in recreational fishing in Majorca showed that recreational fishing is one of the main leisure activities and is undoubtedly important to the coastal marine ecosystem as well as being socio-economically important. In many countries, recreational fisheries provide significant revenue for coastal communities, some of which are in peripheral areas with limited resources.

Mussel fishery in the coastal zone

Mussels (*Mytilus edulis* and *Mytilus galloprovincialis*) and other bivalve species are important suspension and deposit feeding organisms in the coastal zone forming more or less coherent beds on tidal flats, where the bivalves periodically are exposed to air, and in subtidal beds down to around 40 meters water depth. They live on different sediment types from sandy sediments to solid rocky shores. Mussels have multiple roles in the coastal zone. These extensive coastal beds may play an important role in protecting coastlines from erosion. Mussels may serve as sentinels for contamination analyses. If harvested regularly they may also contribute to managing nutrient loading in fjords and coastal areas with intensive upland agriculture.

The mussel stocks amount to several million tonnes around the European coasts, in the Mediterranean, the Atlantic, the North Sea and Baltic Sea. Many stocks are exploited either for culture or traditional fishery (dredging). Mussels and other bivalve species are mostly cultured in the majority of European countries. Exploitation by traditional fishing only takes place in few EU-countries. Therefore very few bivalve stocks are actually monitored and assessed to establish management plans for a sustainable exploitation of stocks.

The bivalve stocks in Danish waters have been monitored and assessed during the last couple of decades and the results were presented to the WGICZM as an example of how it can be accomplished. The most important bivalve commercial species in Danish waters are mussels (*Mytilus edulis*), cockles (*Cerastoderma edule*), clams (*Spisula solida*) and European flat oysters (*Ostrea edulis*). Other bivalves are sporadically caught and landed in small amounts such as queen scallops (*Chlamys opercularis*). The main fishing areas in Denmark for mussel are the Limfjord, Kattegat, Little Belt and the Wadden Sea. Cockles are fished in the Danish Wadden Sea both east of the islands and outside the Wadden Sea in the coastal area. Clams and cockles have been landed from Horns Reef and Roede Klit Sand for almost 10 years. The oyster landings from Limfjorden have the last three years been around 1,000 tones annually; an ancient fishery previously as a Royal prerogative. The management and exploitation advice has been based on traditional biological parameters. Introduction of GIS has made it possible to improve the exploitation advice by mapping the stock abundance and biomass for smaller subdivisions that the fishing waters have been divided into for limiting the fishing effort to only the most productive beds among the different shellfish stocks. Local stock variations and mortality rates and growth conditions can be mapped and used in the management advice to keep the exploitation of the Danish shellfish stocks on a sustainable level.

Mussels have been fished in The Danish Wadden Sea, an International Wildlife Reserve for many years. In the 1980s the mussel stock collapsed, and for a short period the food supply for birds was critically reduced. The number of mussel fishing licenses was drastically reduced, and since 1986 the mussel stocks have been monitored by the Danish Institute of Fisheries Research. Aerial photographs and mussel sampling have been used to estimate the bed area and for monitoring and assessment of the population. The mussel beds have varied between 1,192 ha in 1991 to 632 ha in 1996. In 1999 the total mussel beds were 1,051 ha. On the subtidal beds samples were collected by dredging using a commercial dredge and on the intertidal beds by a large number of frames. Combining these two factors the biomass was estimated. The biomass of mussel in The Danish Wadden Sea has varied considerably over the years between 5,840 t in 2004 and 117,000 t in 1993. Based on the biomass observed during autumn, the production of mussels for the next year was estimated. The estimated annual production was divided between birds and fishery in a way that at least 10,300 tonnes were allocated to the birds before a TAC was allocated the fishery. This management plan is intended to supply mussel foraging birds with sufficient food and to prevent overexploitation of the mussel stocks.

WGICZM Recommendations

Based on the documents reviewed and the group's discussions the following are the ICZM working group's recommendations

1) Coastal fish and shellfish monitoring should be integrated with other coastal monitoring programmes, in order to work towards an ecosystem approach to coastal zone management. To this end information on the different monitoring programmes and methods should be compiled.

2) There is evidence to suggest that there could be a significant social and economic benefit from sustainable management and use of coastal recreational fish stocks; data on this aspect of recreational fisheries should be compiled.

3) Recreational fishing is seen as a useful data source on rare, endangered and protected species and procedures should be put in place to ensure such data is compiled. This will be useful for Natura 2000 fish monitoring.

4) There is a need to better understand and quantify the impact of recreational fisheries on coastal fish stocks. This should include monitoring natural shellfish stocks.

5) Many different types of gear and fishing methods are permitted and used in recreational fisheries and details of these should be collected e.g. rod, nets, longline, traps.

6) Where possible information on the number of chartered sport fishing boats (species and catch per trip) should be collated.

7) The impacts of bait collecting should be considered a recreational fisheries impact on the coastal zone and information should be collected on the extent and impact of this activity e.g. lugworm digging.

8) Very few European bivalve stocks are monitored and assessed. An overall knowledge of the European bivalve stocks is actually not available. Member Countries should monitor and assess their bivalve stocks to secure a sustainable exploitation level of all the European bivalve stocks.

9) Very limited information is available on the extent of exploitation on the different European bivalve stocks and if, in some regions, the stocks are over-exploited. Statistics on bivalve fishery and the number of licences in fisheries issued by each Member Country (information by number of licenses, species, gear type, and coastal area) should be collected

10) Knowledge on the ecological effect of mussels dredging is limited (few scientific papers). Research in the effect of dredging and culture of bivalve in the coastal zone is therefore important to deliver the needed knowledge to secure a wise and sustainable exploitation level of bivalves in the coastal zone.

3.6 Report on the effects of hypersaline waters produced by desalinations plants (ToR f)

About one-third of the world's population lives in countries with moderate to high water stress. If present consumption patterns continue, two out of every three persons on Earth will live in water-stressed conditions by the year 2025. The declining state of the world's freshwater resources, in terms of quantity and quality, may prove to be the dominant issue on the environment and development agenda of the coming century. In Europe not only the Mediterranean countries but also some parts of UK, France and Germany have or would have freshwater shortages (UNEP, http://www.unep.org/vitalwater/).

As the world’s fresh water resources become more meagre the world’s attention is diverted towards the oceans and seas as an immediate resource for fresh water. In the past decades, the bottleneck of desalination was the energy cost which was generally higher than the costs of other water supply alternatives that may be available (e.g., water transfers and groundwater pumping). Albeit, technological progress increased process efficiency, and although socio-economically context dependent, desalination has turned into an extensively applied solution for an increasing number of regions around the world, and in particular in various countries of the Mediterranean region (i.e. Spain, Malta, Italy, Tunisia, Algeria).

Desalination plants produce liquid wastes (i.e. 0.55 l brine for each 0.45 l of fresh water) which may be discharged directly into the ocean, combined with other discharges (e.g., power plant cooling water or sewage treatment plant effluent) before ocean discharge, discharged into a sewer for treatment in a sewage treatment plant, or dried out and disposed of in a landfill. Marine resources in the vicinity of a desalination plant can be affected by the constituents present in the waste discharges, by the waste discharge method used, and by the process of feedwater intake.

The constituents of discharges of particular concern for marine organisms include biocides, high metal concentrations, and low oxygen levels. Besides, 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. In addition, discharges from desalination plants will be denser than seawater and could sink to the bottom, potentially causing adverse impacts to benthic communities. The seriousness of the environmental impact depends on the characteristics of the desalination process (i.e. distillation or reverse osmosis determining the composition of the produced brine) but also of the natural hydrodynamic and bathimetric conditions, as well as biological factors of the local marine environment.

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. Moreover, few studies have assessed the brine impact in a suitable time and space scale.

From the review on available information (see Annex 9) and joint group discussions, the problem of power plant cooling effluents was raised.

Freshwater is a very valuable resource of increasing shortage; therefore there is a need to avoid its wasteful misuse (i.e. flushing toilets). This is very serious problem in some areas like in coastal tourist areas at present, but there are indications at this likely to become more general at short interval.

WGICZM recommends that:

- responsible use of this limited resource (drinking water) is promoted.

The WGICZM further recommends that:

- information on thermal, chemical and saline pollution from power or desalination plants should be collated to identify lacks and needs to elaborate future recommendations.
- the placement of desalination and power plants and their discharges are carefully considered in relation to their impact on coastal ecosystems .
- the problem arising from desalinisation plants be considered under the umbrella of the EU Water Framework Directive or other intergovernmental instruments.
- impact assessment and quality control of methodologies should be standardised and adequately monitored at time scales sufficient to determine long term effects of brine and temperature outputs, as well as chemical pollutants coming from desalination plants and power plants.

3.7 Report on progress in valuable component or management tools (ToR g)

Coastal management is by itself a challenge since it implies an integrated approach where social, economic and biological factors should be assessed and pooled. In addition, each factor represents a large complexity, which may not be easily interpreted or measured. The assessment of biological productivity in coastal areas is a particular complex task since both anthropogenic and natural variation within a comparatively small scale must be considered. It is generally agreed that a sustainable use of coastal resources should rely on a consistent biological assessment within the framework of an ecosystem approach. This will necessitate a development of ecological indicators that can be objectively applied and related to the biological status of coastal ecosystems.

Fisheries management have since long been based on single-species assessment. There is a growing understanding that exploited fish must be considered as an integral component of

ecosystem function. Therefore new methods need to be developed in order to monitor and evaluate fish resources within an ecosystem perspective. In this context, ecological indicators have become a key concept. FAO has initiated international consultation on the use of ecological indicators and has provided guidelines on how to develop, test and apply such indicators (Garcia and Staples, 2000). SCOR and IOC established an expert group on "Quantitative ecosystem indicators for Fisheries management" in 2001. The group discussed the scientific basis, reviewed existing knowledge, evaluated the utility of ecological indicators and considered frameworks for their implementation. Results were presented at an international symposium in Paris 2004. (Cury and Christensen, 2005). Although these results specifically relates to fisheries management, they do have relevance to coastal management: Identical scientific evaluations and similar frameworks can also be used to assess the biological resources in coastal areas.

Ecological indicators encompass a wide range of natural and anthropogenic factors that effect ecosystem structure and function. They may be classified in three main categories:

- Environmental indicators that quantify climate change or environmental variability including habitat change and their ecosystem effects;
- Ecosystem indicators that characterise the status and dynamics of aquatic ecosystems on the basis of species composition, size distribution and trophodynamics;
- Fisheries indicators that quantify the impact of fishing on the exploited and unexploited components of ecosystems.

Brander (2005) showed that climate change, as represented by the North Atlantic Oscillation index, can have significant effects on the recruitment of cod when spawning biomass is low. The mechanism appears to be related to changes in water circulation and available food resources (Beugrand *et al.*, 2003). The message is that natural variation in climate indicators should be considered in an integrated assessment of fish stocks. Blanchard *et al.* (2005) confirm that climate effects can confound the effects of fishing and therefore needs to be incorporated in fish stock assessments.

Ecosystem indicators are primarily used to indicate the state of ecosystems. They may be classified by known ecosystem properties such as species composition including rare species, trophic structure and efficiency, community size-spectrum, energy flow and network parameters (production, consumption, respiration, etc.). Fulton *et al.* (2005) listed 36 indicators that were tested as potentially useful to indicate ecological state at population, community and ecosystem levels. Best performance across models and aggregation was achieved with indicators that reflect biomass, consumption, diversity and foodweb structure. They also suggest that the main biological groups that need to be represented are:

- Species with fast turnover rates since they respond quickly to ecosystem changes;
- Exploited species since they indicate status of the ecosystem of interest to humans;
- Habitat-defining species in order to capture essential habitats (e.g. costal areas) for ecosystem production;
- Sensitive keystone species that require special ecological niches or are particularly vulnerable. Examples are rare species and top-predators.

More specific tests have been made on trophic and size-based indicators in order to evaluate the ecosystem effects of fishing. Cury *et al.* (2005) used data from the Benguela ecosystems in order to evaluate six trophodynamic indicators: catch and biomass ratios, primary production to support catch, consumption ratios and predation mortality, trophic level of the catch, fishing-in-balance index, and mixed trophic impact. Although some of these indicators could be related to ecosystem changes the authors conclude that the indicators are sensitive to the

choice of trophic level for certain species and that trophodynamic indicators appear to be conservative and respond slowly to structural changes in the studied ecosystems.

Shin *et al.* (2005) tested size-based indicators and stressed that such indicators (e.g.) are easily obtained from existing sampling programs without the need for elaborate models. Tests of indicator response were based on changes in mean length or size spectra relative to null hypotheses. The authors conclude that no single size-based indicator can serve as an effective overall indicator of heavy fishing. Rather, suites of indicators should be selected. They also suggest that expected reference directions may be more useful than historically based reference points in order to detect fishing or environmental disturbance on ecosystems. Although reference points or intervals might be easy to define they do not provide a scientifically based guideline for management target points. However, given that fishing or anthropogenic impacts in most cases are considered too large, reference directions may provide alternative management targets. Jennings and Dulvy (2005) applied size-based indicators based on data from field surveys and showed that the statistical power to confirm/reject changes of reference directions is poor in time scales less than 5–10 years. They therefore recommend that size-based indicators should be used for management advice on a medium term rather than by a yearly period.

Thus, many scientists agree that single indicators are not sufficient to describe changes in marine ecosystems. Therefore, a suite of ecological indicators need to be selected based on scientifically criteria. These criteria could include performance tests. Rice and Rochet (2005) suggested a framework for the objective selection of appropriate indicators. The framework consists of several components including specification of user needs, lists of candidate indicators, lists of appropriate criteria, a score methodology of indicators against criteria and a final choice of indicators. The framework was evaluated by the use of scientific experience (Rochet and Rice, 2005). Local and non-local experts were asked to follow the framework schedule/steps and select ecological indicators for three marine ecosystems (Bay of Biscay, Gambia River estuary and eastern Scotian Shelf). Results differed between the two categories of experts where local experts tended to rely less on indicators based on historical data. It was also obvious that individual experts tended to favour similar indicators irrespectively of differences between ecosystems. A conclusion is that further performance tests need to be developed in order to achieve quality assurance in the choice of indicators.

A selection of ecological indicators has been implemented in the federal groundfish fisheries in Alaska. Livingstone *et al.* (2005) report that these indicators were chosen to correspond to three broad objectives:

1) to maintain predator/prey relationships;
2) to maintain energy flow and balance; and
3) to maintain diversity.

The framework provides a way of assessing ecosystem factors that influence target species, the impact on associated species and ecosystem-level impacts of fishing. The approach will be expanded to include a variety of models with the aim to predict possible future trends in various ecosystem indicators.

An important point is to communicate the expected quality and performance of ecological indicators outside the scientific community. Thus, the choice of indicators may be hampered by the understanding and recognition of the concerned fishers and management authorities. Therefore, it is essential that ecosystem evaluations and management procedures are widely acceptable to users while also being scientifically valid. Studies in south-east Asia and southern Africa indicates that local ecological knowledge is linked to the current problems of local users (Degnbol, 2005). For example, scientific data demonstrate that larger cichlids in Lake Mweru, Zambia were depleted 20 years ago. However, fishers consider the present

situation as normal. Therefore, in order to achieve sustainability as a long-term goal, adaptive management could be employed. This will enable a successional monitoring of progress as well as an acceptance by users.

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Recommendations

The present legal and institutional framework for regional and local management in coastal areas varies between and within countries. WGICZM recognizes the need to further analyse the implications of these differences in order to achieve scientific sound approaches and to suggest plans for capacity building for sustainable management of coastal ecosystems.

Ecological indicators to assess ecosystem state and function are currently being developed and tested within ICES. WGICZM recommends that:

- this methodology be further modified and diversified to match management criteria for the ecological assessment of diverse coastal ecosystems.

3.8 Revise and develop the draft on the development of a framework for integrated evaluation of human impacts in the coastal zone and how integrate this information for CZM, identifying ICES' role in the application of the WFD in the coastal zone (ToR h)

As more information on ICZM is generated, awareness has shifted towards the need for comprehensive coastal programs designed to resolve conflicting demands on the use of coastal resources, maintain coastal biodiversity and ensure long-term economic sustainability of these resources. While expert knowledge is valuable it represents a narrow point of view and does not represent a systems view; rather ICZM requires generalist expertise able to understand the interaction between sea and coast and between nature and socio-economic driven pressures.

The approach to ICZM may differ between countries and between regions due to differences in needs, traditions, cultures or management systems. A list of issues that need to be addressed before or while setting up an ICZM programme could be useful to encourage a comprehensive programme rather than the single-factor form of management practised today. This may counteract problems arising from the management of a system based on single-purpose management, and encourage cooperation between different agencies which have jurisdiction over the different activities or resources. Beneath environmental planning and sectoral planning and management schemes, spatial planning (extended into the sea) is recognised in several European countries as one additional tool/instrument to reach a more integrated approach in coastal and marine management. But spatial planning will have to be linked with a systems approach, which links ecological, economic and social/cultural system processes.

Research needs on sectoral problems are important as there is a need to understand the external forcing processes that cause constant changes in the ecosystem. Even more important is research on assessing interactions between different coastal uses, and particularly considering human interchanges with the coastal ecosystem. This also includes the evaluation of resources and potential negative impacts of human activities on resources, using risk and vulnerability analyses, social science tools like assessments about the perception, people have from the environment, the sea, specific human activities. In addition, tools from ecological economics can help to identify priorities and conflicts.

An example of sensitivity analysis for particular biotopes is given in http://www.marlin.ac.uk/sah/biotope_information04.php.

An example of research on assessing interactions is the German research project "Coastal Futures", which aims to develop an integrated assessment approach for coastal and marine changes by using offshore wind farms as case study for changing spatial structures. Issues addressed include impacts on ecosystem and habitat structures, local economy and infrastructure, conflicts between stakeholders and social values such as perception of the coast by local people. To ensure methodological integration, a system characterization structured along the Driver-Pressure-State-Impact-Response (DPSIR) approach and an integrated assessment approach linking tools from both natural and social sciences – e.g. scenario techniques, modelling and stakeholder dialogues form the overall framework.

A specific role for ICES within such a framework could be to deliver the baseline information and expertise to:

- develop a model to assess the vulnerability of marine and coastal ecosystems to changes which relate to human activities;
- having progressed this the next step is to integrate the vulnerability assessment with risks associated to human activities.

This could be organised in the following manner:

- **Natural Resources**:
  - Identification of these resources (e.g., fish, invertebrates, minerals, land);
  - Their exploitation levels and/or observed anthropogenic impacts (e.g., beach erosion, landfill or reclamation, habitats, climate change, etc.);
  - Their role and function within the ecosystem; and
  - Their vulnerability to impacts, which relate to human interventions.
- **Human demands for coastal and marine space and resource use including Coastal Zone Conflicts**:
  - Identification of human activities such as urbanisation, tourism, aquaculture, energy production or other uses;
  - their interactions with coastal and marine ecosystem processes;
  - the risk associated with these activities to create a severe impact on ecosystem functions (e.g. risks from oil spills, pollution,…);
  - problems that may arise such as xenobiotic organisms introduced directly or indirectly by human activities.

Some of the ICES regional working groups have begun the process of integrating biological, ecological and environmental information emerging from the different sectoral ICES groups and WGICZM encourages this work is also continued with a focus on coastal ecosystems. This information should feed into the description of natural resources within different areas, deal with primarily cross-border issues, but endeavour to process this information in a format that would be useful in ICZM; i.e., processing the data to meet the need of managers (e.g. as vulnerability maps and interaction matrices and developed further to impact scenarios in the medium term).

The role of stakeholders as well as drivers for human interactions (like energy policy or globalisation) need to be addressed because systems management decisions, which do not consider the views or concerns of stakeholders or do not recognise driving frameworks, may be as problematic as those taken catering entirely to stakeholders interests. This includes gaining an understanding of the economic contribution of coastal resources to society. Although this may be beyond the realm of ICES, it may provide information on the state of knowledge on potential impacts of different stakeholder activity such as fishery, shipping, dredging and offshore constructions on the marine resources as well as on the marine environment.

The EU Water Framework Directive

The EU Water Framework Directive (WFD) has the following purposes related 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;
- Aims at enhance 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.

Responding to achieve these aims, the implementation of the WFD include characteristics of river basin districts, review of the environmental impact of human activities, establishing coastal water types using a common typology, divide the coastal waters in bodies of surface waters according to the typology and assessment of ecological status of all these bodies of water.

In the assessment of the ecological status of coastal water specific biological quality elements are considered (phytoplankton, macroalgae and angiosperms, benthic invertbrate fauna), as well as hydromorphological 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 is 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. The latter involve most of the ICES-member countries.

Examples of questions and tasks to be dealt with by the ICES community could be:

- Development of ecological quality objectives and indicators on environmental quality in coastal- and transitional water;
- Establishing of reference conditions/values;
- Assess interplay between natural variability and cycles and pressure due to human activities;
- Effects of changes in climate;
- Advice on best and/or most relevant ecological quality elements for assessment of pressure from human activities and the ecological status of bodies of water (examples; application of biological quality elements versus physio-chemical quality elements in assessment of, evaluate presence of introduced species as a criteria for classification of ecological status);
- Revisit the categorization in coastal water, transitional water and heavily modified waters bodies done by different EU-countries;
- How to tackle cross-bounder pressure, for example long-distance transport of nutrients and pollutants;
- Scientific based limits between high, good, moderate ecological status;
- Advice on monitoring and surveillance programmes, methods and outlines;
- Promote comparative studies, inter-calibration exercises and a sound scientific basis for the implementation of the WFD;
- Consider potential and realism in enterprises and measures to improve ecological status in coastal- and transitional water.

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 for assisting OSPAR or other commissions. Examples of contributions are listed in Table 2 (Annex 10), which is not complete.

ICES should identify and further improve co-ordination of the WFD related work done by its various WGs with a view to achieving ICZM'

Based on the discussions WGICZM recommends that ICES works to:

- develop a model to assess the vulnerability of marine and coastal ecosystems to changes which relate to human activities
- having progressed this, the next step is to integrate the vulnerability assessment with risks associated to human activities

The WGICZM further recommends that ICES:

- Continues to develop ecological quality objectives and indicators on environmental quality in coastal- and transitional waters;
- Establishes reference conditions/values;
- Assesses interplay between natural variability and cycles and pressure due to human activities;
- Further examines the effects of changes in climate for the coastal zone;
- Revisits the categorization of coastal water, transitional waters and heavily modified water bodies done by different EU-countries;
- Examines how to tackle cross-boundary pressures, for example long-distance transport of nutrients and pollutants, shipping;
- Defines scientific based limits for high, good and moderate ecological status;
- Advices on monitoring and surveillance programmes and methods for coastal monitoring;
- Promotes comparative studies, inter-calibration exercises and a sound scientific basis for the implementation of the WFD;
- Considers potential and realism in enterprises and measures to improve ecological status in coastal- and transitional water.

Annex 1: List of participants

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Annex 2: Agenda

Wednesday, 19 April

09.00	Welcome. Josianne Støttrup (Chair). House keeping and support arrangements Vivian Piil
09.15	Introduction of participants, Review of Terms of Reference, Designation of Rapporteurs, Report layout (Chair + Members).
09.45	ICES ACME – ToR of particular interest to ACME.
10.00	ToR h: Update on WFD and ICES' role in the application (Einar Dahl). Management of blue mussel fishery in coastal areas relative to different directives (Per Sand Kristensen). Initiate discussion on this TOR.
12.00	*LUNCH*
13.00	Status and progress regarding Tor b (Clare Greathead).
13.30	Status and progress regarding Tor f (Beatriz Morales).
14.00	Status and progress regarding Tor d (Jessica Hjerpe).
14.30	Coffee break.
14.45	Status and progress regarding Tor c (Andreas Kannen).
15.45	Status and progress regarding Tor e (Eugene, Ireland) with few Presentations (Per Sand Kristensen –coastal blue mussel fisheries, Josianne on voluntary registration of Danish recreational fishery).
16.45	Collate different input into the report.

Thursday, 20 April

08.00	Plenary. Overview of work to be carried out. Drafting groups form.
10.00	Drafting groups reconvene
10.15	Coffee break
11.45	Drafting groups reconvene
12.00	*LUNCH*
13.00	Progress and update on ToR a (Josianne Støttrup)
13.30	Progress and update on ToR g (Johan Modin)
14.30	Revisit ToR h.
15.30	Work in groups towards the completion of the WG report.
16.45	Days Progress distributed and read.
17.00	Presentation of progress and discussion.

Friday, 21 April

08.00	Rapporteurs pass draft recommendations and 2007 ToR proposals to be discussed in forum.
09.00	Work in drafting groups.
10.00	Drafting groups reconvene – short update on progress
10.15	Coffee Break
11.15	Discussion of 2007 ToR and recommendations.
12.00	*LUNCH*
13.00	Discussion of draft final document and proposals for 2007
14.30	Final modifications of draft.
15.00	End of 2006 meeting.

Annex 3: WGICZM Terms of Reference 2006

The **Working Group on Integrated Coastal Zone Management** [WGICZM] (Chair: J.Støttrup) will meet in Mallorca from 17–20 April 2007 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;

b) update and report on ICZM activities in different ICES countries using the new ICES ICZM reporting format and review progress from the EU country report (http://europa.eu.int/comm/environment/iczm/), and on activities in different international organisations (e.g. EU and developments concerning EU ICZM);

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

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

e) provide national reports on coastal activities including:

f) an update on monitoring coastal recreational fisheries and evaluate the progress;

g) an overview on national time-series coastal monitoring programmes (including Natura 2000) and the extent of the data accessibility;

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

i) revise and develop the 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.

WGICZM will report by 3 May 2007 for the attention of the MHC, ACME and ACE.

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) and other local or trans-boundary management issues within ICES Member Countries.
RESOURCE REQUIREMENTS:	Much of the research is already underway and a list of data products has been drawn up. Some of these may constitute the remit of this Group. Many from this list should, however, be fed back to other ICES Expert groups.
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 all three advisory committees, but especially ACE and ACME
LINKAGES TO OTHER COMMITTEES OR GROUPS:	MHC, MARC and several Working Groups within these committees.
LINKAGES TO OTHER ORGANIZATIONS:	EU, OSPAR, HELCOM.
SECRETARIAT MARGINAL COST SHARE:	ICES 100%.

Annex 4: Recommendations

RECOMMENDATION	ACTION COMMITTEE (WG/SG)
1. There is a need for focus on genetic identification of locally adapted coastal fish stocks (e.g. coastal cod in Norway).	MARC (WGAGFM)
2. Maps on coastal Essential Fish Habitats for target and non-target species during different life-stages should be drawn up.	MHC, MHM
3. There is a need to compile information on coastal fish communities and coastal fisheries.	ACFM
4. Coastal fish monitoring methods on sandy bottom need to be intercalibrated and there is a need to develop "standard" coastal fish monitoring techniques on other sea bottom types as well as intertidal zone sampling techniques.	FTC
5. There is a need to examine the effect of fishing gear, when used in coastal areas, on the marine coastal habitats.	FTC
6. Zooplankton seem sensitive to environmental changes, and these could be used as an indicator for climate change or other impacts. Also jellyfish occurrences and distribution should be monitored.	OC
7. Changes in benthic-pelagic coupling in coastal areas where dense shellfish farming is practised need to be examined.	MARC (WGMASC)
8. Data on shore nourishment, amounts and spatial and temporal information need to be compiled as well as the impact of this activity and other coastal alteration on coastal ecosystems.	MHC
9. Need to examine the effects of noise from both surface sources (katamaran ferries, small fast boats, near-shore installations) and underwater sources (geophysical mapping techniques) on coastal marine fish, birds and sea mammals.	FTC (WGFAST)
10. WGICZM **recommends** continuing to update and report on ICZM activities in different ICES countries using the new ICES ICZM reporting format which was established during the 2006 meeting. The report should include progress on ICZM issues reported in the EU country report (http://europa.eu.int/comm/environment/iczm/) and highlight particular problems raised within this report. WGICZM also recommends reporting on activities in different international organisations (e.g. EU).	MHC, (WGICZM)
11. WGICZM recommends continuing the monitoring and reporting on the progress and developments from larger EU ICZM projects.	MHC, (WGICZM)
12. Coastal fish and shellfish monitoring should be integrated with other coastal monitoring programmes, in order to work towards an ecosystem approach to coastal zone management. To this end information on the different monitoring programmes and methods should be compiled.	ACFM (WGICZM will next year collect information on county coastal fish and shellfish monitoring-but work (e.g. on methods) should be directed to more relevant WG/SG)
13. There is evidence to suggest that there could be a significant social and economic benefit from sustainable management and use of coastal recreational fish stocks; data on this aspect of recreational fisheries should be compiled.	ACFM
14. Recreational fishing is seen as a useful data source on rare, endangered and protected species and procedures should be put in place to ensure such data is compiled. This will be useful for Natura 2000 fish monitoring.	ACFM
15. There is a need to better understand and quantify the impact of recreational fisheries on coastal fish stocks. This should include monitoring natural shellfish stocks.	ACFM
16. Many different types of gear and fishing methods are permitted and used in recreational fisheries and details of these should be collected e.g. rod, nets, longline, traps.	ACFM
17. Where possible information on the number of chartered sport fishing boats (species and catch per trip) should be collated.	ACFM (WGICZM will endeavour to collate available information on this topic next year, but further work should be directed to more relevant WG/SG)

RECOMMENDATION	ACTION COMMITTEE (WG/SG)
18. The impacts of bait collecting should be considered a recreational fisheries impact on the coastal zone and information should be collected on the extent and impact of this activity e.g. lugworm digging.	MHC
19. WGICZM recommends the collection of statistics on bivalve fishery and the number of licences in fisheries issued by each Member Country (information by number of licenses, species, gear type, and coastal area).	ACFM
20. WGICZM recommends to compile knowledge on the ecological effect of mussels dredging in the coastal zone.	MHC/FTC
21. WGICZM recommends that responsible use of this limited resource (drinkwater) is promoted.	General ICES recommendation
22. WGICZM recommends that the placement of desalination and power plants and their discharges are carefully considered in relation to their impact on coastal ecosystems	General ICES recommendation
23. WGICZM recommends that the problem arising from desalinisation plants be considered under the umbrella of the EU water framework directory or other intergovernmental instruments.	General ICES recommendation
24. Impact assessment and quality control of methodologies should be standardised and adequately monitored at time scales sufficient to determine long term effects of brine and temperature, as well as chemical pollutants coming from desalination plants and power plants	General ICES recommendation
25. WGICZM also recommends considering other sources of coastal impact like power plant cooling effluents should be included in this TOR. Power and desalination plants thermal, chemical and saline pollution impact studies need to be collated to identify lacks and needs to elaborate future recommendations.	WGICZM intende to elaborate on this topic in 2007.
26. Ecological indicators to assess ecosystem state and function are currently being developed and tested within ICES. The WGICZM recommends that this methodology be further modified and diversified to match management criteria for the ecological assessment of diverse coastal ecosystems.	General ICES recommendation
27. WGICZM recommends that ICES works to develop a model to assess the vulnerability of marine and coastal ecosystems to changes which relate to human activities and connect in the next step the vulnerability assessment with risks associated to human activities	ACME/ACE
28. WGICZM recommends that ICES continues to develop ecological quality objectives and indicators on environmental quality in coastal- and transitional waters.	ACME/ACE
29. WGICZM recommends that ICES establishes reference conditions/values applicable for the coastal zone	ACME/ACE
30. WGICZM recommends that ICES assesses interplay between natural variability and cycles and pressure due to human activities	ACME/ACE
31. WGICZM recommends that ICES further examines the effects of changes in climate for the coastal zone.	ACME/ACE
32. WGICZM recommends that ICES revisits the categorization in coastal water, transitional waters and heavily modified water bodies done by different ICES/EU-countries.	ACME/ACE
33. WGICZM recommends that ICES examines how to tackle cross-boundary pressures, for example long-distance transport of nutrients and pollutants, shipping.	ACME/ACE
34. WGICZM recommends that ICES Defines scientific based limits for high, good and moderate ecological status	ACME/ACE
35. WGICZM recommends that ICES Advices on monitoring and surveillance programmes and methods for coastal monitoring.	ACME/ACE/ACFM
36. WGICZM recommends that ICES Promotes comparative studies, inter-calibration exercises and a sound scientific basis for the implementation of the WFD	ACME/ACE/ACFM
37. WGICZM recommends that ICES Considers potential and realism in enterprises and measures to improve ecological status in coastal- and transitional water	ACME/ACE/ACFM

Annex 5: Activities and information of relevance to ICZM of different ICES Working and Study groups

Table A5.1. ICES Working or Study Groups that address climate change influence or impact of different human activities on coastal ecosystems, or address key issues of relevance to coastal ecosystems/ICZM (Tor a). The following table is not comprehensive and only 2005 reports were available.

	NATURAL INFLUENCES	KEY ISSUES	COMMITTEE KEY TASK	RELEVANT WG/SGS	GAPS IDENTIFIED
	Climate change	Habitat change	**Oceanographic**: understand and quantify the role of climate variability.	**WGAGFM:** Local adaptation in fish species/evolutionary potential **REGNS#: A**vailable data on Modelled tidal currents /surge, tidal heights for coastal North Sea. Also sea level observations at fixed points.	Predictions of habitat change? Habitat changes due to climate change in coastal zone may be more pronounced?
		Changes in freshwater runoff		**WGAGFM:** Local adaptation in fish species	Changes in salinity as well as flow/currents, depth, etc.
		Changes in water temperature		**WGAGFM**: Genetic response to increasing water temperatures. Evolutionary ability of fish stocks to respond to climate change. **WGCCC**: effects of inc. temperature on cod, zooplankton effects, **WGPE**: to look at timeseries data to examine climate change impacts on phytoplankton. **WGZE**: zooplankton has been primary research area that has demonstrated regime shifts and climate change, yet not included in monitoring under WFD, OSPAR, etc. Concern about time series monitoring being given lower priority.	What about "coastal stocks" and their evolutionary potential? Changes in temp., sal., etc. may be more pronounced in coastal zone. More information is needed on juvenile stages, their habitats and effects/impact of climate change. Information on zooplankton abundance mostly offshore (not coastal). Range of freshwater fish species in coastal waters may be important in certain regions as the freshwater fish may compete with marine fish species for zooplankton (e.g. Baltic Sea). Zooplankton data could be used as indicator for climate change in coastal areas.
	Human Activity		**Habitat**: Understand and quantify human impacts on marine ecosystems		
1	Mariculture Primarily CZ activity. EU-WFD.	Eutrophication	**Mariculture**: Evaluate the ecosystem effects of mariculture.	**WGEIM:** Integrated culture systems. Sustainability index. **MCWG***: guidelines for frequency and spatial coverage of nutrient monitoring (OSPAR) **WGHABD***: occurrences of HABs and impacts, dynamics of HABs, develop monitoring tools, chemical nature and action of HABs. Data on HAB (monthly/yearly/seasonal in coastal areas)	

	NATURAL INFLUENCES	KEY ISSUES	COMMITTEE KEY TASK	RELEVANT WG/SGS	GAPS IDENTIFIED
1	(continued)	Habitat deterioration/restoration		**WGEIM**: fish and shellfish culture relative to WFD/Habitat directive. Impacts of EU Marine Strategy on Aquaculture activities.	
		Biodiversity/endangered species		**WGEIM**: Report in progress concerning potential impact of escaped non-salmonids. Risk analysis used as a method of identifying environmental risks associated with marine aquaculture. **WGPDMO**: Disease transmission between reared and wild.	
		Changes in trophic structure		**WGEIM**: shellfish culture carrying capacity. Spatial and temporal variation – models. Risk assessments for culture of individual species.	Benthic-pelagic coupling in coastal areas where dense shellfish farming is taking place needs to be examined.
		Impact on local biomass		**WGEIM:** Risk analysis of potential impacts of escaped marine fish for single species being compiled. Carrying capacity into 4 subcomponents: physical, production, ecological and social cc. for shellfish farming. Sustainability index. **WGMASC**: Carrying capacity for shellfish.	
		Impact of mariculture on wild fish stocks (feed + disease)		**WGPDMO**: Disease transmission between framed and wild fish and shellfish.	Problems with transfer of shellfish from one area to another (e.g. imported shellfish species, or in connection with depuration where both target and bycatch species are transferred from one area to another). Impact of feed supply based on wild stock fishery (fish meal + fish oil) for aquaculture not addressed.
2	Fisheries	Habitat deterioration/restoration	**Mariculture:** Evaluate the ecosystem effects of fishing. **Fisheries Technology**: Design and testing of fishing gears and methods to reduce the impacts on bottom habitats and other non-target ecosystem components	**SGBFFI#** reviewed information on coastal herring grounds in the Baltic. **WGFE**: Examined/reviewed Essential Fish Habitats for deep-sea species. **WGFTFB**: Topic group on environmentally friendly gear for traditional species and examining static gear such as traps and pots.	Need to map EFH for target and non-target species at different life stages, including nursery grounds (what is their value for the fish stock/biodiversity?) Need information on fish mobility in coastal areas. Concern that environmentally friendly gear may result in increased pressure on local fish stocks especially in the coastal zone.
		Biodiversity/endangered species		**SGEH#**: Loss of biodiversity mainly observed at habitat level and associated loss of fauna (Baltic Sea) **SGBFFI#**: reviewed monitoring data on coastal fish communities. Coastal fish poorly covered e.g. in assessment, monitoring data, etc. (Baltic Sea).	**SGEH**: Identified need to examine data on fish community/fisheries available for coastal areas; Coastal fish poorly covered, e.g., in assessment, monitoring data.

	NATURAL INFLUENCES	KEY ISSUES	COMMITTEE KEY TASK	RELEVANT WG/SGS	GAPS IDENTIFIED
2	(continued)	Changes in trophic structure		**SGSTS**: reviewing survey trawl design and design of ICES standard bottom survey trawl, where the 'ideal standard' gear is discussed.	More focus on the further development of highly selective fishing gear to avoid by-catch of young fish and non-target species. Does not address near-shore bottom trawl for juvenile fish surveys. Design of Intercalibration studies may be useful for developing intercalibration studies for juvenile trawls used in coastal surveys. Other gear than trawl used near-shore. This is not addressed at all?
		Impact on local biomass		**WGAGFM:** Fisheries induced evolution in maturation. USE of PMRN as ECO Q metric.	Need to collated information on the recreational fishery catches and their magnitude relative to fish stock. There is also a need to study the relationship between recreational and commercial fishery with respect to spatial distribution and life-stage history of the individual fish species.
3	Oil and gas	Chemical contamination		JAMP guidelines on Monitoring the Environmental Effects of offshore oil and gas activities. **WGBEC** effects of oil spills in coastal areas; Biological effects techniques for assessing long-term impacts of oil. **WGSE**: oil spill impact on seabird populations.	
		Habitat deterioration/restoration		**MCWG, WGBEC**, Impact of oil on different types of habitats **SGASC**: ICES Cooperative Research Report on Acoustic Seabed Classification; its status and developments. Working with WGMHM regarding metadatabase development for biological habitat mapping (*)	Not clear how near-shore this technology is today. Depth limitation? What about intertidal zone? For integrated management it would be important to map these activities and ensure future activities are promote the use of cable and pipe corridors.
		Biodiversity/endangered species		**WGBEC, BEWG, MCWG**: on guidelines for long-term monitoring effects of oil spills on marine and coastal life. WKIMON.	
4.	Mineral extraction	Chemical contamination		JAMP Guidelines on Sediment and Biota monitoring, Contaminant Biological Effects Monitoring + ICES **WGBEC*** on methods, General biological effects monitoring. **WGMS*** on sediment contamination	
		Habitat destruction/restoration		**WGMHM***: marine habitat mapping aimed at delineating areas for protection or utilisation. **WGEXT**: Effects of mineral extraction	Data on offshore extraction. No data on extent of nearshore sand nourishment and impact on benthos and fish.
		Biodiversity/endangered species		**WGBEC***: review of ongoing work on biological criteria for selection of dredged material disposal sites. **WGEXT**: Effects of mineral extraction	

	NATURAL INFLUENCES	KEY ISSUES	COMMITTEE KEY TASK	RELEVANT WG/SGS	GAPS IDENTIFIED
4	(continued)	Impact on spawning/nursery habitat (critical/ essential habitat)			Need maps
5.	Tourism, recreation	Eutrophication		**SGEH#**: proposed as EcoQO for Baltic Sea **WGHABD***: occurrences of HABs and impacts, dynamics of HABs, develop monitoring tools, chemical nature and action of HABs.	
		Chemical contamination		JAMP Guidelines on Sediment and Biota monitoring, Contaminant Biological Effects Monitoring + ICES WGBEC on methods, General biological effects monitoring. **WGMS*** on sediment contamination **SGEH#** consider effects of hazardous substances and monitoring several substances to include as EcoQo element/indicator (Baltic Sea)	
		Habitat destruction / restoration		**WGNHN***: marine habitat mapping.	Near-shore habitat difficult to map due to difficult physical conditions. Impact of tourism and related activity is the primary issue in some ICES countries but the habitat impact of this activity needs to be examined. In some areas diver impact on habitat may be deleterious. The extent of this activity is generally unknown.
		Introduced species			
		Impact on local biomass			
		Impact on spawning/nursery habitat (critical/ essential habitat)			
6.	Transport/Port	Chemical contamination		JAMP Guidelines on Sediment and Biota monitoring, Contaminant Biological Effects Monitoring + ICES WGBEC on methods, General biological effects monitoring. WGMS on sediment contamination	
		Noise/infrasound		**WGFAST**: detection and reaction of fish to infrasound. Noise from vessels effects particular fish species. (mainly examining potential effects of research vessel noise on stock assessment)	Need to examine inshore impacts of noisy vessels (e.g. recreational boats/ nearshore installations) for fish mobility, migration to fjords, for anadrom/catadrom species, mammals and birds.

	NATURAL INFLUENCES	KEY ISSUES	COMMITTEE KEY TASK	RELEVANT WG/SGS	GAPS IDENTIFIED
6.	Continued	Introduced species	**Mariculture:** Evaluate the potential impacts of intentional and accidental **introductions of non-native species**, including genetically modified organisms, on marine ecosystems	This issue has been dealt with intensively under the auspices of a previous WG working on introductions and transfers of marine organism, either intentionally or unintentionally e.g. through ballast water.	
		Navigational dredging			Dredging for navigational purposes or for harbour entrances, together with beach improvement projects, although on small scale, may in the coastal zone have cumulative effects.
7.	Residential/ Urban development	Eutrophication		**SGGIB#** on HAB in the Baltic Sea **WGHABD***: occurrences of HABs and impacts, dynamics of HABs, develop monitoring tools, chemical nature and action of HABs.	
		Chemical contamination		WKIMON Workshop. JAMP Guidelines on Sediment and Biota monitoring, Contaminant Biological Effects Monitoring +ICES WGBEC on methods, General biological effects monitoring. **MCWG*, WGMS*, WGSAEM***. Specific pollutants, monitoring strategies. **MCWG***. Effects of different pollutants. Contaminants in marine fish and other orgs.	
		Habitat destruction/restoration			Effects of coastal defences and harbour or promenade development, beach regeneration and beach cleaning on coastal ecosystems including Essential Fish Habitats, sea grass beds, etc., need to be examined.
		Impact on spawning/nursery habitat (critical/ essential habitat)			Effects of coastal erosion prevention /harbour and other development on Essential Fish Habitats
8.	Physical structures	Thermal, chemical or brine contamination			Effects of thermal, brine or chemical contamination from power plants, desalination plants, etc., need to be examined.
		Habitat destruction/ restoration		**WGMHM***: marine habitat mapping	

	NATURAL INFLUENCES	KEY ISSUES	COMMITTEE KEY TASK	RELEVANT WG/SGS	GAPS IDENTIFIED
8.	Continued	Impact on spawning/nursery habitat (critical/ essential habitat)			
		Renewable energy (windfarms, wave energy)			Promote the use of cable corridors.
9.	Land use practices/ Dams	Eutrophication		**OSPAR:** Eutrophication status every 5 y in North Sea + coastal areas. **WGHABD**: occurrences of HABs and impacts, dynamics of HABs, develop monitoring tools, chemical nature and action of HABs. **WGPBI**: examined the responsiveness of ecological models to changes in anthropogenic loads (one also included atmospheric sources). Among conclusions: effects strongest in coastal areas). Models appropriate for management.	
		Chemical contamination		OSPAR (**WGSAEM, WGMS or MCWG):** data compiled (annual) on coastal atmospheric inputs of Cd, Hg, N, P,Pb, biota-radionuclides, contaminants in fish and shellfish – CBs, metals (Cd, Pb, Ni, Cu, Zn, etc), pesticides. Contaminants in seawater and sediments. **WGBEC**: TBT-specific effects in marine snails.	
		Habitat destruction/restoration		**WGNHN***: marine habitat mapping	
		Impact on local biomass			
		Impact on spawning/nursery habitat (critical/ essential habitat)			
		Impact of physical barriers on migratory species			

*** The key Issue is addressed and the information may be relevant to a number of human activities. # The information is focused regionally (e.g. Baltic Sea, North Sea, etc).**

Other coastal information or data available.

WGSE: seabird adult survival, breeding in numbers, breeding productivity, breeding season diet, clutch size, distribution at sea in coastal areas, egg laying date available –mostly annual data and for variable number of species.

Annex 6: Current ICZM activities and progress in different ICES Member Countries

Collated by Clare Greathead, UK

At the 2003 meeting, national reports were provided on the status and progress of Integrated Coastal Zone Management (ICZM) for the Study Group on ICZM. This was updated at the 2004 meeting with information on national implementation of the EU Water Framework Directive and EU Habitat Directive. In 2005 the first report of the WGICZM was compiled and some of the country reports were updated. This document for the 2006 WGICZM has more complete country updates and the structure was revised. This structure will be used as the basis for all future updates.

6a. Belgium

There is no strict definition of the coastal zone in Belgium. In the context of ICZM we use a flexible definition of the zone which compromises both sides of the Belgian coastline: sea and land. 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. This task force group was installed in 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 NGO's, the Flemish minister for environment set up an Interministrial co-operation 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 Co-ordination Centre for integrated coastal zone management (ICZM) was established in 2001. The partners of the Co-ordination Centre are the Province of West Flanders, acting as project manager; Flanders Marine Institute (VLIZ), acting as data and information centre; the Ministry of Flanders, Environment and Infrastructure department, and more in particular two divisions of this Service, viz. AMINAL, Department of Nature, Division Coastal Zone Management, and the Waterways and Marine Affairs Administration, Coastal Division. Because the European Recommendation on ICZM strives to an integrated national implementation, in 2004 the Federal Public Service for Public

Health, Safety of the Foodchain and Environment, Directorate General for the Environment, Section Marine Environment, became also a partner of the co-ordination centre.

The mission of the co-ordination centre on ICZM is promoting sustainable management of the Belgian coastal zone and acting as a point of contact for all cross-sectoral themes in the coastal area.

To accomplish this mission the following objectives are formulated:

1) Communicate with regard to integrated and sustainable coastal zone management and assume an awareness raising role;
2) Act as a contact point in respect of integrated coastal zone management, nationally and internationally;
3) Assist with the implementation of the European Recommendation on ICZM (Recommendation of the European Parliament and the Council of 30 May 2002 concerning the implementation of Integrated Coastal Zone Management in Europe 2002/413/EC, publication of 6.6.2002), among other things by being present at the coast, by communicating with the people concerned and by offering support to the administration in the preparation of points of view and reports for European institutions;
4) Update the Sustainability Barometer for the coast and conduct an active communication strategy regarding sustainability indicators;
5) Promote the integration of planning and coastal policy.

The Coordination Centre, as main ICZM platform, tries to stimulate long-term sectoral planning, and self-reflection about integration. This can form the basis for a long-term strategy for the coast.

Since 2003, Belgium appointed a minister for the North Sea. This minister has the responsibility for the political co-ordination between the different actors that are involved in the management of the Belgian marine area. For a better co-ordination 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, five 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 at deriving 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 type surface water types (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, categorised 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.

6b. Canada

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:

- Sharply declining stocks of commercial ground fish over the last 10 years
- impacts on the economies of coastal communities
- Impact of offshore oil and gas exploration, development and production activity on fish stocks
- A wide range of negative environmental impacts is being attributed to coastal sea cage culture of salmon and suspended culture of blue mussels, including the degradation of fish habitat, effects of escapees from farm and disease transmission to wild fish stocks.
- 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 continue to be an issue in the coastal zone particularly near larger urban areas.
- 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, gives the minister of the Department of Fisheries and Oceans (DFO) the responsibility to facilitate the development of integrated management plans. While the Act makes reference to coastal waters and marine waters it does not define these two terms. In practice the 12 nautical mile line (headland to headland) and the low water mark bound the coastal zone. However the provisions of the Oceans Act are very broad and thereby DFO has an obligation to facilitate oceans management without regard to these borders.

The main goal for coastal zone management in Canada is the sustainable use of aquatic resources through integrated management and the application of the precautionary approach. DFO is being challenged to take an integrated approach in dealing with a number of current management and advisory issues. The scrutiny on human activities including commercial fishing has increased due to declining fish stocks. The impact of mobile fishing gear such as trawls, drags and suction dredges on commercial fish habitat and prey species is being questioned.

Activity related to integrated management in Canada was given a higher priority in March 2005 when the government committed "to move forward on its Oceans Action Plan 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." It articulates a government-wide approach to seize opportunities for sustainable development. Fundamental to this initiative are new oceans governance arrangements ("integrated management" under the Oceans Act), and ecosystem science to improve the management of the marine environment.

Phase 1 of this Action Plan is focussed on producing firm deliverables from existing integrated management pilot programs and initiating activities in other priority areas. These

priority areas are large ocean management areas (LOMAs) on Canada's three coasts. From east to west these LOMAs are Placentia Bay-Grand Bank, the Gulf of St. Lawrence, the Scotian Shelf, the Beaufort Sea, and the Pacific Central Coast.

The most advanced of the integrated management initiatives is the Eastern Scotian Shelf Integrated Management (ESSIM) plan. Several years of work with a comprehensive group of stakeholders has resulted in an agreement on a governance structure for decisions on integrated management plans. It is expected that a "high-level" IM plan will be tabled for cabinet approval sometime later this year. This high level plan will prescribe the basic goals of the IM plan and the framework for the development of operational objectives with the associated indicators, reference points and targets.

A framework has been developed for providing the scientific support for IM planning. Science is responsible for the production of an ecosystem overview and assessment report (EOAR). The ecosystem overview is a comprehensive description of the knowledge base for the IM area while the assessment report presents the current scientific understanding of the structure and function of the ecosystem. This latter report is typically a major challenge for our existing scientific understanding of marine ecosystems. Based on this report science is also responsible for developing a map of ecological and biological significant areas (EBSA). These reports encompass local ecological knowledge (LEK) as well as scientific knowledge and the process includes regular communication with the stakeholders. Finally ecosystem objectives are determined based on conservation and fisheries management objectives.

In parallel with these scientific activities there is a process to compile socio-economic information and to develop a human use atlas. Stakeholder groups are then engaged in a structured process to identify human use objectives. These human use objectives will then be brought together with the ecosystem objectives to prepare the overall management objectives, indicators and reference points. It is anticipated that by the end of 2007 much of this process will have been completed for ESSIM.

While the main focus of this initiative has been the offshore there are two coastal components of this initiative that are of particular relevance to WGICZM. One subcomponent is the development of an IM plan for the Bras d'Or Lakes, a brackish basin with limited connection to the sea. This initiative has been driven by local community interest and the EOAR and draft EBSA documents have been prepared. The second subcomponent is the development of a framework for preparing the EOAR and EBSA for coastal areas where the spatial scales of relevance are much smaller than for the offshore ESSIM plan. A major challenge for these inshore IM initiatives is the development of a structure to deal with a complex, multi-layer governance environment.

One of the other LOMAs, the Beaufort Sea will be highlighted at the Coastal Zone Canada 2006 Conference, to be held in Tuktoyaktuk, Northwest Territories from August 14 – 16, 2006. The Conference will address issues associated with the most susceptible of the Northern regions – its coastal zones. The first of this series to be hosted in the Canadian Arctic, the Coastal Zone Canada 2006 Conference examines three key themes that draw on the knowledge of Northern Communities, Arctic research scientists, politicians and stakeholders. The first, "Drivers of Change – Implications for the Arctic", explores the role climate change will play in the economic development of Northern Communities. "Community Well Being" underlines existing factors that define northern communities and means by which livelihoods and communities may be protected and preserved when addressing responses to climate change. Finally, issues of ocean governance in the context of the Ocean Action Plan, established by the federal government in March, 2005, and designed to provide an integrated national/territorial framework for ocean and coastal management and marine ecosystem protection, in addition to the Arctic Marine Strategic Plan, a collaborative program of eight circumpolar nations, adopted by the Arctic Council in 2004, and intended to create a comprehensive international framework to investigate pollution, coastal areas, and health in Northern communities, are examined in "Ocean Management and Governance."

Initial work has also started on the potential governance structure for the Georges Bank-Bay of Fundy area of eastern Canada. The trans-boundary fisheries in this highly productive area are already under an international (US-Canada) management framework. The challenge will

be to develop an acceptable governance structure for the integrated management of all human activities in this area. Preliminary discussions have also been held to determine how to develop the ecosystem overview and assessment reports. There are many existing coastal management initiatives in this area and there is considerable interest by stakeholders and local governments in a better integrated and more comprehensive approach to coastal resource management.

6c. Denmark

The costal zone in Denmark is an important spawning and nursery ground for both commercial and non-commercial fish 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 counties, while coastal land areas are managed by the counties 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, co-ordination among sectors and a high degree of public participation, which has developed over several years.

Key issues of concern in the coastal zone include:

- The severe decline in coastal fish populations of both commercial and non-commercial species;
- Marine aquaculture;
- Mussel dredging;
- Eutrophication;
- Shore nourishment;
- Extraction of raw materials.

ICZM Policy Activities

In the *Protection of Nature Act* (1992), revised in 1994, a coastal protection zone is set within a 100 m from the beginning of continuous land vegetation in summer cottage areas and similarly within 300 m in rural areas. In 2002 a special commission terminated an 8-year process of defining a permanent coastal protection line according to the rules laid down in the act, with exceptions placing it closer to the coast. The *Planning Act* (2000) describes a coast-nearness zone - a coastal planning zone excluding urban areas – with guidelines on planning and management in the coastal zone; since 1993 defined as generally extending 3 km inland. This zone is neither a no-build nor a no-development zone, but development has to be planned carefully in harmony with nature and landscape.

The Protection of Nature Act can be applied within the entire fisheries zone and EEZ. According to the *Planning Act* from 2000 it is imposed on the county councils to elaborate and implement plans for the quality and use of coastal waters. These plans are, in part, based on the concept of “environmental quality objectives” as described in guidelines on water quality planning from the *Environmental Protection Agency* (1983). According to these guidelines, all bays and fjords and other coastal areas out to a depth of 6 m or at least within 1 NM from the shore are to be considered part of the counties responsibility regarding environmental protection and water quality.

Concerning the exploitation of natural resources and raw materials and the use of the seabed for construction of any form, these matters are regulated according to a number of different laws. Normally an *Environmental Impact Assessment* in accordance with the EU-directive has to be carried out by the applicant. With respect to the management of *marine fisheries*, a coastal zone extending 3 nm from the low-water line is defined in the *Sea Fisheries Act*. Within this zone the *Sea Fisheries Act* has laid down restrictions mostly on the use of different fishing gears. However, since Denmark is part of the European Union the fishery is managed within the framework of the *Common Fisheries Policy* (CFP). The Danish *Commission of Commercial Fisheries* with members from the Ministry of Food, Agriculture and Fisheries, The Fishermen's Organizations, the PO's and the Union manages national fishery. There is no distinction between coastal and high sea fisheries; all fisheries follow the same regulations with a few exceptions.

ICZM Data Projects

In the management of mussel dredging and marine aquaculture the use of GIS mapping has been taken into use. The largest fjord in Denmark including adjacent coastal areas has been the site for a case study for integrated management. GIS has been implemented to provide a good overview of the different usages or conservation needs within the system and is available at: http://gis.dfu.min.dk/website/Limfjord/viewer.htm. Distance to beaches and summerhouse areas will also be incorporated.

Three counties bordering this fjord are involved in this case study and the partnership includes stakeholders such as fishermen and research institutes that advise on the stocks or the environment within the system. Inclusion of tourism, the terrestrial environment and other societal interests would provide a more integrated management for this ecosystem but have as yet not been addressed.

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).

Water Framework Directive

The EU Water Framework Directive (WFD) was accepted by the Danish Parliament in December 2003 and the work with implementing the directive continues on schedule. Denmark has been divided in 12 water districts and the responsible local authorities (counties) have been nominated. This new directive is not expected to increase the number of monitoring programmes in the coastal zone since such programmes have been running for the last 20 years. A six-yearly plan should be drawn up for each water district and should be ready by 2009. The planning has started this year with the publication of a working programme. This should be followed up in 2007 with an overview on the major problems within management of coastal waters, before the final proposal for a water plan is put forward for a 6-month public consultation in 2008. By 2009 a final six-year water plan should be in place together with a Natura-2000 plan and monitoring program. At present it is not clear to which degree the implementation of the Water Framework Directive will affect fishing and aquaculture in the coastal waters in Denmark. The municipal system has been reorganised and the new reform will be in place 1 January 2007. This would entail a shift in responsibility from municipality to government.

Natura 2000

The EU Habitat Directive (HD) has been in force since the beginning of the nineties and 254 habitats including bird protection zones have been defined (http://www2.skovognatur.dk/natura2000/om_natura2000/). Of these habitats, 52 include both land and marine areas, while 27 are solely marine. The work with marine habitat areas is not quite completed since within the EU there is still consultation going on regarding the

definitions that apply to defining marine habitats. The off-shore boundary to marine habitats which was originally perceived to cover only the Territorial waters (12 nautical miles from land) is now believed to include the Exclusive Economic Zone/Fisheries Territory i.e. 200 nautical miles from land. The habitat areas together with the bird protection areas constitute the Danish Natura 2000 areas, and a part of an ecological network of protected areas throughout the EU. There are only few restrictions for fishing activities within EU Habitats and several older marine fish farms established before 1992 are situated within EU Habitats. On the other hand no new aquaculture activities will be accepted within the EU Habitats.

The monitoring programme for Natura 2000 has recently been updated with a technical guide for monitoring fish in coastal waters aiming at gaining information on biodiversity within different defined habitat types, and at gaining information on specific fish species which have been given a high priority. These are the sea lamprey *Petromyzon marinus*, river lamprey *Lampetra fluviatilis*, houting *Coregonus lavaretus oxyrhynchus*, twait shad *Alosa fallax*, allis shad *Alosa alosa*.

In total, Natura 2000 marine sites cover an area corresponding to 11.2% of the Danish sea and land area combined. See map on Figure A6.1. These consist of either Habitat or Bird Protection areas or a combination of both. The majority (78.4%) are marine coastal areas covering 12.3% of the total Danish marine territory. Of the 254 Habitat areas, around 28% are terrestrial covering 7.4% of the Danish land area. The remaining habitat sites are marine and cover around 7.5% of the Danish maritime area.

Of the 113 Bird Protection areas, 17.7% are terrestrial covering 6% of the Danish land area and 82.3% are marine covering 11.4% of the Danish sea territory.

In 2005 a report was compiled examining the overlap and synergy between the Habitat Directive, Bird Protection Directive and the Water Framework Directive with focus on coastal waters. The report, which is in Danish can be found in the website www.skovognatur.dk/Emne/Natura2000/Seneste_nyt/Seneste_nyt_Natura_2000-2005/Seneste_nyt_Natura_2000-2005.htm. WFD and HD have parallel objectives and there is some overlap between these directives but the WFD ensures the strictest criteria emerging from the HD to be withheld. The criteria proposed for assessing 'favourable preservation status' are general and do not include higher trophic levels i.e. fish, birds and mammals.

The Water Framework- and Habitats Directives may have some influence on the new developing mussel farming industry in DK and on existing mussel dredging activities in the coastal waters.

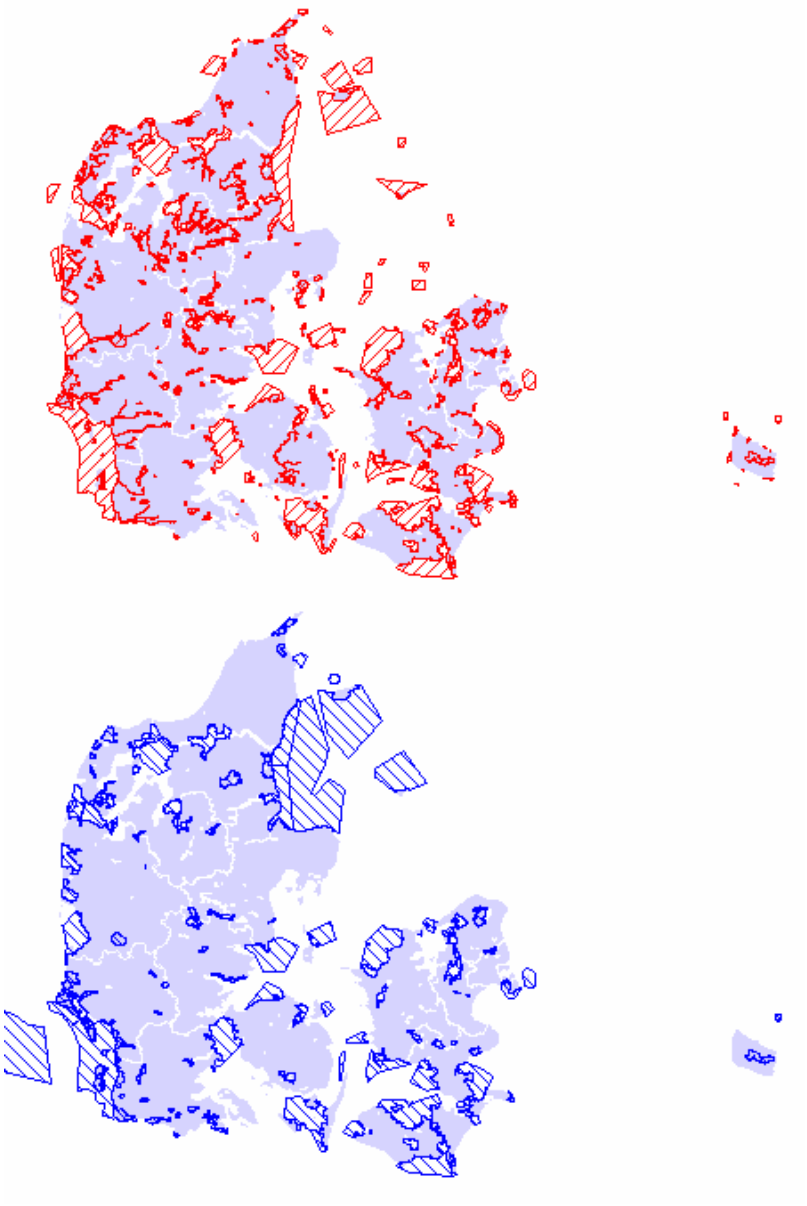

Figure A6.1. Areas designated as habitat protection areas (above; red), and bird protection areas (below: blue) within Denmark. Source: www.sns.dk.

6d. Germany

Germany has a coastline of 3379 km divided roughly into 1300 km along the North Sea and 2000 km along the Baltic Sea. Along the German Baltic Sea coast, the tide is almost absent and the water is brackish. It is a shallow coast with numerous bays, lagoons, cliffs, peninsulas and islands. The North Sea coast is in contradiction characterised by a tidal regime and mainly characterized by tidal flats, islands and marshland.

There is no official definition of the coastal zone in Germany. For terrestrial planning purposes on the local level responsibility generally ends at the mean high tide. The state of Schleswig-Holstein has established a 100-metre inland-protected strip along the coast under its

Nature Conservation Act and the state of Mecklenburg-Vorpommern has established a 200 metre wide inland- and a 200 m wide offshore-protected strip under its Nature Conservation Act. Most of the German North Sea coast is protected as National Park. In the most northern part of the North Sea coast in Schleswig-Holstein the waters between the National Park and the 12 sm line are designated as a whale sanctuary. Generally it needs to be noted that the territorial waters are in the responsibility of the regional (Laender) level, except public waterways, especially the access routes to harbours, while the public waterways and the EEZ are managed within the responsibility of the Federal government.

According to the national ICZM strategy the following areas have to be considered in ICZM (BMU: Integriertes Küstenzonenmanagement in Deutschland: Entwurf für eine nationale Strategie für ein Integriertes Küstenzonenmanagement (as from 13 Febuary 2006, see also www.ikzm-strategie.de (German only)):

- the Exclusive Economic Zone (EEZ);
- coastal waters;
- transitional waters in the sense of the WFD;
- in estuaries those waters, which are influenced by the tide;
- on the terrestrial side the adjoining rural counties (Kreise);
- flexible handling of inland boundaries according to the specific problem to be addressed.

Key issues for ICZM in Germany are:

- the development of offshore wind-farms in the EEZ;
- the increase in planned sediment extraction activities in offshore waters;
- the establishment of nature conservation areas in the framework of the EU habitat and bird directive;
- the development of ports and harbours, especially in Hamburg, Wilhelmshaven and Bremerhaven;
- the decline of fish stock due to over-fishing;
- the preservation of tourism as major economic factor for the coastal region
- coastal defence strategies;
- the possible development of inshore and offshore aquaculture.

ICZM policy activities

In relation to coastal management, both the federal government as well as the federal states (Bundesländer) have joint responsibility for most areas of coastal planning issues. The Federal Ministry of Transport, Construction and Housing is responsible for providing national guidelines and coordinating planning policy from which the individual states derives their own planning legislation. This entails that for regional planning, water management, coastal protection, nature conservation and others the federal states establish their own legislative structure and adhering laws, albeit having to be in accordance with the federal legal framework.

Due to increasing activities in offshore and coastal waters, especially planning of offshore windfarms, the federal states extended spatial development and provided spatial plans dealing with human activities and potential conflicts in the territorial waters. According to the Federal Building Act, spatial planning will be introduced for the German Exclusive Economic Zone (EEZ). The formulation of targets and principles for spatial development in the EEZ is currently in preparation and will be accompanied by an environmental assessment report. Both are expected to be released during 2006.

A very detailed report covering human activities and the institutional setting from the perspective of spatial planning has been elaborated within a research project of the Ministry of Transport, Construction and Housing and the Federal Agency for Housing and Spatial Planning. This will be published in a final version before summer 2006. The results of the research project including recommendations for the national ICZM strategy have been discussed with a wide range of stakeholders and scientists in two conferences, one in October 2003 and one in February 2005. A final report will be issued during the first half of 2006. Interim results have been published in several conference proceedings.

Following the conference in February 2005, a national ICZM strategy (www.ikzm-strategie.de, German only) has been prepared in 2005 by the Federal Ministry of Environment. The strategy will be publicly discussed end of April 2006 on a conference in Bremen. It includes a revised stocktake of human activities based on the above mentioned research project as well as a description of the legislative setting.

With respect to the EU Habitat and Bird Directive the federal states of Schleswig-Holstein, Niedersachsen and Mecklenburg-Vorpommern identified areas in the territorial waters that have been or will be soon reported to the Commission. Based on the work of the Federal Agency for Nature Conservation, the Federal Ministry of Environment is proposing areas under the Habitat Directive and under the Bird Directive for the German EEZ to the federal government.

On 25 June 2002 the EU Water Frame Directive was implemented into national law. By the end of 2004 the different national working groups will finish their evaluation on the ecological state of the German coastal waters.

The federal government as well as the Laender are also involved in the development of the Marine Policy under the frame of the EU. Discussion concerning the EU Marine strategy is just about to start. At the Wadden Sea level a major instrument of trilateral cooperation is the Trilateral Wadden Sea Cooperation. Extending from the traditional nature protection focused approach of the trilateral cooperation, the Wadden Sea Forum focuses on development issues and developed a range of development proposals which are expected to guide future development within the Wadden Sea area. The members of the forum are local and regional representatives from authorities as well as from local communities, NGOs and interest groups. Representatives from the government of the federal states and from the federal government participate as observers in the forum.

ICZM data projects

The Federal Maritime and Hydrographic Agency (BSH) has established an information system called CONTIS, which is the acronym for Continental Shelf Information System. This GIS database comprises information on the different existing and planned uses like offshore windfarms, pipelines, cables for energy transfer and telecommunication, military training areas, sediment extraction sites, dumping sites for dredged material, shipping routes, anchoring areas as well as nature conservation areas on the German shelf. Maps can be downloaded from the BSH website (see www.bsh.de/en, go to CONTIS maps).

There is a wide range of other projects and mechanisms dealing with environmental data and/or meta data, especially regarding the physical setting and environmental conditions of the North Sea and the Baltic Sea.

ICZM research projects

ICZM development in Germany is accompanied by two large pilot research projects (currently funded from 2004-2007), each of them with a range of subprojects. The aim is to accompany ICZM development with relevant research as well as methodological development for ICZM including tool development.

1) Zukunft Küste Coastal Futures: The project is designed to support sustainable development along the North Sea coast of Schleswig-Holstein. The thematic focus is on the assessment of interactions regarding offshore-windfarms, including impacts for regional economic development and infrastructure, conflicts between stakeholders and associated societal values like the perception of the coast by local people. Based on scenario techniques as integrating element for natural and social sciences, the project works along four lines of ICZM:
   a) human demands and perceptions and the communication processes between stakeholders;
   b) dealing with risk and uncertainty in ICZM;
   c) dealing with development chances and potentials in ICZM;
   d) managing and steering sea use changes at different scales.
2) ICZM-Odra: The aims and tasks within the project result from the specific situation and demands of the region, especially with the aim to establish and support a regional initiative on ICZM. Major element for public participation and the involvement of authorities is the Regional Agenda 21 'Oder Lagoon'. The creation of sustainable perspectives and structures, exceeding the duration of the project, is the core of all activities.

Other research projects include RETRO (2003–2005), which analysed several case studies of formal planning and permission procedures in relation to ICZM and the junior research group IMPULSE, which works with modelling in an ICZM context.

It should be noted, that a range of projects funded under the EU-INTERREG program for the North Sea and Baltic Sea regions dealt with ICZM issues or coastal and marine planning activities. Maybe the most prominent one for the Baltic Sea was the **BaltCoast** project, which covered a range of case studies dealing with spatial planning and typical conflicts between different interests in coastal areas. For the North Sea several projects dealt with issues like coastal defence, but also with shipping safety. The **POWER** project deals with offshore wind farm development, especially from the perspective of regions, which hope to benefit economically from this development. The project includes a range of activities dealing with regional economic impacts and strengths and weaknesses of these regions in this respect.

6e. Ireland

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 stocktake to identify the major actors, laws and institutions that influence the management of their coastal zone. Ireland is in the process of finalising 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 stocktake 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. Ireland's coastline is 7,100 km long

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, co-ordinated social partnership and stable public finances. In 2004, Gross Domestic Product (GDP) was €149 billion.

Key issues for ICZM in Ireland:

- 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 & 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 Communications, Marine and Natural Resources under the *Foreshore Act 1933* as amended. The Foreshore Acts require that before the commencement of any works or activity (including the erection of any structures, the laying of pipes and cables and dredging) on State-owned foreshore a licence or lease must be obtained from the Minister for Communications, Marine and Natural Resources. In addition to a Foreshore Act, aquaculture activities are regulated by the *Fisheries (Amendment) Act 1997*, which requires all aquaculture to be carried out under an aquaculture licence issued by the Minister for Communications, Marine and Natural Resources.

Natura 2000

Ireland has selected 544 Natura 2000 sites and of these 158 have a marine element noted in their selection. A total of 4196 km^2 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*. The legislation provides for the protection of the status of all waters, the establishment of "river basin districts" (RBDs), co-ordination of actions by all relevant public authorities for water quality management in an RBD including cross-border RBDs, characterisation of each RBD, establishment of environmental objectives and the development of programmes of measures and river basin management plans (RBMP).

Eight RBDs have being established on the island of Ireland, North and South. 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. 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 lakes (above 50 hectares), 196 transitional and 113 coastal water bodies.

A baseline risk assessment of human pressures and impacts on all water bodies has been completed. In terms of environmental objectives, the Directive aims to ensure that there is no further deterioration in the status of any waters and that, by 2015, all waters achieve at least good status or such higher status as is appropriate in the case of protected areas. 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, 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 characterisation will be focussed on these water bodies to confirm risk.

6f. Norway

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 utilisation 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, 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 neighbourhood. 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 and benefits from marine protected areas in coastal areas;
- 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/).

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.

Water Framework Directive

The implementation of the EU Water Framework Directive is in progress and according to the timetable agreed upon. The water along the Norwegian coast are divided into 23 coastal water types, and with references to these types, more than 1 500 water bodies are identified and classified with respect to ecological status. The classification should be considered as a first approach and will be more carefully evaluated by the new regional WFD-authorities. In addition there are some efforts on stakeholder involvement associated with the implementation of the WFD.

6g. Poland (not updated since 2004)

There is no precise legal definition of the entire coastal zone in Poland; therefore boundaries are taken according to the purpose of different needs and different activities. For the purpose of coastal defence against erosion the “Technical Belt” has been established legally. It is “an area designed for maintaining the coast in a state conforming to the requirements of safety and environmental protection”. It extends along the whole Polish coastline and includes the surf zone and a 200 meters wide terrestrial strip. In some areas, it has been increased to as much as 1 km in width, but in urban areas and along the shores of the lagoons it can be narrower. The relevant Maritime Office must approve all uses of the strip; however it is primarily intended for coastal defence and environmental protection

The total length of the open Polish coastline is 524 km and 843 km when including length of the coasts of lagoons. It includes mostly sandy shores (about 60 %), cliff coast (about 20 %) and delta plains (about 10 %). Most of the coast is open and subjected to sea erosion. There are two open bays (Pommeranian Bay and the Gulf of Gdansk), one semi enclosed bay (Internal Puck Bay) and two lagoons (Szczecin and Vistula Lagoon). These morphological units can be regarded as ecological sub-systems (also managerial units).

Perhaps the most important key issue is erosion of the coast. Over 100 km of the coast is now protected in some form: groynes, seawalls, bulkheads, revetments, and increasingly, artificial beach nourishment.

The coastal zone is a traditional mass recreation and tourism activity which is almost exclusively concentrated on summer season, therefore in some places exceeding environmental and infrastructure capacity. A number of popular tourist spots have experienced devastation of flora on sand dunes and cliffs and deterioration of coastal forests.

There is no national legislation and/or national policy that can be identified as ICZM plans, however there is so called “spatial planning” which can be regarded as a sort of substitute to ICZMs. During the last decade there have been several local initiatives taken which can be regarded as ICZM planning. Unfortunately most of these initiatives were confined to administrative borders and did not really cover natural borders.

6h. Spain

The National Shores Act, "Ley de Costas", defines the coastal zone as the shore of the sea and its inlets between high and low water marks of equinoctial tides, or up to the limits reached by the waves of the major storms; along the river margins it extends as far as the effects of the tides are noticed. The coastal zone also includes all saltmarshes, lagoons, and, in general, all lowlands than can be flooded by sea either through waves, tides or underground infiltration, the beaches and cliffs. The Act establishes a 100 m-wide area, "Servidumbre de protección", extending along the landward side of the coastal zone where all human activities are strictly regulated; for some of them the regulated area extends to 500 m from the landward side of the coastal zone. 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 public domain, 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 30 % of the human population lived in coastal municipalities in 1995;
- 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, a Master Plan for Coastal Sustainability is being promoted by the Spanish Government as an instrument for the Implementation of ICZM at the Spanish national level. This new instrument is based on a framework for the integration of coastal administrations at national, regional and local level, completed by a strong public participation mechanism. The objective of the plan is the planning of coastal works and initiatives under the principles of sustainable development and the promotion of knowledge-based decision-making along the whole process, integrating techniques for the assessment of environmental and socio-economic issues with spatial database technologies and numerical modelling of coastal processes.

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 retard in the identification of the SACs and on their protection was manifest.

Legislation establishing the basis for the Spanish National Hydrological Plan (SNHP) was passed by the Spanish Parliament in July 2001 and entered into force in August 2001. The Plan had two parts: A new water transfer of 1,050 cubic hectometres of water per year from the Ebro river to another four basins in the east of the country and, secondly, a “package” of 889 public works. The Ebro water transfer was the main bulk of the SNHP. The impacts of this water transfer could ultimately include the total disappearance of the Ebro Delta (a proposed Special Area of Conservation under the EC Habitats Directive, a Ramsar site and the third most important wetland in Spain). The change of Government in 2004 and a more environmentally friendly attitude has changed this approach, following EU environmental recommendations. A new strategic actuation towards sustainable water use and preservation and restoration of associated 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 fulfil 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, 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 Governement 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 developping 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.

6i. Sweden

There is no formal definition of the coastal zone but the jurisdiction of the smallest administrative unit, the municipality, comprises land and coastal waters to the 12 nautical mile line. Each municipality is obliged to have an overall plan for land and water use within their jurisdiction. On regional and national scales, the definition of the coastal zone varies depending on activities and resources being managed, e.g., coastal fishery are sometimes defined by distance to the baseline (1–4 nautical miles) and sometimes by vessel size rather than by geographic boundaries.

Sweden's coastline is about 7,600 km long, including mainland bays and the coasts of the larger islands. The salinity of the water decreases from about 30 parts per thousand in the Skagerrak to about 1 part per thousand in the northern Bothnian Bay. The marine ecosystems off the Swedish west coast are rich in species whereas the estuarine ecosystems in the Baltic are characterised by few species occurring in large numbers, and the co-occurrence of marine and freshwater species.

Key issues for ICZM in Sweden:

- In the inshore areas of Sweden, several problems threaten a sustainable use of the coastal resources, e.g. local over-fishing, rapidly developing recreational fishing and fishing tourism, conflicts between stakeholders with differing interests;
- Poor economy in the commercial fisheries and increased use of ecosystem goods and services in coastal areas.

ICZM Policy Activities

To obtain a long-term sustainable development the Swedish parliament has approved on 15 national environmental quality objectives. One of them –"A Balanced Marine Environment, Sustainable Coastal Areas and Archipelagos" – specifically apply to the marine and coastal areas. To achieve this objective eight interim targets were decided in 2001

(http://miljomal.nu/english/english.php). The interim targets include actions such as long-term protection of the marine environment, action programmes for endangered species and fish stocks, control of catches to enable fish stocks to recover and to reduce by-catch of mammals, as well as birds and undersized fish, to levels that do not have an adverse effect on the populations.

The fisheries co-management initiative

The Swedish Board of Fisheries has been commissioned by the Government to investigate the possibilities for local and regional co-management of fisheries in Sweden. The Government wants to continue and develop the work with new forms of fisheries management in coastal and inland waters. Regional development is the focal point of the work. The Government seeks a broad participation and refer to the ongoing process in the EU with Regional Advisory Councils (RAC) and the EU guidelines for Integrated Coastal Zone Management (ICZM).

The Government points out that not only the commercial fishing fleet should participate in the process, but also other stakeholder groups that may locally affect the resource, such as anglers or subsistence fisheries. More interest groups are welcome to participate such as the universities, nature conservation groups and fisheries industry. Furthermore, the process of fisheries co-management should include ecological as well as social and economical aspects of sustainable development.

An important part of the Government remit is to identify ways of working with local and regional fisheries co-management. Currently, there is some confusion about what may be implied with the concept in the Swedish context. Participation from different interests and stakeholders in the management process is clearly pointed out, but the Government notes that national authorities must still have a central role. The Government is looking for forms of cooperation and decision making processes that may be a base for future work with co-management of fisheries in Sweden.

ICZM Research Projects

Several studies are being conducted to address the key issues. Areas of current and future research relevant to coastal zone management in Sweden are as follows:

- Integrating fishery with environmental management and social sciences.
- To harmonize management units with spatial distribution of local resources (e.g., genetic characterization of sub-populations) and to identify important local spawning sites and nursery areas.
- Assessing effects of eutrophication, physical disturbances (such as increased boat traffic, dredging, constructions as e.g. harbours, obstacles in migration routes etc) and biological interactions (predation by seals and cormorants) on fisheries dependent on local resources.
- To develop fishery-independent monitoring systems of coastal stocks and schemes to obtain statistics concerning recreational fishing, as well as improving the quality of statistics obtained from commercial catches.

Water Framework Directive

In accordance with the EU Water Framework Directive, Sweden has been divided into 5 regional river basin districts each draining into one of the major sea basins surrounding Sweden. The Bothnian Bay, The Bothnian Sea, the North Baltic Proper, the South Baltic Proper and the Kattegat - Skagerrak. In each district a regional water authority has been established. It is of importance that there are no responsible governmental body on national level that coordinates the work among the five regional authorities. Instead, a committee or a board governs each water authority. The committee is lead by the county governor and the delegates are non-political civil servants appointed by government. The committee is solely

responsible for decisions regarding environmental objectives, programme of measures and river basin management plans. Each water authority has a secretariat with a responsible water management director. The secretariats task is to prepare different questions for the committee and to organise the work within the district.

The districts are subdivided into two or more sub districts with a county responsible for organising the work within each sub district. All counties have obligations and are on an equal level responsible for information and contributions from their own county. At each county there is a secretariat that is responsible for organising county work.

This new way of working means new institutional structures and new networks must be developed. Cooperation is central in this new way of working. The water-authorities have come up with a strategy for cooperation to ensure that all stakeholders have an opportunity to be part of the work with the WFD. The strategy is based on regional cooperation groups being formed, so called “water-councils”. These water-councils should take part in the all work with the WFD, as for example the forming of action programmes. The water-authorities have had a series of meetings and workshops to identify and involve stakeholders and the interest for this new way of working has been extensive. Norway is part of one of the five water districts and a dialogue has started up dealing with how and what the countries may cooperate about and to exchange data.

Dissipation of information is one important tool to involve stakeholders. As part of this work, an interactive GIS-map with information related to water and water management has been put together by the water-authorities and the counties. The map is accessible at www.gis.lst.se/vattenkartan. Here you can find the different catchment areas, protected areas and risk and effect evaluations from The Swedish Environmental Protection Agency. The map is being continuously upgraded and the information updated.

The Swedish Environmental Protection Agency is working with the development of new criteria for evaluation to ensure coherence within Sweden as well as with other EU member states. They also work with new regulations and general advice connected to the WFD.

There are a few pilot projects started up to get experience of working within the WFD. For example, NOLIMP is an INTERREG project where an evaluation of the waters connected to the catchmentarea of the fiord of Gullmaren has been made (http://www.gullmarn.org/).

6j. The Netherlands (not updated since 2004).

The coastal zone is the relatively small and dynamic zone between land and sea. It is defined as a strip of land and sea of varying width depending on the nature of the environment and management needs. It seldom corresponds to existing administrative or planning units. The natural coastal systems and the areas in which human activities involve the use of coastal resources may therefore extend well beyond the limit of territorial waters and many kilometres inland. 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.

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 must be ready by 2004 / 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. Finally, the policy agenda places great importance on shaping integrated coastal zone policy. It stimulates the development of the national government's vision of the coastal zone, which is based on the basic qualities of the coast: resilience, cohesion and horizon.

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.

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.

6k. The United Kingdom

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 Act extended marine fish farming to local authority control in terms of planning permission. 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 recognised, specifically in relation to dealing with coastal erosion and flood defence. The coastline around Scotland is highly indented 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 Scotland'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 UK's long complicated coastline, is summarised in the following table.

GEOGRAPHICAL AREA	LENGTH KM	% GB COAST
Great Britain total	18838	
England	5496	29%
Scotland (mainland)	6482	35%
Scotland (islands)	5295	28%
Wales	1562	8%

Key issues for ICZM in the UK:

- 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.
- 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 wind farm development.

ICZM policy activities

In the UK, Defra (Dept. of the Environment, fisheries and rural affairs) commissioned a stocktake on ICZM. This report was published in April 2004 and successfully summarises the current legal framework for managing coastal activities, including the roles of Government departments, executive agencies and non-departmental public bodies and local government.

The Stocktake findings present a mixed picture of how the principles of ICZM are being implemented in the UK. There are examples of good practice, for example local and regional coastal fora, communication links between local to regional government level appeared to be improving, but there is room for improvement in many other areas. These include: the sectoral approach to managing coastal issues in the UK, minimal long-term planning for ICZM, lack of engagement of the private and commercial sector, the need for clarification of the roles of individuals and organisations, and how ICZM can support other government policies (e.g. ecosystem approach), initiatives (e.g. marine stewardship), requirements (e.g. Water Framework Directive), and developing marine spatial planning.

The report also outlined Drivers that would influence future ICZM in the UK. Across the UK these include: The outcome of the Government's review of development in coastal and marine waters (to be published shortly); the outcome of the Government's Review of Marine Nature Conservation (Published July 2004); the development of the ecosystem approach to management and planning of activities at the coast; implementation of the EU Water Framework Directive and the programme of offshore renewable development. In England: the development of regional spatial strategies and the expected revision of planning policy guidance for the coast; the study by the Inter-Agency Committee on Marine Science and Technology into integrating marine and coastal data; development of second generation shoreline management plans; development of English Nature's Maritime Strategy. England and Wales have published a strategy document 'Developing ICZM Options for England and Wales' in December 2005.

In Scotland, the Scottish Coastal Forum coastal strategy (published July 2004), the Scottish Sustainable Marine Environment Project and the development of a Strategic Framework for the Marine Environment by the Scottish Executive (Published September 2004) are current ICZM initiatives. The Scottish Executive is committed to adopting the ICZM strategy by spring 2006.

In Wales there is the work of the Wales Coastal and Marine Partnership and the development and implementation of People, Places, Futures - The Wales Spatial Plan' and Northern Ireland are trying to establish a Coastal Forum to take forward a strategy for the management of the Northern Ireland coast.

(www.defra.gov.uk/environment/water/marine/uk/iczm/stocktake/index.htm)

Defra also publish a biannual newsletter, Wavelength, which is issued in the spring and autumn and designed to cover crosscutting government initiatives in the coastal and marine environment.

The Royal Society for the Protection of Birds (RSPB) and Scottish Natural Heritage jointly commissioned Hull University to make some recommendations as to how well the current system for managing Scotland's inshore fisheries is protecting the environment on which the fisheries depend. The RSPB is now working with the government and the fishing industry to investigate how these recommendations can be taken forward. The Scottish Executive has produced a strategic review, undertaken by the Scottish Inshore Fisheries Advisory Group, with the fishing industry and other stakeholders directly involved. The key output is a strategic framework for inshore fisheries in Scotland. This sets out a strategic direction for inshore fisheries policy and a network of inshore fisheries groups around Scotland to plan the management of inshore fisheries locally. This also signifies a change in the processes for policy development and decision making in relation to inshore fisheries. The fishing industry and other stakeholders have been directly involved in developing this new structure and direction for inshore fisheries, which is reflected in the plans for inshore fisheries groups. An action plan has been prepared in association with this strategic framework

(www.scotland.gov.uk/library5/fisheries/sfifs-00.asp).

This was published in March 2005, and includes consideration of the results of the collaborative project between Scottish Natural Heritage and the Royal Society for the Protection of Birds into Scottish Inshore fisheries

(www.rspb.org.uk/scotland/policy/inshorefisheriesreport.asp).

Coastal Fora: Many coastal forums have been set up to co-ordinate coastal issues at a local scale and are very succesfull. However, as was outlined in the ICZM Stocktake, they can suffer from the lack of sustained core funding.

Marine Stewardship: The first Marine Stewardship Report “Safeguarding Our Seas” was published in May 2002 and sets out the Governments vision and strategy for the conservation and sustainable development of our marine environment. A consultation paper (Seas of Change 2002) provided an up-date on progress made since May 2002; the responses to this have now been published. Key proposals in this report include application of the ecosystem approach, commitment to undertake a pilot for spatial planning and establish a working group to support and engage local coastal fora in England. A ‘State of the Seas’ report has also been published (March 2005) as part of the Marine Stewardship Initiative.

(www.defra.gov.uk/environment/water/marine/uk/stateofsea/index.htm)

ICZM data projects

There are several data projects in the UK ongoing or completed including: MDIP/MEDAG provides a framework for managing data and information across UK organisations; SEABED Map (SEArchable BEnthic Data) is an interactive and intuitive method for interrogating the huge amount of data that has been collated by MarLIN (Marine Life INforamtion Network); and ICZMap that was designed enable the integration of terrestrial and marine geographic data held by British Geological Survey, Ordnance Survey and United Kingdom Hydrographic Office and other organisations across the coastal zone, so that this can be accessed readily by users to satisfy diverse coastal zone applications and services. This project has now been completed and a final report published.

ICZM research projects

The UKSeaMap (formerly CMap) project is extending the work and outputs of the Irish Sea Pilot project to the sea area under UK jurisdiction, by taking a geophysical approach using

available physical datasets, and building on the methodology developed during the Review of Marine Nature Conservation (RMNC) to integrate, define and map landscape types. This is closely linked with MESH. The project is being implemented in two stages:

Stage 1: Deriving landscape units from existing geophysical information for: (a) seabed features and (b) water column features.

Stage 2: Exploring the ecological validity of landscape units using biological information

Natura 2000

SACs in terrestrial areas and marine areas out to 12 nautical miles are designated under the Conservation (Natural Habitats, etc.) Regulations 1994 (as amended). The list of candidate SACs is updated whenever the UK submits new data to the EC. The most recent tranche of cSACs was submitted to the European Commission on 30 July 2004. This comprised of no new marine sites, and minor amendments to four of the existing 382 marine SACs. As at 24 December 2004, there were 379 Marine Coastal and Halophytic Habitat SACs and three SCIs.

Sandbanks that are slightly covered by sea water all of the time.	23
Estuaries	15
Mudflats and sandflats not covered by seawater at low tide	27
Coastal lagoons	19
Large shallow inlets and bays	14
Reefs	33
Other vegetated habitats	104
Coastal sand dunes and continental dunes	147

The UK Marine SACs Project was set up to establish management schemes on selected marine SACs. Its activities have focused on a selection of twelve Marine SACs around the UK and on developing specific areas of knowledge needed for the management and monitoring of European marine sites.

WFD

The implementation came into force on the 2nd of January 2004, as The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003. There are to be nine river basin districts in England and Wales covered by The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003, which have been made jointly with the National Assembly for Wales. For the cross border river basin districts of Northumbria and Solway Tweed separate regulations have been introduced. At the end of November 2003 it was decided to have a single river basin district for Scotland, with separate arrangements for the cross-border area with England. These new arrangements were introduced by means of a Designation Order under the Water Environment and Water Services (Scotland) Act 2003. A water classification scheme is aimed to be in place by 2006. This will also need an assessment of habitat sensitivity with regards to fishing pressure and aquaculture developments. Once classification is completed, a monitoring programme will be developed. A EU Pilot River Basin network, comprised of fifteen river basin projects, to test the implementation process has been set up. The UK participates in this network through the Ribble Pilot River Basin project, located in the North West River Basin District. The UK Technical Advisory Group (TAG) was set up by the UK Administrations to provide technical advice to assist the process of implementing the WFD in the UK. It consists of the UK Environment and Countryside Agencies together with a representative from the Republic of Ireland (Department of Environment and Local Government). In the UK a group of Task

Teams are working towards selecting the tools for ecological assessment; inter-calibration and risk assessments in each of the river basin districts has been carried out.

Characterisation reports have been written for England and Wales (www.environment-agency.gov.uk), Scotland (http://www.sepa.org.uk/publications/wfd/index.htm) and Northern Ireland (www.ehsni.gov.uk/environment/waterManage/policy/policy.shtml).

ICES WGICZM- FRAMEWORK FOR COUNTRY UPDATES

Introduction

To include: General information on the key features of coast and sea

ICZM stocktake

ICZM strategy

Coastline length

Key issues

Policy activities

Data projects (Non EU projects)

Research projects (Non EU projects)

Natura 2000 position (Non EU countries submit information on any similar legislation)

Water Framework Directive position (Non EU countries submit information on any similar legislation)

Highlight problems applying ICZM

Include EU Country Report updates

http://europa.eu.int/comm/environment/iczm/home.htm

Annex 7: Monitor and report results generated from larger EU funded projects (PROTECT, MESH, etc) that are directly relevant to ICZM needs (ToR d)

Collated by Jessica Hjerpe, Sweden.

Many projects linked to ICZM aim at communication, building networks and information exchange such as best practice. As ICZM is new to most regions, many projects aim at developing tools for the implementation of ICZM in the area. A number of network projects are described below.

a. Name of Project: Coastal Practice Network (CoPraNet)

Estimated Time Frame: 2004 to 2006

Description

The Coastal Practice Network is a three-year Interreg IIIC project to help establish a coastal practitioner's network and bridge the gap between planners, managers and the research community throughout Europe. It has been set up to develop and exchange information on best practice in the coastal zone on the issues of sustainable tourism and coastal erosion and beach management. The network will serve to equalise the differences in regional coastal development by bringing together Priority 1 and 2 partners in a partnership embracing research, advisory and implementing organisations. CoPraNet has two primary objectives:

1) To develop a network of coastal stakeholders to exchange information and examples of best practice to support local and regional efforts for an integrated planning of coastal areas. This network must bridge the gap between planners, managers and the research community throughout Europe.

2) To support interregional exchange of best practice information on (a) sustainable tourism and (b) coastal erosion and beach management through an integrated approach.

Sectoral approaches to coastal development including tourism, beach management, erosion and nature conservation are no longer a sustainable option. Today, throughout Europe, coastal regions and local authorities are making efforts to develop integrated coastal zone management (ICZM) planning approaches to lead to a sustainable economic development. However, this effort is being hampered by a lack of an effective means of information exchange e.g. an example of best practice developed in a particular European region will not necessarily be introduced elsewhere because other regions are unaware of its existence.

Quality enhancement and sustainability are key objectives for tourism development. These should be part of an integrated, multi-sectoral planning approach which also ensures that conservation of coastal marine and natural resources (including landscape) is seen as a fundamental asset for regional recreation development. Within the context of sustainable tourism is the important question of beach management, linked to erosion. With one quarter of the EU's coastline currently eroding, despite the development of a wide range of measures to protect shorelines from erosion and flooding, local and regional authorities are facing major damage and risks to their coastal regions.

Links with ICZM: Special attention is been given to ICZM tools and techniques. In order to reach practitioners throughout Europe, the information and experiences collected during the project are being incorporated into a Clearinghouse and disseminated through the CoPraNet website www.coastalpractice.net

Results so far of relevance to ICZM: Informative website at www.coastalpractice.net. The development of a transparent international quality label for sustainable tourism destinations - ***QualityCoast*** - is currently in progress. The CoPraNet partners representing a tourism destination are developing activities to validate and test a core list of quality milestones – a set of key high level conditions for which information will be made available and operational. Information of the four pilot locations is available at

http://www.coastalpractice.net/en/qualitylabel/index.htm.

Two of these locations are located on the island of Ireland, Newcastle, Co. Down and Cork Harbour.

b. Name of Project: European Network on Coastal Research (ENCORA)

Estimated Time Frame: 2006 to approximately 2009 (6th Framework programme)

Description

The capacity to generate knowledge for sustainable coastal development is spread in Europe over many hundreds of institutes and research groups. Many hundreds of institutions have responsibility for coastal policy-making and coastal management. Many similarities exist in the research and management tasks carried out by this large number of organizations. However, the links existing at present within the coastal science and practitioner community are weak. Europe is not yet capable of taking advantage of its scale and to efficiently tackle the challenges posed by the future of our coasts. The ENCORA Coordination Action provides a networking mechanism that contributes to overcoming existing fragmentation - in effect it is a network of networks.

Recently, Ireland formed an Irish Coastal Network (I-CoNet), which is now a part of the ENCORA Network.

Ten trans-national, cross-disciplinary Thematic Networks, led by institutions with outstanding expertise, address major ICZM issues; they include participants from all EU countries, including those where a national network is not yet established. After three years the project will deliver a fully operational and tested European coastal network structure supporting the exchange of knowledge and experience within and between the communities of science, policy and practice.

ENCORA aims to:

- Initiate a self-sustaining process of cooperation in Europe, with new mechanisms for knowledge-sharing within and between the communities of coastal sciences and coastal practice;
- Stimulate multidisciplinary approaches;
- Strengthen communication between scientists, practitioners and policymakers.

Links with ICZM: The project is a network of excellence for ICZM. This project will help to identify urgent coastal issues and share best practices in coastal management and policy making. It will, over the long-term, help to find the balance between environmental, economic, social, cultural and recreational objectives for coastal areas.

Results so far of relevance to ICZM: This project has a website at www.encora.org.

To date 13 member states have organizations affiliated to ENCORA. Networking facilitation will commence during May 2006.

Usefulness to ICZM in general: The multi-sectoral and multi-disciplinary approach adopted by ENCORA will encourage the exchange of knowledge and experience between sectors,

disciplines, communities and member states to aid the development and implementation of ICZM in Europe.

c. Name of Project: Coastal Communities Network (CoCoNet)

Estimated Time Frame: 2002 to 2005

Description

The objective of this project was to establish a network to promote Integrated Coastal Management (ICM) in the INTERREG III A - Southern Irish Sea - area and to identify future INTERREG III A area projects. The project developed a network of community stakeholders with an interest in sustainable management of their local coastal resources. Stakeholders include national and regional authorities, local community interest groups (fishermen, tourist operators, fish farmers, conservationists, property developers, shipping operators, sailors, coastal rescue teams, teachers etc.). Three workshops were held and the full reports and presentations for all Workshops are available from the CoCoNet website at http://coconet.ucc.ie.

The final workshop was held in Wexford in June 2004 and culminated in the Wexford Declaration calling on governments to support the empowerment of local communities, including local government, to secure local sustainability of the coastal and marine environments.

Wexford Declaration

In Recognition of the EU ICZM Recommendation and in the context of the principle of subsidiarity, governments are urged to support the empowerment of local communities, including local government, to secure local sustainability of the coastal and marine environment.

To achieve this, priority actions include measures to: Engage local communities in the formulation of coastal policy and in the adoption of responsible local management practices.

1. *Secure government support for the development and implementation of ICZM programmes, including national programmes, which promote local actions and the provision of guidelines for local authorities.*
2. *Raise public awareness, respect and understanding of the coastal environment, including its natural, historic, cultural and socio-economic character, and related issues.*
3. *Share experiences of and promote best practice in implementing local community-based management initiatives.*
4. *Facilitate communication and collaborative working between coastal stakeholders in recognition of the environmental, socio-economic and cultural benefits of integrated management.*
5. *Support and promote coastal networks in achieving ICZM at all levels.*

Links with ICZM: Focus entirely on ICZM

Results so far of relevance to ICZM: Website **(**http://coconet.ucc.ie) from which workshop reports and final reports are available. The publication and wide circulation of the Wexford Declaration has helped to raise awareness of the public as well as local and national government.

Usefulness to ICZM in general: Important initiative in raising awareness and formation of links between planners and ICZM practitioners in the Southern Irish Sea region. The project had a direct impact on the development of the Corepoint project, the Living Coasts, Living

Seas project and on the establishment of a national advisory group on ICZM facilitated by the Irish Department of Communications, Marine and natural Resources.

d. Name of Project: Coastal Zone Management Network (CZM-Net)

Estimated Time Frame: 2003 to 2004

Description

The EU's European Strategy for Integrated Coastal Zone Management aims to promote a collaborative approach to planning and management of the coastal zone within a philosophy of governance by partnership with civil society. This also includes collaboration between national and trans-national agencies and the services of the European Commission in order to harmonise the overall approach to coastal zone management. This collaboration is the aim of the Coastal Zone Management Network 'CZMnet'.

CZMNet brought planners from both Wales and Ireland together, under the Interreg IIIA programme, to discuss topics of mutual interest such as coastal zone planning for climate change, coastal zone by-laws and development control in a dynamic environment. By sharing such knowledge, problems encountered by some can be avoided by others with the ultimate beneficiary being the coastal environment and a more unified approach to coastal zone management.

The emphasis in CZM-Net was towards the way different aspects of coastal management interact, with a view to deepening understanding of the concept of integrated coastal zone management following publication in June 2002 of the European Union's Recommendation concerning the Implementation of Integrated Coastal Zone Management in Europe (ref. 2002/413/EC).

Links with ICZM: Developed a network of planners between Wales and Ireland to exchange views on ICZM

Results so far of relevance to ICZM: CZMNet final report published on the http://coconet.ucc.ie website.

Usefulness to ICZM in general: Successful network formed and the report provides some useful information on the Irish and Welsh situation.

e. Name of Project: Corepoint

Estimated Time Frame: 2004 to 2008

Description Concerns for coastal problems are shared across NW Europe coastal countries. Following the completion of the Demonstration Programme on ICZM a set of recommendations on a European Strategy were formulated. Subsequently, there have been varying levels of engagement with this strategy across EU Member States. The Corepoint partners have identified the lack of integrated planning**,** management, engagement**,** communication (with political representatives, general public and between researchers and policy makers) and the lack of sustained capacity and expertise within local authorities as being important barriers to ICZM**.**

To overcome these problems it is essential that experience in the implementation of ICZM be developed both at a European and local level. This should strive to deliver concrete solutions consistent with current best practice and include social and political involvement. Ultimately, this should help to deliver a NW European spatial vision on ICZM.

Taking the concept of "think global, act local" this project recognises the importance of spatial planning and decision-making at the local level for bringing real change to coastal communities. This action will implement ICZM initiatives in local study areas throughout NWE, by building on the lessons learned from the EU Demonstration Programme on ICZM

Links with ICZM: This project is based on the EU Principles of best practice in ICZM

Results so far of relevance to ICZM: Website http://corepoint.ucc.ie/index.php http://corepoint.ucc.ie/index.php A number of ICZM capacity building initiatives have been developed in local authorities involved in the partnership through the development and delivery of the Corepoint ICZM School. Links between researchers and policy makers have also been strengthened.

Usefulness to ICZM in general: Could assist in the development of national policies on ICZM. Corepoint will help to make the EU principles of best practice in ICZM relevant to a wider audience in NW Europe by providing concrete evidence of management solutions that work.

f. Name of Project: AquaReg

Estimated Time Frame: 2003 to 2006

Description: Galicia (Spain) the Border Midlands and West Region (BMW-Ireland) and Trøndelag (Norway) are all strong marine regions, situated at different latitudes along the Atlantic Coast. The AquaReg CZM Project is looking at reviewing best practice in aquaculture and inshore fisheries management and producing guidelines of best practice for use by these industries. It is a co-operative project between the Marine Institute in Ireland, CETMAR (Socio-economic institute for the Marine) in Galicia, Spain and the Sor-Trondelag Fylkescommune in Trondelag, Norway. The aim of Aquareg within these regions is to establish a long-term cooperation in aquaculture and fisheries and to make more efficient use of the experience and knowledge of aquaculturists, fishermen and scientists, across regional and national borders.

Three strategies have been identified:

- **AquaLink:** Linking aquaculture/fisheries business and research. The major element of AquaLink is to stimulate the collaboration between researchers and the aquaculture business, and the implementation of commercially oriented innovation projects.
- **AquaEd:** Education and training. AquaEd introduces an interregional European dimension to education and recruitment in aquaculture, fisheries, and seafood industries in the cooperating regions. It will contribute towards formation of long-term collaborative relationships and increased workforce mobility between European coastal regions.
- **AquaPlan:** Coastal zone planning and management. AquaPlan comprises exchange of experience and best practice between planning authorities at local and regional level, to achieve positive interactions amongst coastline users. The creation of a basis for a biological and commercially sustainable industry in a main objective of AquaPlan.

Links with ICZM: Integrated spatial planning and management of the coastal zone is still a fairly new exercise for most coastal regions. AquaPlan comprises exchange of experience and best practice between planning authorities at local and regional level, to achieve positive interactions amongst coastline users, contributing to the maintenance of coastal communities in the future.

There is a strong need for knowledge about the quality and conditions of the coastal marine environment: AquaPlan will also focus on restocking and recovery of marine species contributing to create a basis for a biological and commercially sustainable industry.

Results so far of relevance to ICZM: Informative website at www.aquareg.com

Usefulness to ICZM in general: The AquaReg approach and ambition is concrete co-operation at operational level, involving marine industries, marine researchers, marine schools and coastal zone planners.

g. Other projects

A range of projects funded under the EU-INTERREG program for the North Sea and Baltic Sea regions are dealing with ICZM issues or coastal and marine planning activities. Maybe the most prominent one for the Baltic Sea was the **BaltCoast** project, which covered a range of case studies dealing with spatial planning and typical conflicts between different interests in coastal areas. For the North Sea several projects dealt with issues like coastal defence, but also with shipping safety. The **POWER** project deals with offshore wind farm development, especially from the perspective of regions, which hope to benefit economically from this development. The project includes a range of activities dealing with regional economic impacts and strengths and weaknesses of these regions in this respect.

2. One project concerns the use of Marine Protected Areas as a management tool in coastal zone management.

a. Name of Project: Ecosystem conservation and fisheries management through Marine Protected Areas (PROTECT)

Estimated Time Frame: January 2005 to June 2008

Description

Marine protected areas are currently seen as a tool for both fisheries management and marine environmental protection. However, although many potential benefits of MPAs can be identified, little empirical evidence exists to demonstrate the full potential of MPAs in a temperate water setting. This is partly due to insufficient scientific knowledge and tools for MPA selection, design, implementation, monitoring and evaluation. In particular, linkages between fisheries management and marine environmental protection require attention.

PROTECT is a new research project involving 17 European institutions aiming 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 coordinated by the Danish Institute for Fisheries Research.

The project seeks to assess the costs and benefits of conservation and fisheries management through effective marine protected areas. Marine Protected Areas (MPA) are seen as an instrument for improving both fishery (including aquaculture) management and marine environmental protection. Although such benefits are often easily identified, little empirical evidence exists to demonstrate the real effectiveness of MPAs. This is due to insufficient information and instruments for MPA design, monitoring and evaluation.

The project's aim is to provide European policy-makers with improved tools for the identification, design and management of MPAs. It will bring together the collective expertise of 17 leading European marine research institutes who will:

- Evaluate the potential of MPAs as a tool to protect sensitive species and habitats against the effect of fishing;

- Develop scientific methods and information products to design and evaluate the effect of MPAs;
- Co-operate with other EU-funded projects, such as EMPAFISH;
- Organise a series of thematic workshops and compile reports that will draw from experience and lessons learnt from specific case studies.

Links with ICZM: Marine Protected Areas (MPA) and the Natura 2000 network are seen as a vital part of the strategy to conserve and protect the marine ecosystem. The vast majority of Natura 2000 sites (most of which will be designated MPA also) are coastal and fundamental to managing the coastal zone.

Results so far of relevance to ICZM: Project is still in the early stages, but information can be found at

1. Website: www.mpa-eu.net

2. Flyer (see website)

3. Report on the State of the Art of MPAs as a Tool for Ecosystem Conservation and Fisheries Management March 2006. pp 1–150. (see website).

Usefulness to ICZM in general: MPAs can be used as a management tool in coastal zone management. Furtheron, they could be very useful in developing a strong ecosystem approach to managing the coastal zone and in particular fishing and aquaculture activities. The project should identify those activities that would be consistent with the objectives of the protected area and those that are not.

3. A couple of projects deal with the use of GIS (spatial planning) as a tool in coastal zone management

a. Name of the project: BALANCE

Estimated timeframe: until 2007

Description

The Baltic Sea is subject to severe environmental degradation caused by commercial and leisure activities such as dredging, fisheries, coastal development and land based sources of pollution, placing increasing pressures on vulnerable marine habitats and natural resources. Conflicting priorities and lack of integrated management planning is a key obstacle for resolving the current state of affairs. An ecosystem-based approach to marine management, based on trans-national spatial planning, would be a strong tool to overcome this challenge. Spatial planning, which merge data on marine landscapes, habitat distribution, economic values and conservation status with information on user practices and stakeholders dependence on natural resources, is a needed for a holistic planning and informed decision-making. E.g. trans-national spatial planning can assist implementation of the measures set in place for protecting the ecosystem structure, such as the Natura 2000 Network, by facilitating a balanced designation of sites representing a continuum of marine habitats, as well as promoting “blue corridors” between vulnerable areas.

Today, a set of technical constrains halt the use of an integrated management approach, including lack of habitat maps, lack of data, tedious data exchange, inconsistent data formats and generally poorly co-ordinated efforts between stakeholders. BALANCE aim to provide the BSR with marine spatial planning tools through development of a management template, which can help to overcome these problems.

The work package composition illustrates this aim. WP1 collate, intercalibrate and validate cross-sectoral and trans-national data in order to provide a cost-effective use of existing data.

WP2 will use these data to characterise marine landscapes and their distribution in the entire Baltic Sea, including Skagerrak. Habitat maps will be produced for 4 transnational pilot areas based on existing data and through the development of predictive models. WP3 will use these maps to evaluate the ecological coherence of the Baltic network of marine protected areas (MPAs), and to develop the "blue corridors" concept and promote its use. WP4 will use the habitat maps, the MPA evaluation and stakeholder involvement to develop a regional zoning approach in order to show the value of marine spatial planning. WP5 will disseminate the results through appropriate media defined by the target audience.

The BALANCE legacy will be a trans-national marine management template and increased public awareness, which can assist stakeholders in planning and implementing effective management solutions for sustainable use and protection of our valuable marine landscapes and unique natural heritage. BALANCE thus provides a trans-national solution to a trans-national problem.

Links with ICZM

Habitat maps for marine juvenile flatfish in an area located in the inner Danish waters will be made, based on bathymetric GIS maps of the area, a number of abiotic data series, and a time-series of fish catches dating back to 1951.

Inshore nursery and spawning areas for marine fish species in the Swedish Archipelago will be mapped. Habitat models of benthic habitats (e.g. community structure, biodiversity, biomass and/or densities of flora and fauna) will be produced along the Lithuanian coastline.

Results so far of relevance to ICZM

All habitat maps generated could be useful for management of coastal areas with respect to flatfish juvenile nursery grounds, spawning areas for important fish species and vegetation coverage.

b. Name of project: MESH - Mapping European Seabed Habitats

Estimated timeframe: 2004 to 2007

Description

MESH is an international marine habitat mapping programme. A consortium of 12 partners across the UK, Ireland, the Netherlands, Belgium and France gained financial support from the EU INTERREG IIIB fund for this international programme. The MESH partnership covers all five countries in the Interreg (IIIb) north-west Europe area, drawing together scientific and technical habitat mapping skills, expertise in data collation and its management, and proven practical experience in the use of seabed habitat maps for environmental management within national regulatory frameworks.

MESH aims to produce seabed habitat maps for north-west Europe (see MESH study area) and develop international standards and protocols for seabed mapping studies. The end products will be a meta database of mapping studies, a web-delivered geographic information system (GIS) showing the habitat maps, guidance for marine habitat mapping including protocols and standards, a report describing case histories of habitat mapping, a stakeholder database and an international conference with published proceedings.

Link to ICZM: Marine habitat mapping may be used as a tool in the physical planning process and thus enable ICZM

Usefulness to ICZM in general: The GIS-mapping is a valuable tool in the coastal planning processes and enables integrated management.

Results so far of relevance to ICZM: http://www.searchmesh.net/

4. Issue-specific projects related to ICZM

a. Name of Project: **KEYZONES**

Estimated Time Frame: 2005 to 2007

Description

This project deals with the characterization of the carrying capacity of key European coastal zones for commercial production of bivalve shellfish. The research is designed to produce powerful tools which would enable shellfish producers in the targeted areas to optimize production capacity, recruitment of young stock and quality whilst reducing waste. The project aims to help increase the quality commercial production of bivalve shellfish (oysters, scallops and mussels etc) whilst reducing waste in terms of human, financial and natural resources. This will have a positive impact on local production and harvest of these shellfish in the targeted areas throughout Europe, improving the quality and sustainability of the produce.

The research consists of the collection and storage of historical data that describe environmental parameters and processes at each culture environment.

In the field the objectives are to measure:

- temporal and spatial variations in the environmental parameters that act as forcing functions driving our simulations of shellfish growth and ecosystem processes (e.g. food availability, light temperature);
- physiological responses required to parameterize the generic physiological model for each shellfish species;
- natural shellfish growth and ecosystem variables (e.g. chlorophyll) that will be used to calibrate and validate the models.

Ecosystem scale modelling will be used to describe and predict carrying capacity.

Links with ICZM: Could ultimately lead to better site selection for different types of aquaculture and avoid situations where carrying capacities, economic and ecological, are exceeded.

Results so far of relevance to ICZM: A website is up a running at

http://www.keyzones.com/intro.html

Usefulness to ICZM in general: Could inform the process and result in better decision making in relation to aquaculture site selection.

b. Name of Project: Predictive Irish Sea Models - PRISM

Estimated Time Frame: 2002 to 2005

Description

Climate change and its potential impact on the coastline of the Irish Sea is a problem of high urgency that confronts both Ireland and Wales. Central and local government agencies in both countries must develop plans for dealing with beach erosion and the threat of flooding due to increased storminess and storm surge. In addition, new EU water quality regulations will require a greater understanding of the physical processes that control flushing and dispersion in the nearshore waters. This project helped to solve such problems by taking modelling skills and products developed within the academic and research communities and making them

available to a wider user community through the use of web-based interfaces. The project is developing a website that hosts a mapping system to present wind, wave, current and sea temperature forecasts.

Links with ICZM: Locally useful to ICZM practitioners

Results so far of relevance to ICZM: Website developed, work ongoing on forecasting models

Usefulness to ICZM in general: Locally useful to ICZM practitioners

c. Name of Project: Marine Biodiversity and Ecosystem Functioning (MarBEF)

Estimated Time Frame: 2006 to 2009

Description

The creation of the network of excellence MarBEF (Marine Biodiversity and Ecosystem Functioning) aims at integrating research efforts by forming a dedicated group of marine scientists and institutes and creating a virtual European institute with a long-term research programme and dedicated links with industry and the public at large. This involves coordination of research, training, personnel and data exchange and outreach activities in several relevant fields of science, including marine ecology and biogeochemistry, fisheries biology, taxonomy and socioeconomic sciences. Better integration of research is also required to support the legal obligations of the EU and its member states and associated states for the Convention for Biological Diversity, the OSPAR and Barcelona conventions as well as several EU directives (Bird and Habitat Directives, Water Framework Directive).

A key task of the MarBEF Network is the integration of different resources related to marine biodiversity. The inventory of these resources can be found on the www.marbef.org website. At the moment, this relational database includes information on different European marine biodiversity research sites and European marine biodiversity datasets. The European Register of Marine Species, ERMS and the European node of the Ocean Biogeographic Information System, EurOBIS is also accessible through this website.

The specific integration effort of MarBEF is focused into the following major activities:

- Creating a virtual centre for integration and improving access to resources.
- Calculating the socio-economic importance of marine biodiversity.
- Providing specialist training.
- Developing an integrated marine data and information management system.
- The transformation of MarBEF's long-term, strategic approach into policy.

Links with ICZM: The project recognises the important links between marine biodiversity and social and economic development. The network will also improve links with the large and growing number of industries depending on the sustainable use and exploitation of marine biodiversity. This includes tourism, fisheries and aquaculture but also new industries that explore and commercialise marine genetic and chemical products.

Results so far of relevance to ICZM: The MarBEF website (www.marbef.org) accessing the European Register of Marine Species (ERMS), the European node of the Ocean Biogeographic Information System (EurOBIS) the BIOMARE European Marine Biodiversity Datasets and information on some of the European Marine Biodiversity Research Sites is operational. Search engines allow information to be extracted. Biogeographical and other information can be also submitted through the website.

Usefulness to ICZM in general: Could, depending on how the links with industry and the work on calculating the socio-economic importance of marine biodiversity are developed, prove very useful to implementing ICZM.

d. Name of project: EuroCAT

Estimated timeframe: 5th Framework programme, 2001–2004

Description

The project was part of the global LOICZ and of the European ELOISE network. It focussed especially on linking scientist, working in river catchments with those working in the coastal and marine environment. The project provided a set of case studies which aimed to model material flows from catchments to coastal waters, especially nutrient flows. It is therefore methodologically related to the EU WFD.

Link to ICZM: Dealing with catchment – coast interactions

Usefulness to ICZM in general: The interdisciplinary conceptual approach using the DPSIR framework as a tool to structure information and using scenarios to deal with uncertainty and multiple management options can be seen as a major step forward towards an integrated assessment approach. The approach is used in an adapted form for the ICZM pilot project "Zukunft Kueste-Coastal Futures" which involves 12 subprojects and is currently funded by the German research ministry (BMBF) in order to develop an integrated assessment approach for changing human demands in coastal and marine areas.

e. Name of Project: Delivering Alien Invasive Species Inventories for Europe, DAISIE.

Estimated Time Frame: 36 months

Description

Effective control of invasive alien species has been hampered by the lack of monitoring for alien species at frequent enough intervals in regions of concern and an effective means of highlighting the occurrence of new invasive species. This project will deliver a "one-stop-shop" for relevant information, a European alien species database and a species distribution maps and spatial analysis of all invasive alien species in Europe known, or suspected of having, environmental or economic impacts.

Links with ICZM: No direct links with ICZM. However, considering shipping ballast water management and climate change etc., it is important to be aware of and have the capability to integrate knowledge on invasive alien species (both temporal and spatial) and their potential environmental and economic impacts into the decision making process.

Results so far of relevance to ICZM: It is intended to have a European Alien Species Database by November 2006, the Invasive Alien Species Accounts by June 2007 and the Distribution Maps and Spatial Analysis by August 2007. There is a website that provides information on new invasive alien species in European waters - http://www.daisie.se/.

Usefulness to ICZM in general: To ensure that anthropogenic impacts are within natural limits it is essential to establish, as far as possible, the natural dynamic. Important information when considering issues such as ballast water management for example ballast water exchange in ports or offshore.

f. Name of project: Managing Fisheries to Conserve Groundfish and Benthic Invertebrate Species (MAFCONS)

Estimated timeframe: April 2003 to June 2006

Description

This is a project funded under the European Union Quality of Life and Management of Living Resources programme.

The conservation of biological diversity is a key principle of the North Sea Ecosystem Approach to management. Fishing is perhaps the most widespread impacting activity in the North Sea and thus there is a clear need to inform managers of the consequences of their actions on diversity. MAFCONS aims to examine processes, such as fishing, that control fish and benthic invertebrate species diversity. This is primarily a NORTH SEA scale project based on the Q3 International Bottom Trawl Surveys.

The overall aim of **MAFCONS** is to provide the scientific advisors to fisheries managers with the mathematical tools that would allow them to quantify the consequences to groundfish and benthic invertebrate species diversity of achieving particular fisheries objectives.

MAFCONS objectives:

- Bring together and formalise the relevant ecological theory in order to develop suitable hypotheses related to the mechanisms through which the ecological disturbance of fishing affects the diversity of fish and benthos communities.
- Collect the relevant data to test these hypotheses, including data on:
    - variation in fishing effort to estimate variation in ecological disturbance.
    - variation in benthic invertebrate productivity and species diversity.
    - variation in groundfish species diversity.
- Establish the relationships between fishing effort (which will be used to predict ecological disturbance) and the tools used to manage fisheries (at present TACs, but moving towards restriction of effort and closed areas or seasons in some situations).

MAFCONS is made up of seven separate work packages (tasks) and include: developing a management protocol; establish the theoretical basis of the ecology underlying the protocol; collecting data and field samples to derive a detailed understanding of the spatial and temporal patterns of disturbance, productivity and species diversity; determine the relationship between TACs, landings and the pattern of fishing effort needed to attain these catches.

http://www.mafcons.org/

Links with ICZM:

Fisheries are a major user in the coastal zone and therefore their management is a key issue for ICZM. This project, although mainly concentrated away form the coastal area, is concerned with the North Sea, a Regional Sea suitable for applying ICZM principles, and it could also provide data to inform the management of more coastal fisheries.

Results so far of relevance to ICZM:

All the sampling and analysis has been done and the final report will be published in June. However the analysis of fishing effort by using Vessel Position Monitoring has had some problems.

Usefulness to ICZM in general:

As this project was designed to inform management decisions on fisheries in the North Sea this will be very relevant to any ICZM planning in the North Sea.

Annex 8: Country reports on the status/progress on monitoring recreational fisheries

Denmark

Monitoring recreational fisheries in Denmark

A yearly coastal monitoring programme has been conducted at several set stations within the Danish coastal waters since 1957, with a pause between 1972 and 1984. All surveys were conducted during July–August at depths of 1.5–3 m and using the same gear; a Johansen juvenile trawl as described in Nielsen *et al.* (1998). Each trawl haul lasted 10 min and the same stations were visited each year. This data has recently been quality assured and is now available in a database. Based on the information from this database, several studies are underway to examine biodiversity changes and possible causes or to map juvenile habitats along the Danish coast in the Kattegat region.

The catch registration project (2002–2004) aimed at documenting and registering fish catches in nets and traps in Danish coastal waters. This project was launched on the initiative of, and based on voluntary work by recreational fishermen organised within two organisations: Danish Organisation for Amateur Fishermen and Danish Union of Recreational Fishermen.

The results from the catch registration project provide a good overview of fish occurrence, size and abundance expressed as catch per unit effort. The results were presented in a report: "Registreringer af fangster i indre danske farvande 2002, 2003 og 2004. Slutrapport. DFU-rapport nr. 155.05" available on the website www.difres.dk. The results provide important documentation for future investigations of changes in catches or in fish abundance in coastal waters. There is no doubt that fish abundance and thereby catches have declined over time, but to date there is no documentation on this negative trend observed by coastal and recreational fishermen. The catch registration project provides an opportunity to document future changes, including positive effects of fish releases and habitat restorations with the aim to enhance the natural resources in different local areas, and which are undertaken by the Danish Institute for Fisheries Research and financed by the Marine Stocking Program.

The data has been computed in an Excell file and comprises a total of 30 stations which were fished with nets and/or traps. These were pooled into 23 localities an include data on species caught in the different gear at a particular area and time. Data on no catches were also reported providing CPUE and the length of the fish were measured in most cases. The catches of crabs were also registered. In cooperation with another project, accidental catches of birds or mammals were also reported.

The highest number of fish species was registered in Århus Bay and Isefjorden. Those species caught in most areas were eel *Anguilla anguilla*, flounder *Platichthys flesus*, eelpout *Zoarces viviparus*, cod *Gadus morhus*, sea scorpion *Myoxocephalus scorpius*, plaice *Pleuronectes platessa* and turbot *Psetta maxima*. Eel and flounder are the two most common species in Danish coastal waters. Most of the registered fish were small in size. The catch per unit effort was relatively low for most species and in most areas. The highest catches of flounder per unit effort were those from Århus Bay with trammel nets. The highest catches of eel per unit effort were those in Odense Fjord, Southern Fynen and in the southern part of Øresund. However, the precision for the comparison of catch per unit effort between areas is low. This is due to the high temporal and spatial variability of registration and the different gear used. The gear is often adapted to match local conditions with regards to currents, depth and other environmental conditions. Between the different regions of the country there are also differences in fishing season and catches.

In most areas there is a tendency for increasing distribution and abundance of crabs and increasing damage to the fisheries because they eat the caught fish. The growth of the crab populations may be due to a number of causes. For example in many areas there are fewer predators (cod) that could eat crab. Once the crabs have gained a high population level the predation rate on the juveniles in coastal areas may be significant. Thus, the crabs may prevent a natural increase in fish population levels.

To improve the ability to compare catches per unit effort and to better understand the variations in catches between different regions, the Danish Organisation for Amateur Fishermen, the Danish Union of Recreational Fishermen and the Danish Institute for Fisheries Research decided to continue the catch registration project with associated 'key'- fishermen. These key-fishermen are voluntary participants fishing with nets or traps provided by the Danish Institute for Fisheries Research. Key fishermen fish on fixed positions within a time-period from the 1st to the 10th of each month. A temperature logger has been provided to each fishermen to register the temperature at the gear position every third hour throughout the year. Monitoring the temperature allows the exploration of the influence of temperature on local fish catches throughout the year. Temperature is crucial for the water environment, fish welfare, distribution and growth. It is therefore important to monitor the temperature and its effects on fish catches and the environment in the years to come.

Ireland

Sea Bass Protection. The Bass Bye-Law

Under the Bass Bye-Law, Sea bass, *Dicentrarchus labrax*, have enjoyed legal protection in Ireland for over ten years. The current measures in place for anglers are:

- A bag limit of 2 bass per angler in any one 24-hour period.
- An overall size limit of 40 cm (tip of snout to end of tail), where all smaller fish are returned alive.
- A closed season from 15 May to 15 June.

Sale or offer for sale of bass (other than bass which has been imported into the State) is prohibited.

Annual report of the Irish Specimen Fish Committee

For the past 50 years the Irish Specimen Fish Committee have prepared a report on the thousands of anglers that have submitted specimen fish claims to the Committee for ratification. Both freshwater and marine species are considered. Sufficient information must be submitted so that the Committee can identify the species such as photographic evidence and in, in some cases, the body of the fish.

It is recognised that, over the 50 years, misidentification has occurred but the reports are seen as a valuable source of data on the changing size of the largest fish caught in Ireland coastal waters. Annual reports for 2004 and 2005 are available from www.irish-trophy-fish.com.

Marine Sportfish Tagging Programme

Currently, sea angling tourism revenue is worth about €30 million to the Irish economy. The Irish Central Fisheries Board's Marine Sportfish Tagging Programme was initiated in 1970. By the late 1960s, results from sea angling competitions were showing a decline in the capture of some of the most important species such as Blue Shark, Tope, Monkfish, Skates and Rays. At that time, virtually all fish caught by anglers were killed and taken ashore for weighing and photographic opportunities.

As little was known at the time about the biology and migration patterns of these species, it was decided to introduce a tagging programme with the explicit purpose of introducing conservation measures and to learn more about the migratory patterns of sea angling species. The majority of Irish recreational fishing skippers, of which there is approximately 108, participate in the Marine Sport Fish Tagging Programme on a voluntary basis. To date over 30,000 fish have been tagged and released including such species as shark, tope, monkfish, common skate and ray. In sea angling, most cartilaginous sport fishes are tagged and returned alive by charter skippers.

Skippers of angling charter vessels agreed to tag the targeted species and record data on the fish in a dedicated tagging log book. Accurate details such as the tag number, location of tagging, date of tagging, length, weight and sex of the fish, were all recorded where possible so that details of the migratory pattern, if any, could be worked out from recaptures and additional information on the biology of the species could be collected

Blue Shark

Initially, different types of tags were tested, including Petersen Discs, Spaghetti type tags, and jumbo Rototags which were manufactured in Ireland and used for tagging cattle. The jumbo Rototag was chosen because of ease of supply, ease of application, it is easily seen and carries a clear message stating that a reward was offered for its return to the address on the tag. The tag was applied to the posterior edge of the dorsal fin by means of an applicator. A few enthusiastic skippers were selected to initiate the tagging operation. The feedback from the participating skippers and from the anglers was most encouraging.

Blue Shark is one of the largest of Irish marine sport fishes. They are found in Irish waters from Malin Head in Donegal, around the west and south coasts as far as Hook Head in Wexford. They occur mainly during the months of June to October and are readily caught on rod and line during settled weather conditions, and especially when the sea water temperatures exceed 140°C. They are captured by anglers by laying a trail of chopped up mackerel and fish oil, usually at a distance of 5 to 10 miles offshore.

Up the end of 1998, 15,037 Blue Shark were tagged around the Irish coast. Recaptures have amounted to 490 fish representing a minimum return of 3.25%. From the pattern of returns it is clear that the Irish stocks of Blue Shark extend across the North Atlantic. The migratory pattern appears to follow the continental shelf of Europe and West Africa across the Atlantic ocean, northward along the north-eastern coast of South America past the West Indies and upwards towards Newfoundland, in a clockwise direction. The largest number of recaptures was in the vicinity of the Azores Islands, where 350 recaptures have been made (see Figure A8.1). The majority of these are taken by Spanish fishing vessels using longlines. In the vicinity of the Canary and Cape Verde Islands, 80 tagged fish have been recaptured mainly by Korean and Japanese longlines.

Figure A8.1.

The other two major groups of recaptures have been taken by anglers off Long Island, Montauk and Nantucket in the USA, and tags have been returned by American and Canadian longliners from the fishing grounds south of Newfoundland, Canada. So far, there have not been any recaptures of Blue Shark south of the equator, although a number of recaptures have been reported within 150 miles of the equator. As with all tag and recapture programmes, the exact details as to the recapture location is vital but, despite everyone's great endeavour, anomalies can arise. Some fishermen hold on to the tags as souvenirs, some report them immediately and some hold on to them for a considerable length of time before reporting or returning them. They may also have tags from other programmes and it is possible that they can be mixed up (e.g. the Board has had one of its tags returned stating that it was taken from a turtle off the Azores), Other returns have given locations up to 200 miles from the sea: one tag was found in a magpie's nest in Holland and a tag was found by an English tourist, on the beach, in the Gulf of Mexico.

The longest distance travelled by a recaptured Blue Shark was 4250 miles. This fish was tagged off Loop Head, Co. Clare, and was recaptured off Venezuela. The longest number of days at liberty is 1623 days (4.5 years) although tagged fish in Irish waters can be caught again between 2–15 days after initial capture. We are confident that the retention of tags is good because we have had returns from other shark species after 15 years at liberty. Blue Shark is a pelagic species that must continually swim for water to pass over their gills for the abstraction of oxygen. The returns have indicated that the minimum continuous swimming speed is at least one mile per hour based on direct routes between tagging locations and recapture locations.

A lot of valuable information has been collected during this voluntary tagging programme. The charter skippers take details of the tagged fish and also note the number of anglers on board, the other species of fish caught as well as the nationalities of the anglers. On the 74 charter boats participating in 1999, the total number of rod angling days was 32 800. Almost 33 000 fish were tagged to the end of December 1999.

Tope

As with the Blue Shark, Tope were tagged in the dorsal fin with jumbo rototags, which were originally designed as a tag for cattle.

The distribution of tope was known to be confined to the North East Atlantic Ocean but nothing was known of their migratory patterns until this study was initiated. Up to December 2000, a total of 3220 tope were tagged and released. To date 268 (8.3%) have been recaptured. The migratory movements are shown in Figure A8.2.

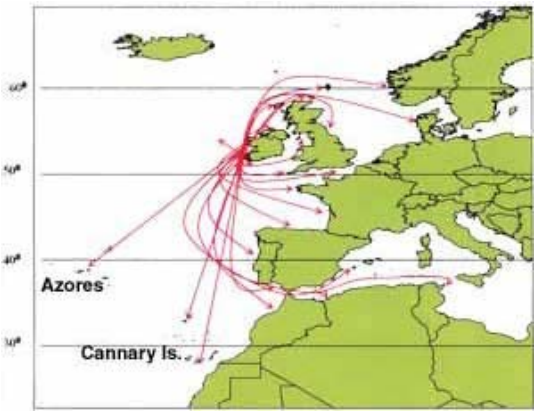

Figure A8.2: Results of migration patterns of 268 tagged tope in the North East Atlantic.

The greatest distance travelled by a tagged tope was 2185 miles. This fish, released in Tralee Bay was recaptured in the Mediterranean Sea off the cost of Tunisia in less than three years after being tagged. The longest period a tagged tope had been at liberty was 5538 days - over 15 years. This tope was tagged in Donegal Bay in 1982 and was taken on rod and line off the west coast of Scotland in 1997 and was released again alive.

Tope are recaptured in gill nets, tangle nets, by trawlers of various nationalities and by anglers at home and abroad. Recaptures have been made recorded from such locations as Denmark, Norway, the North Sea, Faroe Islands, United Kingdom, France, Spain, Portugal, the Atlantic coast of Morocco, the Canary Islands and the Azores Islands. Three recaptures were made in the Mediterranean Sea, off Spain, Algeria and Tunisia. Of course quite a number of tagged tope have been taken all around the Irish Coast.

A number of tope tagged in Irish waters have been recaptured close to their release point shortly after tagging. One fish was recaptured after 405 days close to its tagging site, was released alive and was again recaptured after another 405 days at liberty only 50 miles away. This poses the question - where did this fish travel to in the intervening periods? If a similar study was to be carried out off the Iberian coasts, the Canary Islands and the Azores further information would be obtained which might show cyclical movements within its distribution range.

There is evidence to show that some tags have fallen off tope after being released. Tags have been returned after they were found on beaches on Irish shores and from Penzance in Cornwall. A few tags were returned after they were found caught up in gill nets, demonstrating that there could be a significant loss of tags when tope come into contact with gill nets. Undoubtedly some of these tags would fall out of the gill nets and be lost.

The 8.3% recapture rate must be regarded as a minimum figure. It is expected that additional returns will be made on fish tagged over the last three to four years. It is also a possibility that some captors may not return their tags and an allowance must also be made for fish shedding their tags.

A lot of valuable information has been collected during this voluntary tagging programme. The charter skippers take details of the tagged fish and also note the number of anglers on board, the other species of fish caught as well as the nationalities of the anglers. On the 88 charter boats participating last year, the total number of rod angling days was 38 430.

Monkfish migrations

Monkfish or Angel fish (*Squatina squatina*) was one of the species selected for tagging. The two prime locations for capturing numbers of these species were Tralee Bay and Clew Bay. Even in these bays, monkfish populations were known to be confined to very specific areas.

Initially two types of tags were tried out, Jumbo Rototags (which are used on the ears of cattle) and Petersen discs. The voluntary taggers found that when the monkfish were taken on board for tagging, they could be quite aggressive and great care had to be taken when they were being handled. For this reason they opted for the Jumbo Rototag which was much easier to use when inserting the tag into the dorsal fin using an applicator.

All of the monkfish tagged were caught on rod and line in shallow waters usually not exceeding five metres in depth. The fish was taken onto the boat, the hook was removed carefully and after details were recorded the tagged fish was returned alive to the water. The tagging programme began in 1970 and 1,107 monkfish were tagged up to the end of 2001. The captured fish ranged in size from 6.5 kg to 26 kg weight with the average size being approximately in the 14–18 kg bracket. The majority of the fish tagged came from Tralee Bay (939) whilst 70 monkfish were tagged at Clew Bay.

The general areas of recapture are shown in Figure A8.3 and to-date 187 recaptures have been recorded. This represents a return rate of 18.3% which is regarded as an extremely high return rate for any tagged fish. The main bulk of recaptures have been taken by rod and line angling (47.6%), trawling (19.25%), tangle nets (16%) and gill nets accounted for 5%. Five tags have been found washed ashore on beaches. Overall, it appears that tag retention is good. However, in situations where tangle nets are used and where monkfish are captured it is possible that tags could be ripped from the dorsal fin and because the tags are close to neutral buoyancy they could be carried ashore by water currents. All the fish recaptured by anglers on rod and line were subsequently returned to the water alive with the tag in place after their details were recorded.

Figure A8.3: General areas of recapture for monkfish.

179 of the returns were taken in Irish coastal waters whilst eight recaptures were returned from abroad having been taken by commercial means. Of these, five were recaptured in French coastal waters, two were taken off the south coast of England and one was taken off the north coast of Spain. A movement pattern spreading north and south from Tralee Bay has been identified whilst movements from Clew Bay, to-date, show a southerly migration.

The longest number of days a monkfish was at liberty was 4352 days (almost 12 years). This fish which was originally tagged in Tralee Bay, was recaptured 3 km north of Kerry Head after 4325 days, released again and after a further 27 days was recaptured again off Bunmahon, Co. Waterford – some 345 km away. At least three further fish were at liberty for over ten years. These three fish were originally tagged in Tralee Bay and were recaptured within the general Tralee Bay area. The longest distance travelled by a recaptured monkfish was 1160 km. This fish was tagged in Tralee Bay and recaptured by a trawler off San Sebastian, Spain in the Bay of Biscay. From the recapture records, it is evident that the species is long lived. This, in conjunction with the high recapture rate, demonstrates that monkfish are vulnerable to fishing effort.

In total 96 recaptures have been recorded from the Tralee Bay area which probably reflects the localised distribution of the species. It also reflects, to a great extent, the intensity of fishing effort by both anglers and commercial fishing. Commercial fishing effort is not specifically targeted at the species and any monkfish being caught would appear to be accidental. Having analysed the angling fishing effort in Tralee Bay from 1977 onwards there is a dramatic fall off in the numbers of monkfish being caught recently (Figure A8.3). In the five-year period

1987–1991, 320 fish were tagged whereas in the period 1997–2001 only 16 fish have been tagged despite the angling effort being relatively constant.

This long-term study has contributed to knowledge of Irish monkfish populations but has also highlighted many gaps in our understanding of their biology.

Sweden

Recreational fisheries in Sweden

Recreational (non-commercial) fisheries are practiced in more than 100,000 lakes in the inland and along the entire Swedish coast which extends more than 3200 km in length. Most minor lakes are privately owned and licence permits are normally required to fish in these lakes. However, since 1985 sport fishing with rod and line is also free in the four largest lakes and along the entire Swedish coast.

The Swedish law defines recreational fishing to include both subsistence use and sport-fishing. Following the Swedish definition, sport-fishing is fishing with rod, hook, and line for the purpose of recreation, and the catch are for use in the own household. Compared to sport-fishing, subsistence use is normally carried out with multi-catch equipment (for example, a net), but the catch is primarily consumed by the household. Recreational fishing, both subsistence use and sport-fishing (hand-gear) is not included in the Swedish right of public access. Fishing with nets, traps, pots, etc are restricted by gear restrictions. Fishing with large gears like trawl, seines, commercial nets requires a commercial fishing licence.

Fisheries management in Sweden has traditionally focused on the commercial, resulting in that less is known about the extension of recreational fishing. Focusing on recreational fishing, efforts are necessary to shed light on the biological impact as well as the benefits and costs of the use of fish resources.

The Swedish Board of Fisheries has together with the Swedish Environmental Protection Agency investigated the potential for the development of fishing tourism in Sweden.

A survey of the fishing habits of Swedes

The Swedish Board of Fisheries has conducted surveys of recreational (non-commercial) fishing every five years since 1990. The study in 2005 was commissioned by the Swedish Board of Fisheries and carried out by Statistics Sweden. A postal questionnaire was sent to 8,000 randomly selected permanent residents in Sweden. Only adults between 16 and 74 years of age were included in the survey. The response rate was 62.4 percent. This survey did not include fishing by visitors in Sweden, but Swedes fishing abroad are included.

Results show that recreational fishing is popular in Sweden. Around three million persons expressed some interest in recreational fishing. Around 1.4 million persons fished during 2004. Men are more interested in fishing than women; more than 70 per cent of the recreational fishermen were men. The total number of fishing days was estimated at 22 million days in Sweden, a little more than half of these days occurred during the summer. The number of fishing days using rods and line was more than 17 million days while fishing with gillnets, fykenets, pots, traps, etc., was estimated to five million days. The total catch amounted to approximately 26 million kilos, which corresponds to almost 10% of the total commercial landings. Most of the recreational catches, i.e. 60% were taken in inland waters. Large catches were also noted in the Sound between the Kattegat and the Baltic Sea, while catches in the Bothnian Sea were less large. The most common species were perch and pike. However, commercial species like flatfish, herring and cod were also caught in substantial amounts. Total expenditure on recreational fishing was estimated at less than three thousand million SEK.

Table A8.1: Catches (kg) by species and area from recreational Swedish fishermen.

	SKAGERRAK +KATTEGATT	SOUND	BALTIC	INLAND	TOTAL
Cod	431	421	275	0	1127
Other codfishes	187	29	25	0	241
Herring	72	188	1784	0	2044
Mackerel	1295	18	0	0	1313
Flatfish	153	28	441	0	622
Salmon	85	3	230	370	688
Sea trout	108	66	287	1390	1851
Arctic charr	0	0	0	870	870
Whitefish	0	0	578	722	1300
Grayling	na	na	na	510	510
Other Salmonids	na	na	na	655	655
Pike	97	25	1172	3921	5215
Perch	116	29	1201	4411	5757
Pike-perch	na	na	na	585	585
Cyprinids	41	1	86	592	720
Eel	18	20	144	65	247
European lobster	189	0	0	0	189
Crab	352	3	0	0	355
Mussels	47	0	0	0	47
European crayfish	0	0	0	183	183
Signal crayfish	0	0	0	867	867
Other species	58	70	267	278	673
Total	3249	901	6490	15419	26059

Future monitoring of recreational fisheries

On the initiative of the Swedish government, the Swedish Board of Fisheries collated a report on different options of reporting catches from recreational fisheries in 2005. The different options considered were circulated for comment amongst relevant stakeholders before submission of the report. The Board suggests that reporting of recreational catches could be made mandatory for a few important species, but should then be linked to a general fee for recreational fishing. Currently, there is an investigation being carried out about weather such a fee should be put in practice or not.

The means of collecting data suggested in the report is by:

1) Collection of catch data through postal questionnaires, deep interviews and field studies;

2) A database for catch information from authorities and the general public. The database should be made accessible to the public;

3) Additional trials:

- Voluntarily reporting of all catches of specific species or geographical areas;
- Making use of established organisations in surveying the amount of fishing gear in use in the field.

Spain

Recreational fisheries Spain

Recreational fishing is very important in Spain albeit its real importance is scarcely known; some recent studies in the Mediterranean are the only ones providing estimation of efforts, catches and social aspects. This report focuses in this geographical area, and in the main results of the projects developed.

The Mediterranean recreational fisheries

Recreational fishing has economic, social, and cultural roles in the Mediterranean, where commercial fishing is largely the domain of small-scale concerns operating in coastal areas. Recreational fishing is particularly important in the Mediterranean, representing more than 10% of total fisheries production in the area (EU, 2004). Recreational fisheries have been poorly studied in the Mediterranean, although this has not prevented implementation of some management measures. For instance, a fishing licence is needed, and current legislation limits both fishing effort (number of gears) and daily bag, and stipulates minimum lengths and closed seasons for certain species. In addition, several marine reserves have specific restrictions on fishing. While the number of licences provides a certain measure of the fishing effort expended, inspectors have detected a significant number of recreational anglers who are not official licence-holders, so the actual number of people involved and the yields remain unknown.

Although direct confirmation is unavailable, the response of certain species to protection measures suggests that the coastal fish populations are probably overexploited. For instance in Majorca Island, a shallower distribution and increased biomass for grouper (*Epinephelus marginatus*) followed closure of recreational fisheries in a protected area (Coll *et al.*, 1999). The larger mean size of razor fish (*Xyrichthys novacula*) in the same protected area compared with exploited areas is another example of answer to less fishing effort (Riera and Linde, 2001).

A total of five studies on the recreational Mediterranean fishery have been funded (Table A8.1). However, few publications are available. The increasing awareness on the importance for the ecosystem of the recreational and sportive fisheries is reflected on a thematic session on the IV World Fisheries Congress (2004) and at another scale on the organization of the I Congress on Mediterranean Recreational Fishing (Majorca, 2006).

The case of the Balearic Islands

Catch and effort records of spear fishing competitions since 1975, in the Balearic Islands, were used as a tool to study the temporal evolution of rocky littoral fishery resources. Competition spear fishing affected over 30 species, among which the most abundant were *Diplodus sargus*, *Symphodus tinca*, *Labrus merula* and Mugilidae. A decreasing trend over time for the mean CPUE (kg fisherman^{-1} h^{-1}) was shown. *Epinephelus marginatus* was a key species in the evolution of the CPUE, since individuals weighing more than 4 kg diminished drastically after 1987. The species recorded as largest specimens clearly changed since this date, showing a serial depletion process. These results taken as a whole describe a situation of overfishing for some target fish inhabiting rocky bottoms between 0 and 40 m. Both recreational and competition spear fishing seem to have had an important effect on these resources and probably contributed to the lack of profitability of some traditional and highly selective fishing gears (Coll *et al.*, 2004).

Recently in a study funded by the Regional Government and carried out by IMEDEA, t he Majorca recreational fishery was evaluated using creel surveys, interviews, visual census and sampling on site. Data reliability was tested by cross-checking the data collected from the different sources of information available. Although admittedly subject to some shortcomings

(see Figure A8.4 below), the study reveals that with 37265 people (5.14% of the population of Majorca Island in 2001) involved, recreational fishing is one of the main leisure activities and is undoubtedly important to the coastal marine ecosystem as well as being socio-economically important. Actual numbers of recreational anglers are probably higher, because people may well not have told the truth during the telephone survey of households, either because they fish without a licence or because they have other, personal reasons of their own. A veracity check carried out on 100 households having a family member who was a member of a recreational anglers' association showed that 5% denied having any family member actively fishing (Morales-Nin *et al.*, 2006). Therefore, some underestimate of actual levels of fishing activity is probable. Moreover, there was a sharp rise in the number of fishing licences issued is probably related to a major drive to enforce fishing regulations, and itself points to a very active fishery.

The most popular fishing method is from a boat (62.9 %), followed by fishing from shore (32.4 %) and spear fishing (3.6 %). The mean time spent fishing is 3.86 ± 0.03 h·d^{-1} with more than one gear (mean = 1.27 ± 0.21) used simultaneously by a single fisherman. The frequency of fishing is 4-6 times per month, mainly on holidays and weekends and increasing in summer. Effort for each fishing method was measured as 387 001 (outings·year^{-1}) for boat, 205 552 (outings·year^{-1}) for fishing from shore and 22 320 (outings·year^{-1}) for spear fishing. The total effort for the recreational fishery was 614 873 fishing outings·year^{-1}. The recreational fishery on Majorca Island is a predominantly middle-class (most anglers are boat-owners who keep boats at marinas), middle-aged male activity that is carried out mainly from boats. The activity is concentrated on weekends and holidays in the coastal strip to a distance of 3 km offshore. An increase of the fishing effort was observed between June and July and a sharp decrease between October and November. The highest fishing effort was near the shore (until 1.41 Km offshore) although in the Bays the effort expands up to 6 km offshore. Fishing from a boat show high aggregation within 2000 meters; given a recreational boat fishing off the Island, the number of boats found fishing within this distance is twice the number of boats expected from a random distribution. This aggregation is particularly important in months with higher fishing pressure (from July to October) and smoothes with decreasing effort, disappears in months with lower pressure (June and November). August escapes from this pattern, showing no aggregation, which is attributable to special characteristics of pearly razorfish (*Xyrichthys novacula*) fishery that occur during this month (Morales-Nin *et al.*, 2005; 2006).

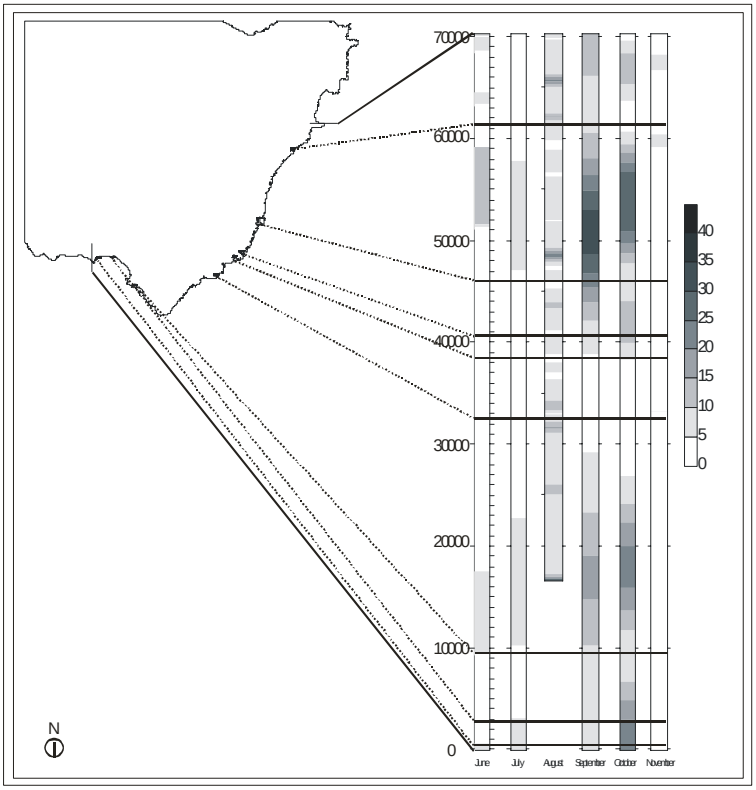

Figure A8.4: Synoptic map of the recreational fishing effort measured as mean nº of observations (nº boats fishing) by port of origin for the six sampled months (June–November 2002) in South and East Coast of Mallorca.

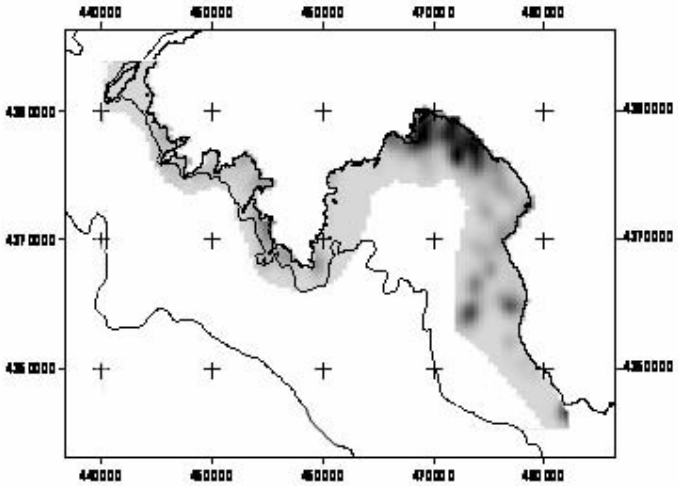

Figure A8.5: Descriptive map of aggregative patterns of the recreational fishing boats in Palma Bay produced with August and September data.

The fishers not allowed to weigh the daily bags (except during recreational fishing competitions) precluding accurate estimation of yields in the recreational fishery. For this reason, three approaches to estimating yield were employed, namely, what anglers say they catch (both in interviews and logbooks), on-site estimates by interviewers, and the bag weights in recreational fishing competitions. The first of these three approaches resulted in the highest estimates. The other two approaches produced quite similar results, with the values based on the competition data being slightly higher. There are several different sources of error in the yield estimates. In the telephone survey, error may arise from the anglers' own perception; i.e. selective memory, exaggeration, or perhaps failing to include zero bags in their daily bag assessments. In the on-site interviews, the main source of error is the greater likelihood of interviewing the most active, and hence the best, anglers. This also applies to the fishing competitions. Assessing this source of bias is difficult, because individual fishing success varies widely even among experienced anglers (Morales-Nin *et al.*, 2005). This has been highlighted by a recent study of fishing competitions in the Balearic Islands spanning 27 years, which revealed considerable variability in individual bags among participants (Coll *et al.*, 2004). In any case, the similar estimates based on the information compiled by the interviewers and the fishing competition data lend support to the results obtained.

It follows, then, that the recreational fishery is landing a minimum of 1 209.25 t year^{-1} (based on the on-site interviews and logbook data) and a maximum of 2 678.81 t year^{-1} (Morales-Nin *et al*., 2005). Assuming that the lower value is probably more accurate, this amounts to approximately 27.44% of the commercial catch of fish and cephalopods in 2002 (unpublished data from the DG de Pesca, Govern de les Illes Balears). Moreover, in many cases the commercial and the recreational fisheries exploit the same species. In terms of the numbers of people taking part, involvement is two orders of magnitude higher in the recreational fishery (37 265 recreational anglers) than in the commercial fishery (769 professionals in 2001, according to data from the DG Pesca, Govern de les Illes Balears).

The recreational fishery in the Balearic Islands is highly seasonal, mainly the consequence of seasonal variability in abundance of the key target species and variations in the fishing methods used depending on weather conditions. The target and incidental species varied not only with season but also with fishing method, bottom substratum type, and fishing depth. Accordingly, the main species caught from shore are: on hard bottoms, *Symphodus* spp., *Coris julis*, *Diplodus annularis*, and *Serranus cabrilla* if bottom fishing, and *Oblada melanura* and *Sarpa salpa* if fishing nearer the surface; and on soft, sandy bottoms *Lithognathus mormyrus*, *Umbrina cirrosa*, *Sparus aurata*, *Diplodus* spp., and *Ariosoma balearicum*. The main species caught from boats near the bottom are: on *Posidonia oceanica* beds, *Serranus scriba*, *D. annularis*, and *Coris julis*; on sandy bottoms *Bothus podas*, *Trachinus* spp., *Synodus saurus*, and *Xyrichthys novacula*, the last taken only in summer and autumn; and on hard bottoms *Serranus cabrilla*, *Pagellus* spp., *Pagrus pagrus*, *Diplodus vulgaris*, and *Spondyliosoma cantharus*. Boat-fishing also harvests other species that are markedly pelagic, such as *Trachurus* spp. and young of the year *Coryphaena hippurus* and *Seriola dumerili*, taken mainly by trolling near the surface. Finally, the main species caught by spearfishers are *Epinephelus marginatus*, *Sciaena umbra*, *Diplodus sargus*, and *Octopus vulgaris*. The results for species share in the catches obtained in this study may be biased by the more-intensive sampling in summer. For this reason, the importance of *Xyrichthys novacula* in the boat-fishing catches may well have been overestimated. On the other hand, fishing activity targeting *Xyrichthys novacula* has increased in recent years, i.e. since the closed season was established.

There have been few studies on exploitation of the coastal marine fauna in the Mediterranean, but available information seems to indicate that species are heavily exploited (Tserpes and Tsimenides, 2001; Coll *et al.*, 2004). Because of the size of these coastal resources and the relative absence of direct economic value to recreational anglers, ordinarily there is a tendency

to overlook recreational fisheries as input for proper management, and to disregard the need for scientific research. Although the lack of earlier data and the study's own limitations preclude evaluating the available biomass and the degree of overexploitation, it is clear that recreational fishing must be taken into account for management purposes. Moreover, regulations such as those in place in Majorca might not be enough to keep fishing mortality at rates that are sustainable at sufficiently high levels of effort (Post *et al.*, 2003). Compliance with regulations in Majorca is low. Depending on the information source, from 25% (number of infractions reported by fishing inspectors, DG Pesca, Govern de les Illes Balears, unpublished data.) to 59% (data from our interviews) of anglers do not have a fishing licence. In practice, therefore, the recreational fishery is an open resource. Typical regulations like the bag limits and closed seasons used in the Mediterranean are not rigorous enough to affect total exploitation levels in open-access sport fisheries (Cox *et al.*, 2002). Therefore, management of recreational fishing requires stronger enforcement of regulatory measures and/or additional regulations such as the restricted and closed areas that are being enforced around Majorca.

The considerable diversity of species caught, with some differences between fishing methods, reflects highly varied exploitation of the littoral fauna. Most effort is concentrated in water shallower than 30 m, from the shore to 3.21 ± 1.23 km offshore. Besides the biomass extracted (1 209.25 t $year^{-1}$), the disturbance caused by 614 872.5 fishing outings annually (nearly 2.5 million h fished) must be far from negligible given the small size of the island. In fact, relating the biomass removed to the 3663.76 km^2 of estimated shelf area exploited by recreational fishing (the surface area from the coastline to the 100-m isobath) results in direct removal of 330.06 kg km^{-2} $year^{-1}$. Putting the carbon content of fish at 41.61% (Sterner and George, 2000; Cabral *et al.*, 2002), the amount extracted comes to 137.34 kg C km^{-2} $year^{-1}$. Littoral Majorcan fish occupy a high trophic level (TL) of between 3 and 4 (Jennings *et al.*, 1997; Deudero *et al.*, 2004), although they do exhibit a certain degree of omnivory and undergo changes in diet with ontogeny. Mediterranean waters are oligotrophic (Estrada *et al.*, 1985), and littoral Mediterranean *Posidonia oceanica* meadows are important net organic carbon burial sites (García *et al.*, 2002). It follows, then, that shallow-water Mediterranean foodwebs should be benthic-based rather than plankton-based. Primary production of *Posidonia oceanica* meadows has been estimated at 445 883 kg C km^{-2} $year^{-1}$ (Gazeau *et al.*, 2004). Taking this value as an indicator of production in the littoral zone and 10% as the transfer between trophic levels, production by fish ranges between 446 (TL 4) and 4 458 kg C km^{-2} $year^{-1}$ (TL 3). Accordingly, the recreational fishery is removing 31% of production at TL 4. Although these are gross estimates, the values do point to the pressure exerted by recreational fishing on coastal fish communities (Morales-Nin *et al.*, 2005).

Recreational and competitive spearfishing has a sizeable impact on serial depletion of large rocky-bottom littoral fish, and contributes to the non-profitability of some gears used by the small-scale fleet (Coll *et al.*, 2004), and commercial and recreational fishing have similar demographic and ecological effects on exploited populations (Coleman *et al.*, 2004). If the goal of fisheries management is to sustain viable populations and ecosystems, recreational and commercial fishing requires effective regulation.

Existing management programmes in the Mediterranean are based on effort regulation, but this does not include recreational fishing. Considering that both the effort expended and the biomass extracted by this leisure activity are quite high, planning and implementing a comprehensive coastal management strategy must include recreational fishing. Additionally, recreational fishing activity has major social repercussions, and the benefits of the activity need to be weighed against investments in resource protection.

Table A8.2: Recreational fishery studies on the Mediterranean

YEAR	PARTICIPANTS	TITLE	STUDY AREA
1996–1999	CE. EU FISH and ISMAR Italy, Greece	Sport fisheries in Eastern Mediterranean (Greece & Italy): parameter estimates, linkages and conflict with professional fisheries	Adriatic Sea and Ionic Sea
2001–2003	CSIC-Imedea and D.G.Fisheries Balearic Islands	Study of some aspects of the recreational fisheries of Majorca Island	Majorca
2003–2006	CE. EU FISH and CSIC-CEAB Spain, Italy, France	Sport Fishing: an informative and economic alternative for tuna fishing in the Mediterranean	Spain to Italy coastline
2005–2008	CSIC-Imedea and D.G.Fisheries Balearic Islands	Emergent indirect effects in predator/prey systems: The case of population dynamics of littoral fishes exploited by recreational fishing	Majorca
2006	IEO and Spanish Federation of Responsible Fishing	Technical study on recreational fishing effects in marine protected areas	Mediterranean marine reserves and protected areas

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Annex 9: Impacts on the coastal zone of brine discharge produced by desalination plants (ToR f)

Beatriz Morales-Nin, Spain.

Introduction

About one-third of the world's population lives in countries with moderate to high water stress. The problems are most acute in Africa and West Asia but lack of water is already a major constraint to industrial and socio-economic growth in many other areas, including China, India and Indonesia. If present consumption patterns continue, two out of every three persons on Earth will live in water-stressed conditions by the year 2025. The declining state of the world's freshwater resources, in terms of quantity and quality, may prove to be the dominant issue on the environment and development agenda of the coming century. In Europe not only the Mediterranean countries but also some parts of UK, France and Germany have or would have freshwater shortages (UNEP, http://www.unep.org/vitalwater/).

As the world's fresh water resources become more meagre the world's attention is diverted towards the oceans and seas as an immediate resource for fresh water. In the past decades, the bottleneck of desalination was the energy cost which was generally higher than the costs of other water supply alternatives that may be available (e.g., water transfers and groundwater pumping). Albeit, technological progress increased process efficiency, and although socio-economically context dependent, desalination has turned into an extensively applied solution for an increasing number of regions around the world, and in particular in various countries of the Mediterranean region ((Meerganz von Medeazza; Papapetrou, Epp *et al*.; Cipollina *et al*., 2005). The problems related to desalination impact will become severe in the near future, especially in the Mediterranean area and southern coasts increasingly when the use of solar energy decreases the cost per cubic meter produced. The potential problems have been already envisaged by the European Desalination Society (http://www.edsoc.com) that has called for an international meeting on "Desalination Strategies in South Mediterranean Countries" EuroMed 2006, to be held in 2006.

This document summarizes the coastal zone impacts of brine discharge produced by desalination plants taking as an example the case of Spain. Albeit, similar problems are found in other Mediterranean countries were the general increase of drought has given rise to the construction of a number of desalination plants for civil, agricultural and industrial uses.

Sources of impacts

Desalination plants construction activities could result in the following types of coastal zone impacts: air emissions; disturbance of dune, surf zone, and seafloor ecology; disturbance to seabirds, marine mammals, other land and marine species, and their habitats; disturbance to archaeological and paleontological resources; erosion; interference with public access and recreation; noise; nonpoint source pollution; and obstruction of views by machinery, piping, or tall structures. Significant construction impacts may also occur away from the desalination plant site if long pipelines are needed for seawater intake or for distribution of the product water, or if power transmission lines or distribution facilities must be built. Pipeline routes may have adverse impacts on benthic habitats such as surfgrass and rocky tidepools. Streambed or lagoon ecosystems along proposed power transmission line routes would be of particular concern.

Desalination plants produce liquid wastes which may be discharged directly into the ocean, combined with other discharges (e.g., power plant cooling water or sewage treatment plant effluent) before ocean discharge, discharged into a sewer for treatment in a sewage treatment plant, or dried out and disposed of in a landfill. Desalination plants also produce a small

amount of solid waste (e.g., spent pretreatment filters and solid particles that are filtered out in the pretreatment process). Marine resources in the vicinity of a desalination plant can be affected by the constituents present in the waste discharges, by the waste discharge method used, and by the process of feedwater intake.

In general, discharges from desalination plants may have the following types of potentially adverse constituents and qualities:

- Salt concentrations above those of receiving waters (seawater salt concentration is about 35 000 ppm; desalination plants discharge brine with 46,000 to 80,000 ppm). Salt concentrations may be reduced by mixing desalination plant discharges with other discharges, such as wastewater;
- Turbidity levels above those of receiving waters;
- Chemicals from pretreatment of the feedwater (these may include biocides, sulfur dioxide, coagulants (e.g., ferric chloride), carbon dioxide, polyelectrolytes, anti-scalants (e.g., polyacrylic acid), sodium bisulfite, antifoam agents, and polymers);
- Chemicals used in flushing the pipelines and cleaning the membranes in RO plants (these may include sodium compounds, hydrochloric acid, citric acid, alkalines, polyphosphate, biocides, copper sulfate, and acrolein);
- Chemicals used to preserve the RO membranes (e.g., propylene glycol, glycerine, or sodium bisulfite);
- Temperatures above those of receiving waters (about 5° F increase at the point of discharge) for discharges from distillation plants;
- Oxygen levels below those of receiving waters from deaeration to reduce corrosion (distillation plants only);
- Organics and metals that are contained in the feedwater and concentrated in the desalination process; and
- Metals that are picked up by the brine in contact with plant components and pipelines.

The constituents of discharges of particular concern for marine organisms include biocides, high metal concentrations, and low oxygen levels. Besides, 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 *Posidonia* and algae 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.

Changes in salinity and/or temperature from the brine discharges may also affect migration patterns of fish along the coast. If some fish species sense a change in salinity or temperature, they may avoid the area of the plume and move further offshore. As a result, the fish would be forced to swim a longer distance, they would leave the areas of highest food concentrations, and they would have increased exposure to predators. The potential impacts of this nature are uncertain because of limited knowledge about fish migration along the coast and uncertainty about how large the plume would have to be to cause this effect.

The seriousness of the environmental impact depends on the characteristics of the desalination process determining the composition of the produced brine- but also of the natural hydrodynamic and batimetric conditions as well as biological factors of the local marine environment. The massive development of the desalination activity in some coast lines has caused evident environmental damage that has been denounced by the UNEP (2003).

The case of Spain

The need for desalting sea and brackish water in Spain arises from the fact of the hydrographic irregularity in time and space and the concentration of population, tourism and industry in water deficient areas, namely the Mediterranean littoral, Canaries and Balearic Islands (Cantera *et al*., 1981). The first desalination plant was built in Lanzarote (Canary Islands) in 1965. The relevance of the water supply in Spain is shown by the inclusion of this subject in the Prime Minister Investiture Speech on 2004.

The hydrologic resources management in regulated by Law (National Hydrological Plan Law 10/2001 modified by Law 2/2004) following the European framework 2000/60. The A.G.U.A. Plan (http://www.mma.es/agua/) implements the Laws and describes “desalination as the guaranty of littoral areas water supply”. Now Spain occupies the 5º position at world level in development of desalination plants and technology, with more than 700 desalination plants producing 800.000 m^3 /day, 47.1% coming from marine waters and mainly produced by reverse osmosis (70%) (Torres). Urgent future measures foreseen to obtain additional 1.100 Hm^3 /year with an investment of 3900 M€ (White Book of Water in Spain). Desalination by reverse osmosis has become the most extended method due to its reduced inversion costs and its lower energy and space consumption (Morton *et al*., 1996).

The significant increases in the use of desalination to produce high-quality water from saline water needs a normative regulation that takes into account the necessity of an integrated water resources management and environmental and financial sustainability. The production of desalinated water demands energy intensive use, given that each m^3 produced demands around 1 kg of oil equivalent (Meerganz von Medeazza, 2005). A proper water price should be the most effective way to manage water demand, albeit the policy of intervention in water price darkens the effect of open market (Gasco, 2004). Moreover, the policy of subvention in water price has given sustainability to the water desalination industry in Spain (Gasco).

Between the impacts of desalination the use of energy is not one of the less important. For instance, at the above foreseen production levels it has been calculated that Spain will increase its percentage of CO_2 emissions by 4–9% by 2010 (Meerganz von Medeazza, 2005). Recent developments in renewable energy use may hold potential to reduce this impact and cost, wind and solar powered seawater desalination plants are becoming frequent and have been already installed in Spain (Gran Canary Island, Lindemann, 2004).

If we consider that for each litre of sea water we obtain 0.45 l of fresh water and 0.55 l of brine with a salinity of 69.000 ppm (Plant of Javea, Torres, 2004), the amount of brine waste

is significant and is discharged in littoral areas. Thus, by normative before installing a desalination plant an impact study has to be performed and measures minimizing the impact must be taken.

These measures are at the level of marine water intake, water pre-treatment, the desalination process itself, post-treatment of brine and disposal of the waste brine product (Malfeito *et al*., 2005). In general the more severe impact is due to the waste brine product and the chemicals used in the desalination processes (Perez Talavera and Quesada Ruiz, 2001). The density difference between brine and seawater induces the formation of a stratified system, with the brine forming a bottom layer that can affect the benthic communities that depend upon stable salinity environments (Gacia and Ballesteros, 2001).

Although available information dealing with thee impacts of desalination plant discharges is limited, negative effects on echinoderms and bivalves (Castriota *et al*., 2001) and in seagrasses and macroalgae have been published (Chesher, 1975; Tomasko *et al*., 1999).

In the Mediterranean the endemic seagrass *Posidonia oceanica* meadows are protected and constitute one of the most important and productive ecosystems (Boudouresque and Meinesz, 1982). The species has been described as a stenobiotic seagrass, negatively influenced by increased salinity. Plants in experimental conditions suffer considerable mortalities above 42 psu and below 29 psu, but surviving plants are able to regain their original growth rate when returned to normal salinity (Fernández-Torquemada and Sánchez-Lizaso, 2005). This response to salinity changes is common to other seagrasses (Fernández-Torquemada *et al*., 2005). A 100% of mortality has been detected on experimental conditions at salinities of around 50 psu after 15 days exposure; while in field studies the negative impact has been confirmed but in some cases the effect was confounded with the high nutrient level of the brine product (Latorre, 2005). In summary, salinity increase causes growth reduction, permanent leaf fall, appearance of necrosis in the tissues, structural pattern changes of the grassland, diminution of the abundance of the accompanying macrofauna and raise of the mortality rates. These studies have made clear that the brine has to be discharged on sandy bottoms, at a distance from seagrasses and if not possible, the discharge must be such as never happen 25% of the time above 38.5 psu neither 5% of the time above 40 psu (Latorre, 2005). Unfortunately, no study is available on the long term effects on the *Posidonia* ecosystem subject to hypersaline conditions. Uncertainties, therefore, remains whether the above mentioned effects would be accumulative or synergic in chronic situation. Moreover, the season, depth variability and light availability probably also alter the observed reactions.

Although, from basic hydrodynamic principles it is well known that the salinity gradient generally decreases from the outlet pipe, depending on the sea bed topology the brine solution would flow-down the bathimetric slope. This has been shown in the Alicant plant in one of the few studies on this issue that has demonstrated fast dilution close to the discharge but an increase of 0.5 psu above the average salinity in the area up to 4 km from the discharge (Férnandez-Torquemada *et al*., 2005). This study also has shown that Posidonia was in poor condition being less affected in the zones with less impact, Echinoderms that are osmoconformers, have disappeared from the zone. This study showed that dilution of the brine may be lower than the usually accepted. The place of the brine discharge is relevant for the impact, for instance in Javea plant the brine is discharged in a river bed and has rapid dilution arriving to sea and following the bathymetric gradient (Malfeito *et al*., 2005). The interaction with other urban waste may increase the effects (Pérez Talavera and Quesada Ruiz, 2001).

In conclusion, the development of removable energy desalination plants probably will result in more plant construction, once the energy cost is minimized. Although the UNEP suggested some guidelines and procedures for the disposal of brine according to the land-based sources and dumping protocol, aiming at identifying a common management approach in line with the Barcelona Convention (UNEP, 2003), so far no legal requirements oblige the treatment of the

residue before being dumped back to the sea. Albeit environmental impact assessment procedures have been proposed, standards, codes and technical solutions are still in their early phases. An internationally agreed methodology and a new directive -in development- would provide a legal frame for decision making processes assessing, for a given situation, the best suited option.

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Annex 10: Summary of ICES Expert Groups relevant to WFD tasks.

Table A10: Examples of activities in ICES Groups relevant to WFD tasks (not complete). Activities are compiled from the ICES Expert Groups Terms of Reference for 2006.

SCIENTIFIC COMMITTEES NUMBER OF WGS IN EACH COMMITTEE	REFERENCE VALUES	MONITORING	DATA	QUALITY ASSURANCE	PRESSURE POLLUTION	EQO INDICATORS	INTEGRATED ASSESSMENT	MARINE STRATEGY
1. FTC 10 Expert Groups								
2. OCC 19 Expert Groups	WGPE Long-term data WGZE Long-term data WGHABD Harmful algae	WGPE Phytopl. WGZE Zoopl. WGHABD Harmful Algae WGPBI Operational oceanogr. WGMDM Operational oceanogr.	WGPE Long-term data WGZE Long-term data WGMDM Dataman. GIS	WGPE Phytopl. Chl. A WGMDM QA	WGPE Eutrophication	WGPE Chl. a Species Groups WGHABD Harmful algae	WGZE Integration Collaboration	WGZE ICES/EU WGMDM Data exchange
3. RMC 12 Expert Groups								
4. MHC 10 Expert Groups	WGBEC Contamin.	WGMHM Habitat mapping Strategies Techniques	WGBEC Contamin.		WGBEC Contamin. WGMHM Assessing pressure	WGBEC Background responses BEWG Indicators	WGMHM Assessing ecosystem BEWG Ecosystem overview Ecosystem health Integrated assessment	WGBEC OSPAR HELCOM SGNSBP Alliances WGEXT OSPAR HELCOM EU, MPA BEWG OSPAR

SCIENTIFIC COMMITTEES NUMBER OF WGS IN EACH COMMITTEE	REFERENCE VALUES	MONITORING	DATA	QUALITY ASSURANCE	PRESSURE POLLUTION	EQO INDICATORS	INTEGRATED ASSESSMENT	MARINE STRATEGY
5. MCC Six Expert Groups					WGMASC Impact of shellfish aquaculture WGEIM Sustainable aquaculture	WGMASC Indicators	WGPDMO Ecosystem overview Ecosystem health Integrated Assessment WGMASC Integrated evaluation of shellfish Aquaculture WGEIM ICZM normal approach	WGEIM WFD Implications Aquaculture WGMAFC Fish welfare
6. LRC 19 Expert Groups						WGFE EQO for fish communities		WGFE WFD and nature concervation issues
7. BCC 10 Expert Groups	SGEH Historical reference points	SGPROD Integrated productivity monitoring WKIAB Develop monitoring for integrated assessment			SGEH Eutrophication Hazardous substances	SGEH EcoQ elements SGPROD Indicators for productivity	SGEH Ecosystem Approaches WKIAB Develop framework for integrated assessment of the Baltic	SGEH ICES HELCOM EU User-friendly Decision maker friendly WKIAB Involve ICES, HELCOM, EU

SCIENTIFIC COMMITTEES NUMBER OF WGS IN EACH COMMITTEE	REFERENCE VALUES	MONITORING	DATA	QUALITY ASSURANCE	PRESSURE POLLUTION	EQO INDICATORS	INTEGRATED ASSESSMENT	MARINE STRATEGY
8. DFC Three Expert Groups								
Advisory Committees, including their Expert Groups		WKIMON Integrated monitoring Contaminants	WKEUT Long-term data MCAP EU Data Collection Regulation	STGQAC QA Chemical measurements STGQAB QA Biological measurements MCAP OA-work in ICES	WKEUT Eutrophication SGESME Sound from wind farms	WGECO EQO OSPAR WKEUT EQO Eutrophication	WGRED Integrated advice WGECO Regional approach to assessment of human activities	ACE OSPAR HELCOM WGECO OSPAR EU ConC European Marine Strategy WKREP ICES Structure Efficiency Profile

Acronyms can be decoded from the ICES website: www.ices.dk.