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9–12 March 2010

Mallorca, Spain



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Executive summary

The Working Group on Integrated Coastal Zone Management [WGICZM] (Chair: B. Morales-Nin, Spain) met at IMEDEA, Spain, from 9–11 March 2010. The WG discussed particularly how it can respond to current trends within the field of ICZM and Marine/Maritime Spatial Planning (MSP). Therefore group discussions expanded beyond the scope of the ToRs of WGICZM. The main highlights of the annual meeting were:

With regard to the report of progress of ICZM in ICES MS (ToR b) it needs to be noted that most ICES countries still have fragmented responsibilities for legislation and policies among authorities, and a lack of a legal framework to support ICZM nationally and internationally. This raises concern over the lack of compatibility among legislations at the national and eco-region (ICES) levels and the inefficient collection, communication, dissemination, and compatibility of available data sets. It has also become clear that many of the key issues facing decision-makers in the coastal zone are localised and therefore require a local solution. Overall policies within MS as well as on Regional Seas scale remain patchy and do not offer a clear coherent picture.

However, even though the group recognises that it is confronted with a lack of input from some countries, some successes were identified, including:

- Common drivers – economic development is a strong force for coastal and marine policies and is a challenge for MSP and for ecosystem based management;
- Development of powerful tools e.g.: Canada's Strategic Initiative for ICZM, UK's Crown Estate Decision Support tool, Spain's ICZM project or Germany's approach to MSP;
- Specific legislation concerning coastal and marine planning and management developed in some countries (at least in part), e.g. UK and Germany;

Furthermore, there is a wide range of projects (ToR c) that are highly relevant for ICZM and MSP. Many of these projects are funded by the EU and most of them deal with the development of technical and non-technical tools for decision making in the frame of Integrated Management, the ways (including institutional processes) for implementation of marine policies and the increasing competition by multiple users for marine space. In summary, in science as well as planning practice, the limits of sector based assessments and sector based management have been recognised more and more. However, scientists and practitioners are currently in a process of identifying, discussing and developing ways for implementation of integrated approaches (ToR b). This covers technical tools such as GIS based models, indicators and other types of decision support tools, but also principles and rules of decision making, and appropriate multi-sectoral multilevel governance structures.

A very particular issue covers the role of uncertainty and risk based decision making (ToR d). The approach and framework applied in Canada offers a structure from problem formulation to more focussed assessments which include ecological, socio-economic, socio-cultural and governance issues. From this integrated fact base advice for discussion among relevant policy makers can be determined in order to facilitate coordinated management decisions for aquatic activities as well as land-based activities, who affect aquatic ecosystems. However, risk based decision making (even though not named as such) is also included in other approaches to marine planning and management, e. g. zoning within the spatial plans for the German North and Bal-

tic Seas, where in particular areas assigned to the development of offshore wind farms and shipping have to be separated from each other in order to avoid the risk of collisions, which are feared to potentially result in a major spill. The issue of risk based management is intended to be further discussed at the ICES ASC in Nantes this year within session B (convened by 3 active members of WGICZM).

Very specifically, OSPAR requested input on the environmental interactions of wave and tidal energy generation devices (ToR g). The WG concluded that from a theoretical point of view, ocean energies could cover more than the Worlds electricity consumption of 16,000 TWh/year. High resources of wave energy are located along the Western European coast and off the coasts of Canada and the USA. Currently there are a number of large scale test installations are under development but technologies as well as the related industry sector are still in an early stage of development. Due to the small scale of the existing installations, not much is reported about conflicts with other users of the marine environment. In Environmental Assessments the most reported potential conflicts are with fisheries and shipping/navigation. Depending on the size of future operational developments and their specific impacts on the non-biotic and biotic environment conflicts can potentially arise with conservation areas, scientific research areas and military areas, but also telecommunication cable lines and dredge spoil disposal sites. Beside their positive impact on CO2 emissions, an argument used by developers in favour to ocean energies is that they have a positive impact on local employment, often including diversification of employment across sectors, and stimulation of declining industries, e.g. shipyards. While analyses of the available ocean energy resources have been conducted, an overlay with constraints that prevents its exploitation, including environmental barriers as well as conflicts with other sea uses and missing infrastructure, e.g. transmission lines and grid connection, still needs to be done.

In many countries both issues, ICZM and MSP are administratively and politically separated in different departments and/or ministries. But from the perspective of WGICZM both are closely connected to each other. The mentioning of ICZM as a tool within marine policies in the EU, particularly the EU Marine Strategy Framework Directive (MSFD) and the EU Maritime Policy (IMP) are examples for this connection, but also many of the implementation issue discussed above. In this context, the formation of the Strategic initiative for Coastal Zones and Marine Spatial Planning (SICZSP) within ICES is very timely.

Discussing the SCICOM/ACOM request to comment on the formation of SICZSP the WG propose to:

- expand the remit of WGICZM in the future and include linkages to Marine Spatial Planning (MSP), ecosystem-based management and land-sea interactions. WGICZM feels that this would be best achieved by developing a set of ToRs that address a wider range of issues relating to the development of ICZM in ICES MS and change the name of the WG accordingly to WG on Marine Planning and Coastal Zone Management (WGMPCZM). The overall objective of the WGMPCZM will be to provide scientific advice on the key issues pertaining to the sustainable use of marine resources that can be answered through the implementation of Integrated Management (IM), e.g. thresholds, catchment-coast interactions, tools to trigger management action and integrated governance frameworks for IM. New ToRs were developed for the group that would encompass the three high priority areas stated in the ICES Science Plan (2009-2013) that are of relevance to

this group, i.e. MSP, socio-economics and coastal zone habitats. This would also fit with the ToRs of the proposed SICZSP. Looking at the SICZSP ToRs relating to data warehousing identification of potential clients and collaborators WGICZM feels that the development of an ICES MSP Facility supporting data processing, management, analysis and visualization is out of the remit of this WG.

WGICZM was also requested to report to SSGHIE on plans to promote cooperation between EGs covering similar scientific issues. WGICZM recognised the relevant scientific contributions that could be provided from other EGs to the ToRs of this group. Further the group would be able to identify linkages on a needs basis and facilitate appropriate collaborations and would welcome requests for advice and collaboration from other EGs.

The Chair B. Morales-Nin stepped down and the group selected as Chair Andreas Kannen (Germany).

1 Opening of the meeting

The Chair, Beatriz Morales-Nin, Spain, opened the meeting at 9:30 on Tuesday, 9 March 2010, welcomed the participants and made some announcements regarding domestic arrangements.

Five ICES countries: Spain, Germany, Norway, UK and Canada were represented at the 2010 meeting. A list of participants is included in Annex 1.

Clare Greathead (UK), kindly agreed to act as general editor of the report.

2 Adoption of the agenda

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

3 Terms of Reference

- a) Update and report on activities of relevant ICES Working and Study groups to identify Update and report on activities of relevant ICES Working and Study groups to identify information pertaining to the coastal zone and evaluate this information relative to ICZM needs and to monitor progress on policies and programmes in the UN, EU, LOICZ and ICES member countries;
- b) Update and report on ICZM activities in different ICES countries including information on initiatives towards integrated governance in the CZ;
- c) Continue to monitor and report results generated from larger projects that are directly relevant to ICZM needs;
- d) Progress the development of an integrated decision making framework for ICZM;
- e) Continue the assessment of tools related to ICZM;
- f) Continue to report on progress on catchment-coast fluxes in the ICZM management plans of ICES countries, but be more broadly focused on coastal system sustainability based on integrating human ecological systems as they relate to Land-Ocean Interactions. This ToR should also provide advice on the integration of all the issues highlighted in the ToRs of this WG, to be addressed in ToR f.
- g) Environmental interactions of wave and tidal energy generation devices (Marine wet renewables) (OSPAR request 2010/4).
- h) To provide advice on the extent, intensity and duration of direct and indirect effects and interactions of marine wet renewable energy production (wave, tidal stream and tidal barrage systems) with the marine environment and ecosystems of the OSPAR maritime area, and with pre existing users of these ecosystems, including:
 - i) actual and potential adverse effects on specific species, communities and habitats;
 - ii) actual and potential adverse effects on specific ecological processes;
 - iii) irreversibility or durability of these effects.

- i) Report to SSGHIE on potential and current contributions of your EG to the Strategic Initiative on Coastal and Marine Spatial Planning (SICMSP);
- j) Report to SSGHIE on your plans to promote cooperation between EGs covering similar scientific issues.

WGICZM will report by 21 April 2010 for the attention of ACOM and SICOM.

3.1 Update and report on activities of relevant ICES Working and Study groups to identify information pertaining to the coastal zone and evaluate this information relative to ICZM needs and to monitor progress on policies and programmes in the UN, EU, LOICZ and ICES member countries (ToR a)

The ICZM process involves many aspects of work that the expert groups of ICES are involved in. In the first instance ICZM is a management process that incorporates all the activities in a given area. To manage these activities successfully detailed information on the requirements, impacts on ecosystem services, interactions with other sectors, thresholds for contaminants, indicator frameworks etc of each activity is required, these are then processed using an ICZM decision support system/ management framework or Marine Spatial Planning.

This year the working group has concentrated on revising the remit and ToRs of the working group to reflect the significant reorganisation of the purposes and structures of ICES and the increasing role of MSP and other tools in ICZM. Therefore the activities of only a couple of the ICES working groups have been reviewed here, however other programmes of relevance to ICZM within the EU and UN have been reviewed.

3.1.1 Review of relevant ICES Working and Study Groups

The figure below (Figure 3.1.1) shows the role of this working group within ICES and the identification of different ICES Working Groups with respect to information on human activities or issues relevant to ICZM (Figure 3.1.2). A summary of relevant ICZM information from these WGs is presented below.

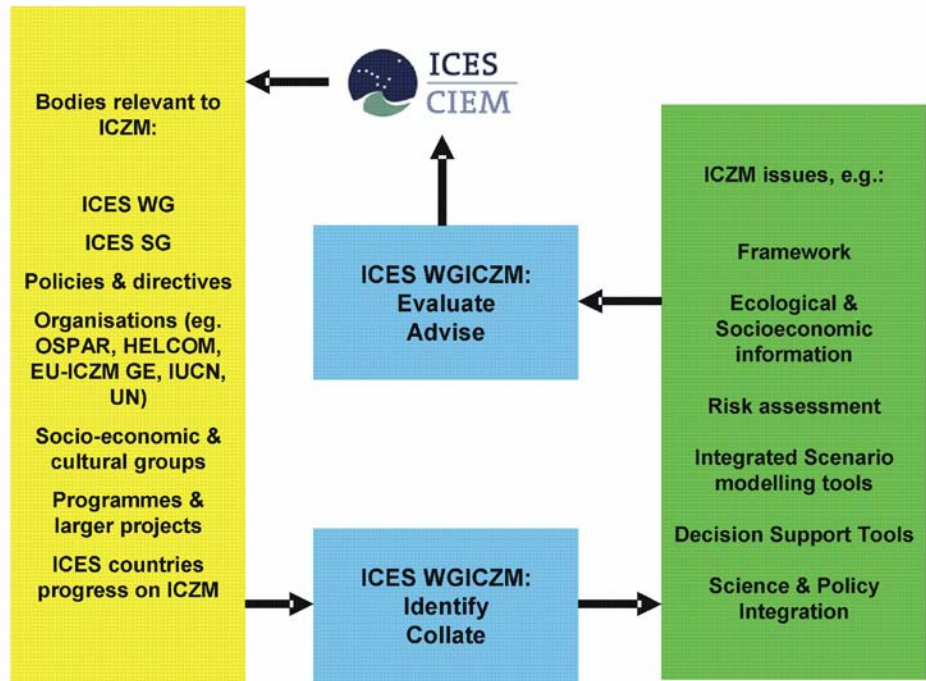


Figure 3.1.1. The role of WGICZM within ICES.

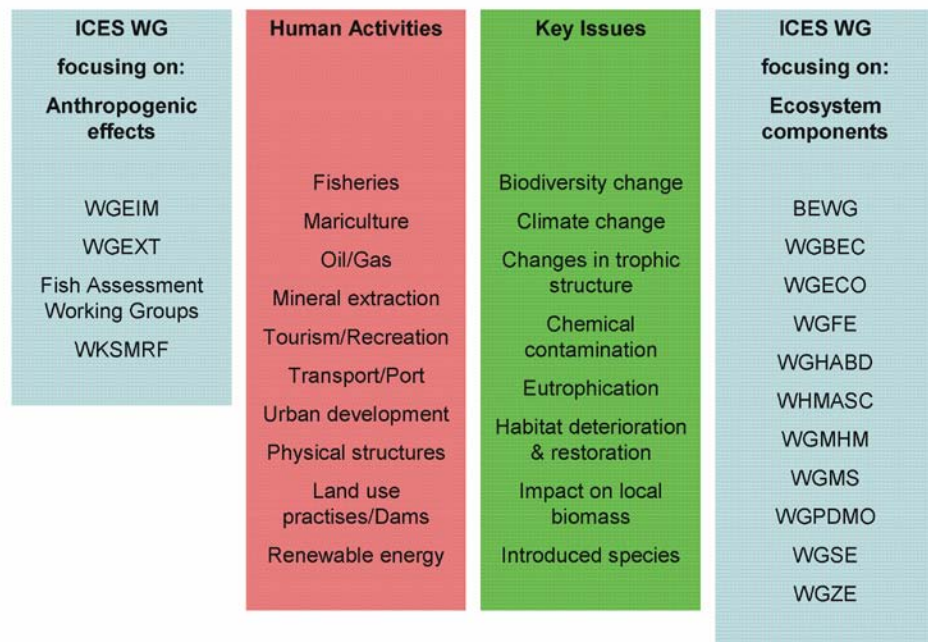


Figure 3.1.2. The identification of different ICES Working Groups with respect to information on human activities or issues relevant to ICZM.

3.1.1.1 WGMASC

The Working Group on Marine Shellfish Culture (WGMASC) in its 2009 report, included as a TOR to complete the development of a recommended framework for the integrated evaluation of the impacts of shellfish aquaculture activities in the coastal zone (ToR b). After a thorough review from the point of view of the ecosystem management approach, they concluded:

- An integrated ecosystem approach to aquaculture (EAA) management has been defined as a strategy for the integration of aquaculture within the wider ecosystem in such a way that it promotes sustainable development, equity, and resilience of interlinked social and ecological systems.
- A global activity related to the development of an EAA is the creation of performance-based standards that are linked to certification schemes and management frameworks designed to minimize the key social and environmental issues associated with shellfish farming while permitting the industry to remain economically viable.
- A recurring bottleneck to the establishment of an EAA is the need to define an “unacceptable” impact. This decision needs to be made within an integrated framework that is both science and ecosystem based, but which also incorporates societal values.
- The DPSIR (Driving Forces-Pressures-State-Impacts-Responses) framework is recommended as the basis for an EAA as it identifies environmental problems, their causes and solutions, and recognizes important linkages between ecological and socioeconomic systems. DPSIR provides the means to structure sets of indicators in a manner that facilitates their interpretation, can aid an understanding of how different issues are inter-related, and is recommended as a basis for the assessment, evaluation and operational management of the impacts of shellfish aquaculture activities in the coastal zone.

A large suite of potential ecological indicators were reviewed that communicate information about ecosystem status and the impact that aquaculture activities may have on ecosystems to responsible authorities and to the public. Evaluation of impacts specific to shellfish aquaculture presents a challenge owing to the wide range of culture species, husbandry practices, and environmental settings, and variable spatial scale. Indicator selection criteria were provided to facilitate constraining the number of indicators within a flexible performance-based management framework. A variety of modelling activities are contributing to the movement from reactive to proactive aquaculture management. Modelling facilitates an understanding of how all culture units interact over a scale relevant to coastal ecosystems and are useful within the DPSIR framework to identify indicators of ecosystem status and aquaculture impacts, and contribute to the establishment of impact thresholds (regulatory triggers).

It is recommended that EAA be based on a tiered environmental monitoring approach that is structured on the principle that increased environmental risk requires an increase in monitoring effort. Aquaculture monitoring has generally focused on the benthic marine habitat in the immediate vicinity of a farm. However, local benthic geochemical and community parameters, while useful for site-specific environmental monitoring, are of limited value as indicators of changes at the ecosystem level. Some combination of modelling and measurement of selected far-field indicators related to benthic and pelagic communities, suspended particle depletion, shellfish performance is needed over relatively large (inlet-scale) areas to adequately assess the ecosys-

tem-level impacts of shellfish culture. It is recommended that regulatory decisions be based on partitioning the range of variation of an indicator into more than two classes/categories (acceptable vs. unacceptable). A few more threshold classes permits implementation of mitigation measures prior to reaching an unacceptable ecological state.

The recommended EAA framework, which is linked to the DPSIR scheme, was assessed relative to the focus of EU legislations and policy frameworks. Most legislative and policy frameworks relevant to shellfish aquaculture revolve strongly around assessment of the state of the environment and aquaculture impacts. The introduction of the Marine Strategy and Water Framework Directives (also Canadian Oceans Act) mandates a DPSIR-type EAA approach that links ecological and socio-economic systems. It is therefore essential that the development of a management framework should be inclusive with diverse stakeholder participation, transparency and communication.

3.1.1.2 WGHMP

The Working Group on Marine Habitat Mapping convened in Copenhagen, Denmark from 21–24 April 2009. The key points from the meeting were the revision of MHM projects and programmes, protocols, models and uses of MHM.

Marine habitat mapping is being underpinned at European level by a) the upcoming MSFD (Marine Strategy Framework Directive) and b) the delivery in 2008 by Member States of the outlines of their Natura 2000 extension to sea. These, along with a strong push towards the creation of MPA (Marine Protected Areas) in both the coastal zone and the deeper waters, are prompting the community towards the delivery of more habitat maps. As the territories increase in size and not all countries can follow the Irish or Norwegian examples blended approaches of detailed surveys and interpretation and modelling techniques are in particular focus. The importance of applying quality standards to better inform map users was also recalled.

International programmes

A few international programmes will be dealing with habitat mapping in 2009. This is the case for parts of Charm 3 (UK-France) extended to the whole Channel, for Coral-Fish (deep sea corals in relation with fisheries) and for Prehab (habitat modelling and pressure of human activities in the Baltic Sea). A project called EuSeaMap is currently underway under JNCC lead to provide global models of several European marine basins. It is part of the Emodnet initiative launched by DG/MARE and it connects with other lots due to deliver several types of marine data sets over the next two years. A follow-up to Mesh (Mesh-Atlantic) applying to the Interreg Atlantic Area Programme will be submitted in June.

Protocols and standards for habitat mapping

The crucial importance of map confidence assessment was once again emphasised by the group. The group discussed the assessment of modelled maps for which fewer efforts have been made in past studies than for detailed maps. The relevance of working towards a spatial confidence throughout the final habitat map was also stressed, rather than delivering a single overall score (as had been produced by Mesh). The emphasis was therefore placed on assessing the reliability of the source data layers that are commonly used in modelling (bathymetry, substratum and physical drivers) and how these can be combined. The group agreed on using the various fora to re-

mind data providers of the importance of associating accuracy and confidence scores to their data at all times. The group will work on producing a position paper on this topic.

Habitat modelling

A number of modelling studies were presented, with proves a continued interest for this type of indirect approach. Most modelling examples were applied to single species/habitats. These studies call for an improvement in source data layers resolution and quality.

Use of habitat mapping in a management context

The group discussed a table sorting out various types of marine human activities versus the range of scales of habitat maps and whether specific types of maps could serve specific needs. Participants are invited to contribute this matrix with relevant comments and cases. When some progress is made, these cases will be handed over to the ICZM working group for cross-fertilization.

3.1.1.3 WGEIM

The WGEIM was held on April 2008 dealing in 'Tor a' with the indices for the environmental effects of mariculture. As the subject is of relevance to our group an extended summary is included on the principals.

The WGEIM defined sustainability indicators as different from "impact" indicators in that they are more comprehensive, including considerations of not only environmental but also social and economic sustainability. Recognizing this, members of the WGEIM believe it is the proper role of the WGEIM to better define environmental indices that represent discernible environmental changes as a result of mariculture rather than involve itself in discussions of economic and social indicators where it has no expertise.

For science to supply advice on management of marine species and ecosystems, scientists need to be aware of how indicators fit with the broader structure of management knowledge. A useful structure for looking at that broad knowledge base and its associated classes of indicators is the commonly used "Driver-Pressure-State-Impact-Response" structure. Classes of such indicators include:

- Diagnostic (compliance) indicators: Are people/industries following the rules?
- Status and trend indicators: What is the status and trend of the ecosystem and its component properties? This could include ecosystem function indicators: how well is ecosystem function X being served, for example, the amount of a habitat needed to support a particular number of fish, for habitats of different state or quality. This could be used in evaluating compensation as well as achievement of ecological objectives.
- Limit indicators: Are the conservation objectives (limits) being respected for properties essential to ecosystem structure and function?
- Target indicators: Are policy aspirations being met?

These classes of indicators are not necessarily independent of each other. They can be thought of as functions that indicators may serve, and many indicators can serve more than one function. For example for eutrophication issues, concentrations of ni-

trogen in coastal waters may be used both as a limit indicator and a status and trend indicator.

Indicators useful for management should be sensitive to pressures on the system, but need not necessarily diagnose exactly the mechanisms of change. They are effective as long as they give reliable signals to science and management in order to start examining the situation in detail. For several functions, particularly limit and target indicators, there should be a link between indicators and programs within which management undertakes decision making.

Defining a single set of indicators to be used by all regions is not practical, nor desirable, considering their differences in characteristics and objectives. The alternative would be to agree upon a set of selection criteria and a process to evaluate potential indicators. Using such a standard would provide formal justification for why an indicator might be used in one region but rejected for use by another region.

A preliminary list of indicator selection criteria found in Rice and Rochet (2005) is a starting point for discussion:

- Interpretation (Concreteness, Public Awareness, Theoretical Basis)
- Implementation (Availability of Historic Data, Cost, Measurability)
- Application (Sensitivity, Specificity, Responsiveness)

The following eight step framework is used to help tailor selection of indicators to optimally meet the above criteria (Rice and Rochet, 2005):

- 1) Determine users, their needs & objectives
- 2) Move from Objectives to candidate Indicators
- 3) Weight the screening Criteria
- 4) Score Indicators on the Criteria
- 5) Summarise results of the Scoring
- 6) Decide how many Objectives are required
- 7) Select the suite of Indicators
- 8) Report on status using the Indicators

The 2006 report of WGEIM noted that the Integrated Coastal Area Management (ICAM) guidance of UNESCO (2003) defines an indicator as a “parameter or value, which provides succinct information about a phenomenon”. The ICAM guidance has three basic categories of indicators, one of which is “environmental” described as follows:

Environmental: reflect trends in the state of the environment; are descriptive in nature; and become performance indicators if they compare actual conditions to desired conditions expressed in terms of environmental targets.

The combination of descriptive indicators with some expression of desired conditions or desired direction of change can provide a point of comparison (or threshold) for indicators of performance. Pathway is commonly used as a framework of pathways of effects. The WGEIM believes that “zero effects” is an unattainable goal that has little place in a discussion of sustainable development as it is a wholly unrealistic goal.

3.1.2 LOICZ 2010

LOICZ has finished a series of priority topics (dealing with social-ecological systems, biogeochemical fluxes and coastal governance) which have been addressed in the last years. For the next years the new overarching topic "Vulnerability and Adaptation to Global Change in the Coastal Zone" is initiated. This issue will be addressed using case studies and reference sites with a focus on:

- Megacities;
- River-Mouth Systems (estuaries, deltas, lagoons);
- Small Island Developing States;
- The Arctic.

Moreover, LOICZ will use the ICSU visioning document (<http://www.icsu-visioning.org/>) and try to address five challenges:

- Improve the usefulness of forecasts of future environmental conditions and their consequences for people;
- Develop the observation systems needed to manage global and regional environmental change;
- Determine how to anticipate, avoid and cope with dangerous global environmental change;
- Determine what institutional and behavioural changes can best ensure global sustainability;
- Develop and evaluate innovative technological and social responses to achieve global sustainability.

3.1.3 Review of progress on policies and programmes of relevance to ICZM in the UN, EU and ICES member countries

3.1.3.1 Report on progress on ICZM policies and initiatives in the EU: "Follow-up to the EU ICZM Recommendation"

Following the evaluation of the implementation of the EU ICZM Recommendation 2002/413/EG, the Commission envisages proposing a follow-up to the EU ICZM Recommendation in 2011. The process to define the follow-up to the EU ICZM Recommendation must be accompanied by an impact assessment, in accordance with the Commission procedures. The impact assessment process includes use of expertise and consultation.

At the 8th meeting of the EU ICZM Expert group in Venice, 27 November 2008, DG Environment invited the ICZM expert group to set-up a Working group with the purpose of providing early stage, strategic orientations in the process leading to the follow-up to the EU ICZM Recommendation ("scoping"). The Working Group met for the first time on 16–17 March 2009.

The report of the 1st Working Group was discussed and endorsed at the EU ICZM Expert Group meeting of 7 September 2009 (<http://ec.europa.eu/environment/iczm/home.htm>). The meeting concluded that a new meeting of the Working Group would be useful to elaborate further on the linkages to existing instruments, and the development of objectives, including the regional seas adaptations and implementation over different governance levels.

This discussion document served as a basis for the 2nd Working Group meeting of 25-26 February 2010. Aim of the meeting was a kind of scoping the basic elements, to provide an outline of the substance of options, but not drafting actual proposals. The key questions to be addressed currently are:

- What objectives can be set for ICZM, adding value to existing EU policies and legislation;
- What deliverables and tools can be set out;
- To what extent should objectives differ for different levels of governance, including regional seas context;
- To what extent would the above objectives differ for different policy options that have been defined for the impact assessment (i.e.: no-change, revised Recommendation, Framework Directive, Programme Decision).

In support of this process the European Commission (DG Environment) requests the Member States to provide an update on progress in implementation ICZM Recommendation and further experiences with the implementation of their national ICZM strategies. The reports from the Member States will be used to share experience on the implementation of the ICZM Recommendation and to inform the directions for ICZM policy at EU level in the future. The report should cover the period from 2006 to 2010 and should be sent to the Commission, DG Environment, by December 2010.

It is recommended that the report follows the structure and content items suggested hereafter:

- Introduction (brief overview);
- Activities undertaken to support the implementation of ICZM;
- An assessment of progress in ICZM and the state of the coast;
- Outlook for further implementation of ICZM;
- Process (Information on how the report was compiled).

The reports will be published on the ICZM website on EUROPA.

EU Expert Group on ICZM: <http://ec.europa.eu/environment/iczm/home.htm>

3.1.3.2 UK – Marine Bills

Marine and Coastal Access Act (2009)

The Marine and Coastal Access Act (2009) received Royal Assent in November 2009. Measures within Act will make a significant contribution towards integration in coastal areas. The key elements of the Act are the introduction of a system of Marine Planning; licensing reform, merging some disparate regimes for development consents; new nature conservation measures in territorial and offshore waters to implement marine protected areas (called Marine Conservation Zones); the creation of a Marine Management Organisation to deliver some or all of the above, together with some existing functions; and changes to inshore fisheries' management in England to be passed into law as the Marine (Scotland) Act 2010.

Work to develop a UK wide Marine Policy Statement is also moving forward, building on the Joint High Level Marine Objectives the UK Government, Welsh Assembly Government, Northern Ireland Executive and Scottish Government published for the (MPS) - will result in integrated management of UK marine area in April 2009. See <http://www.defra.gov.uk/environment/marine/legislation/hlmo-sharedseas.htm>.

Scottish Ministers will participate in the formulation of the MPS. This is due for publication in 2011, in particular:

- Marine Planning - if the MPS is adopted by Scottish Ministers, marine planning in the offshore and inshore area will be guided by the MPS;
- Marine Licensing - combines FEPA and CPA consent, making Scottish Ministers responsible for issuing new marine licenses in the Scottish offshore region;
- Marine Conservation - Scottish Ministers will have a power to designate Marine Protected Areas in Scottish waters;
- Common Enforcement Powers - Scottish Ministers new enforcement powers extend to marine conservation and licensing.

Marine planning in particular will lead the process of integrating marine with terrestrial planning and further enable greater integration along the coast. Marine planning implementation work is moving forward with a model structure of a marine plan having been developed (<http://www.mfa.gov.uk/mmo/planning.htm> and <http://www.mfa.gov.uk/mmo/structure.htm>).

The Marine Management Organisation (MMO) will be vested in April 2010 <http://www.mfa.gov.uk/mmo/mmo.htm>

We also recently published a consultation on a series of proposed marine plan areas for the English Inshore and English Offshore Marine regions. The proposed marine plan areas have been identified using previous stakeholder input and overwhelming consensus that the areas should be based on ecosystem and biographic considerations while also benefitting integration with terrestrial planning at the coast. <http://www.defra.gov.uk/corporate/consult/marine-plan/index.htm>.

International responsibilities for the implementation of the Marine Strategy Framework Directive in the Scottish inshore and offshore region, will fall to Scottish Ministers who are the competent authority.

Scottish Marine Bill

The Bill completed Stage 3 in the Scottish Parliament on 4 February 2010 and is currently awaiting Royal Assent. Full implementation of the provisions within the Marine Bill in its final form is expected to take approximately two years. The Bill will introduce legislation to ensure the sustainable management of Scotland's coasts and seas to balance the competing interests for use and protection of the sea. The powers within the Scottish Bill extend to 12nm but executive devolution from 12-200nm to Scottish Ministers through the UK Marine and Coastal Access Act will allow the Scottish Ministers to manage Scotland's seas from 0-200nm. International, EU and national interests will be met through the National Marine Plan while regional planning and ICZM will be met through Scottish Marine Regions (SMRs). The Scottish Coastal Forum, is currently consulting with stakeholders to advise Scottish Ministers on a range of characteristics for identifying SMR's prior to establishing their boundaries via secondary legislation. A workshop was held in Edinburgh on 13 March 2009 to identify and discuss possible characteristics for the boundaries. A comprehensive report on the workshop can be found at:

<http://www.scotland.gov.uk/Resource/Doc/17888/0092157.pdf>

The Marine Planning Partnerships comprising representatives of stakeholders and local authorities of each SMR will be responsible for regional marine planning. The

requirement in the Bill for regional marine plans to be compatible with adjacent regional marine plans and similarly with adjacent terrestrial plans provides a mechanism for delivering ICZM. Where required, Scottish Ministers may also use their power of direction in the Bill to ensure ICZM is delivered by those carrying out regional marine planning functions.

Marine Scotland (the Scottish MMO) was established, as a delivery-orientated Directorate of Scottish Government, on 1 April 2009 and is the lead marine management authority in Scotland. It brings together, as a first step in the implementation of improved, better integrated marine management arrangements in Scotland, functions and resources of the Marine Directorate of Scottish Government, Fisheries Research Services and the Scottish Fisheries Protection Agency. It seeks to integrate and improve upon existing marine management functions and will take on new responsibilities and functions once the Marine (Scotland) Bill receives Royal Assent. Marine Scotland will do this both by working with others and by the way in which it carries out its own functions of:

- Evidence based policy development and marine planning;
- Streamlining and licensing and consenting;
- Sound science;
- Effective compliance monitoring and enforcement.

3.1.3.3 ICZM Protocol of the Mediterranean

A new Protocol on Integrated Coastal Zone Management (ICZM) was signed in Madrid on 21 January 2008 at the Conference of the Plenipotentiaries on the Integrated Coastal Zone Management Protocol. Fourteen Contracting Parties to the Barcelona Convention signed the Protocol at the Conference, and the others announced to do so in very near future. The signing of the Protocol came after a six-year process of consultation, negotiation and refinement on the Protocol layout and dedicated work of all the Parties. The ICZM Protocol is the seventh Protocol in the framework of the Barcelona Convention and represents a crucial milestone in the history of MAP. It completes the set of Protocols for the Protection of the Marine Environment and the Coastal Mediterranean Region. It will allow the Mediterranean countries to better manage and protect their coastal zones, as well as to deal with the emerging coastal environmental challenges, such as the climate change. This Protocol is a unique legal instrument on ICZM in the entire international community and could serve as model for other regional seas.

3.1.3.4 EU key principles for MSP and UN MSP guidelines

MSP can be defined as analysing and allocating parts of the three-dimensional marine spaces to specific uses or non-uses, to achieve ecological, economic, and social objectives which determined through political processes. Thus it reflects a vision of the future of the marine space and ecosystem.

The commission published ten key principles for MSP to give guidance on good practice for the plan development (see box 1). For instance management of maritime spaces through MSP should be based on the type of planned or existing activities and their impact on the environment. This means that a marine plan does not necessarily cover areas defined by national jurisdiction such as the EEZ of a member state. Also MSP should facilitate simplified permit systems and reduce costs of regulatory and administrative procedures.

Box 1: Key principles for maritime spatial planning (EU, 2008).

- 1) Using MSP according to area and type of activity
- 2) Defining objectives to guide MSP
- 3) Developing MSP in a transparent manner
- 4) Stakeholder participation
- 5) Coordination within Member States – Simplifying decision processes
- 6) Ensuring the legal effect of national MSP
- 7) Cross-border cooperation and consultation
- 8) Incorporating monitoring and evaluation in the planning process
- 9) Achieving coherence between terrestrial and maritime spatial planning in relation with ICZM
- 10) A strong data and knowledge base

To fill the gap between the marine spatial planning process and existing scientific expertise the UNESCO published a step-by-step guide for MSP (Ehler and Douvère, 2009) which describes “good practice” on how to operationalise the MSP process. The guidelines propose a number of steps comprising for instance the establishment of the context, the organisation of the process and stakeholders or the analysis of current conditions. These steps have been developed on the basis of actual MSP initiatives from around the world. Thus “good practice” is extracted from the documented success and failure of practical international MSP experience. These guidelines should support the successful implementation of the MSP process and the documented MSP steps are as follows:

- Establishing context and authority for marine spatial planning;
- Obtaining financial support for marine spatial planning;
- Organizing the process for marine spatial planning;
- Organizing stakeholder participation for marine spatial planning;
- Defining and analyzing existing conditions for marine spatial planning;
- Defining and analyzing future conditions for marine spatial planning;
- Preparing and approving the spatial management plan;
- Implementing and enforcing the spatial management plan;
- Monitoring and evaluating performance of the spatial management plan;
- Adapting the marine spatial management process.

References

- EU. 2008. Roadmap for Maritime Spatial Planning: Achieving Common Principles in the EU. COM (2008) 791 final.
- Ehler, Charles, and Fanny Douvère. 2009. Marine Spatial Planning: a step-by-step approach toward ecosystem-based management. Intergovernmental Oceanographic Commission and Man and the Biosphere Programme. IOC Manual and Guides No. 53, ICAM Dossier No. 6 Paris: UNESCO, 2009.

3.2 Update and report on ICZM activities in different ICES countries including information on initiatives towards integrated governance in the CZ (ToR b)

Issues: lack of input from other countries

- Main drivers seem to be economic;
- ICZM not high enough up the agenda for some MS;
- ICZM experts in different government departments than traditional ICES experts;
- Conflict of interest with MSP development;
- Lack of clarity of role of working group.

Successes:

- Common drivers – economics;
- Development of powerful tools e.g.: Canada's Strategic Initiative for ICZM, UK's Crown Estate Decision Support tool, Spain's ICZM project;
- ICZM included in the ICES Science Plan, however there are still some issues with the mind set of ICES;
- Specific legislation developed in some countries e.g. UK and Germany.

Spanish ICZM: During the last two years, several ICZM researchers and practitioners of Spain have been working together in association with AENOR (Asociación Española de Normalización) to develop guidelines for the application of ICZM processes for the Spanish coast. As stated in the EC Green paper (Towards a future Maritime Policy for the Union), "a future maritime policy has to build instruments and methods for ensuring consistency between land and marine systems in order to avoid duplication of regulations, or the transfer of unsolved land-planning problems to the sea". Under such mandate, the group was initially pushing the idea to use formal environmental management standards for ICZM in a proposal for the development of a new norm UNE-ISO; finally they have produced a booklet that contains a series of guidelines for the implementation of these processes in practice. As a previous development of the group, they published a book on this topic, very relevant for Spain, "Gestión integrada de zonas costeras" (AENOR Publ.).

UK Decision Support tool: MaRS is a decision-support tool, facilitated by the Crown Estate (CE), which interrogates third party data sets using GIS technology to identify potential areas for sectoral development. The tool produces three key outputs: site suitability for potential business activity, the sustainability value of that activity and financial analysis of the potential revenue to the business which will enable long term informed decision-making for marine development. MaRS will increase the CEs expertise in the management of offshore national assets and to ensure the multiple demands on this resource are managed in a responsible manner, and will improve the management of the increasingly complex interactions between competing development activities, environmental considerations, legislative compliance and stakeholder demands.

Prospective areas suitable for offshore wind energy development have already been specified; in January 2010 Round 3 of prospective areas suitable for offshore wind energy developments was proposed.

Please see Table 4.2.1 for summaries of progress towards ICZM in ICES member countries.

WGICZM recommends:

- to continue reporting on ICZM activities in ICES member countries including information on initiatives towards integrated governance in the CZ. – restructure;
- WGICZM should take the opportunity of the theme session at the ICES conference and publish the papers in a special issue in a journal (e.g. Marine Policy) and the conference proceedings.

3.3 Monitor and report results generated from larger projects that are directly relevant to ICZM needs (ToR c)

Below are outlines of some more recent large projects that are of relevance to ICZM; table 3.3.1 outlines projects that are continuing but have been reported on in previous reports.

3.3.1 BaltSeaPlan

The 3.7 m EUR project BaltSeaPlan is one the major EU initiatives in the field of maritime spatial planning in the coming years. With 14 [partners](#) from seven Baltic countries, the project will provide key input into the realization of the EU Maritime Policy, HELCOM Baltic Sea Action Plan and the VASAB Gdańsk Declaration. Coordinator is the German Federal Hydrographic and Maritime Agency (BSH).

With a learning-by-doing approach BaltSeaPlan will overcome the lack of relevant legislation in most Baltic SeaRegion countries. Seven important Baltic areas were chosen for [pilot maritime spatial plans](#), among them the Pomeranian Bight, Gulf of Gdańsk or the Middle Bank area between Poland and Sweden.

A broad scale stocktake of maritime uses will be carried out in each pilot area. Additional information will be collected with application of newest tools and methods, such as sea-bed modelling and climate change scenarios. All data will be harmonised according to requirements of the EC INSPIRE directive and compiled in a [joint data base](#).

Additionally, BaltSeaPlan will provide key input into [National Maritime Strategies](#) as required by the EU Blue Book on Future Maritime Policy. In 2011 a common spatial development vision for the Baltic Sea will be produced as a synergy of the national visions and plans of all Baltic SeaRegion countries.

3.3.2 MESMA

MESMA (2009-2013; www.mesma.org) is coordinated by IMARES and concerned with the monitoring and evaluation of spatially managed areas. It will supply innovative methods and integrated strategies for governments, local authorities, stakeholders and other managerial bodies for planning and decision making at different local, national and European scales. This will also comprise an easy accessible information system to gain support from politicians, stakeholders and the public in general for difficult (inter)national decisions that will be needed for sustainable use and protection of this vulnerable area. MESMA will supply strategic tools for sustainable development of European seas and coastal areas. The major challenge is to combine an optimized use with a sustained ecosystem of high quality, taking into account ecolog-

ical and economic differences. By studying and comparing different national situations and solutions from a selected number of sites throughout Europe and by determining common features and differences, including the socio-economic settings and requirements, an integrated toolbox that can be applied throughout Europe will be made available.

3.3.3 COEXIST

COEXIST (May 2010-2013) is coordinated by IMR, Norway and is concerned with the interaction and sustainable integration of aquaculture and fisheries in coastal waters. COEXIST aims to develop a broad, multidisciplinary approach to evaluate these interactions with the ultimate goal to provide a roadmap to better integration, sustainability and synergies among different activities in the coastal zone. The project will study the interactions between capture fisheries and aquaculture and evaluate mutual benefits and possible bottlenecks for concomitant development of these activities in the coastal zone within the context of the ecosystem approach to management. It will propose, develop and evaluate the efficiency of spatial management tools (zoning, closed areas, etc) to promote different forms of coastal aquaculture and fisheries at different scales (e.g. local, regional) and it will exploit mutual opportunities (e.g. artificial reefs, protected areas, wind farms, tourism etc) within a context of competition for space by multiple users. The project will address differences in acceptance of activities (fisheries, aquaculture, and other use of the coastal zone) by the society. A detailed strategy for communication and involvement of stakeholders and for dissemination of results to general and targeted audiences is integrated in the project. By these actions, the project will support the new European Maritime Policy and spatial planning of coastal areas.

3.3.4 PEGASO

The PEGASUS project (2010-2014) follows the criteria established by the conventions of Barcelona and Bucharest, which aim to achieve a coordinated approach in the management and sustainable development of resources in order to protect these regional seas and the quality of life of their people.

The basins of the Mediterranean and Black Sea suffer from severe environmental degradation which has negatively affected the economic activities and welfare of people living in the regions. In January 2008, the European Union put into action its Integrated Coastal Zone Management Protocol. According to the protocol, the main objective of PEGASO is to set new common focus points for the development of integrated policies in coastal, marine and maritime regions of the Mediterranean and Black Sea basins.

The process of implementing PEGASO will last 48 months, from February 2010 to January 2014. The project will be coordinated by researcher Françoise Breton, lecturer at the UAB Department of Geography.

Project Web Site: <http://www.pegasoproject.eu> (operative in 2010)

A newsletter can be found at:

<http://www.tourduvalat.org/ozhm/Newsletter/NL8/PEGASO%20presentation.pdf>

Table 3.2.1: Current ICZM activities and progress in different ICES member countries.

ISSUE	CANADA	DENMARK	GERMANY	IRELAND	NORWAY	POLAND	SPAIN	SWEDEN	UK
Updated	2010	2009	2010	2008	2010	2006	2009	2007	2010
Has the coastal zone been defined for management?	Between low water mark and 12 nautical mile line	Between 3 km inland and either 6 m depth or 1 nm seaward	In the national ICZM strategy the Exclusive Economic Zone (EEZ); coastal waters and transitional waters in the sense of the WFD and in estuaries those waters, which are influenced by the tide are included and on the terrestrial side the adjoining rural counties (Kreise).	No, coastal boundaries defined by WFD, EEZ, ICES areas.	No The EU WFD definition of 'coastal water': 1 nautical mile off the baseline is adopted.	Not reported.	EU WFD definition of 'coastal water': 1 nautical mile off the baseline of interior waters is adopted.	No	Guidance Note 20 on coastal planning offers guidance on defining the coastal zone.

ISSUE	CANADA	DENMARK	GERMANY	IRELAND	NORWAY	POLAND	SPAIN	SWEDEN	UK
Updated	2010	2009	2010	2008	2010	2006	2009	2007	2010
Competent authority for coastal zone use.	Department of Fisheries and Oceans.	Sea: Two ministries and three authorities. Land: One ministry via the Agency for Spatial and Environmental Planning. From 2007, 78 coastal municipalities will be responsible for CZM.	Land and coastal waters (12 sm): Laender, for some issues sectoral responsibilities (e.g. public waterways), EEZ: Federal Ministry of Transport, Building and Urban Development is responsible for spatial planning; Federal Environment Ministry for nature protection; Other Federal Ministries are included in decision making.	Department of Agriculture Fisheries & Food. Department of Environment (and local authorities) for planning & development on terrestrial side. (Departments restructured in 2007).	Several ministries and directorates. Counties and municipalities are leading the planning of their areas, both on land and in the sea (from land to the baseline).	Not reported	There are 2 levels of management, at the Estate level: Directorate General of Coasts(Dirección General de Costas); at the regional level (federal governments) Regional Autonomous Authorities.	12 authorities have on a sectoral basis competence in relation to the use of the coastal zone. The municipalities lead the physical planning out to 12 nm.	Scotland: Marine Scotland England and Wales: Department for Environment Food and Rural Affairs (Defra)-Marine Environment Division.

ISSUE	CANADA	DENMARK	GERMANY	IRELAND	NORWAY	POLAND	SPAIN	SWEDEN	UK
Updated	2010	2009	2010	2008	2010	2006	2009	2007	2010
Is there a consultation process? Who is then involved in the consultation process?	Integrated management plans, rules governing oceans and fisheries, new oceans governance arrangements, ecosystem science.	Consultation with sectors and stakeholders.	Consultation with sectors and stakeholders within statutory planning procedures.	Depending on the issue but normally with other Departments, Governments Agencies, NGO and stakeholders.	Consultation with sectors and stakeholders.	Not reported	Master Plan for Coastal Sustainability (POL in Cantabria, POLA in Asturias, PDUSC in Catalonia, PTSL in the Basque Country); Territorial sectorial plan of the littoral zone; and the city level.	The local communities and resource users through the process of municipal planning and hearings; The sectoral authorities; user's organizations; the Co-management groups, where these exist.	Yes Intergovernmental co-operation Coastal Fora Stakeholder involvement.
Responsible authority ICZM (EU Recommendation)	Not reported	Ministry of Environment.	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.	Department of Agriculture, Fisheries & Food. (CZM section).	Not reported	Not reported	Ministry of Environment, Ruaral and Marine Environment created in April 2008.	The National Board of housing, building and planning (NBHBP).	Marine Scotland and Defra.
EU ICZM Stock-take (1)	Non-EU yes	Ministry of Environment. Two reports. No decisions as yet on how to proceed.	Yes	In progress	Not reported	No	Yes	In progress	Yes

ISSUE	CANADA	DENMARK	GERMANY	IRELAND	NORWAY	POLAND	SPAIN	SWEDEN	UK
Updated	2010	2009	2010	2008	2010	2006	2009	2007	2010
EU ICZM Strategy (2)	Non-EU yes	No strategy formed as yet.	Partly, orientation towards procedures, measures and instruments, not yet including substantial agreed targets.	Stocktake drafted. No formal strategy since 1997 Draft ICZM Policy.	Not reported	No	Yes	In progress	Yes

ISSUE	CANADA	DENMARK	GERMANY	IRELAND	NORWAY	POLAND	SPAIN	SWEDEN	UK	
Updated	2010	2009	2010	2008	2010	2006	2009	2007	2010	
Key activities identified	Ground fishing, oil and gas exploration, aquaculture, pollution near urban areas	1. Coastal marine wind farms, 2. Aquaculture, 3. Harbour & coastal defence structures, 4. Nature & habitat restoration, 5. Mineral extractions, 6. Pipelines, 7. Dredging 8. Mussel farming, 9. Fishery, incl. recreational, 10. Shipping & boating, 11. Tourism, 12. House boats, and 13. Agriculture.	1. Offshore wind-farms, 2. Marine aggregate extraction, 3. Fishing, 4. Nature conservation, 5. Development of ports and harbours, 6. Tourism, 7. Coastal defence, 8. Aquaculture and Blue Biotechnology 9. Reducing land consumption as a political target in the German sustainability strategy 10. Electricity grid development on- and offshore.	1. Shipping and maritime transport, 2. marine energy, 3. Aquaculture, 4. Marine tourism, 5. Fishing, 6. Nature conservation,	1. Shipping and maritime transport, 2. marine energy, 3. Aquaculture, 4. Marine tourism, 5. Fishing, 6. Nature conservation,	Marine resource exploitation Limited knowledge of coastal species and processes Fish stocks Carrying capacity Introduced species Aquaculture.	1. Seasonal tourism, 2. Coastal urbanisation, 3. Coastal industries, 4. Commercial and fishery ports, 5. Land reclaim for agriculture.	Urban and mass tourism development, coastal occupation, recreational uses (fisheries, marinas), intensive aquaculture and fishery	1. Fishing, 2. Recreational fishing, 3. Tourism, 4. Marine resource exploitation,	Aquaculture Fishing Harbours and shipping Off shore energy Power stations Distilleries Recreation

ISSUE	CANADA	DENMARK	GERMANY	IRELAND	NORWAY	POLAND	SPAIN	SWEDEN	UK
Updated	2010	2009	2010	2008	2010	2006	2009	2007	2010
Key Issues identified		1. Spatial competition, 2. Un-quantified environmental impacts, 3. Coastal eutrophication & pollution and urban areas, 4. Habitat loss & deterioration, 5. Overexploited fish stocks, 6. Climate change, incl. floding, erosion & increased temperatures, 7. Carrying capacity issues, and 8. Mineral extraction.	1. Spatial competition, 2. Habitat loss, 3. Over-exploited fish stocks, 4. Coastal pollution, 5. Adaptation to Climate Change	1. Spatial competition, 2. Eutrophication & Environmental impacts, 3. Improve knowledge gap on resource use 4. Carrying capacity issues. 5. Over exploited fish stocks, 6. Real time monitoring & better knowledge of marine events.		1. Coastal pollution and carrying capacity issues, 2. Coastal pollution, 3. Coastal pollution, 4. Habitat loss and spatial competi-tion, 5. Habitat loss,	Overexploita-tion of natural resources, hydromorpho-logical alteration, eutrophication, ecosystem changes (jellyfish blooms, biodiversity changes, habitat destruction), water quality.	1. Poor economy in the commercial fisheries and over exploitation of fish stocks, 2. Local over-fishing, 3. Coastal pollution and carrying capacity issues, 4. Conflicts between stakeholders Increased use of marine resources.	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.

ISSUE	CANADA	DENMARK	GERMANY	IRELAND	NORWAY	POLAND	SPAIN	SWEDEN	UK
Updated	2010	2009	2010	2008	2010	2006	2009	2007	2010
ICZM relevant Legislation	Oceans Act 1997	System of laws Protection of Nature Act (1992) Planning Act (2000) EU Directives (WFD, HD, BD, MSD), Integrated Maritime Policy.	Nature Conservation Act, Federal Regional Planning Act Federal Building Act, Planning jurisdiction to MHW, Environmental legislation including e.g. Federal law on water balance.	Planning jurisdiction to HW Foreshore Act between HW and territorial limit-licences for marine works, Local Government Planning & Development Acts – planning on the terrestrial side. Sea Fisheries Acts – regulation of sea fishing. Foreshore Acts - licensing for aquaculture. Water Quality & pollution legislation. Transposition of EU Legislation on WFD, BWD, HD, Shellfish Water Dir.	More than 13 relevant laws including planning, management, fisheries, aquaculture pollution, nature conservation, recreation, navigation, etc.	Not reported	The Shores Act = Ley de COSTAS (22/1988, July 28th), Law on Evaluation of Plans and Programmes (Ley de Evaluación de Planes y Programas) (application of the Strategic Environmental Assessment Directive); Eu Framework Directive: Water, Habitat,Flows, Marine Strategy.	The planning and building Act (1987) The Environmental Code (1999) The Fisheries Act (2003)	Planning jurisdiction to MLWS. Crown estate lease required to 12 nm. Licences required for coastal and marine works (FEPA), other discharges and aqua-culture also require a licence (CAR) UK Marine and Coastal Act (2009) and Marine Act (Scotland) 2010

ISSUE	CANADA	DENMARK	GERMANY	IRELAND	NORWAY	POLAND	SPAIN	SWEDEN	UK
Updated	2010	2009	2010	2008	2010	2006	2009	2007	2010
Precautionary approach applied?	Yes	Yes	Not reported	Yes – in the decision making process	Yes	Not reported	Not reported	Yes, to a certain extent on a sectoral basis and in the municipal planning process.	Yes – in theory
National ICZM projects, consortia or networks	Integrated management pilot programs	Not reported	Zukunft Küste –Coastal Futures and ICZM-Odra (both research), EUCC Germany (network), several smaller projects/ consortia, e.g. competition/pilot project on Sustainable Coastal Deveelopment in Schleswig-Holstein.	I-CoNet initiative. AquaReg CZM. Corepoint.	GIS Maps of marine nature for use with ICZ planning and Management	Not reported	HISPACOSTA EKOLURRAL-DEA (Basque Country)	ENCORA/ SENCORE Regional and local projects	Local Coastal forums/Partnerships Regional schemes e.g Irish Sea Pilot and SSMEI. Aquaculture Frameworks Marine Planning policy document.

ISSUE	CANADA	DENMARK	GERMANY	IRELAND	NORWAY	POLAND	SPAIN	SWEDEN	UK
Updated	2010	2009	2010	2008	2010	2006	2009	2007	2010
Integrated data management initiatives	Not reported	Through MariNet (not active), The Danish Nature & Environment Portal (DMP)	CONTIS (Continental Shelf Information System), GeoSeaPortal, several other projects on environmental data and/or meta data including MUDAB (Marine Environment Database).	National Sea Bed Survey. http://www.gsi.seabed.ie/ Marine Data Repository Smartcoast. Smartbay. Aquareg CZM.	Not reported	Not reported	In development an Integrated Data management system for the Director Plan on the Sustainable Coastal management (http://www.gisig.it/eco-image/presppt/Nice/).	Ongoing process. Models for integrating data on recreational fisheries are being designed.	UKDMOS MDIP MCEN UKSEAMAP
Environmental national research initiatives relevant to ICZM.	Ecosystem overview and assessment report (EOAR), map of ecological and biological significant areas (EBSA).	BERNET, BALANCE. Baltic Sea Breeze, WATERSCETC H, Safety at Sea, Comrisk, comcoast, lancewadplan, Wadden Sea Forum, POWER, FSII, PROTECT, COEXIST SPICOSA, OUR COAST.	Several projects and programs, not all directly related to ICZM, but to coastal environmental change.	National Sea Bed Survey, Review of Marine Environmental Indicators. Smartcoast.	GIS Maps of Marine nature MAREANO Project on the ecological impact of introduced King Crab.	Not reported	There are a number of National Funded R & D Projects with a wide range of objectives from GIS to biodiversity including socioeconomic aspects, EU Funded initiatives (SPICOSA).	Swedish EPA is supporting many research initiatives of relevance. Major programs such SUCOZOMA and WASTRA are now completed. Sweden is involved in EU-projects of relevance such as Interreg.	

ISSUE	CANADA	DENMARK	GERMANY	IRELAND	NORWAY	POLAND	SPAIN	SWEDEN	UK
Updated	2010	2009	2010	2008	2010	2006	2009	2007	2010
Socio-economic issues considered into ICZM.	Yes, human use atlas	Geo-spatial information on ecosystem goods & services, and cultural and socio-economic uses/values are not all available, and not integrated between sectors and governance bodies.	See key activities and key issues, conflict resolution mechanisms.	National Spatial Strategy County Development Plans	Municipalities plans for their coastal zones, Statistics from fisheries and aquaculture.	Not reported	There are several research and monitoring activities that incorporate SEC issues. Eg. Strategic Research Area for ICOM and sustainability science, SOCIB; OBSAM, Menorca; INE, National Statistic Programme.	Conventional socio-economic data is used in planning.	Socio-economic studies e.g. PML project

ISSUE	CANADA	DENMARK	GERMANY	IRELAND	NORWAY	POLAND	SPAIN	SWEDEN	UK
Updated	2010	2009	2010	2008	2010	2006	2009	2007	2010
Initiatives towards integrated governance on the CZ.			Consulting projects ongoing on structures to implement ICZM, focus on non-statutory and voluntary structures, establishment of Maritime Spatial Planning for the EEZ, establishment of a coastal focal point (Kuesten-Kontor).			Not reported	AENOR-practical guide for the implementation of ICZM in Spain (report to be published this spring).	Not reported	Marine Bills and Marine Policy Statement and Marine Strategy Forum.

(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.

Table 3 3.1: Large projects that are directly relevant to ICZM needs.

LARGE ICZM INITIATIVES	DATES	AREA	KEY ISSUES	WEBSITE	CONTACT PERSON
BaltSeaPlan	2009-2012	Baltic Sea	<p>With 14 partners from seven Baltic countries, the project will provide key input into the realization of the EU Maritime Policy, HELCOM Baltic Sea Action Plan and the VASAB Gdańsk Declaration.</p> <p>With a learning-by-doing approach BaltSeaPlan will overcome the lack of relevant legislation in most Baltic SeaRegion countries. Seven important Baltic areas were chosen for pilot maritime spatial plans, among them the Pomeranian Bight, Gulf of Gdańsk or the Middle Bank area between Poland and Sweden. A broad scale stocktake of maritime uses will be carried out in each pilot area. Additional information will be collected with application of newest tools and methods, such as sea-bed modelling and climate change scenarios. All data will be harmonised according to requirements of the EC INSPIRE directive and compiled in a joint data base.</p> <p>Additionally, BaltSeaPlan will provide key input into National Maritime Strategies as required by the EU Blue Book on Future Maritime Policy. In 2011 a common spatial development vision for the Baltic Sea will be produced as a synergy of the national visions and plans of all Baltic SeaRegion countries.</p>	www.baltseaplan.eu	Contact: nico.nolte@bsh.de

LARGE ICZM INITIATIVES	DATES	AREA	KEY ISSUES	WEBSITE	CONTACT PERSON
Coexist	2010–2013	Europe	<p>COEXIST aims to develop a roadmap to better integrate different activities in the coastal zone. The project will study the interactions between capture fisheries and aquaculture and evaluate mutual benefits and possible bottlenecks for concomitant development of these activities in the coastal zone within the context of the ecosystem approach to management. It will:</p> <ul style="list-style-type: none"> - propose, develop and evaluate the efficiency of spatial management - exploit mutual opportunities (e.g. artificial reefs, protected areas, wind farms, tourism etc) within a context of competition for space by multiple users. - address differences in acceptance of activities (fisheries, aquaculture, and other use of the coastal zone) by the society. A detailed strategy for communication and involvement of stakeholders and for dissemination of results to general and targeted audiences is integrated in the project. The project will support the new European Maritime Policy and spatial planning of coastal areas. 		<p>Contact: oivind.bergh@imr.no</p>
<p>MESMA (Monitoring and Evaluation of spatially managed areas)</p>	2009–2013	Europe	<p>Supply innovative methods and integrated strategies for governments, local authorities, stakeholders and other managerial bodies for planning and decision making at different local, national and European scales.</p> <p>MESMA will supply strategic tools for sustainable development of European seas and coastal areas. By studying and comparing different national situations and solutions from a selected number of sites throughout Europe and by determining common features and differences, including the socio-economic settings and requirements, an integrated toolbox that can be applied throughout Europe will be made available.</p>	www.mesma.org	<p>Contact: Remment.terhofstede@wur.nl</p>

LARGE ICZM INITIATIVES	DATES	AREA	KEY ISSUES	WEBSITE	CONTACT PERSON
Knowseas	2009–2013	Europe	<p>Strengthen the science base for managing Europe’s seas through the practical application of systems thinking working at the Regional Sea Scale and Member State Economic Exclusive Zones (EEZs). Key initiatives include:</p> <ul style="list-style-type: none"> - Decision Space Analysis approaches - new studies of climate effects, fisheries and maritime industries - case studies for assessing changes to natural systems and their human causes - research social impacts of changes to ecosystem goods and services - costs and benefits of various management options <p>Institutional and social analysis</p> <ul style="list-style-type: none"> - institutional and policy analysis in different Regional Seas and EEZ areas - development of managerial tools 	www.knowseas.com	Contact: Laurence.Mee@sams.ac.uk
OURCOAST	2009–2012	Europe	<p>Aims to ensure that lessons learned from the coastal management experiences and practices will be shared and made accessible to those who are seeking sustainable solutions to their coastal management practices. Numerous tools, studies and development activities include:</p> <ul style="list-style-type: none"> - A multi-lingual database of Europe-wide ICZM practices - review of ICZM case studies - Comparative analysis of the state of the art ICZM - Review of relevant EU policies and legislation - Guidance for future integrated coastal and marine planning - Setting of an implementation agenda of ICZM and contact lists 	ec.europa.eu/environment/iczm/ourcoast.htm	

LARGE ICZM INITIATIVES	DATES	AREA	KEY ISSUES	WEBSITE	CONTACT PERSON
IMCORE	2008–2011	NW Europe	Promote trans-national, innovative and sustainable approach to reducing the Ecological Social and Economic impacts of climate change on coastal resources		v.cummins@ucc.ie CMRC, University of Cork, Ireland
Gulf of Maine Council on the Marine Environment	2007–2012	Canada/US Gulf of Maine	Maintain and enhance environmental quality in the Gulf of Maine to allow for sustainable resource use by existing and future generations. The council	www.gulfofmaine.org	Contact:
SPICOSA	2007–2011	Europe	Integrating science and policy through a Systems Approach Framework that allows the assessment of different policy alternatives.	www.spicosa.org	Daniel Roy (Spicosa Project Manager), IFREMER Centre de Brest Technopole Brest Iroise BP 70, 29280 Plouzané, France
ENCORA	2006–2008	Europe and N Africa	ENCORA and other networks have established to harness knowledge and resource capabilities in Europe towards more sustainable use of coastal and marine resources and the conduct of maritime affairs. An external review of the ENCORA project was conducted by Professor Peter Burbridge and can be downloaded from the Encora Portal.	www.encora.org	
AQUA REG	2005–2008	Europe	To provide opportunities and design strategies for sustainable development of peripheral coastal communities by promotion of inter-regional co-operation in aquaculture and fisheries. Application of seabed mapping to coastal management and the development of Geo-databases for the pilot areas	www.aquareg.com	Gabriel de Labra Chas, Galacia (e-mail: glabra@cetmar.org) Sigurd Bjørge, Norway (e-mail: sigurd.bjorgo@stfk.no) Alan Drumm, Ireland (e-mail: alan.drumm@marine.ie)

LARGE ICZM INITIATIVES	DATES	AREA	KEY ISSUES	WEBSITE	CONTACT PERSON
PROTECT	2005–2008	Europe	<p>The overarching goal of the project was to strengthen the decision base regarding marine protected areas (MPAs) in Northern Europe as part of an ecosystem-based approach to fisheries management. Result reported:</p> <ul style="list-style-type: none"> - Marine Protected Areas as a Tool for Ecosystem Conservation and Fisheries Management - Report on the State of the Art of MPAs as a Tool for Ecosystem Conservation and Fisheries Management - Knowledge required to model & management success criteria - A study on monitoring strategies for MPA's 	www.mpa-eu.net	<p>Scientific Coordinator: Erik Hoffmann</p> <p>info@mpa-eu.net</p>
COREPOINT	2004–2008	NW Europe	<p>Result reported: the book “Who Rules the Coast?” Policy Processes in Belgian MPAs and Beach Spatial Planning), edited by Dirk Bogaert and Frank Maes</p> <p>The book represents the results of two years of research carried out in the framework of project consisting of a thorough scientific analysis of two policy processes in the Belgian marine and coastal environment: the designation of the marine protected areas and the drawing up of provincial spatial implementation plans for beaches and sea dikes. The book analyses the legal framework and the concrete application of this for both cases.</p>	corepoint.ucc.ie	<p>v.cummins@ucc.ie</p> <p>Coastal and Marine Resources Centre (CMRC) University of Cork, Ireland</p>
ECASA	2004–2007	Europe	<ul style="list-style-type: none"> - to identify indicators of the effects of aquaculture on the environment and vice-versa, and to assess their applicability; - to develop operational tools, including models, to establish and describe the relationship between environmental conditions and aquaculture activities over a range of ecosystems and aquaculture production systems; and - to develop effective environmental impact assessment and site selection methods for coastal area management. 	www.ecasa.org.uk	<p>Averil Wilson (averil.wilson@sams.ac.uk), Kenny Black (kenny.black@sams.ac.uk)</p>

LARGE ICZM INITIATIVES	DATES	AREA	KEY ISSUES	WEBSITE	CONTACT PERSON
LOICZ	1993–2012	Global	Biogeochemical fluxes, ecosystem governance, social-ecological systems analysis	www.loicz.org	Hartwig Kremer (Chief Executive Officer), hartwig.kremer@loicz.org
ACZISC	1992 (Established)	Atlantic coast	Foster cooperation in Atlantic Canada with regards to Integrated Coastal and Ocean Management (ICOM), coastal mapping and geomatics. Developing GIS portal for sharing geo-spatial database.	aczisc.dal.ca	Michael J.A. Butler (Director) michael.butler@dal.ca
PEGASO	2010–2014	Europe	The PEGASUS project contemplates the criteria established by the Barcelona and Bucharest Conventions, which seek to achieve a coordinated approach to the management and sustainable development of resources in order to protect these regional seas and the quality of life of their people	www.pegasoproject.eu (operative in 2010)	Françoise Breton (Scientific Co-ordinator) Francoise.breton@uab.cat

3.4 Progress the development of an integrated decision making framework for ICZM (ToR d)

ICZM decision-making needs to be based on integration of scientific knowledge need to be based on integrated scientific tools and innovative governance frameworks that provide practical, viable and meaningful advice to inform management actions. Such tools include geo-spatial mapping of ecosystem and socio-economic indicators operating within governance frameworks (such as participatory action, conflict resolution), and models. Decision-making frameworks combined with comprehensive geo-spatial analysis can provide the basis for the development of marine spatial plans.

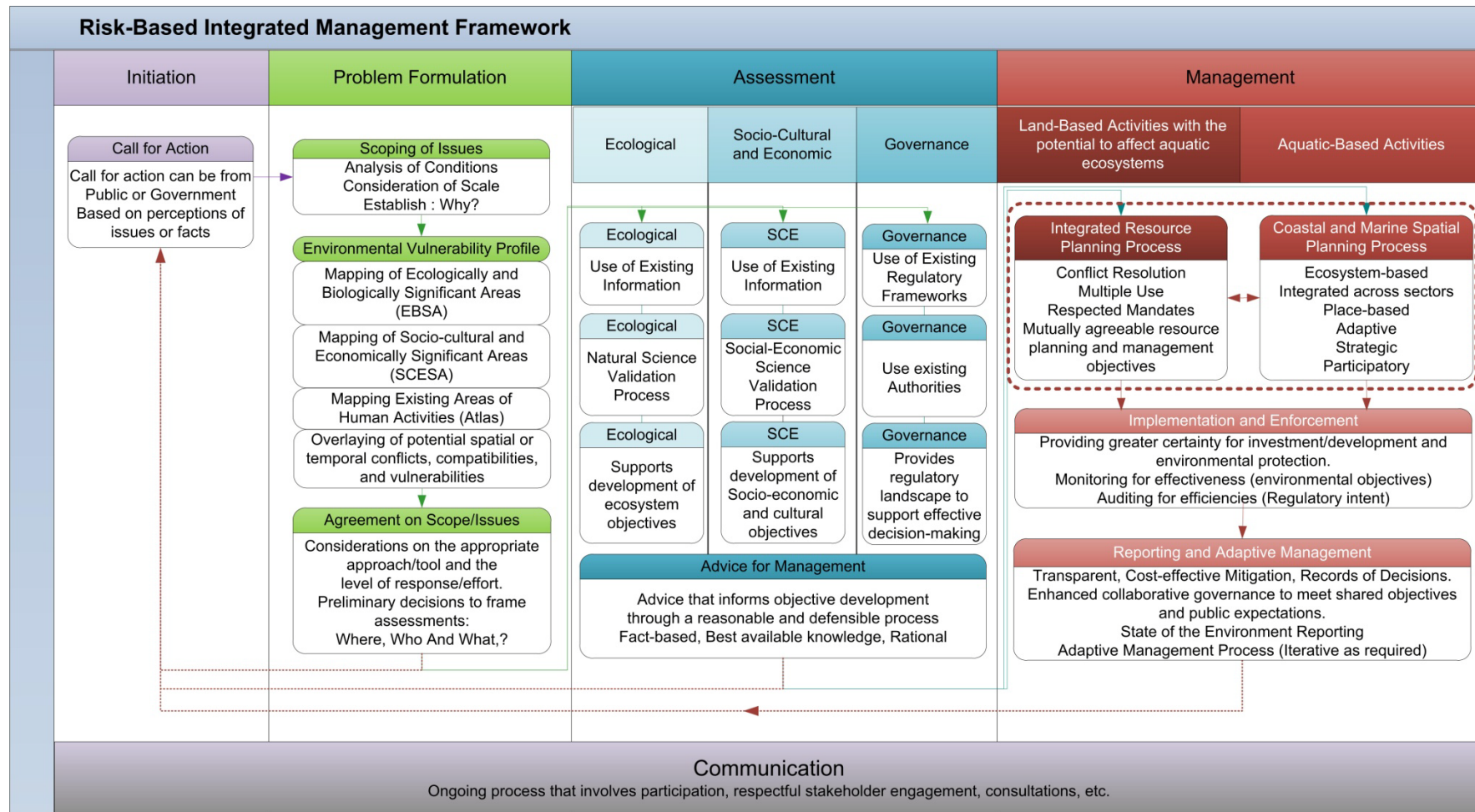
Relevant activities could include bringing together approaches such as risk characterisation (which draws upon all of the tools referenced previously) within a structured and integrated decision-making framework to ensure that problems are adequately formulated and that relevant risks to ecosystem, social, cultural, and economic components are taken into account with appropriate governance and accountability mechanisms. Relevant activities in the ICES countries include:

Risk-based decision-making in Canada

In Canada, the development of risk-based approaches to support decision-making continues to be a priority for integrated coastal zone management. The development of a conceptual framework for risk-based integrated management (Figure XX) is considered as a means to more effectively use existing information and ensure the efficient deployment of resources as well as renewing the focus priority on setting. Strengthening the initial phases of this process is key to building a credible and pragmatic management process that has the potential to be successful at achieving realistic goals within a well defined scope and scale of issues. The retooling of the best available information is being considered in regards to the development of Environmental Vulnerability Profiles in order to incorporate:

- 1) ecologically significant areas;
- 2) social-cultural and economically significant areas;
- 3) human use activities and their zone of influence; and
- 4) characterizing the potential conflicts and compatibilities.

The intent is to provide the context to frame preliminary decisions in regards to the appropriate approach and level of response required for leading to more focused assessments relating to ecology, socio-cultural and economic, and governance issues. The elements being considered are founded on the recognition of jurisdictional authorities and their respective accountabilities for the management of issues that can not be resolved unilaterally by any organization or entity alone. Moreover, a risk-based framework is being examined as a means to provide an objective, structured, and iterative approach that may serve to validate facts and perceptions around public concerns while enhancing communication and engagement.



Development Draft – March 4, 2010

Figure 3.4.1. The development of a conceptual framework for risk-based integrated management.

3.5 The assessment of tools related to ICZM (ToR e)

This year the working group has concentrated on revising the remit and ToRs of the working group to reflect the significant reorganisation of the purposes and structures of ICES, the Strategic Initiative on Coastal and Marine Spatial Planning (SICMSP) and the increasing role of MSP and other tools in ICZM. Section 4 outlines the discussions with regard to this and the resolutions derived. Therefore our discussions on this ToR were limited and are summarised below.

Decision – making in coastal and marine management needs to be based on scientific tools that provide practical, viable and meaningful advice to inform management actions. These tools should refer to all steps of a management or planning circle:

- Drawing up a guiding vision for coastal and marine areas;
- Defining and analysing existing and future conditions;
- Identifying issues and problems;
- Developing solutions for the problems identified (aims, objectives);
- Drawing up a plan/ an action program;
- Implementations and enforcing;
- Monitoring and evaluation performance;
- Revision.

In this regard it is important, that scientific activities do not only deal with stocktaking and mapping but also develop useful tools for co-ordinating and implementing different interests in the coastal and marine areas (e.g. priority zones, marine protected areas, compensation measures, economic incentives, quotas on land consumption). Beyond that applied research should work out suitable instruments for organising the procedures (e.g. stakeholder participation).

Contaminants as performance indicators

The primary focus of ecosystem-based integrated management regimes is in terms of setting management and ecosystem objectives. Objectives serve as the basis for planning resulting in enhanced cooperative or comprehensive policy alignment. With the implementation of an integrated management, performance indicators are needed to ascertain if the plan is meeting its objectives. Performance indicators form part of monitoring activities often presented in the “state of” reports and auditing activities of plan implementation. In the case of contaminants, related indicators and thresholds can be used as performance indicators. They measure the end result of mitigation and control measures providing important insight as to the plans performance and effectiveness in achieving its objective.

Joint ICES/OSPAR Study Group on Integrated Monitoring of Contaminants and Biological Effects (SGIMC)

Chemical contaminants are released into the aquatic environment from a wide range of sources. The resultant concentrations of contaminants in water, sediment and biota have the potential to be harmful. Much environmental management is directed at preventing concentrations rising to a point at which they do cause harm. These concentrations can be represented as thresholds or quality standards. Spatial modelling of data can be used to integrate contaminant sources and to predict the concentrations of contaminants in environmental matrices, and also to assess the efficacy of

options for control measures. In order to do this, it is necessary to compare field or modelled data against relevant quality standards.

In relation to hazardous substances, the OSPAR Joint Assessment and Monitoring Programme seeks to address the following questions:

- What are the concentrations in the marine environment, and the effects, of the substances on the OSPAR List of Chemicals for Priority Action ("priority chemicals")? Are they at, or approaching, background levels for naturally occurring substances and close to zero for man-made substances?
- Are there any problems emerging related to the presence of hazardous substances in the marine environment? In particular, are any unintended/unacceptable biological responses, or unintended/unacceptable levels of such responses, being caused by exposure to hazardous substances?

In the MSFD context of the objective of achieving seas that are clean, safe, healthy, biologically diverse and productive, chemical contaminant concentrations is an aspect of clean seas. A potential consequence of seas that are chemically contaminated is that organisms or processes in the sea show biological responses and in some case may be adversely affected.

OSPAR Integrated monitoring of contaminants and their effects

The JAMP Guidelines for the Integrated Monitoring and Assessment of Contaminants and their Effects contain advice on the appropriate combinations of chemical and biological effects measurements in integrated monitoring programmes of fish and shellfish (mussels). The process of integrated monitoring and assessment of these data leading to conclusions of status and associated feedback loop was conceptualised in the diagram below:

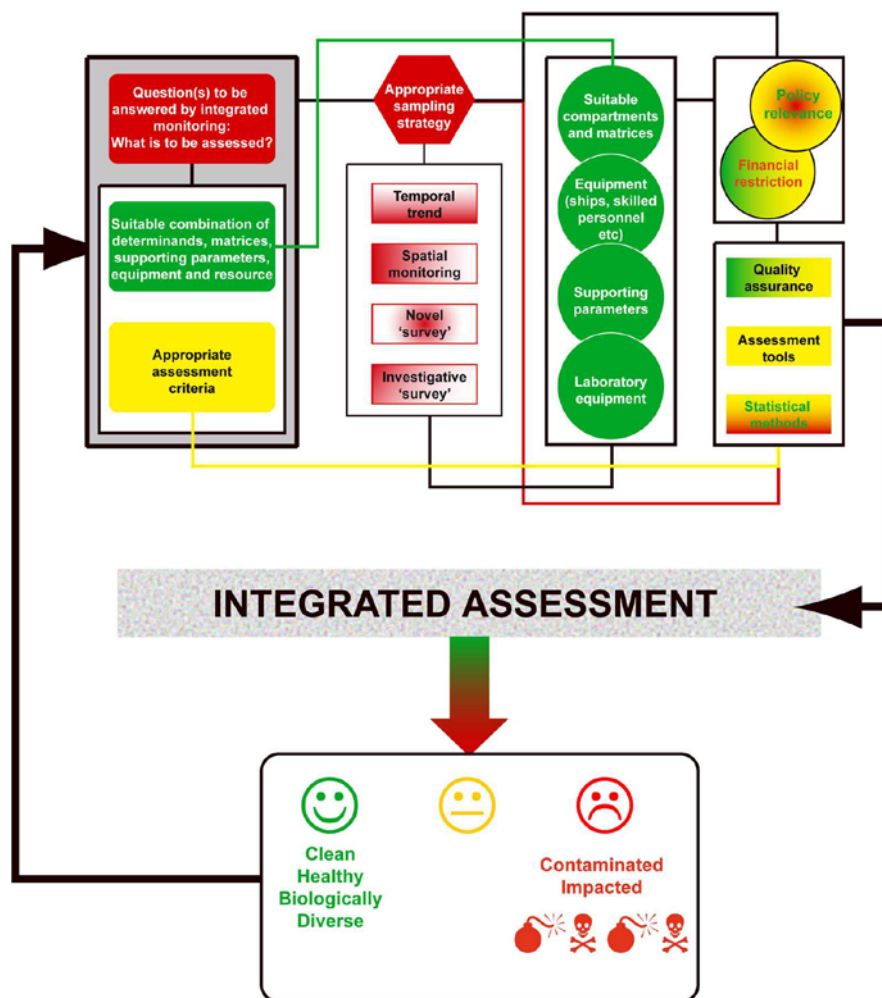


Figure 3.5.1. Feedback loop for the Integrated Monitoring and Assessment of Contaminants and their Effects.

This scheme uses assessment criteria to categorise data into a “traffic light” system. To form the basis of assessment schemes, OSPAR has used two forms of assessment criteria in the interpretation of chemical monitoring data in sediment and biota: background (assessment) concentrations (BC/BACs) and environmental assessment criteria (EACs). The former correspond to the green/orange boundary and the latter to the orange/red boundary. These have been used by OSPAR MON and other groups to develop assessments of contaminant concentrations in sediment and biota for the QSR 2010 project.

Water quality standards (EQS values) been developed for use in status assessments under Water Framework Directive (and similar contexts), and can be used as similar thresholds.

The application of a similar approach to the assessment of biological effects data also requires assessment criteria to be defined. The concepts of a background level of response (enzyme activity, metabolite concentration, etc), representing the response found in organisms which have been exposed to low concentrations of the causative contaminants has been found to be applicable to biological effects measurements. A higher level response that represents harm to the organism has also been found to be applicable to some biological effects measurements. SGIMC and WGBEC are con-

tinuing the work of developing assessment criteria for biological effects measurements.

3.6 Progress of catchment–coast fluxes in the ICZM management plans of ICES countries (ToR f)

This ToR was not discussed at this year's meeting, due to the extended discussions around the re-structuring of this EG. However any relevant information regarding catchment-coast fluxes in the ICZM management plans of ICES countries may be covered in the revised ToRs for this group in future years.

3.7 Environmental interactions of wave and tidal energy generation devices (Marine wet renewables) (OSPAR request 2010/4) (ToR g)

WGICZM was requested by OSPAR to provide advice on the extent, intensity and duration of direct and indirect effects and interactions of marine wet renewable energy production (wave, tidal stream and tidal barrage systems) with the marine environment and ecosystems of the OSPAR maritime area, and with pre existing users of these ecosystems, including:

- i) actual and potential adverse effects on specific species, communities and habitats;
- ii) actual and potential adverse effects on specific ecological processes;
- iii) irreversibility or durability of these effects.

A basic source of information used in this section is the Ocean Energy Position Paper for IPCC from Soerensen and Weinstein¹, one of the few documents available, which provide a global overview on ocean renewable energies. While these marine renewable energies are often seen to represent one of the largest renewable energy resources available on the planet, it needs to be noted that the term covers a number of physically different energy sources. Soerensen and Weinstein list:

- Wave energy, represented by surface and subsurface motion of the waves;
- Hydrokinetic energy that harvests the energy of ocean currents and tides;
- Ocean thermal energy conversion uses the temperature differential between cold water from the deep ocean and warm surface water;
- Osmotic energy uses the pressure differential between salt and fresh water.

The differences in physical principles and the resulting technological concepts imply that environmental impacts can differ strongly between different approaches for the energy generation from renewable ocean energy sources. The theoretical potential is estimated according to Soerensen and Weinstein in the order of:

- 8,000–80,000 TWh/year for wave energy;
- 8,800 TWh/year for tidal current energy;

¹ Hans Chr. Soerensen and Alla Weinstein (2009): Ocean Energy: Position paper for IPCC. *In* IPCC Scoping Meeting on Renewable Energy Sources – Proceedings.

- 2,000 TWh/year for osmotic energy;
- 810,000 TWh/year for ocean thermal energy;

Therefore, from a theoretical point of view, ocean energies could cover more than the World's electricity consumption of 16,000 TWh/year. On the other hand wave and also tidal energy are unevenly distributed over the globe. High resources of wave energy are located along the Western European coast and off the coasts of Canada and the USA and also the south-western coasts of Australia, New Zealand, South America and South Africa. According to Soerensen and Weinstein, resource studies identify for the north-eastern Atlantic area, including the North Sea, resources of about 290 GW. Concerning the global tidal range energy potential the same authors estimate this to be about 3 TW, of which 1 TW is available at comparatively shallow waters. Within the European Union, France and the United Kingdom have sufficiently high tidal ranges of over 10 metres. Beyond the European Union, Canada, Argentina, Western Australia and Korea have potentially interesting sites.

Technically it has to be differentiated between tidal range energy (using the potential energy from the difference in height between high and low tides) and tidal current energy (using the kinetic energy of the water particles in a tide or in a marine current). The resource potential of marine currents in Europe is estimated to exceed 12,000 MW of capacity. Locations with particularly intense currents are placed around the British Isles and Ireland, between the Channel Islands and France, in the Straits of Messina between Italy and Sicily, and in various channels between the Greek islands in the Aegean. Other large marine current resources are located in regions such as the east and west coasts of Canada and South East Asia.

However, independent of the theoretically available resources the use of these energies is to date in a pilot stage, technologically and also in terms of economic feasibility. Only few operational systems exist around the globe. Newly developed wave energy converters include a wide range of technical approaches, e.g. the Pelamis, the Archimedes Wave Swing, AquaBuOY, Oceanlinx or the Wave Dragon.

Currently, a number of large scale test installations are under development. Soerensen and Weinstein list the following installations:

Wave Energy:

- 0.4 MW and 0.5 MW Oscillating Water Column plants off the islands of Pico and Islay;
- 0.2 MW AquaBuOY off the coast of Oregon, USA;
- 2.25 MW Pelamis off the coast of Portugal;
- 7 MW Wave Dragon off the coast of Wales;

Tidal energy:

- Barriers: 240 MW La Rance since 1966, 20 MW Canada, 5 MW China;
- Currents: 1 MW MCT of North Ireland.

In summary, technologies as well as the related industry sector are still in an early stage of development.

Marine renewable energies (except offshore wind) in different ICES and OSPAR Member States or parts of Member States

This section draws on contributions from several individual members of the ICES WGICZM. It is not fully comprehensive because information is sometimes difficult to

find and dispersed, demonstrating that in most Member States no strategic planning or development of the Ocean energy sector and the exploitation of renewable ocean energy resources takes place yet. This is a significant difference to today's status of offshore wind energy. Nevertheless, exceptions exist.

Ireland (Information provided by Eugene Nixon)

Ireland is in the process of completing an SEA on all offshore renewables for all relevant parts of our waters. This process will assess the generic impacts of wave and tidal energy, but it is at an early stage yet. Information on the SEA can be found at http://www.sei.ie/Renewables/Ocean_Energy/Offshore_Renewable_SEA/;

The only specific developments at the moment are a ¼ scale test site in Galway Bay and the development of a full scale grid connected in Mayo. Generally there are tidal power resources as well as wave energy resources that can potentially be exploited in Ireland. The wave resource is one of the best in the world but has not yet been fully quantified. Ireland's Ocean Energy Strategy plans with 500 MW from ocean energy resources by 2020.

Scotland (Information provided by Ian Davies, Marine Scotland Science, Aberdeen)

Background

Scottish Government has a stated target of meeting 50% of Scottish demand for electricity from renewable sources by 2020. Scottish Government has to ensure the sustainable development of wave, tidal and offshore wind energy sectors in the seas around Scotland, and wet renewables (wave and tidal stream energy) are expected to make a significant contribution towards meeting this target.

Scottish Government undertook a Marine Renewables Strategic Environmental Assessment in 2007 to ascertain the full extent of Scotland's renewable energy resource. Scotland's seas can provide 25% of Europe's tidal power and 10% of its wave power. The main areas of wave and tidal power resource to the north and west of Scotland are shown in Fig. 1. The West Coast of the Hebrides and the Northern Isles are fully exposed to the Wind and Wave Energy of the North Atlantic. Powerful tidal currents are experienced in some Sounds and Firths such as the Pentland Firth, immediately to the north of the Scottish mainland.

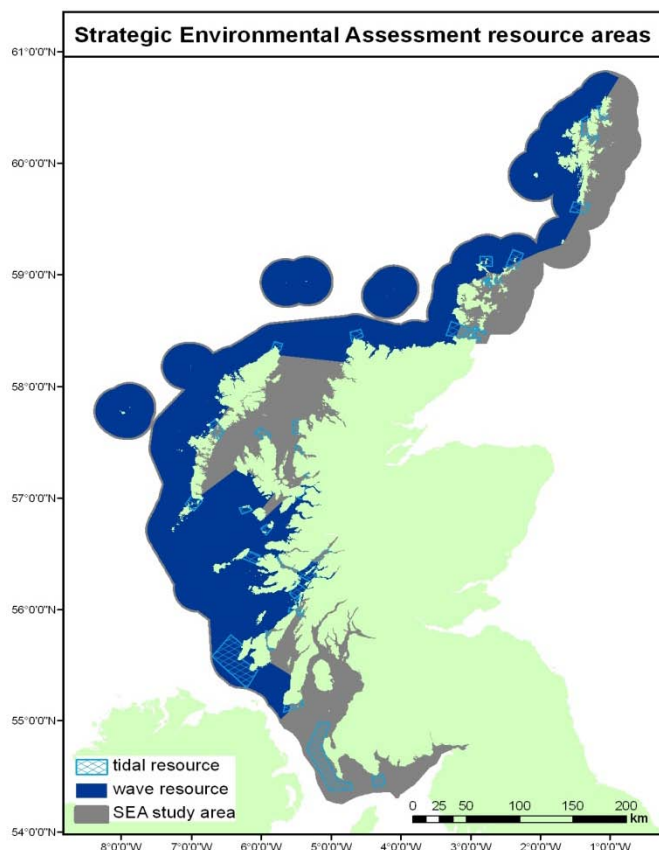


Figure 3.7.1. Areas of potential wave and tidal energy resource identified by the Scottish Government commissioned Strategic Environmental Assessment for wet renewables in 2007.

The successful growth of the wet renewables industries is heavily dependent on developers identifying the commercial potential of different parts of Scottish coastal waters and matching the characteristics of the waters to the engineering requirements of power generation devices.

In order to gain some understanding of the views of the industries on development potential, Scottish Government worked with the Scottish Renewables Forum in 2009 to undertake a survey of the industries. Developers were invited to identify broad areas that were of potential interest to them and to indicate the approximate time-scale of developments. The outcome of the survey (Figure 2) clearly demonstrates widespread interest in commercial developments for both wave and tidal technologies and gives confidence that there is sufficient commercial interest to ensure that these new industries will grow.

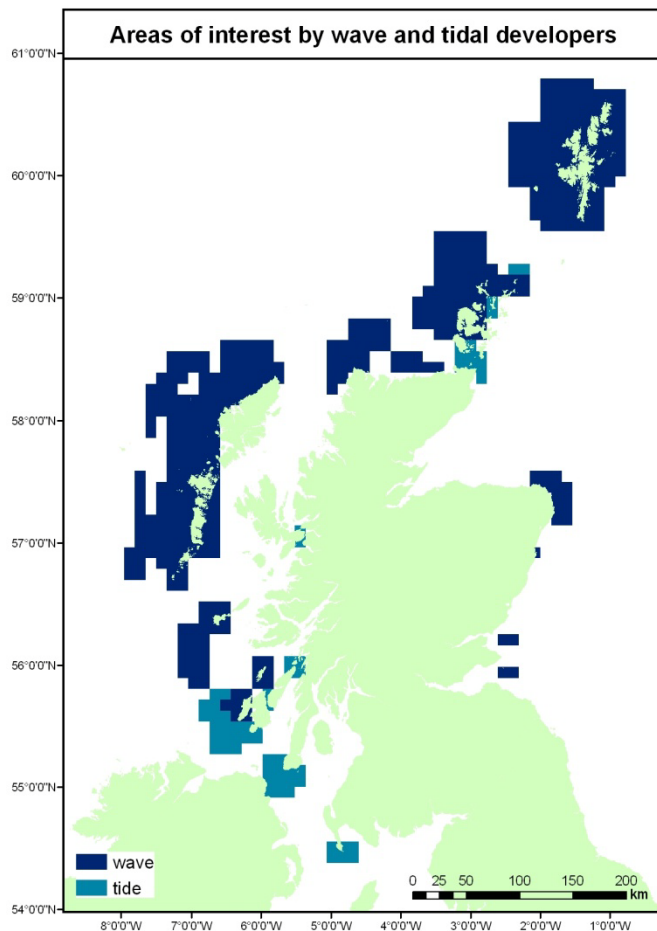


Figure 3.7.2: Areas of developer interest for wave and tidal stream energy generation.

Scottish Government response

To assist in the development of these new industries, the Scottish Government has created a Marine Energy Spatial Planning Group (MESPG) in response to the Marine Renewables SEA. A partnership approach is being adopted, and therefore MESPG includes representatives from a range of stakeholders. The MESPG is led by Scottish Government (Marine Scotland) and includes representatives from SG Energy Dept, industry representative bodies, development agencies, conservation agencies and The Crown Estate.

MESPG has adopted the following 4 themes in its work programme:

- Develop Marine Planning / Locational Guidance;
- Simplify Licensing Procedures;
- Undertake Environmental Research;
- Facilitate Regional Initiatives.

Current state of development

The wave and tidal industries are generally at a pre-commercial stage of development. A test centre (the European Marine Energy Centre, EMEC) has been established in Orkney, where developers can deploy and test full scale devices in demanding (but realistic) conditions for wave and tidal stream power generation.

Test areas have been equipped with transmission cables to shore-based facilities which allow full scale engineering testing and monitoring of the power generated under different conditions. The engineering testing is supported by environmental monitoring of both the physical conditions and the interactions of all stages of projects, from site survey through installation and operation to decommissioning, with potentially sensitive components of the environment including seabed habitats, marine mammals and seabirds.

It is expected that The Crown Estate (which acts as landlord for the seabed) will announce the granting of a series of agreements with developers for the installation of arrays of wave and tidal power devices in the Pentland Firth and Orkney waters. The granting of full leases will be dependent on developers obtaining all the necessary licences and consents. The likely timetable of development in this area should result in an installed capacity of 2Gw by 2019. It is expected that further leases will be granted in this and other areas over the coming years, and that the installed capacity in Scottish waters will considerably exceed this figure – but how much is not yet clear.

Norway (Information provided by Erlend Moksness, IMR, Arendal)

Tidal differences in Norway vary between 0.3 m (South) and 2.1 m (North). This is in practice too small to exploit tidal energy potential. Instead, Norway focuses to exploit tidal kinetic energy. The Norwegian coastline consists of many narrow and deep fjords where tidal currents can be strong. This kinetic energy can be converted to electrical energy like wind energy in a wind power plant. Although the speed of the tides is much smaller than the wind speed, water is heavier than air and forces acting on the turbines will therefore be larger. The tidal power company “Hammerfest Strøm” has previously estimated the technically achievable potential in Norway to about 650 GWh / year. According to company “Statkraft”, who is also designing a pilot plant, the potential in Northern Norway only is as high as 2 TWh / year.

The company “Hammerfest Strøm” is the front in promoting the development of tidal technology. In 2003, the company installed a 300 kW turbine (propeller) on the bottom of Kvalsundet outside Hammerfest, Northern Norway. This pilot plant turbine produces power almost continuously now for four years. In May 2007, “Hammerfest Strøm” signed an agreement with “Scottish Power”, on the further development and production of the technology in the United Kingdom. A 1 MW prototype is under construction and will be installed outside of Scotland in 2010. “Scottish Power” plans to build three tidal farms based on this technology, with a total capacity of 60 MW. These will be built off the coasts of Scotland and Northern Ireland and are scheduled to be ready in 2011.

The Norwegian company Hydra Tidal Energy Technology (HTET) has developed a concept based on a floating, anchored steel structure and produces electricity based on tidal energy from four large turbines. Turbines and generators will be below the waterline, but can easily be brought to the surface for maintenance. Since the tidal power plant floats on the water, there will be no more permanent encroachment on the seabed. In May 2009 the Hydra Tidal awarded a concession from the Norwegian Water Resources and Energy Directorate (NVE) for deployment of its “Morild” concept in Gimsøystraumen in Lofoten, Northern Norway. Plans call for it to be put into operation during spring 2010. If the prototype shows good results, the company has plans to build a major tidal power park in Moskstrømmen, Lofoten.

The total energy from waves along the Norwegian coast is estimated at 400 TWh / year. Only a small fraction of this potential will in practice be exploited. Assuming that 10% of the coastline can be developed with a utilization of 20%, this will provide about 8 TWh. NVE did a study of the potential for annual production and the potential was calculated to approx. 6 TWh / year if a coastline of 130 km is developed. This study has been sent as a preliminary report to the Norwegian Storting (Report No. 65 (1981-82)). It assumed three different technologies, two of which could be exploited far from the coast.

In the most favorable areas off the Norwegian coast (between Stad, Western Norway and Lofoten, Northern Norway) the wave energy constitutes in average 30-40 kW per m wave front. Out in the open sea this can raise towards an energy density of 100 kW / m. Several prototypes for converting wave energy into electrical energy have been developed, but so far none of them evolved to become a commercial product.

The Norwegian company "Langlee Wave Power" has developed a technology that is based on a floating framework anchored to the seabed. The design has mounted water wings that move by waves of horizontal energy. Langlee has signed a letter of intent to build a wave power plant in Turkey. Phase one of this contract involves construction of a pilot plant in 2010. A full-scale plant will then be constructed over the next three or four years. When the entire system is in place, the wave power plant has a capacity of 24 MW. A demonstration plant off the Norwegian coast is also scheduled to be set up in 2010.

The Norwegian company "Wave Energy AS" has developed a wave power concept with a background in the oil industry. The Wave power plant is planned to be constructed on the slopes with several floors where the principle is to let the water from three different pools operate more running wheels on a common shaft. Thus, the waves at all levels are going to be exploited. The technology will prevent the start and stop sequences on the turbine, even if it only supplies water to run the wheel on one level. This increases the stability of supply of electricity and the lifetime of the generator. Tests conducted at the University of Aalborg, Denmark, show that wave power plant can utilize 50 percent of the energy in the waves. The concept can be used in the coastal zone as floating devices. The company is planning a full-scale prototype plant to Kvitsøy, Southern Norway, but the project was stopped due to complaints from a neighbour. The company (Wave Energy AS) is now considering other options.

When it comes to financial support, there is none today. However, both wave and tidal power will probably be covered by the "elsertifikatordningen", if a common market with Sweden is established. If an agreement is signed with Sweden, the idea is that the common market will be in operation from 2012. Such a scheme is technology neutral and will not comply with the wave or tidal power in particular. Concerning research and development, research funding for renewable energies from the Norwegian Research Council or Enova can be applied for.

Germany (Information provided by Andreas Kannen, based on a report by Birger Dircks, Anke Schmidt & Kai Ahrendt: Potentiale der Energiegewinnung mit Wellen-, Gezeiten und Strömungskraftwerken in der südlichen Nordsee, 56 pages)

The potential for the exploitation of ocean energies in the Southern North Sea and therefore along the German North Sea coast is estimated to be very low. Therefore ocean energies in Germany are framed from an industrial perspective offering economic opportunities also in locations where direct use is not possible. Several Ger-

man companies participate in a range of projects and contribute for example turbine technologies or hydraulic technologies for ocean energy converters. Investments in this economic sector and in related technological research is therefore seen as way to support export of technology.

Canada (Information provided by Roland Cormier, DFO, Canada)

Canada possesses considerable resource potential for ocean energies on all three coasts and some of the highest power densities for wave and tidal energy in North America. A recent resource assessment (Cornett, A. 2006: Inventory of Canada's Marine Renewable Energy Resources. Canadian Hydrologics Centre – National Research Council Canada, CHC-TR-041, April 2006)) identified a total of 190 sites with potential mean tidal power greater than 1 MW. The total mean potential power at these 190 sites exceeds 42,000 MW. The same assessment identified approximately 37,000 MW of annual mean wave power for Canada's Pacific coast, while the annual mean wave power for Canada's Atlantic coast totals roughly 146,500 MW. Wave energy resources are spatially and temporally variable (greatest in deep water during winter). However, this equates approximately 1,600 Twh/yr. Potential nearshore resources (annual mean values) include:

- 35kW/m near the Queen Charlotte Islands (~9,600MW);
- 25kW/m near Vancouver Island (~9,400 MW);
- 25kW/m near Sable Island (~1,000 MW);
- 25kW/m near SE Nfld (~9,000 MW).

This inventory, while likely not fully comprehensive, represents the optimistic 'potential' projections and needs to be tempered by operational realities such as grid availability / proximity and existing conversion rates. In addition, all of the resource characterization work completed to date is preliminary, further research is underway to improve both the accuracy and resolution of existing resource assessments.

Wave and tidal power development are largely in the early demonstration stages in Canada. North America's first tidal in-stream energy conversion (TISEC) testing centre has been built in the Bay of Fundy, near Parrsboro, Nova Scotia. This demonstration project will include the installation and grid connection of three 1MW TISEC devices for a period of 3-4 years. Wave and TISEC devices have also been deployed on Canada's Pacific coast with a pre-commercial 100-kW wave energy device about to begin testing in open ocean conditions near Tofino, British Columbia and a 65kW TISEC device having been successfully operating at Race Rocks, British Columbia since 2006.

Provinces have lead authority over development and management of sites and facilities for the generation of electrical power within their boundaries including "internal waters". This, together with the industry sector being in early stages of development, has contributed to the situation, that there are no national objectives for wave and tidal energy development. However, several provinces have now either legislated renewable energy standards or developed strategies which recognize the potential role these forms of renewable energy may play in meeting provincial objectives.

Both federal and provincial governments, as well as the industry itself, have elected to adopt an adaptive management approach which will inform any possible future developments. In the Bay of Fundy for instance a Strategic Environmental Assessment (SEA) of the entire Bay was undertaken in 2008. This involved the participation of a wide range of stakeholders and the general public, and resulted in recommenda-

tions to the provincial government on whether, where and how to develop tidal energy in the Bay of Fundy. The SEA was further used as part of the project related environmental assessment which was conducted for the demonstration facility in Minas Passage. One recommendation from this was to form an advisory group, consisting of DFO, community stakeholders, and First Nations amongst others to review and advise the federal and provincial governments on environmental protection requirements for the Minas Basin demonstration project. The advisory committee will review monitoring results and as required recommend adaptation of the mitigation and monitoring if warranted.

Conflicts between ocean renewable energies and other marine human uses (put together by Andreas Kannen, GKSS Research Centre, Institute for Coastal Research)

Due to the small scale of the existing installations, not much is reported about conflicts with other users of the marine environment. In Environmental Assessments the most reported potential conflicts is with fisheries and shipping/navigation. Areas might have to be kept free of fisheries in order to avoid damage to boats as well as energy generating installations. In addition, floating devices will have to be appropriately marked for navigation in order to avoid accidents. According to Soerensen and Weinstein, in addition to lights, sound signals, and radar reflectors, highly contrasting day-markers will be required. Even though these might have to meet Coast Guard requirements of being visible within one nautical mile (1.8 km) at sea, they are expected to have negligible visual impact when viewed from shore. For wave energy technologies the visual and acoustic impact are expected to be low, particular of offshore or submerged devices.

Depending on the size of future operational developments and their specific impacts on the non-biotic and biotic environment can potentially arise with conservation areas, scientific research areas and military areas, but also telecommunication cable lines and dredge spoil disposal sites. However, in most cases these problems can be dealt with in proper location planning and recognition of ocean energies in Marine Spatial Planning (MSP). In contrast to wind energy, ocean energy converters lead in most cases to low visual impacts, because they are below the sea-surface, or rather small and not visible from larger distance. Also the amount of land-use is seen as negligible. Despite this, experiences with offshore wind farm developments suggest including a dialogue with potentially affected groups as well as local population in the early stages of project development in order to avoid emotional or cognitive based non-acceptance.

Beside their positive impact on CO₂ emissions, an argument used by developers in favour to ocean energies is that they have a positive impact on local employment, often including diversification of employment across sectors, and stimulation of declining industries, e.g. shipyards. Soerensen and Weinstein expect an increase in jobs that is estimated to be in the range of 10–20 jobs/MW in coastal regions.

However, detailed studies, particularly studies looking at cumulative impacts of ocean energies together with other human uses are still missing. While analyses of the available ocean energy resources have been conducted, an overlay with constraints that prevents its exploitation, including environmental barriers as well as conflicts with other sea uses and missing infrastructure, e.g. transmission lines and grid connection, still needs to be done.

3.8 Report to SSGHIE on potential and current contributions of your EG to the Strategic Initiative on Coastal and Marine Spatial Planning (SICMSP) (ToR h)

The working group has discussed the resolution 2009/4/SCICOM02 SICMSP and have outlined below our responses to each ToR.

- a) to develop a coordinated network of experts working on coastal zone sciences and management issues with the aim of establishing consistent international scientific approaches to Coastal Zone Management such as the use of Marine Spatial Planning; decision making tools and frameworks including risk characterization, and to assess the usefulness of goods and services as a tool to link the ecosystem approach to management based on strong sustainability principles;
 - This working group has re-adjusted its agenda to include Marine Spatial Planning and propose that this group (re-named WG for Marine Planning and Coastal Zone Management, WGMPCZM) can contribute to this topic within ICES as laid out in Section 5 of this report, specifically the new TORs A and B of WGMPCZM (see below).
- b) to consolidate and provide access to coastal data on environmental status and human impacts and integrate this into a common knowledge geo-referenced base that can be related to off-shore issues and off-shore databases;
 - The group recognises the importance of data warehousing. However the WG considers that the first impediment for ICES to acquire non fisheries sector activity data may be in terms of the present ICES convention with Member Countries, which focuses primarily on fisheries, oceanography and marine environmental information.
- c) to identify priority research needs to advance the scientific basis of Marine Spatial Planning (MSP) in coastal zone science and management, and to develop science based protocols aiming to formulate common studying, monitoring and management strategies for the coastal zone;
 - WGMPCZM response to this is covered by ToRs A and B and D of WGMPCZM (see below)
- d) to describe data requirements for MSP in coastal zone science and management and needs for data-access through online-databases and networks;
 - WGMPCZM response to this is covered by Tor D of WGMPCZM (see below)
- e) to initiate the development of an ICES MSP Facility supporting data processing, management, analysis and visualization;
 - WGMPCZM considers that this would be out-with the remit of this group
- f) to identify potential clients and collaborators, and promote the development of funding opportunities for activities supporting ICES coastal science and advice in support of requests regarding MSP;
 - The members of WGMPCZM would be able to contribute to identifying potential clients and collaborators and identifying areas of re-

search that require funding. The group sees particular value in trans-Atlantic collaboration as similar problems are experienced on either side.

- g) Propose on the specific roles of ICES in providing science and advice on the Marine Spatial Planning (MSP), and to identify priority research needs to advance the scientific basis of MSP in coastal zone science and management, and to develop protocols aiming to formulate common studying, monitoring and management strategies for the coastal zone.
- WGMPCZM response to this is covered by the new ToRs of WGMPCZM

New ToRs for WGMPCZM

ToR a: Marine spatial planning is an emerging priority for member countries of ICES who are undertaking the integrated management (IM) of the multiple uses of the oceans. The main goal of this research topic is to develop and evaluate spatial planning tools to assist IM practitioners. Therefore WGMPCZM aims to provide advice on the development and use of MSP including the following:

- Risk analysis processes applied in MSP
- Harmonisation of policy drivers and institutional interactions in MSP
- Technical development of practical tools for MSP
- Operational application of MSP

BY:

- Identifying good practice and gaps
- Identifying trends in technical development and application
- Reviewing effectiveness and utility of MSP application
 - in particular trans-boundary and inter- organisational issues

ToR b: ICES is being increasingly asked for advice on management plans and mixed fisheries interactions. To allow ICES to carry out this advisory task, there is a need to develop an understanding of the behavioural responses/strategies of the users of ocean ecosystems. Therefore WGMPCZM aims to provide advice on the socio-economic and cultural understanding of marine resources in the application of IM including the following:

- How to integrate cultural values into socio-economic goods and services in the context of IM and/or MSP
 - Human / environment links in socio-ecological systems
 - Broadening definition of goods and services to include cultural attachments and political processes
- Development of social/cultural objectives for Marine Planning and Coastal Zone Management

BY:

- Identifying gaps and good practice
- Identifying trends in practice/application

ToR c: Sustaining ecosystem goods and services, while meeting growing societal needs, requires ecosystem-based marine spatial planning. This topic will focus on processes linking habitat to spatial patterns at the population and community levels.

Therefore WGMPCZM aims to provide advice on the application of IM to address the interactions between commercially exploited species and natural systems including the following:

- Non-fisheries and aquaculture risks to commercial fish species

BY:

- Assessing best practice with regards to impact assessment, drivers, and pressures

ToR d: Quality assurance is essential to the effective implementation of marine planning and coastal zone management. The working group will develop and review procedures for the quality assurance of IM. Quality of advice to managers is dependent on the quality of information used in IM tools including:

- quality assurance of implementation of plans
- quality assurance of effectiveness of plans (sustainability appraisal)
- SEA as an element of QA

BY:

- Review good practice and gaps
 - Adequacy/ quality of impact/ monitoring data for QA of plans
- Review Spatial /Temporal requirements of monitoring data
 - Quantifying, incorporation and communications of uncertainty into data assessment

3.9 Report to SSGHIE on your plans to promote cooperation between EGs covering similar scientific issues (ToR i)

This group recognises the relevant scientific contributions that could be provided from other EGs to the ToRs of this group. Further the group would be able to identify linkages on a needs basis and facilitate appropriate collaborations and would welcome requests for advice and collaboration from other EGs.

4 Other Items

4.1 Review of the ToRs of the Working Group

The WG noted that its Terms of Reference have not been reviewed since the WG was created in 2004. There has been significant reorganisation of the purposes and structures of ICES in that time, in addition to progress in the science and practical application of marine planning. The WG therefore decided to review its terms of reference, with particular reference to ICES priorities, as described in the ICES Science Plan for 2009–2013.

High Priority Research Topics in the ICES Science Plan that are relevant to the WG are:

- 1) Marine spatial planning, including the effectiveness of management practices (e.g. Marine Protected Areas (MPAs)), and its role in the conservation of biodiversity;
- 2) Contributions to socio-economic understanding of ecosystem goods and services, and forecasting of the impact of human activities.

- 3) The role of coastal-zone habitat in population dynamics of commercially exploited species;
- 4) Influence of development of renewable energy resources (e.g. wind, hydropower, tidal and waves) on marine habitat and biota;

The WG therefore presents the discussion and recommendations below for a reformulation of its Terms of Reference to respond to ICES science priorities.

1) The ICES Science Plan recognises that integrated management (IM) of the multiple use of the oceans and the coastal zone is an emerging priority for member countries of ICES; Marine Spatial Planning (MSP) is widely recognised as an emerging tool to support IM. MSP integrates spatial data from multiple sectors; Integrated Coastal Zone Management (ICZM) enhances that process by incorporating those land based sectors that influence the marine environment. ICZM, as an IM framework, has a major role in many issues that are of relevance to ICES and its working groups. During discussions at the 2010 meeting of WGICZM it was proposed that the group should expand its remit and include linkages to Marine Spatial Planning (MSP) and ecosystem-based management of land-sea interactions. WGICZM feel that this is best achieved by developing a set of ToRs that will address a wider range of these issues relating to the development of ICZM in ICES Member States and as a result a name change is appropriate. Therefore we recommend that the working group should be renamed WG on Marine Planning and Coastal Zone Management (WGMPCZM). The working group also considers its geographical scope to include those parts of the land and sea where ICES Member States have jurisdiction over marine management, which could extend out to the EEZ for some sectors.

2) The ICES Science plan also states that there is a need to develop an understanding of the behavioural responses/strategies of the users of ocean ecosystems. This requires more understanding on the social and economic motivations of marine stakeholders than is currently the case. It requires a better understanding of how ecosystem goods and services are turned into economic and social value.

3) The ICES Science Plan states that coastal zone habitats include highly productive estuaries and bays, which are essential nursery grounds for a number of commercial and recreational fish and shell fish species. This habitat is also critical to successful mariculture operations. Coastal habitats are threatened by human activities associated with urbanization, energy production and harvesting. Sustaining ecosystem goods and services, while meeting growing societal needs, requires marine spatial planning.

This working group considers ICZM to be essential for bringing together multi-disciplinary, multi-sectoral and interacting processes (social, ecosystem, economic, governance) into a practical decision-making framework. ICZM allows for the harnessing of the complexity of land-sea interactions that make up the coastal zone and reflects a global movement towards the recognition that maritime and land-based activities should not be managed by sectors. Therefore spatial and resource management tools are essential to ICZM. This WG has recognised that although ICZM has promoted the development of many useful tools, there is a requirement for improved understanding of the processes involved in developing and implementing spatially explicit tools such as MSP. Management and political processes are also essential to the application of IM, and relevant to the implementation of the ecosystem based approach within ICES member states. This WG recognises the need to improve the implementation of the ecosystem based approach.

The implementation of IM requires practical, integrated scientific responses to address sustainability issues, including innovative models for management and decision-making. IM provides a useful forum for the practical application of the tools, models and processes addressed by a range of ICES working groups. Science for IM should respond to specific needs and objectives of stakeholders and decision-makers which, in turn, should be used to define the spatial and governance context for each individual case.

Resolution

Within these contexts, the overall objective of the WGMPCZM is to provide scientific advice on the key issues pertaining to the sustainable use of marine resources that can be answered through the implementation of IM, e.g. thresholds, catchment-coast interactions, tools to trigger management action and integrated governance frameworks for IM. This reflects the original objective of the study group from 2003 that formed the basis for the establishment of this WG, as well as the three high priority areas stated in the ICES Science Plan (2009-2013), i.e. MSP, Socio-economics and coastal zone habitats.

WGMPCZM has developed key objectives and ToRs for the group that will link the ICES Science plan and Strategy with the principles of IM.

Science Priority 1: Marine spatial planning, including the effectiveness of management practices (e.g. Marine Protected Areas (MPAs)), and its role in the conservation of biodiversity;

ToR a: Marine spatial planning is an emerging priority for member countries of ICES who are undertaking the integrated management (IM) of the multiple uses of the oceans. The main goal of this research topic is to develop and evaluate spatial planning tools to assist IM practitioners. Therefore WGMPCZM aims to provide advice on the development and use of MSP including the following:

- Risk analysis processes applied in MSP
- Harmonisation of policy drivers and institutional interactions in MSP
- Technical development of practical tools for MSP
- Operational application of MSP

BY:

- Identifying good practice and gaps
- Identifying trends in technical development and application
- Reviewing effectiveness and utility of MSP application
 - in particular trans-boundary and inter-organisational issues

Science priority 2: Contributions to socio-economic understanding of ecosystem goods and services, and forecasting of the impact of human activities.

ToR b: ICES is being increasingly asked for advice on management plans and mixed fisheries interactions. To allow ICES to carry out this advisory task, there is a need to develop an understanding of the behavioural responses/strategies of the users of ocean ecosystems. Therefore WGMPCZM aims to provide advice on the socio-economic and cultural understanding of marine resources in the application of IM including the following:

- How to integrate cultural values into socio-economic goods and services in the context of IM and/or MSP

- Human / environment links in socio-ecological systems
- Broadening definition of goods and services to include cultural attachments and political processes
- Development of social/cultural objectives for Marine Planning and Coastal Zone Management

BY:

- Identifying gaps and good practice
- Identifying trends in practice/application

Science priority 3: The role of coastal-zone habitat in population dynamics of commercially exploited species

ToR c: Sustaining ecosystem goods and services, while meeting growing societal needs, requires ecosystem-based marine spatial planning. This topic will focus on processes linking habitat to spatial patterns at the population and community levels. Therefore WGMPCZM aims to provide advice on the application of IM to address the interactions between commercially exploited species and natural systems including the following:

- Non-fisheries and aquaculture risks to commercial fish species

BY:

- Assessing best practice with regards to impact assessment, drivers, and pressures

Quality assurance

ToR d: Quality assurance is essential to the effective implementation of marine planning and coastal zone management. The working group will develop and review procedures for the quality assurance of IM. Quality of advice to managers is dependent on the quality of information used in IM tools including:

- quality assurance of implementation of plans
- quality assurance of effectiveness of plans (sustainability appraisal)
- SEA as an element of QA

BY:

- Review good practice and gaps
 - Adequacy/ quality of impact/ monitoring data for QA of plans
- Review Spatial /Temporal requirements of monitoring data
 - Quantifying, incorporation and communications of uncertainty into data assessment

WGICZM recommends:

- a) The WGICZM is renamed WG for Marine Planning and Coastal Zone Management (WGMPCZM).
- b) The ToRs developed above should be adopted to guide the future work of WGMPCZM
- c) That the group membership includes experts from MSP, socio-economics, IM practitioners.

4.2 ICES Theme session papers – Abstracts 15th April, paper submissions 20th August

Text from session webpage

- a) Bringing together the risk characterisation and the indicator characterisation approaches within an integrated decision-making framework;
- b) Developing a general framework for the indicator selection process for ICES countries. Within that framework should be the clear definition of objectives and the integration of the indicator system into the overall management process;
- c) Investigate the usefulness of assessing ecosystem goods and services as a tool to link the ecosystem approach to management, the assessment of human impacts and subsequent decision making;
- d) investigate how the type of integrated assessment processes can be included in “Ecosystem-based Management” and thus also be included in a decision making framework for ocean and coastal management.

4.3 The 2nd International Symposium on Integrated Coastal Zone Management Arendal, Norway, 3 – 7 July 2011

Session 4 - Linking science and management

- How can indicators be useful to improve management practices
- Information needs for policy making and management
- Linking watersheds and the coastal zone
- Managing water resources (water quality and supply)
- Preserving cultural heritage and local coastal communities
- Resolving problems of scale and seasonality
- Integrating science advice into policy decisions
- Linking Coastal Zone Management and marine value creation (fisheries and aquaculture)

4.4 Election of a new Chair

Beatriz Morales-Ninn (Spain) has chaired WGICZM successfully for 2 years, however due to recently being promoted to Director of IMEDEA she felt unable to continue as Chair of the group.

After prior discussions and a vote Andreas Kannen from the GKSS Research Centre, Germany agreed to become the new Chair.

Annex 1: List of participants

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Annex 2: Agenda

Working Group on Integrated Coastal Zone Management (WGICZM)

9–12 March 2010

IMEDEA Institut Mediterrani d'Estudis Avançats

Miquel Marques 21, 07190 Esporles, Mallorca, Spain

<http://www.imedea.uib.es/donde.php>

9 March 2010

9:30–18:00 – Convene at IMEDEA

- Welcome. Beatriz Morales Nin (Chair). Housekeeping and support arrangements.
- Introduction of participants. Agenda approval.
- Review of Terms of Reference, Designation of Reporters, Report layout (Chair + members).
- ToR a) Update and report on activities of relevant ICES Working and Study groups to identify information pertaining to the coastal zone and evaluate this information relative to ICZM needs and to monitor progress on policies and programmes in the UN, EU, LOICZ and ICES member countries;
- ToR b) Update and report on ICZM activities in different ICES countries including information on initiatives towards integrated governance in the CZ;
- Collate different inputs into the report.

18:00 end of the meeting

10 March 2010

9:00–18:00 – Convene at IMEDEA

- Overview and strategy for the two events:

Thematic session at ICES 2010 conference on ICZM: The risk of failing in integrated coastal zone management. Conveners: Roland Cormier (Canada), Beatriz Morales-Nin (Spain), and Josianne Støttrup (Denmark).

The 2nd International Symposium on Integrated Coastal Zone Management Arendal, Norway, 3–7 July 2011

- ICES issues
- Election of a new Chair
- ToR g) Environmental interactions of wave and tidal energy generation devices (Marine wet renewables) (OSPAR request 2010/4)

To provide advice on the extent, intensity and duration of direct and indirect effects and interactions of marine wet renewable energy production (wave, tidal stream and tidal barrage systems) with the marine environment and ecosystems of the OSPAR maritime area, and with pre existing users of these ecosystems, including:

- actual and potential adverse effects on specific species, communities and habitats;
- actual and potential adverse effects on specific ecological processes;
- irreversibility or durability of these effects.
- ToR f) Continue to report on progress on catchment-coast fluxes in the ICZM management plans of ICES countries, but be more broadly focused on coastal system sustainability based on integrating human ecological systems as they relate to Land-Ocean Interactions. This ToR should also provide advice on the integration of all the issues highlighted in the ToRs of this WG, to be addressed in ToR f.
- Collate different inputs into the report.

18:00 end of the meeting

11 March 2010

9:00–18:00 – Convene at IMEDEA

- ToR c) Continue to monitor and report results generated from larger projects that are directly relevant to ICZM needs;
- ToR d) Progress the development of an integrated decision making framework for ICZM;
- ToR e) Continue the assessment of tools related to ICZM;
- Collate different inputs into the report;
- Days Progress distributed for reading.

18:00 end of the meeting

12 March 2010

8:30–12:00 – Convene at IMEDEA

- Rapporteurs of the different ToR pass draft recommendations and 2010 ToR proposals to be discussed in forum;
- Work in drafting groups;
- Collate the report and print out Draft 2 and distribute for reading;
- Convene to discuss the draft report;
- Final modifications of draft.
- Next year venue and dates.

End of 2010 meeting

Annex 3: Terms of Reference for 2011

The **Working Group for Marine Planning and Coastal Zone Management (WGMPCZM)**, chaired by Andreas Kannen, Germany, will meet in Hamburg, Germany, from 22–25 March 2011 to:

- a) Report on the development and use of MSP specifically identifying good practice and gaps in priority based decision making and objective setting in IM and ICES countries;
- b) Prepare a review of existing practices in Quality assurance including a review of formal management standards for its use in IM;
- c) Prepare a review of the measurement and application of ecosystem goods and services in IM;
- d) Update and report on IM activities, including ICZM and MSP in different ICES countries including information on initiatives towards integrated governance in the CZ;
- e) Receive a report on the Strategic Initiative on Coastal and Marine Spatial Planning and plan for the suggested ICES ASC Joint Theme session in 2012;
- f) Report on the ICES 2010 ASC Theme Session B: The risk of failing in integrated coastal zone management progress and the publication of any suitable papers.

WGMPCZM will report by 21 April 2010 for the attention of ACOM and SICOM.

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 that would allow ICES to provide better holistic advice. Consequently these activities have high priority.
Scientific justification and relation to action plan:	<p>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.</p> <p>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.</p> <p>High Priority Research Topics in the ICES Science Plan that are relevant to the WG are:</p> <ul style="list-style-type: none"> • Marine spatial planning, including the effectiveness of management practices (e.g. Marine Protected Areas (MPAs)), and its role in the conservation of biodiversity; • Contributions to socio-economic understanding of ecosystem goods and services, and forecasting of the impact of human activities.

	<ul style="list-style-type: none"> • The role of coastal-zone habitat in population dynamics of commercially exploited species; • Influence of development of renewable energy resources (e.g. wind, hydropower, tidal and waves) on marine habitat and biota; <p>Important components include spatial planning tools to assist IM practitioners; the socio-economic and cultural understanding of marine resources in the application of IM and the application of IM to address the interactions between commercially exploited species and natural systems. This work will contribute directly to the applications of emerging and present coastal directives (e.g. EU-WFD; EU-ICZM, Marine Strategy) and other local or trans-boundary management issues within ICES Member Countries.</p>
Resource requirements:	New experts have been recruited during the past two years and there is a need to engage experts from USA and other ICES countries involved in ICZM and not participating actively within the WG.
Participants:	ICES Member Countries working with coastal zone issues and other experts also involved with ICZM. The Group is normally attended by some 10–14 members and guests.
Secretariat facilities:	None.
Financial:	No financial implications.
Linkages to advisory committees:	There are obvious direct linkages with ACOM
Linkages to other committees or groups:	SCICOM and several Working Groups within this committee, in particular Mariculture related groups.
Linkages to other organizations:	EU, OSPAR, HELCOM, LOICZ.

Annex 4: Recommendations

RECOMMENDATION	FOR FOLLOW UP BY:
1. The WGICZM is renamed WG Marine Planning and Coastal Zone Management (WGMPCZM)	
2. The new ToRs developed in Section 4 should be adopted to guide the future work of WGMPCZM	
3. That the group membership includes experts from MSP, socio-economics, IM practitioners.	
4. That the Chairman of WGMPCZM communicate with the leader of the SICMSP with a view to proposing a joint theme session on ICES role in MSP at ASC 2012.	
5. That ICES create a study group to report on the current state of knowledge of environmental interactions of wave and tidal power generation.	
6. WGICZM should take the opportunity of the ICES ASC Theme session b, 2010: the risk of failing in Integrated Coastal zone management to publish the conference proceedings and publish the papers in a special issue in a journal (e.g. Marine Policy).	

Annex 5: Update and report on ICZM activities in different ICES countries including information on initiatives towards integrated governance on the CZ (ToR b)

5a. Canada (updated in 2010)

Canada has the longest marine coastline (243 792 km) in the world with almost one-quarter of its population living in coastal communities. The area of its territorial seas is two-thirds of the landmass.

Key Issues for ICZM in Canada:

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

ICZM Policy Activities

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

Activities relating to integrated management in Canada were given a higher priority in March 2005 when the government committed "to move forward on its Oceans Action Plan (OAP) by maximizing the use and development of oceans technology, establishing a network of marine protected areas, implementing integrated management plans, and enhancing the enforcement of rules governing oceans and fisheries, including rules governing straddling stocks." The OAP articulates a government-wide approach to reach sustainable development. Fundamental to this initiative, governance structures have been implemented in five Large Oceans Management Areas in support of integrated management. These areas are located on the Pacific North Coast, Beaufort Sea, Gulf of St Lawrence, Eastern Scotian Shelf and Placentia Bay/Grand Banks (Canadian Science Advisory Secretariat (CSAS) SAR 2007/010; http://www.dfo-mpo.gc.ca/csas/Csas/status/2007/SAR-AS2007_010_E.pdf).

From a LOMA perspective, the following elements were produced:

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

Under the Health of the Oceans funding, Canada aims protecting fragile marine environments, counter pollution and strengthen preventive measures by:

- strengthening pollution prevention at source (conservation of natural resources);
- increasing capacity to lessen the effects of pollution when and where it occurs;
- increasing protection of ecologically significant marine areas through the establishment of nine new marine protected areas (MPAs);
- investing in science to better understand the oceans; and
- co-operating more closely with domestic and international partners for more integrated oceans management.

An important goal is to understand and protect the most vulnerable parts of our oceans. Canada is also promoting co-operation with our international partners. Such co-operation will work towards the ultimate goal of ensuring healthy and prosperous oceans for the benefit of current and future generations of Canadians.

The Health of the Oceans initiative also allowed the establishment a Center of Expertise on Coastal Zone Management with the objective of clarifying the Federal, Provincial and Territorial roles and leveraging partnerships among jurisdictions, economic sectors of activity and coastal communities. Given that the primary role of the Federal Government in coastal management is in bringing forward the need to include aquatic ecosystem considerations into relevant jurisdictional decision-making processes, the CoE will focus its efforts in the development of ecosystem-based frameworks and tools with particular focus on managing for cumulative effects. The CoE is developing risk-based decision making processes and governance by drawing on existing international practices, concepts and frameworks. It is drawing on the Driver Pressure State Impact Response (DPSIR) standards as well as the Pathway of Effects (PoE) approaches to risk characterization. Selected coastal pilots are contributing to the development of geo-spatial tools for identifying land-marine interactions points, ecosystem vulnerabilities and for integrating of social, cultural and economic values in decision-making and land-based planning processes.

There is recognition of the need to adapt the approaches and knowledge from the LOMA initiative to the finer scale of coastal and inshore areas. EOARs have already been completed for selected priority coastal areas and Coastal Management Area (CMA) pilot projects are being considered (CSAS PS 2007/025). This task is a challenge for both science and management given the extent and diversity of human activities in the coastal environment as well as the overlapping jurisdictions of municipal, provincial, territorial and federal governments.

Ecosystem Research Initiatives (ERI) have been designated in coastal areas (e.g. Northumberland Strait and Strait of Georgia) to develop ecosystem-based advice for integrated management based on strategic scientific research. The development of ecosystem indicators and reference points is ongoing and considered essential to setting and achieving the goals and objectives. These indicators are tied to the identification of EBSAs/ESS/ESCPs and Species-at-Risk, where the intent is to provide for the overall ecosystem function and structure by protecting key ecosystem components. The renewed emphasis on ecosystem-based science and the identification of vulnerable components is expected to provide guidance in establishing monitoring approaches and scientific priorities (CSAS PS 2006/003; http://www.dfo-mpo.gc.ca/csas/Csas/Proceedings/2006/PRO2006_003_E.pdf).

5b. GERMANY (Updated in 2010)

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. In contrast, the North Sea coast is characterized by a tidal regime and mainly features tidal flats, islands and marshland.

There is no legally binding definition of the coastal zone in Germany, but a definition in the national ICZM-Strategy, where the ICZM does apply, 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; 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. The German coastal Länder extended their spatial planning system to the 12 sm border.

According to the national ICZM strategy the following areas have to be considered in ICZM (Bundesumweltministerium-BMU::Integriertes Küstenzonenmanagement in Deutschland: Nationale Strategie für ein Integriertes Küstenzonenmanagement mit Bestandsaufnahme (as from 13 February 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 and in the EEZ as well as the coastal strip related power supply lines;
- 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;
- implementation of the Marine Strategy Framework 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;
- Land use management and reducing land consumption in the coastal areas on land.

Coastal and marine 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, Housing and Urban Development is responsible for providing national guidelines and coordinating planning policy from which the individual states derive 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 wind farms, 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 has been introduced for the German Exclusive Economic Zone (EEZ). After completion of the public participation procedure the Federal Ministry of Transport, Building and Urban Development (BMVBS) has determined the targets and principles of spatial planning for the German Exclusive Economic Zone (EEZ) in North Sea and Baltic Sea with regard to economic and scientific use, with regard to safety and efficiency of maritime traffic as well as protection of the marine environment. The legal ordinance of the BMVBS concerning the spatial plan for the German EEZ in the North Sea of 21st of September 2009 (BGBl. I p. 3107), which comprises as an attachment the spatial plan (text and map), entered into force on the 26th of September 2009. The legal ordinance of the BMVBS concerning the spatial plan for the German EEZ in the Baltic Sea of 10th of December 2009 (BGBl. I p. 3861), which comprises as an attachment the spatial plan (text and map), entered into force on the 19th of December 2009. The legal ordinances incl. the map of the Maritime Spatial Plan together with justification as well as the environmental reports (in German and English) have been published at the website of the Federal Maritime and Hydrographic Agency: http://www.bsh.de/en/Marine_uses/Spatial_Planning_in_the_German_EEZ/index.jsp

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, Building and Urban Development and the Federal Agency for Building and Spatial Planning. This has been published in 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 has been issued during the first half of 2006. Interim results have been published in several conference proceedings.

A national ICZM strategy (www.ikzm-strategie.de, German only) has been prepared in 2005 by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), based on a research project of the Federal Environment Agency (UBA). A comprehensive and holistic approach to solving the interlinked problems and the involvement of all actors and responsible authorities are important principles of ICZM. Therefore, the working group "National Strategy" was set up including representatives from the responsible federal ministries, the coastal Laender as well as municipal, environment and economy associations. This was done to ensure that the experience and contributions of the various actors will be reflected in the national strategy. The process was concluded, for the time being, when the federal cabinet dealt with the issue in March 2006. The national strategy was then submitted to the Commission and the results were presented to the interested public at a two-day conference in Bremen. steps should be pursued: further optimization of the set of legal instruments according to the basic There was also a decision of the German Parliament (Dt. Bundestag) on further developing ICZM in December 2006.

As a pilot project of the Federal Ministry for the Environment (BMU) and the Federal Environment Agency (UBA), an ICZM contact point for information exchange and networking was established in the end of 2009. The concerned federal ministries, the five German coastal states (Länder) and the associations of local authorities are member of the advisory board. (www.kuesten-kontor.de). Besides an internet platform for the ICZM process in Germany has been set up. (www.ikzm-strategie.de)

The federal government and the Laender are also involved in the development of the Maritime Policy under the frame of the EU. Discussion concerning the EU Marine strategy has started in expert circles. 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.

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 reported to the Commission. Based on the work of the Federal Agency for Nature Conservation, 8 areas in the EEZ with a surface covering almost 950,000 ha were registered as Habitats Directive sites and 2 SPAs with more than 500,000 ha were notified to the Commission as Germany's contribution to the network of protected areas Natura 2000. The SPAs have been designated as national protected areas in the meantime.

On 25 June 2002 the EU Water Frame Directive was implemented into national law. The different national working groups have finished their evaluation on the ecologi-

cal state of the German coastal waters. Implementing the WFD is a task of the Federal States (Laender). In a range of aspects the 16 Federal States used different approaches, especially concerning

- the selection and analysis of assessed parameters like chemical-physical parameters, specific pollutants;
- the determination of significance thresholds and threshold values;
- the aggregation of results to the whole water body.

The assessment, which has been performed by the German Laender until end of 2004 came to the following conclusions regarding surface waters:

- about 14% of the assessed water bodies the environmental targets are likely to be achieved;
- for about 26% of the assessed water bodies it is unclear whether the environmental targets can be achieved;
- about 60% of the assessed water bodies the environmental targets will probably not achieve the environmental targets without additional measures.

About 63% of water bodies have been classified as being in natural conditions, about 23% have been classified as heavily modified and about 14 % as artificial.

CZM 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 wind farms, 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 metadata, especially regarding the physical setting and environmental conditions of the North Sea and the Baltic Sea. A starting point for Geodata is the GeoSeaPortal of BSH: <http://www.bsh.de/de/Meeresdaten/Geodaten/index.jsp>

Within the frame of the setting up targets and principles for spatial planning in the German EEZ, an environmental report following the rules of Strategic Environmental Assessment will aggregate a lot of environmental information for the German EEZ.

Several further databases exist, particularly concerning environmental data, e.g. the Marine Environment Database (MUDAB – Meeresumweltdatenbank).

ICZM research projects

The federal ministry for the Environment, Nature conservation and Nuclear safety supports the implementation of ICZM with 3 research projects. Due to the recommendation to continue the dialogue-process, a research project ICZM Coordination Centre was commissioned. The goal of this research project is to lay the groundwork for the dialogue and the decision-making process among the German federal ministries, the Laender and other relevant institutions with regard to setting up an ICZM Coordination Centre which will act as a moderator and support implementation. The

key objectives of the project include comparing different organizational models and reviewing the respective legal, technical and financial prerequisites. This project should produce well-founded proposals for various organizational options for the ICZM Coordination Centre and its practical implementation.

Another research project aims to propose strategies, instruments and measures for efficient land use on the basis of practical examples. During the first part of the project, a review and analysis of land development is required, whereby the following points will be investigated in 5 work packages:

- 1) Settlement development from 1990 to 2000;
- 2) Environmental impacts, interaction between land and sea;
- 3) Influence of demographic change;
- 4) Impact of rising sea levels;
- 5) Influence of the Water Framework Directive: waterbody expansion and maintenance.

The second part of the project aims to elaborate development paths using scenarios up to 2030 based on the findings about the future development of the coast and, therefore, the demand for land. The third part of the project consists of identifying problems and elaborating solutions for four different practical examples with the help of ICZM. The experience gained will then serve as a basis for recommendations on activities by local or regional organizations and other actors in the ICZM process, in particular with regard to a) legal instruments, b) economic instruments, c) planning instruments and d) an ICZM procedural model.

A third research project deals with the impacts of climate change on the Wadden Sea and has two main goals:

- to contribute to an optimized coordination between coastal protection, nature conservation and other stakeholders in dealing with potential impacts of climate change on the Wadden Sea region; and
- to supply about two or three practical and successful examples of an integrated coastal zone management (ICZM).

In this framework, strategic project management will be tested as a potential model. An independent Project Initiation and Coordination Centre (PICC) will be set up. The Michael-Otto-Stiftung preliminary commissioned with the project management, will provide a neutral platform, moderate and motivate, supported by a project committee of experts. The Coordination Centre will establish different working groups. One will be concerned with outlining a vision for the development of the Wadden Sea region and others with the selection of and support for at least two ICZM projects.

ICZM development in Germany is also accompanied by two large research projects (currently funded from 2004–2007) funded by the BMBF, each of them with a range of subprojects. Both projects have been extended until end of April 2010. 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 development of methodological approaches for sustainable development along the North Sea coast of Schleswig-Holstein. The thematic focus is on the assessment of interactions regarding offshore-wind farms, 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:

- human demands and perceptions and the communication processes between stakeholders;
- dealing with risk and uncertainty;
- dealing with development opportunities;
- mechanisms for managing and steering multi-scale alterations of sea use patterns.

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.

Coastal Futures as well as ICZM Odra are internationally embedded in LOICZ. ICZM Odra works also cross-border in cooperation with Poland. In addition, GKSS Research Centre (www.gkss.de) runs the German node of ENCORA, thereby providing the interface between coastal research in Germany and the European arena. Ongoing EU research projects include SPICOSA, ASTRA and RADOST (all using the Odra estuary as case study).

Since the beginning of 2010 the Federal Ministry for the Environment (BMU) and the Federal Environment Agency (UBA) fund and support a competition "Lust op dat Meer", organized by the Ministry of the Interior of Schleswig-Holstein. Using the example of the North and Baltic Sea area in Schleswig-Holstein selected pilot projects sustainable coastal development and coastal areas with a high quality of life shall be implemented.

5c. NORWAY (updated in 2010)

In Norway the coastal zone (equal to the definition in the EU Water Framework Directive) covers an area of about 100,000 km² and extends about 85,000 km (including islets and islands). It has a complex topography with many deep and sheltered fjords, often with sills toward a more exposed sherry or an open coast. Rocky shores and many basins with relatively large depths are common features along the Norwegian coast. The fisheries along the coast, and in more recent years fish farming, are important to the Norwegian community, its welfare and economy in a long-term perspective. Crucial conditions for these industries are the maintenance of high, natural production and biodiversity and good water quality along the coast, which call for sustainable management of human activities and exploitation of resources. The utilization and production of marine, renewable resources cannot be sustained where the functional integrity of coastal systems is degraded.

The coastal zone is the key area for many marine species. The areas where the large oceanic stocks spawn are important both for the stocks, the coastal ecosystem, the fishermen, and for the people living or recreating along the coast. These spawning areas should be treated as sacred and every necessary measure to secure these areas for spawning also in the future should be taken. The threats from anthropogenic activities to the fishery resources, to the health status and to the biodiversity of the coastal ecosystems in general are much the same. Negative influences may be due to

inputs of nutrients, toxic substances, and habitat alteration from physical encroachment, oil exploitation and transport, and from introduction of alien species. In addition, the fishery itself may overexploit the resources and use methods such as trawling that may damage bottom ecosystems such as coral reefs and soft bottom habitats. Non sustainable fisheries may thereby be a threat both to optimal utilization of the resources and to conservation of the nature and biodiversity. Several of the largest oceanic fish stocks in the North-east Atlantic region migrate to the Norwegian Coast to spawn. These stocks thereby transform and transport the vast oceanic plankton production from the Norwegian and the Barents Seas to the coast. Their spawning products, eggs and larvae, are prey for local fish, mammals and birds and are consequently of vital importance to the sustainability of the coastal ecosystem. The large oceanic fish stocks are the basis for important fisheries that together with aquaculture support people living along the Norwegian coast. Therefore it is important to manage the fish stocks so they remain strong and sustainable, and can support the coastal communities both now and in the future. Advanced genetic studies have recently demonstrated the existence of local stocks of the common species Atlantic cod along our coast, and such populations may have difference in age- and size at maturity, survival rates and growth rates. The size of these local stocks is considered crucial for recruitment and future fisheries. This new knowledge calls for careful and sustainable management, both from a resource and biodiversity point of view. These local stocks use local spawning areas and are also dependent on nursery grounds in the vicinity. It is important to protect the spawning areas and nursery grounds from pollution and 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.

As a following up of the Rio-declaration on Environment and Development an extensive mapping of marine habitats and essential biological assets, as spawning areas and local stocks, has been going on for some years now. This means that we are about to get a much better picture of marine nature and habitats along the coast, although it is still a long way to go to cover the entire coast. In some regions, however, as for the Eco-Region Skagerrak, the mapping is already quite extensive, because local (municipalities) and regional (county-administrations) authorities have given priorities to the mapping tasks and contributed with both money and manpower. The new knowledge on marine nature and biological assets are to some extent already integrated in planning and management processes in these municipalities. And a new law ("Planning and building law"), operative from June 2009, will extend responsibility and tasks of the municipalities for their marine areas from the shoreline to one nautical mile of the sea boundary. Land use can be determined for the water surface, water column and bottom. It can be brought into the area section which groups of species or species of aquaculture which individually or in combination can be established. It can also be called into account zones. These are areas with natural or other qualities that one must take into account when one determines land use.

It is made new rules for the planning process. Municipal council must at least once in each election period, and no later than one year after start of its period, prepare and adopt a municipal planning strategy. It shall include a Plan program. Plan program will explain the purpose of planning, the planning process and arrangements for participation. If the municipal plan is in conflict with the overall national or regional policies, the state or county government will promote an opposition. The new plan

law also gives the Sami Parliament entitled to submit objections to municipal plans. Mediation of a former widespread practice is now statutory. In addition, the deadline for objections has been emphasized. Regional level forum is something that has existed previously in many counties. It is now anchored directly in the law as an optional item. The purpose is clear installation and coordination of the various interests in the planning. As of 1.1.2010 the administrative responsibility for allocation of aquaculture licenses transferred from the Directorate of Fisheries to the counties. Meanwhile, the tasks associated with planning related aquaculture management also transferred to the counties. Directorate of Fisheries will continue to provide input for aquaculture, but the responsibility to promote the objections on behalf of farming interests in the municipal coastal zone planning processes are transferred to the county. Also the task as the responsible authority in accordance with the regulations relating to impact its provisions on aquaculture plant is transferred. The purpose of a KU is to clarify the aquaculture initiative consequences for the environment and society, and provide a basis for more thorough and specific treatment and expanded conditions setting for aquaculture application.

Key issues for ICZM in Norway are:

- Limited knowledge about coastal ecosystems structure and function, and effects of intervention. An important part of this is knowledge about life history of marine organisms;
- What are the threats against maintenance of rich and clean coastal ecosystems;
- How do oceanic stocks affect the coast and what is the significance of the coast for the oceanic stocks;
- Species demand on the environment including suitability and their vulnerability with respect to chemical pollutants and eutrophication;
- Population structure and size of local fish stocks, for example of coastal cod and herring, as well as of other fauna (invertebrates) and flora;
- Sustainable exploitation of living, marine resources in coastal waters (who is harvesting what?);
- Need for monitoring programs to quantify and characterize recreational fishing effort and catches of commercially important species;
- Need for marine protected areas in coastal areas and expected benefits;
- Mapping and monitoring of biodiversity, including marine nature and habitats;
- Carrying capacity of coastal ecosystems for aquaculture and other human activities;
- Interaction between wild and reared organisms;
- Benefits and drawbacks with sea ranching;
- Non-indigenous marine species in the coastal waters;
- Rehabilitation of strained environments, ex. polluted sediments.

Projects and activities of relevance to ICZM

In two recent projects knowledge on the coastal zone are made available to managers and stakeholders. As the first municipality in Norway, Tvedestrand along the southern coast of Norway has got GIS based maps of their marine nature. The information

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

Recreational fishery

The Institute of Marine Research (IMR) is now developing survey methods to provide estimates of total number and weight of commercially important species caught by tourists in Norwegian coastal waters. The project will contribute to increases knowledge of the coastal fisheries resources to support sound management advice that help secure sustainable fisheries. A pilot study that involved the collaboration with 65 businesses was conducted in 2008 to test field data collection methods including the use of catch logbooks for recording catches and effort by tourists. Data on reporting response rates, and on the variation in daily effort and catches from more than 800 weekly catch diary forms filled out by tourist fishers was used to develop field data collection methods now used in a National survey of the tourist fishery. A representative sample of 100 businesses will collaborate with IMR in 2009 to obtain catch and effort data via catch diaries filled out by tourist fishers. Reporting of catch and effort will be provided to IMR for every 6th week throughout 2009 from these businesses, selected by stratified random sampling. In order to obtain better and continuous samples from the coastal fishing fleet, knowledge about fleet behavior and technical developments influencing efficiency and effort, 18 coastal fishing vessels (the Coastal reference fleet) have been contracted. The fleet will probably be expanded during 2008. The vessels are from 9–15 m, and the crew members are trained to conduct self-sampling. Biological samples (length, otoliths, genetic samples, stomachs etc) and logbook data are delivered according to contract, which secure a proper statistical coverage for a number of species in time and area. The observations of rare species are also most valuable information from the fleet, together with continuous information about species that are hardly accessible by research vessels, and observations of sea mammals, sea birds, crabs etc. Further, such trust based cooperation between fishermen and scientist seems to reduce controversies and rather build a common understanding and ownership of improved stock assessments and fisheries management.

MPA

A group at Flødevigen Marine Research Station, IMR, is testing marine reserves (MPAs) as a potential management tool for European lobster (*Homarus gammarus*) in Skagerrak. Catch per unit effort sampling and mark recapture is conducted annually in three experimental lobster reserves and adjacent control areas along the Skagerrak coastline. The research is carried out according to a BACIP (Before After Control Impact Pairs) design. The reserves were implemented in September 2006, but pre-selection sampling and collection of 'before data' was conducted in three years prior to the area closure. The project is preliminarily given a 10 year horizon, which is considered sufficient time to yield information on the effect of protection. The IMR MPA project has attracted funding for two additional projects from the Research Council of Norway 'Havet and Kysten' programme. The first project (Marine Protected Areas in coastal Skagerrak: a model system for understanding lobster demography and successful introduction of MPAs in temperate waters) uses existing mark-recapture data, telemetry and archival tagging in order to understand lobster demography and behavior in relation to shape and size of reserves. The second project (An integrated study of stakeholders and living resources in relation to the potential effectiveness of MPAs as a management tool) focuses on socioeconomic aspects linked to the establishment of the existing experimental reserves as well as future implementation of coastal MPAs with a special emphasis on lobster and cod (*Gadus morhua*). IMR is thus seeking to take a holistic approach whilst generating knowledge on MPA performance (biology) and management (socio-economics). Preliminary results from the first project suggests that lobsters have a high degree of site-fidelity at a scale of a few km, but also have a high activity level (at their home site) during the warm summer months. This project has also estimated natural mortality within a protected area, indicating that male lobsters suffer somewhat higher mortality (0.35) as compared to females (0.30). The second project has made an attempt to map the spatial scale of adaptive variation in coastal cod in Skagerrak, to be used in future spatial management. Roughly, the data suggests that important life-history diversity can be found among local populations at a fjord-scale, corresponding to about 50 km of coastline (Olsen *et al.* 2008). Ongoing field work based on traditional tagging and advanced telemetry will provide estimates of natural mortality, fishing mortality (commercial versus recreational fishers), and site fidelity. An analysis of the implementation process showed that the experimental lobster reserves have a high legitimacy among the local stakeholders, even that most of them (e.g. recreational fishers) were not involved in the implementation process (Pettersen *et al.* in press). Preliminary findings indicate that recreational fishers are catching more lobster than commercial fishers in certain areas, indicating the need to involve these stakeholders in future implementation processes.

Water Framework Directive

The implementation of the EU Water Framework Directive in Norway is now to a large extent brought forward by 9 regional WFD-authorities. Guidelines for this work and information about the progress can be found at the webpage: <http://www.vannportalen.no/hoved.aspx?m=31139>. In addition national authorities (Directorate for Nature Management and State Pollution Authorities) organize national and international cooperation on inter-calibration exercises and development of classification systems for ecological status. Recently the first generation of instruction manuals for monitoring and classification of coastal water, including a proposal of localization of reference stations and trend stations along the coast, are made. By

2010 the first management plans within the framework of the WFD should exist for nine selected coastal areas.

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5d. SPAIN (updated in 2010)

The National Shores Act, *Ley de Costas (Ley 22/1988)*, defines the coastal zone (Maritime-Terrestrial Public Domain, MTPD) as the area between the landward limit of influence of coastal dynamics and the limit of the external continental shelf or of the Exclusive Economic Zone (EEZ). This law, which focuses protecting public use of the coastline, also defines a protection zone, where construction is forbidden that extends 100 meters landward from the limit of the MTPD (or 20 m for zones occupied by urbanizations built before 1988). The Act also defines an area of influence that extends 500 m inland where urban planning issues and management must be taken into consideration. However, coastal management based on this law has not been entirely effective, particularly in relation to the regulation of construction in the 100 m protection zone, due to lack of accurate data delimiting management zones. In 2006, the Coastal Directorate initiated the Master Plan for Sustainability of the Coasts, which has been renamed the Coastal Sustainability Strategy, with the objective of protecting the MTPD and promoting sustainable use of coastal resources through integrated planning and management. This Strategy is described in more detail in the following sub-section.

Key Issues for ICZM in Spain

- Spain is a mature tourism destination and host to some of the most visited “sun and sand” tourism locations in the world (i.e. Balearic Islands, Malaga, Canary Islands);
- Urban development affected 5 % of the surface of a 10 km-wide area along the coastline in 1990, and 40 % of the human population lived in coastal municipalities in 2005;
- Most (65%) of the Spanish industrial production is located in the coastal zone;
- 90% of the imports and 80 % of the exports are done by maritime transport;
- Nearly 70% of the 48 million foreign visitors to Spain have the coastal zone as their destination;
- Coastal 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 ICZM in Spain. The 1978 Constitution transferred most components of environmental and territorial planning to the regional governments, "Comunidades Autónomas". Municipalities are responsible for producing land-use plans. Jurisdiction overlaps are common among national, regional and local governments. ICZM is acknowledged as a desirable goal by the different government levels but there is no standard approach and the degree of implementation varies widely between the different regions. Each region can produce its own environmental legislation.

The Spanish Government is currently elaborating the Spanish Strategy for Sustainable Development (EEDS), which adopts ICZM as a key element to assure the sustainable development of the coastal zone, and declares the cooperation among all levels of the Government and the private sector in the design of integrated strategies for sustainable development as a main goal. As a part of this Strategy, the Coastal Sustainability Strategy, which was mentioned previously, is being promoted by the Spanish Government as an instrument for the Implementation of ICZM at the Spanish national level. This instrument is based on a framework for the integration of coastal administrations at national, regional and local level, which was achieved through a strong public participation mechanism. In addition to generating research to accurately delimit the coastal areas specified in the National Shores Act, the plan is intended to facilitate appropriate coastal planning, based on the principles of sustainable development and knowledge-based decision-making. This is achieved through the development of integrated tools and techniques for the assessment of environmental and socio-economic issues, using spatial database technologies and numerical modeling of coastal processes.

A strong effort was also made to answer to the Recommendation 413/2002/EC on ICZM. The Spanish report was finalized in 2006 and included a stocktaking of actors, laws and institutions which have a relation with the coastal zone and the Coastal Sustainability Strategy as the main instrument for ICZM implementation in Spain. In addition, during the last two years, several ICZM researchers and practitioners of Spain have been working together in association with AENOR (Asociación Española de Normalización) to develop guidelines for the application of ICZM processes for the Spanish coast. As stated in the EC Green paper (Towards a future Maritime Policy for the Union), "a future maritime policy has to build instruments and methods for ensuring consistency between land and marine systems in order to avoid duplication of regulations, or the transfer of unsolved land-planning problems to the sea". Under such mandate, the group was initially pushing the idea to use formal environmental management standards for ICZM in a proposal for the development of a new norm UNE-ISO; finally they have produced a booklet that contains a series of guidelines for the implementation of these processes in practice. As a previous development of the group, they published a book on this topic, very relevant for Spain, "*Gestión integrada de zonas costeras*" (AENOR 2009).

There has also been some restructuring of the national government with respect to the environmental ministries. Specifically, in April 2008, the Spanish National Ministry of Environment and the Ministry of Fisheries joined to become the Ministry of the Environment, and Rural and Marine Environments through the Real Decreto 432/2008. This Ministry assumes the competencies on agriculture, fisheries, alimentation and environmental issues. This Ministry has to deal with the measures against climate change, protection of natural environment, biodiversity and of the seas, water, rural

development, food, fisheries etc. from a sustainable and protective policy (<http://www.mma.es/>), including a project on detection and elimination of jellyfish. Between the multiple activities, the Ministry has issued a methodological guide for the installation of artificial reefs. This protocol deals with methodological aspects as well as on the use of artificial reefs for coast protection, regeneration of ecosystems, recreational uses, as well as to the traditional use for fisheries exclusion.

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

Local and National Research Initiatives

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), including, more recently, Integrated Coastal Zone management (ICZM) studies and applications to fulfill the EC Recommendation on the application of ICZM (EC-30 May 2002). The following sub-sections summarize local and national activities added or updated from previous reports. These are presented by regional area.

Mediterranean/National

It is a fact that coastal zones in the Mediterranean are becoming progressively more seriously degraded. Instrumental to the phenomenon in Spain is the evident failure of the coastal management that the institutions have pursued for over three decades, both under the old, state-centralized model, and the new organizational model with the political division of land into autonomous regions. This failure can in part be explained not only by the inadequate tools the administration possesses to address the dynamism and complexity of the new economic activities that have sprung up along the coast, but also by incoherent sectoral policies. Finally, there has been no all-encompassing political strategy capable of dealing with coastal communities' demands for development and the need for the protection of ecosystems and their natural resources. All this has resulted not only in a deterioration of the area, but also in the discrediting of actions implemented by the institutions, and their plans and programs being perceived as an obstacle to economic development (Suarez & Vivero 2005).

HISPACOSTA

Spain built up a network of researchers and institutions interested in Integrated Coastal Zone Management (HISPACOSTA), which forms an active part of the European Network for Coastal Research Coordination Action (<http://www.encora.org>). Currently, the Spanish National Research Council is a partner on the Knowseas Project (FP7 Programme, <http://www.knowseas.com/>), initiated in 2009.

LIFE + INDEMARES

In early 2009, Oceana and Fundación Biodiversidad presented a proposal to protect marine areas in the Spanish South Atlantic and Mediterranean (www.oceana.org/fileadmin/oceana/uploads/europe/reports/propuesta_areas_marinas_importancia_ecologica.pdf).

The Spanish government, through Fundación Biodiversidad, and in collaboration with Oceana, has begun a project called LIFE + INDEMARES, supported by the European Commission, to study potential new areas for conservation. The project aims to study and propose 10 marine protected areas. This project is aimed at helping Spain to reach the UN international target of protecting at least 10% of the world's marine areas by 2012. Spain currently protects only 0.5% of marine areas.

Mar Menor Lagoon

The Mar Menor lagoon has been studied in a historical context considering the natural variability at geological scale and the human effects by the Universidad de Granada and ICMAN. The effect of storms on the hydrographic basin and lagoon is considered, taking into account the circulation, temperature regimes and their effect upon the biology jellyfish *Cotylorhiza tuberculata*.

Andalucía

This geographical area is extensively developed in its coastal zone with urban, touristic and agricultural developments in the coastal area including the 100 m exclusion marine border.

In Spain, the Junta de Andalucía, supported by the Group of Planning and Integrated Coastal Zones Management of the University of Cádiz, has presented in October 2007 a pioneering document –The Governance of Andalusian coast– that accepts the principles of the European Strategy of ICZM as their own, making compatible a respect for the environment and a rational use of resources. The Andalusian document propounds three general goals: building a system of alliances among administrations, having suitable instruments of coastal management at one's disposal, and getting necessary resources to implement the ICZM. It consists in a generic method that must be put into practice in different ways in each area, as far as each coastal field suffers from own problems. Those goals must be given an expression later to concrete actions aimed for rectifying the faults of management, coordination and communication previously checked in the territorial diagnosis. The challenge consists in using a strategy in which all the sides are involved: politicians, technical experts and citizens in general. In the presence of the current policies of sectorial nature, the new system of management aspires to the coordination of different social actors, by adopting a global perspective of strengths, weaknesses, opportunities and threats, that can be corrected or fortified [report (in Spanish) is available at: <http://www.uca.es/grupos-inv/HUM117/grupogial/paginas/proyectos/proy2/8.pdf>].

The maritime transport of hazardous materials is very intense throughout the Gibraltar Strait, with the linked risks for this area. An integrated model for the maritime transport in Cadiz Bay is being developed by the Granada University, including the effects of waves and wind. This model has the novelty of modelling maritime climate allowing studying the effects of the new port facilities to be developed.

Efforts are dedicated to the integrated Management of the river basins, for instance the Guadalfeo delta (Granada) has been studied by Granada University, considering the last 20 years and the impact of a dam construction. In the on line model the river

dynamics (water and sediments flows), the marine climate (currents and tides) and the weather regime have been included (Ávila, 2007). Other estuarine areas studied by the same University are San Pedro and Guadalete rivers (Cádiz).

ICMAN and Granada University are carrying out a study on the estuary of Guadalquivir. This estuary is a key actor in the interaction between the man and the coast since the origin of western civilization. From the time when it was originally mentioned by Tartessos and Phoenician civilizations as an extremely wide saline lake (the Romans *Lacus Licustinus*), the estuary has evolved along the Holocene to a set of salt marshes heavily modified by man. These modifications were initially motivated by maritime transport and the need to facilitate the access to Seville port during centuries XVIII and XIX. However, the most radical transformations occurred at century XX, when vast areas of salt marshes were desiccated for its use as agriculture land. New pressures derived from aquaculture, mining and urbanization have recently added to these maritime transport and agriculture traditional actors on the estuary. This occurs in a context of extreme environmental sensitivity since the largest natural park in Europe is connected to the estuary (Doñana wetlands) and with impact on other economic sectors like fishery. The combination of human pressures and ecosystem services under strain recently derived into a conflict between conservationism and economic interest as well as between different economic sectors. The conflict incorporated high media and political coverage and demanded a scientific response for a knowledge-based present and future management of the estuary. An ambitious observational program was established for this aim. This study has resolved the different scales driving the physical dynamics of the estuary in connection with human activities, its impact on the biogeochemical and life cycles of key species as well as projections of future tendencies under different climatic and human-driven scenarios.

Catalan Coast

The project DEFCON-EEE (FUNCTIONAL ANALYSIS OF THE LANDSCAPE CONSERVATION ELEMENTS AS AN OBJECTIVE OF THE INTEGRATED COASTAL ZONE MANAGEMENT: THE PRINCIPAL ECOLOGICAL STRUCTURE-CGL2006-13953-C04). The main objective of the project is to formalize the required elements to let Natural Areas, actually protected or not, to maintain its functionality. This has to be done in such a way that the conservation of its Natural Capital be compatible with socio-economic activities within a context of Sustainable Regional Development. In essence, this consists in defining the criteria to design a Natural Areas Network. To fulfill this objective, the key conservation elements have been delimited and social perception on conservation has been assessed. In addition, a functional analysis of the different Natural Areas has been performed and the proper scales to maintain them investigated. This project serves as a tool to study the implementation of a new protection figure, the so-called Principal Ecological Structure, as well as to incorporate recommendations for the improvement of its Governance Processes. The proposed research is carried out in a coastal area (the Costa Brava) of high environmental and tourist-residential values, where societal conflicts derived of Natural Capital substitutions are frequent. The project pursuit the development of general criteria for planning, inside a general framework of Integrated Coastal Zone Management, that can be used in Strategic Environmental Assessments (SEA Directive). This framework could be exported to other areas in which similar processes can be observed.

The project MEVAPLAYA-II (METHODOLOGIES AND KNOWLEDGE TO VALIDATE A NEW INTEGRATED MODEL OF BEACH MANAGEMENT AS AN OBJECTIVE OF THE ICZM (INTEGRATED COASTAL ZONE MANAGEMENT-

CSO2009-14589-C04). The project is aimed to develop a comprehensive enhanced conceptual basis to apply the ecosystem approach to the management of the beach environments, and to construct a Regional Blueprint for a balanced and practical proposal for the establishment of a comprehensive and coordinated beach management effort. In order to do that, we will develop a set of managerial tools to overlap the existing impediments of ICZM mechanisms such as uncertainty in the effective use of science and time scale problems between the interaction of the human and the physical dimensions to be used for beach management. Using these tools as well as a critical assessment of actual beach management models, develop a pathway to move from a CZM model based on competences to an ICZM model based on processes and the ecosystem approach. The final objective of this proposal is the development of a scientific knowledge-based methodology to guide the application of the ecosystem approach to the sustainable management of beach socio-ecological systems. The proposal is aimed to introduce in this new model, the principles of ICZM. The new model proposed combines classical environmental management systems with the concept of ecosystem-based management (IUCN) that melds the core objective of the efficient and equitable use of ecological services, with the traditional idea of minimizing the environmental impact exerted by human activities. The proposed framework aims to be flexible enough for application at any spatial and temporal scale. The proposed research will be carried out in a coastal area (Costa Brava) of high environmental and tourist-residential values, where societal conflicts derived of beach alterations and Natural Capital transformations are frequent.

Galicia

Years ago, a group of researchers of the University of A Coruña initiated a continuous research aimed to investigate the regulatory framework and legal aspects of the introduction of ICZM practices, first in its littoral, and then, all over the coast of Spain. As a result of this work, the group has been able to publish a large monography called *“Estudios sobre la ordenación, planificación y gestión del litoral: hacia un modelo integrado y sostenible”*. This collective work set the state of the art about planning and management of the Spanish Coast under the ICZM framework.

Spanish Islands

In 2006 the report on “The changing faces of Europe's coastal areas” focused on the land/sea interface. However the report does not cover Europe's ultra-peripheral regions, such as small islands (SI). Only when special activities, like tourism are reported the islands appear. The report lightly addresses the economic question on SI with the same approach that we have stated before: Small islands are especially affected by social and economic problems (e.g. migration and lack of economic infrastructure). Improving living standards within coastal communities is therefore an obvious challenge for coastal peripheral regions. In what concerns sea flooding, the report admits that the impact of sea level rise is expected to be more local than global. Low coastal areas and small islands are at more risk than others. And it confirms that: “There is a need to work more on regional sustainable development. Using a regional scope, islands need a specific approach as they have specific problems such as limited land availability, lack of water reserves, waste. The focus on resource needs: human, scientifically, technical and mostly financial. But a new feature emerges: Ocean “boundaries” (ZEE) and the need to claim, manage, explore and monitor this “parcel of space” constituted by water, with the same extreme care as the land based spaces (Calado *et al.*, 2007).

The Balearic Islands

Playa de Palma (Mallorca Island) integrated diagnosis of environmental conditions

Playa de Palma, is located in the southeast of Mallorca and is a long standing tourist destination made up of 10 km of uninterrupted beach systems. There are 34,000 residents and 40, 000 tourist places accommodating 1.2 million of tourists every year, however due to the high population density, this coastal area suffers from very high anthropogenic urban pressures.

The Playa de Palma Consortium has detected the urgent need to revitalise the area. The Consortium has also identified the importance of following sustainable development principles in the regeneration plan.

To this end, a convention was signed with IMEDEA (UIB-CSIC) and the expertise of the scientists at the institute or University has been applied to the project. Adaptation to climate change has been a focal area of study. There is a need to measure and improve resilience to any future climatic changes and combine this with the development of a healthy and sustainable tourism industry while allowing for effective nature conservation. This type of applied investigation, with the aim of designing and re-modelling the PdP System, will assist the Consortium in meeting the challenges faced by this ambitious project. The ongoing progress is reported at <http://www.imedea.uib.es/proyecto/playadepalma/>.

More than 40 professionals from various disciplines are working towards elaborating an initial diagnosis and this will inform engineers and architects in their development plans. Additionally, IMEDEA is modelling the behaviour of the system until 2050/2100.

Science-based ICZM Research

In 2005-2008 the Mediterranean Institute of Advanced Studies (IMEDEA (CSIC-UIB)), a joint institute of the Spanish National Research Council (CSIC) and the University of the Balearic Islands (UIB), implemented a project with the Government of the Balearic Islands (DG Research, Technological Development and Innovation) to support science-based Integrated Coastal Zone Management (ICZM). The project (i+D+I GIZC) represents the first major collaborative step towards establishing ICZM in the Islands. The project activities of fell under three major categories: (1) Targeted, disciplinary research aimed at addressing specific data needs and priorities to progress towards ICZM, (2) interdisciplinary research aimed at addressing cross-cutting issues, and (3) the development of technological and conceptual tools and models to assist decision-makers to effectively manage the coastal zone and address specific issues related to ICZM. Involvement and collaboration of stakeholders and the continuous transfer of information in useable, comprehensible format to decision-makers were important components of this initiative.

SOCIB (Coastal Ocean Observing and Forecasting System in the Balearic Islands), established in 2009, is a multi-platform, integrated facility that will provide streams of oceanographic data and modelling services to support to operational oceanography. SOCIB activities will be mostly (but not only) centred in the western Mediterranean, with focus in the Balearic Islands and adjacent sub-basins (specifically Algerian and Alborán/Gibraltar) and ranging from the near-shore to the open ocean. SOCIB is a research consortium with legal entity that is part of the Spanish Large Scale Infrastructure Facilities (ICTS).

In addition to responding to its scientific and technological objectives within the field of operational oceanography, SOCIB will conduct strategic research that responds to the needs of society. The research and objectives associated with the i+D+I GIZC project are being continued as part of the Sustainability Science and Integrated Coastal and Ocean Management (ICOM) Strategic Research Area (SRA) of SOCIB.

One of the key activities of SOCIB over the coming years will be the application of a Marine Spatial Planning approach, extended to coastal areas, in the Islands through the development of Special Area Management Plans (SAMPS). SAMPS gained recognition through the USA Coastal Zone Management Act (1972) may be defined as “resource management plans and implementation programs developed to improve the management of a discreet geographic area.

Establishment of a Process for the Spatial Management of Limits to Growth of the Coastal Zone in Mallorca

This project, which was initiated in 2007, resulted from a collaboration between the Chamber of Commerce of Mallorca and IMEDEA (CSIC-UIB) with the overall objective of studying limits to growth in the coastal zone of Mallorca and generating awareness at the societal level. SOCIB (Coastal Ocean Observing and Forecasting System in the Balearic Islands) has been continuing this work using internal funds since 2009 in addition to the continued collaboration of the Chamber of Commerce. Specific studies have included an extensive literature review; research on the carrying capacity (physical and social) of recreational boats in bays and beaches; and the establishment of priority objectives for sustainable development of local business owners. The partners are currently working on the development of a publication that will describe the results of the project and outline an innovative process for the management of limits to growth in coastal areas.

Routine monitoring update

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

Natura 2000 Network

A map of LICs (Lugares de Importancia Comunitarias) designated under the Natura 2000 network is available online at the Spanish Ministry of Environment’s webpage (<http://www.mma.es/portal/secciones/biodiversidad/rednatura2000/>). There are currently 1.434 LICs listed on the website, categorized at the level of autonomous communities, including links to text files with information (characterization, vulnerability, quality etc.) pertinent to each area. In accordance with the regulations stipulated by the Natura 2000 Network, each region is required to submit a status report to the EC of habitats and habitats of species designated as LICs every six years.

Pais Vasco (AZTI and Basque Meteorological Agency)

This service provides real-time oceanographic (currents, tides, waves, sea temperature) and meteorological data (air temperature and pressure, winds, radiation, visibility) through a network of seven buoys located in the main ports of the Basque Country, since 2003 (<http://www.euskalmet.euskadi.net/s07->

5853x/es/meteorologia/selest.ap1?e=5) and (<http://estacion.itsasnet.com>). In addition, data on sea temperature are collected daily in San Sebastián since 1946.

Water Framework Directive

The methodologies for establishing indicators associated with the Water Framework Directive are still under development in some transitional and coastal areas of Spain. At the same time, the inter-calibration process is being carried on at national and international levels. The monitoring programs are in operation in almost all the Spanish regions. Spain is participating in the international intercalibration process; at this moment this has been almost finished for the coastal areas. In the next two years this will be carried out for the transitional waters.

System of Indicators for ICZM in the Balearic Islands (Dictamen 5/2007)

In February 2009, the Economic and Social Council of the Balearic Islands (Consell Econòmic i Social de les Illes Balears, CES), an advisory body to the autonomous regional government intended to represent societal needs, presented their official mandate for the implementation of a system of indicators for ICZM in the Balearic Islands (*Dictamen 5/2007*) to the Government of the Balearic Islands, with the support of the Balearic Institute of Statistics (IBESTAT) and the Insular Councils of the Balearic Islands. The system of indicators was developed through a collaborative process between IMEDEA and CES from November 2006 – 2007 (Diedrich et al. 2010). The final document contains a panel of 54 indicators (environmental, governance and socio-economic) and associated implementation plan, intended to respond to the objectives of ICZM in the Balearic Islands, with the overall goal of achieving sustainability in the coastal zone (document online at: <http://www.costabalearsostenible.com/ATenpdf/2.Hor/Sistemaindicadores/inglesfinal.pdf>).

In November 2009 a pilot study was implemented on the island of Menorca by SO-CIB (continuing the work of IMEDEA (CSIC-UIB) with respect to the indicators system (see ICZM country updates), the Balearic Statistics Institute (IBESTAT) and Menorca's Socio-environmental Observatory (OBSAM, see below). The work so far has been focused on the measurement of the 17 indicators with high viability scores and high levels of importance and on the development of a regulatory bill (Proposición no de Ley) to support the implementation of the system. This study will be extended to include other islands and institutions (based on available resources) over time.

Social and Environmental Observatory of Menorca (OBSAM)

An example of long-term monitoring in coastal areas is the Social and Environmental Observatory of Menorca (OBSAM), a permanent program of the Institut Menorquí d'Estudis (IME) to serve the Menorca Biosphere Reserve. It is a tool for collecting and analysing information at local level, which performs functions of monitoring and scientific assistance, and pretends to be another observation point of global change.

OBSAM (www.obsam.cat) collects, develops and maintains information on the state of conservation of natural resources and environment, and on trends affecting the economic and social sustainability of the island. It works as a network of institutions and entities interested in obtaining and improving reliable and realistic indicators on the various issues that are part of management for sustainable development.

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5e. United Kingdom (updated 2010)

This update also provides details of the current marine and coastal initiatives underway in the Republic of Ireland and the Crown Dependencies of Jersey, Guernsey and the Isle of Man.

The coastline around UK is highly variable with rocky cliffs, firths and beaches, creating a large inshore area (within 12 miles of the coast). The diverse habitats in the inshore zone are vital to the UK's fisheries as they provide important spawning and nursery grounds for white fish and flat fish as well as rich feeding areas to several bird colonies. The clean productive seas of Scotland are also essential for the continued development of aquaculture. In the UK, but especially Scotland the network of Local Coastal Partnerships are key to implementing ICZM. In the UK an important aspect of implementing ICZM is the involvement of Coastal Partnerships to ensure that there is Stakeholder involvement at all levels of decision-making at the coast.

Key issues

Economic contribution of activities in the marine area as per the latest available figures was GBP 67 B, which is made up of: oil and gas – GBP 22.3 B; tourism and recreation – GBP 16 B; strategic – GBP 6.5 B; shipbuilding and repairs – GBP 3 B; ports – GBP 1.6 B; and fisheries – GBP 0.5 B.

- The development of urban infrastructure, ports and harbours and the substantial areas of tidal land that has been converted to agriculture through enclosure. This has been particularly intense around the major estuaries;
- A significant percentage (31%) of the coastline is already developed in industrial, commercial, residential and recreational terms. Economic pressure for further expansion of these facilities is likely to increase in the future;
- Approximately 40% of UK manufacturing industry is situated on or near the coast. Much of this industry, along with major cities, is located around large estuaries;
- Most of the Scottish population lives within a few miles of the coast and on its many islands;
- Spatial issues regarding the distribution of resource exploitation in the coastal zone by inshore fisheries, shellfish gathering, aquaculture, game

fishing, offshore oil and gas, shipping, recreation, tourism and small scale agriculture;

- Cumulative impacts of coastal and marine developments;
- Flooding and erosion threat resulting from climate change, sea level rise and isostatic sinking are an issue around the south and east of England, requiring coastal defence;
- Decline in inshore fish stocks due to over-fishing and habitat damage;
- Decline in runs of wild salmon and sea trout in many rivers;
- Fish farming (spatial reclamation, benthic impact, disease, escapes, algae blooms);
- Coastal water pollution threatening the collection and farming of shellfish and the local wildlife;
- Offshore energy development.

New Policy activities (UK)

A strategy for promoting an integrated approach to the management of coastal areas in England

In January 2009 Defra published 'A strategy for promoting of an integrated approach to the management of coastal areas in England'. The 'Strategy' briefly explains the variety of work being taken forward by the UK Government which will contribute to the implementation of ICZM. The Strategy contains the Government vision for the process of coastal management and sets this set of objectives:

- To integrate coastal policies and provide a clear strategic direction to coastal managers;
- To ensure a consistent, joined-up approach to regional and local planning and decision making;
- To promote the benefits of coastal local initiatives which bring together coastal stakeholders;
- To promote awareness and understanding of the value of the coast and the issues facing it; and
- To improve the quality and co-ordination of information about the coast to improve management practices.

There are a series of actions within each objective as well as an overview of the relevant work already being taken forward, this work included: the interest that have occurred during 2009 are the passing of the UK Marine Bill into law as the Marine and Coastal Access Bill (became an Act in November(UK) 2009), mainly and the Scottish Marine Act has been passed and includes marine planning provisions and the reform and streamlining of the marine consents regime; the Local Democracy, Economic Regeneration and Construction Bill (became an Act in November 2009) will provide for the integration of regional strategies into a single integrated regional strategy, a combination of the regional planning strategy, regional economic strategy and other regional strategies, and also enables greater participation from the local level in the development of this Regional strategy.

As mentioned previously the marine planning system will lead the process of integration with terrestrial planning and management through a series of legislative measures and processes for the development of marine plans making a significant

contribution to wider integration and the implementation of Integrated Coastal Zone Management (ICZM) along the coast.

See: <http://www.defra.gov.uk/environment/marine/iczm.htm>.

Marine and Coastal Access Act (2009)

The Marine and Coastal Access Act (2009) received Royal Assent in November 2009. Measures within Act will make a significant contribution towards integration in coastal areas. The key elements of the Act are the introduction of a system of Marine Planning; licensing reform, merging some disparate regimes for development consents; new nature conservation measures in territorial and offshore waters to implement marine protected areas (called Marine Conservation Zones); the creation of a Marine Management Organisation to deliver some or all of the above in waters around England, together with some existing functions; and changes to inshore fisheries' management in England. The Act created new functions for Scottish Ministers on marine planning and conservation in offshore waters adjacent to Scotland

Work to develop a UK wide Marine Policy Statement is also moving forward, building on the Joint High Level Marine Objectives the UK Government, Welsh Assembly Government, Northern Ireland Executive and Scottish Government published for the (MPS) - will result in integrated management of UK marine area in April 2009. See <http://www.defra.gov.uk/environment/marine/legislation/hlmo-sharedseas.htm>. Scottish Ministers will participate in the formulation of the MPS. This is due for publication in 2011, in particular:

- Marine Planning - if the MPS is adopted by Scottish Ministers, marine planning in the offshore and inshore area will be guided by the MPS;
- Marine Licensing - combines FEPA and CPA consent, making Scottish Ministers responsible for issuing new marine licenses in the Scottish offshore region;
- Marine Conservation - Scottish Ministers will have a power to designate Marine Protected Areas in Scottish waters (inshore and offshore);
- Common Enforcement Powers - Scottish Ministers new enforcement powers extend to marine conservation and licensing.

Marine planning in particular will lead the process of integrating marine with terrestrial planning and further enable greater integration along the coast. Marine planning implementation work is moving forward with a model structure of a marine plan having been developed.

See: (<http://www.mfa.gov.uk/mmo/planning.htm> and <http://www.mfa.gov.uk/mmo/structure.htm>).

The Marine Management Organisation (MMO) will be vested in April 2010 <http://www.mfa.gov.uk/mmo/mmo.htm>.

A consultation on a series of proposed marine plan areas for the English Inshore and English Offshore Marine regions has recently been published. The proposed marine plan areas have been identified using previous stakeholder input and overwhelming consensus that the areas should be based on ecosystem and biographic considerations while also benefitting integration with terrestrial planning at the coast. <http://www.defra.gov.uk/corporate/consult/marine-plan/index.htm>.

International responsibilities for the implementation of the Marine Strategy Framework Directive in the Scottish inshore and offshore region, will fall to Scottish Ministers who are the competent authority.

UK-wide Marine Monitoring and Assessment Strategy (UKMMAS)

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

Charting Progress 2: During 2008 and 2009 each of the four evidence gathering groups reporting to the UKMMAS committees have compiled substantive evidence on the status of the seas around the UK. This has in some cases involved considerable work compiling databases, re-analysing past data and developing assessment methodologies. These methodologies have now been adopted to some extent to facilitate the assessments for the OSPAR QSR. The reports from each of the evidence gathering groups are being compiled into one summary report but they will also be available separately. The report is due to be released to peer review in April. The report will also include an assessment of climate change impacts, provided by the Marine Climate Change Impacts Partnership (MCCIP).

MaRS (Marine Resource System)

MaRS is a decision-support tool, facilitated by the Crown Estate (CE), which interrogates third party data sets using GIS technology to identify potential areas for sectoral development. The tool produces three key outputs: site suitability for potential business activity, the sustainability value of that activity and financial analysis of the potential revenue to the business which will enable long term informed decision-making for marine development. MaRS will increase the CEs expertise in the management of offshore national assets and to ensure the multiple demands on this resource are managed in a responsible manner, and will improve the management of the increasingly complex interactions between competing development activities, environmental considerations, legislative compliance and stakeholder demands.

Prospective areas suitable for offshore wind energy development have already been specified; in January 2010 a round 3 of prospective areas suitable for offshore wind energy developments was proposed (See Figure 1).

The system is accessed via the MaRS members portal where registered users will have access to a number of planning tools which can be applied at a detailed site level right up to national scale planning, providing an overarching view of the marine environment. These tools are summarised below:

Locational activity assessment

All analysis in MaRS starts with a 'Locational Activity Assessment' (LAA); this can be produced on a national, regional or local scale for any of the business activities undertaken by the marine estate, datasets permitting. LAA can also identify where further data collection is required to improve results. The LAA will identify potential development locations by applying multiple criteria analysis. Data layers are meas-

ured against each other to produce aggregate scores for a selected marine activity, expressed in map form, identifying the varying degrees of suitability (as a heat map). The output is accompanied with a report indicating the data layers that were used and how constraint criteria were applied.

Area optimisation

Area optimisation is available via the MaRS members portal and enables the user to review, amend and share the boundaries of a proposed activity via the web. Versions of boundaries can also be created for an activity and each version can then be analysed using the following tools:-

Financial analysis

The financial analysis module will enable the user to assess the financial viability of a proposed development area using preset economic models to calculate for example, the NPV (net present value) of a proposed site over a ten year period.

& conflict analysis

Having identified and created a development area via LAA and financial analysis the user may now wish to investigate the interaction, co-existence and possible conflicts with certain surrounding activities or populations. Interaction and conflict analysis calculates a quantitative measure of interaction and overlap between an area and the surrounding activities and populations. Results are reviewed via a reporting module; the user then has the option to optimise the boundary further (or select another version of the boundary) and re-run the analysis. The modified boundaries can then be compared with the original proposal until the optimum area has been identified.

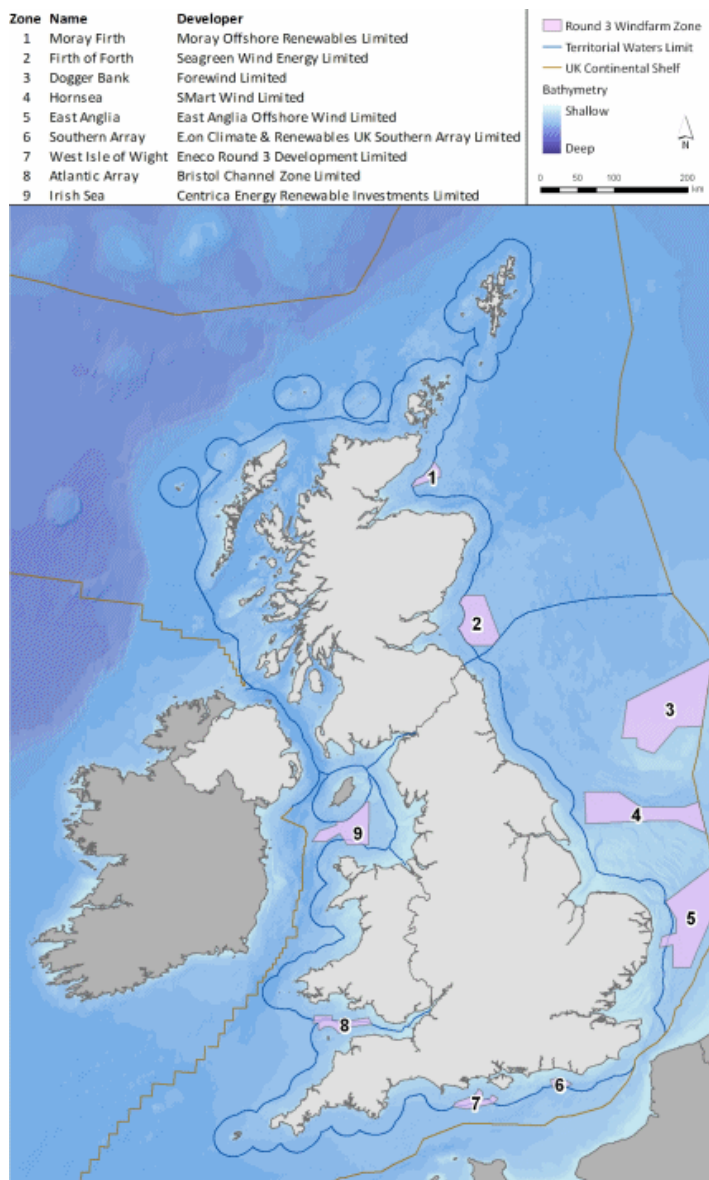


Figure 1: Round 3 proposals for suitable areas for Offshore wind energy development.

Interaction

Sustainability and policy assessment

MaRS informs sustainability and policy decisions for a selected area by providing a selection of quantitative and qualitative sustainability measures & indicators on the social, economic and environmental effects of a particular project proposal. National, regional and organisational marine policy statements will also be accessible via a knowledge base guiding decision makers on how policy may affect a development and how an activity can be optimised in line with policy.

For further information regarding MaRS: www.thecrownstate.co.uk/MaRS

New Policy activities (Scotland)

Marine (Scotland) Act

The Act received Royal Assent in March 2010. Full implementation of the provisions within the Marine Bill in its final form is expected to take approximately two years. The Act will introduce legislation to ensure the sustainable management of Scotland's coasts and seas to balance the competing interests for use and protection of the sea. The powers within the Scottish Bill extend to 12nm but executive devolution from 12-200nm to Scottish Ministers through the UK Marine and Coastal Access Act will allow the Scottish Ministers to manage Scotland's seas from 0–200nm. International, EU and national interests will be met through the National Marine Plan while regional planning and ICZM will be met through Scottish Marine Regions (SMRs). The Scottish Government plans to consult with stakeholders on a range of characteristics for identifying SMR's prior to establishing their boundaries via secondary legislation. A workshop was held in Edinburgh on 13 March 2009 to identify and discuss possible characteristics for the boundaries. A comprehensive report on the workshop can be found at:

<http://www.scotland.gov.uk/Resource/Doc/17888/0092157.pdf>

The Marine Planning Partnerships comprising representatives of stakeholders and local authorities of each SMR will be responsible for regional marine planning. The requirement in the Bill for regional marine plans to be compatible with adjacent regional marine plans and similarly with adjacent terrestrial plans provides a mechanism for delivering ICZM. Where required, Scottish Ministers may also use their power of direction in the Bill to ensure ICZM is delivered by those carrying out regional marine planning functions.

Marine Scotland (the Scottish MMO)

This was established, as a delivery-orientated Directorate of Scottish Government, on 1 April 2009 and is the lead marine management authority in Scotland. It brings together, as a first step in the implementation of improved, better integrated marine management arrangements in Scotland, functions and resources of the Marine Directorate of Scottish Government, Fisheries Research Services and the Scottish Fisheries Protection Agency. It seeks to integrate and improve upon existing marine management functions and will take on new responsibilities and functions once the Marine (Scotland) Bill receives Royal Assent. Marine Scotland will do this both by working with others and by the way in which it carries out its own functions of:

- Evidence based policy development and marine planning;
- Streamlining and licensing and consenting;
- Sound science;
- Effective compliance monitoring and enforcement.

Scottish Sustainable Marine Environment Initiative (SSMEI)

This project comprised four pilot projects (Sound of Mull, St Abbs, The Firth of Clyde and Shetland) in the process of implementation, testing and writing final reports. Each project has been designed to investigate different aspects of Sustainable Marine Management. Topics included are spatial planning, habitat mapping and conflict resolution. The Sound of Mull, The Firth of Clyde and Shetland pilots were focused

on planning and were recently extended to allow them further opportunity to test implementation of the plans.

The Shetland project, which ran from January 2006 to April 2010, developed a Marine Spatial Plan to create a more integrated and robust framework for wider marine planning and management in Shetland. The Plan provides guidance for the placement of different marine activities to improve marine management and reflects extensive public involvement, consultation and consensus and so ensuring that communities understand and participate more effectively in decision making. The Plan underwent a public consultation on the first draft and the many comments received have added significant value to the Marine Spatial Planning development process. The two drafts: "Part One: The Policy Framework" and the "Marine Atlas" (the hard copy of the GIS layers) were tested until May 2009 with its trial implementation by marine planners, regulators, communities and developers. The feedback will be collated to determine whether it adds any value to the current management regimes. A final version is expected later in 2010.

In contrast to the Shetland scheme, the Berwickshire pilot focused primarily on the socio-economic benefits of a high quality marine environment on the local economy through work packages addressing fisheries, integrated harbour and visitor management. Examples of work packages include: an action plan to develop a sustainable Berwickshire fishery; not only operating within environmental limits, but also economically healthy and integrated harbour management to help the diversification of harbour activities into the tourism market. This pilot completed in April 2009 and will publish a final report detailing the key achievements over the past three years later in 2010.

The Clyde pilot is concentrating on the development and delivery of more integrated and sustainable management of the marine and coastal areas of the Firth of Clyde. This will be achieved through an effective and integrated stakeholder - regulator partnership, the development of a Marine Spatial Plan, together with improved decision support mechanisms and integrated decision making. The draft Marine Spatial Plan for the Firth of Clyde was issued for consultation on March 31, 2009.

The Sound of Mull SSMEI pilot aims to encourage more integrated and sustainable management of the marine and coastal areas of the Sound of Mull through the preparation and implementation of a Marine Spatial Plan. The plan is locally orientated and is being developed in conjunction with a purposefully established working group that brings together representatives of users and regulators of the area. A consultation on the draft Marine Spatial Plan for the Sound of Mull began on December 1 and ran until 28 February 2010.

Inshore Fisheries Groups (IFGs)

IFGs aim to improve the management of Scotland's inshore fisheries and to give commercial inshore fishermen a strong voice in wider marine management developments. Fishermen and their representatives sit at the heart of IFGs and it is their knowledge and ideas that will drive the Groups' work. The Groups will be supported by expert advice (including for example, Fisheries Research Services, the Scottish Fisheries Protection Agency and Scottish Natural Heritage) and their work conducted in consultation with all those with a relevant interest in the best management of an area's fisheries and the wider marine environment.

The IFGs will develop realistic Management Plans, drawn up on an inclusive, transparent and consensual basis, for their area's fisheries. Whilst Management Plans will

reflect specific and localised priorities, they will also fit with wider strategic national goals such as sustainable stocks, a healthy marine environment and a profitable fishing sector that supports strong coastal communities. For example, IFG Management Plans could include such things as stock management and enhancement; spatial management initiatives and/or voluntary agreements to improve working relationships amongst different types of fisheries in an IFG area; proposals for funding priorities for an area's fisheries and associated communities; and proposals for legislative change (such as Inshore Fisheries Orders) to support elements of the plan as is appropriate. Six of the 12 proposed IFGs have had initial meetings and set up their committees.

Marine Energy Spatial Planning Group (MESPG)

The successful growth of the wet renewables industries is heavily dependent on developers identifying the commercial potential of different parts of Scottish coastal waters and matching the characteristics of the waters to the engineering requirements of power generation devices.

In order to gain some understanding of the views of the industries on development potential, Scottish Government worked with the Scottish Renewables Forum in 2009 to undertake a survey of the industries. Developers were invited to identify broad areas that were of potential interest to them and to indicate the approximate time-scale of developments.

The outcome of the survey (Figure 2) clearly demonstrates widespread interest in commercial developments for both wave and tidal technologies and gives confidence that there is sufficient commercial interest to ensure that these new industries will grow.

To assist in the development of these new industries, the Scottish Government has created a Marine Energy Spatial Planning Group (MESPG) in response to the Marine Renewables SEA. A partnership approach is being adopted, and therefore MESPG includes representatives from a range of stakeholders. The MESPG is led by Scottish Government (Marine Scotland) and includes representatives from SG Energy Dept, industry representative bodies, development agencies, conservation agencies and The Crown Estate.

MESPG has adopted the following 4 themes in its work programme:

- 1) Develop Marine Planning / Locational Guidance;
- 2) Simplify Licensing Procedures;
- 3) Undertake Environmental Research;
- 4) Facilitate Regional Initiatives.

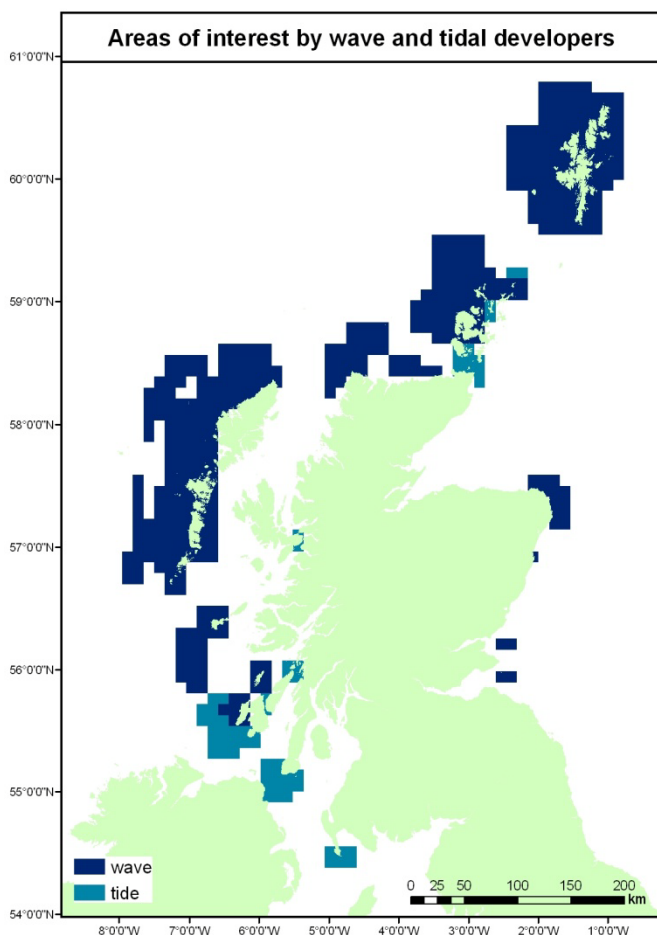


Figure 2. Areas of developer interest for wave and tidal stream energy generation.

Aquaculture Framework Plans

Marine aquaculture was transferred to the local authority planning system in 2007. Several local authorities in locations where aquaculture is important have developed Aquaculture Framework Plans or similar documents which aim to give guidance as to where, and in what form and scale, aquaculture expansion is likely to be permitted. These plans have been developed independently by each local authority and do not always cover aspects required by SPP22. The Scottish Government has commissioned two pieces of work with the aim to rationalise the process of developing Aquaculture Framework Plans (AFPs). The first was a study of methodologies, which explored the present and potential use of existing databases to inform the process, the Norwegian method of zoning areas with respect to their suitability for aquaculture, information necessary to plan development and the development of a potential excel based mapping tool and a methodology for the production of AFPs for all the relevant regions in Scotland.

This study takes the view that an AFP development process will allow multiple-use policy areas or zones. The process of creating these plans takes into account all users of the coastal environment, the name ‘aquaculture’ attached to them should not suggest that this holistic approach has not been followed. Although these AFPs go a long way towards all-sector ICZM plans they would effectively be a quick fix until, if necessary, a full ICZM plan could be completed, which would take considerably longer.

The second report was a baseline study and growth assessment of existing AFPs and to review the coverage of these plans and the expansion foreseen within each plan. The plan coverage and expansion potential foreseen within each plan was presented at three levels: coverage of existing plans in aquaculture areas of Scotland; summary of expansion potential within each plan and detailed assessment of each plan where appropriate.

The coverage of existing plans was split into three categories: AFPs, other coastal plans (ICZM, SSMEI) and no plans. The overriding view from this analysis was that the coverage of local authority generated plans is very patchy in space and the nature of their coverage. Significant parts of the Scottish production areas do not have any plan related to aquaculture, others were very old and in other areas there is a complicated story of ICZM plans, SSMEI projects and AFPs.

The study into expansion showed again that there was very variable coverage of this even where AFPs were in place. The exceptions are Highland region and Argyll and Bute. The 11 individual AFP's developed by Highland Council provide considerable detail in terms of the descriptions of loch usage and the potential for further aquaculture development at a refined geographical scale; and the Argyll and Bute Local Plan of 2006 has a policy of general support for sustainable aquaculture, provided it does not conflict with a range of uses, which are listed in the plan document. Overall the plans are very conservative towards aquaculture development and in the majority of cases read as a discussion of reasons to restrict aquaculture development, as opposed to proactively identifying areas which have the potential for development.

Aquaculture framework plans will enable the assessment of all aspects of aquaculture development including environmental, logistical, spatial, economical, social and visual. As the drive towards sustainable use of inshore waters gathers momentum, aquaculture framework plans should be seen as one component of an increasingly comprehensive and integrated coastal planning system. This system will ultimately also embrace area access agreements for inshore fishing and seabed harvesting, management plans for marine nature reserves, the coastal policy elements of Local Plans and coastal zone management (CZM) strategies at sub-regional level and above. The framework plan can help guide prospective developers who are required to submit EAs as to the specific issues which their EAs should address.

Given improving technology, it may become possible in the future to put fish farm cages on more exposed sites than are currently viable. It will be important however to maintain safe navigational access in these areas. Equipment installed in exposed locations can be prone to storm damage, which can result in floating debris that represents a hazard to vessels over a wide area and ultimately washes up on the shoreline. It may also result in sunken wreckage which forms a more localised hazard to vessels, swimmers or divers. Development in locations considered too harsh for the specified equipment will therefore be discouraged.

The salmon farming industry is increasingly looking towards diversification into new species and there has been interest in the potential for cultivation of cod and halibut in recent years. In the near future it is expected that haddock juveniles will also be available for on-growing in sea cages. Whilst it may be possible to on-grow cod in reasonably exposed sites, including those currently used for salmon, halibut require much more sheltered, inner loch sites. Their cultivation also may require a much greater cage surface area for a given biomass of stock compared to a salmon farm, or alternatively, deeper nets with multiple floors in them.

Interest is also increasing in the potential for polyculture. This could involve growing a species such as mussels and/or certain types of seaweed on the same site as finfish.

Data projects (UK) – See 2009 report

Recreational Sea Angling

There are three projects of relevance to RSA in the UK

Improved understanding and management of recreational sea angling (CEFAS) will run from 2008 until 2011 and has 3 main components:

- 1) A series of desk studies collating and synthesising existing and historic information on a number of species important for RSA and examining how commercial and recreational fisheries have developed in response to management.
- 2) Socio-economic studies to evaluate the implications of potential management options for RSA and commercial sectors. These will focus on developing methodology and evaluating the costs and benefits of potential management options for both commercial and recreational angling bass fisheries.
- 3) Developing new data sources and methodology to evaluate and model recreational fisheries. This will involve identifying and collecting data on species important to RSA. A pilot logbook scheme for anglers to report catch and effort will be established and historic datasets (such as time series of angling matches) will be investigated to provide information relating to historic stock and fishery performance. Other work will investigate assessment and modelling approaches to data poor stocks.

This project has completed some case studies on management of stocks popular for RSA, has managed a small voluntary logbook scheme (not many takers), and conducted some statistical analyses on pre-recruit surveys in the Fal-Helford estuaries. A large socio-economic component of the project was shelved as it became untenable to appoint an economist. Funds have been diverted to reviewing information needed for setting up a sampling scheme to quantify recreational fishery catches as required by the EU data Collection Framework for a limited number of stocks (and also required by the new EC Control Regulation for recovery-plan stocks). A report was also drafted reviewing the bass nursery areas around the coast – purely descriptive.

Recreational sea angling and marine conservation zones (NE) is a baseline study of the fish species targeted by Recreational Sea Angling (RSA): their biology and distribution, angling techniques used and implications with respect to Marine Conservation Zones (MCZ).

The project has two parts:

- 1) A literature review will be carried out to assemble and synthesise data on popular angling species, their geographic ranges, habitat preferences, relevant aspects of biology and behaviour and regional angling practices. This will provide an information base with which Natural England can elaborate the implications of interactions between RSA and potential target fish species in relation to the aims and management of MCZs.
- 2) Surveys of recreational sea anglers will be carried out around the coast by interview and mail, consisting of a questionnaire consisting of 3 sections to capture information regarding:

- a. species and methods,
- b. anglers attitudes to conservation and MCZs,
- c. acceptability of different management measures.

Cefas is carrying out surveys in the Northeast, the Northwest and the Southeast during January 2009. These surveys will provide information on angling as well as providing an opportunity for anglers to make their views on MCZs known. The survey has now been closed, and the results are currently being compiled. A report has been submitted, but has not been agreed for public release yet.

Scottish Technical Report on the Economic impact of RSA in Scotland (July 2009)

Previously, very little was known about the scale of sea angling, its distribution across Scotland, or the economic impact of sea anglers' expenditure. In these circumstances, it is possible that sea angling could have been over-looked when fisheries, tourism and coastal developments were being considered. The Scottish Government has sought to rectify this by commissioning this assessment of sea angling and its contribution to employment and income both in Scotland as a whole and its regions.

The broad aims of the study were to:

- estimate the economic impact of sea angling
- identify:
 - the important local sea angling centres;
 - the main competing areas within and outwith Scotland;
 - the principal characteristics of the sea angling sector;
 - the key trends and;
- consider future prospects for the sector.

Sea angling is a diverse activity in terms of the variety of species targeted, locations and participants. The larger the geographical area under consideration the greater is the possibility that this diversity might be obscured.

Regional approach. In recognition of this, the study partitioned Scotland into eight regions based largely around the new Economic Development Offices (which also function as Tourist Office regions). For each of the eight areas, as well as Scotland as a whole, the study was tasked with estimating such indicators as:

- overall sea angling activity levels, measured in angler days;
- the number of home and visiting anglers;
- the distribution of angler days across shore, private and charter boats
- the target species;
- angler expenditure;
- the economic contribution of sea angling to regional incomes and employment.

In addition, five **case study areas** were selected, reflecting not only the diversity of characteristics but also contemporary issues relating to sea angling in Scotland.

Progress on MPAs (Scotland and UK)

The Marine Conservation Zone Project (<http://www.ukmpas.org/index.php>) has been established by Defra, Natural England and the Joint Nature Conservation Committee to identify and recommend Marine Conservation Zones to Government for England and offshore waters adjacent to England, Wales and Northern Ireland. It will be delivered through four Regional Projects covering the South-West (Finding Sanctuary Project), Irish Sea (Irish Sea Conservation Zones), North Sea (Net Gain Project) and Eastern Channel (Balanced Seas Project) (see map for the areas of sea the projects will work in). They will work with sea users and interest groups to identify Marine Conservation Zones (MCZs) and provide recommendations for sites within their regions. The South West Regional project "Finding Sanctuary" has developed a methodology for the marine conservation zones that will form part of the network of MPAs for England and Wales, stipulated under OSPAR and it has now been adopted as the formal planning mechanism for MCZs.

Since the Marine and Coastal Access Act received Royal Assent in November 2009, the MCZ Project team members have been progressing data collection, drafting guidance and undertaking stakeholder engagement activities. It is planned to have the first meeting of the stakeholder group for Net Gain, Balanced Seas and Irish Sea Conservation Zone project in March 2010.

In Scotland the Marine Acts include new powers to select and manage Marine Protected Areas (MPAs) to enhance marine biodiversity out to 200 nautical miles (and preserve historic assets out to 12nm). Marine Scotland is leading a project with support from SNH and JNCC to complete the MPA network. These new sites will complement existing international requirements (e.g. Natura and OSPAR) but could also ensure that sites of potential importance to Scotland could be designated without any international requirements. See

Draft marine nature strategy url: <http://www.scotland.gov.uk/Topics/marine/marine-environment/draftconservationstrategy>

Draft MPA guidelines url: <http://www.scotland.gov.uk/Topics/marine/marine-environment/mpanetwork/draftmpaguidelines>

Scotland's first 'No-Take Zone'. The Scottish Government has created Scotland's first 'No-Take Zone' in Lamlash Bay on the Isle of Arran. All fishing within the specified area will be banned while a scientific trial will be carried out to investigate the fishery and bio-diversity benefits of leaving the seabed to regenerate naturally without any disturbance. The ban on fishing came into effect on 20 September 2008.

New Policy activities (Northern Ireland)

Northern Ireland's Marine Programme aims to deliver sustainable management and development of the seas through three interlocking pieces of legislation.

The UK-wide Marine and Coastal Access Act 2009 already provides for key aspects of this Programme for Northern Ireland, particularly in respect of marine planning and the reform of marine licensing. As required by that Act, a draft Marine Policy Statement is being prepared. This will be an important document, as its purpose is to set the key policy priorities for the UK's marine environment.

The Northern Ireland Executive gave its agreement to the publication of a pre-consultation paper on an initial draft of the Marine Policy Statement at its meeting on 25 February 2010.

The Department of the Environment (DOE) is also working closely with Defra and the other Administrations on the transposition and implementation of the EU Marine Strategy Framework Directive.

The Programme will be further developed by the proposed Northern Ireland Marine Bill, which forms the third strand – consultation on policy proposals for the Bill will commence in April 2010 with a final Bill being introduced to the NI Assembly in May 2011.

The proposed NI Marine Bill, building on the provisions of the UK Act, will introduce a strategic framework for the management of the marine area. All those working in the marine environment should benefit from this more joined up approach.

The proposed Northern Ireland Marine Bill will establish the DOE as the Marine Plan Authority. In consultation with the other Departments with marine responsibilities (DARD, DRD, DETI and DCAL), DOE will develop a single marine plan for Northern Ireland which will have jurisdiction over planning for aquaculture and need to consider, as far as possible, all of the relevant activities and the impact they may have on each other. The marine plan will address both the current situation, and also emerging and many aspects in any future marine uses and technologies (e.g. carbon capture and storage in the sub seabed, renewable energy sources, and new marine protected areas), whilst also anticipating changing economic and social trends and the impacts of climate change. The marine plan will also consider both the natural and cultural resources within an area, changing ecosystems and seasonal patterns and migration routes. NI expects to have its first marine plan in place by 2014.

The MPS and the marine plan will also guide decisions relating to marine licensing which is the mechanism that will translate the objectives of marine plans into decisions allowing activities (subject to specific conditions) or to bar them. Licensing therefore will articulate how in practice Government policies are to be delivered for the marine environment. to develop aquaculture in their jurisdiction. Aquaculture development in the UK is subject to many controlling forces; the Strategic Framework for Scottish Aquaculture, planning (SPP22 planning guidance), environmental impact assessment, Crown Estate leases and licences to discharge waste.

DOE will consider further licensing reforms in areas which are devolved such as Electricity and Harbours activities through the proposed Northern Ireland Marine Bill. Any reforms in these areas would only be with the agreement of the respective Ministers.

The proposed Northern Ireland Marine Bill will also include powers for the establishment of Marine Conservation Zones (MCZs) in Northern Ireland territorial waters to help protect nationally and locally important species and habitats.

Annex 6: Technical Minutes – Review Group on Environmental Interactions of Wave and Tidal Energy Generation Devices (marine wet renewable) (RGENG)

Special request for advice from OSPAR June 2009: ICES 4-2010

Review Group

Lars Bie Jensen; Jakob Asjes; Antonio Sarmento; Howard Platt

Request

To provide advice on the extent, intensity and duration of direct and indirect effects and interactions of marine wet renewable energy production (wave, tidal stream and tidal barrage systems) with the marine environment and ecosystems of the OSPAR maritime area, and with pre existing users of these ecosystems, including:

- a. actual and potential adverse effects on specific species, communities and habitats;*
- b. actual and potential adverse effects on specific ecological processes;*
- c. irreversibility or durability of these effects.*

ICES requested advice Review Group summary

The reports produced by the two ICES working groups (WGECO and WGICZM) are, in general, very useful as guidance or consulting documents on environmental assessment or environmental coastal management as regards human activities such as wave and tidal energy deployments.

The WGICZM Report does not fully address the OSPAR request as regards environmental effects (see Annex 1) but does address the issue of effects on pre-existing users. It is a good review of the potential of the technology to contribute to renewable energy needs.

The WGECO Report, in general, is more comprehensive and covers most of the relevant subjects and the advice requested from OSPAR as regards potential adverse effects is very complete. There is a paucity of real measurements and data related to the deployment of this technology, so the WG could understandably go no further for the most part than "expert opinion", albeit well-based opinion. The exception is that it should be possible, as stated in the report, to use experience from the offshore wind sector as some of the issues should be very much the same for wet renewables.

WGICZM Report

This WG reported on: "i) **The potential of marine renewable energies (except offshore wind)**", which was not the question asked.

The report hardly mentions environmental issues except for:

Under the section **Scottish Government response**:

*To assist in the development of these new industries, the Scottish Government has created a Marine Energy Spatial Planning Group (MESPG) [which] includes.... **conservation agencies** and The Crown Estate.*

The report notes that:

The engineering testing is supporting by **environmental monitoring** of both the physical conditions and the interactions of all stages of projects, from site survey through installation and operation to decommissioning, with potentially sensitive components of the environment including seabed habitats, marine mammals and seabirds.

Under Canada (**Information provided by Roland Cormier, DFO, Canada**):

Both federal and provincial governments, as well as the industry itself, have elected to adopt an **adaptive management approach**.... to review and advise the federal and provincial governments on **environmental protection requirements**.

However, the WGICZM report does address the supplementary question asked by OSPAR, namely to provide advice on effects on pre-existing users of these ecosystems.

- *Fisheries: Areas might have to be kept free of fisheries in order to avoid damage to boats as well as energy generating installations.*
- *Navigation: Floating devices will have to be appropriately marked for navigation in order to avoid accidents.*
- *Visual impact: they are expected to have negligible visual impact when viewed from shore.*
- *[Conflicts] can potentially arise with conservation areas, scientific research areas and military areas, but also telecommunication cable lines and dredge spoil disposal sites.*
- *Experiences with offshore wind farm developments suggest including a dialogue with potentially affected groups as well as local population in the early stages of project development in order to avoid emotional or cognitive based non-acceptance.*

The report also draws attention to **positive impact** on local employment, often including diversification of employment across sectors, the stimulation of declining industries but note that information on impacts of ocean energies together with other human uses are still missing.

The following requests are left devoid of comment:

- ii) Actual and potential adverse effects on specific ecological processes
- iii) Irreversibility or durability of these effects.

Effects on pre-existing users

Both WGs appear to have largely missed the point that OSPAR also asked for advice on extent, intensity, etc., of **effects on pre-existing users**. The following extracts in the WGECCO report pertain:

- *The presence of the barrage or fence will result in, probably a 0.5 nautical mile exclusion on either side for fishing vessels, vessels anchoring etc.*

- *On most large barrage proposals the passage of shipping through the barrage is maintained by the provisions of appropriate lock systems with associated breakwaters and channels. Thus the effect of exclusion zones is minimal for most users.*
- *Whilst other human activities are likely to be excluded in the area of marine energy converters arrays, the exclusion zones may create de facto marine reserves, in which marine life can flourish.*
- *Industrial sectors such as fishing and shipping are likely to have concerns regarding both spatial exclusions around tidal stream farms.*
- *This potential exclusion will need to be carefully managed to avoid conflicts with other sea users, such as shipping lanes, marine aggregate extraction etc., where site specific requirements for access may also exist.*

Recommendations from the RG

For completeness, additional potential adverse effects and aspects for considerations are listed in the Annex 1 and some suggested examples of pertinent screening questions are listed in Annex II.

That the utilisation of marine energy resources is a new and rapidly growing sector of the marine industry and has great potential is a given. However, there are very limited data allowing environmental impacts to be predicted.

There is a large degree of uncertainty regarding what environmental impacts that will result from deployments and thus there is little scientific evidence/confidence to go further in the WGECO report. More information on this subject will only be possible with investigative monitoring at the deployment phase.

This poses an ecological and ethical dilemma. This is particularly stark as the Habitats Directive has now changed the paradigm from presumption in favour of development to presumption in favour of environmental protection. Regulators and developers now need to pay heed to the precautionary principle. However, at the same time, there is almost overwhelming pressure to pursue sustainable renewable energy sources that will not pass on to our later generations intolerable burdens.

So the question is: **How can we develop wet renewables without the scientific evidence base to assess risk?**

Perhaps still controversial, and potentially in conflict with the precautionary principle, it is suggested that the Advice Drafting Group consider advising an **Adaptive Management Strategy** for new installations. This might apply at least until enough field data and experience is amassed from several actual installations to be able to produce more robust environmental impact assessments for proposed developments.

Essentially, this requires allowing a heavily conditioned licence or consent under national legislation at the same time, if appropriate, advising the European Commission if there are habitats and/or species of Community interest that may be potentially subject to deterioration. European case law (the Wadden Sea judgement) effectively states that **any** deterioration is a significant deterioration.

Each proposed wet renewable installation should be treated for the time being as novel and be dependent on the specific technology proposed and the precise location.

It is advised that any proposal should be subject to detailed initial screening and then if appropriate a Habitats Directive Article 6 assessment. Note that some marine species listed in Annex II are also on Annex IV, with the obligation to provide strict protection wherever they occur, i.e. not just within designated SAC sites.

In trying to address the OSPAR request, and although based on expert knowledge, it might be useful to consider an assessment matrix with impacts classified on predicted levels of irreversibility, durability and extension (near field/far field extension). This will help the definition of impacts prioritization and on the establishment of research priorities regarding environmental monitoring / assessment.

Any proposal under the scheme outlined above should, subject to ADG consideration, provide an analysis of all of the following five phases:

- **Pre-installation** – at least 12 months environmental monitoring of the appropriate marine attributes (including biological, hydrological and physico-chemical) to act as a reference baseline for subsequent phases.
- **Installation:** including effects of any plant needed to install such as Jack-up Barge and effects of sediment caused by drilling to install piles.
- **Commissioning:** deploy marine mammal observers (MMOs), prove active sonar and demonstrate fast shut-down.
- **Operation:** including continued environmental monitoring and maintenance operations
- **Decommissioning:** including subsequent restoration where appropriate.

Although the focus of the present discussion is on the reports review, there are some additional thoughts that might be considered by the ADG. From the developer's point of view, marine energy prototypes are very expensive projects. The environmental concerns are usually considered as non-technological barriers, which can greatly increase project costs, particularly as extensive monitoring will be required. Thus, at this early stage a balanced approach, between scientific, legislative and industry interests is required to optimize effort.

It is still unclear how fast these developments will be and how soon they will provide meaningful amounts of energy. On wave energy, it could be five years for the technology to become pre-commercial and the first 20 MW farms (area 1 km²) to be deployed. Tidal stream could be somewhat faster. The European Association of Ocean Energy estimates that by 2020 as much as 3.5 GW could be deployed in Europe, this representing a total area of about 175 km². This means that with appropriate environmental monitoring of the first (and small) ocean energy farms to be built we will have time to learn and adjust legislation.

The development of ocean energy is being undertaken by small companies – the Carbon Trust report from 2006 refers to £10M to develop a prototype and £10 M to run a two year sea trial program. These values are optimistic as indicated by developers at a recent Ocean Energy conference in Brussels. At that meeting, Aquamarine reported that they spent £70M to build and deploy at EMEC their 360 MW prototype.

Licensing can also be very expensive, in part because of the extensive baseline studies and mitigation measures that will be required. Wave Dragon reported a cost of £0.5M to license their 5 MW prototype in the UK.

It seems reasonable that if society asks companies to risk their money in developing a new technology, society should also accept a reasonable and limited environmental risk. With only small scale projects, say with less than five devices in the same site,

environmental impacts should only be marginal if the devices are not in a very sensitive environment and very intrusive techniques are not used in the deployment.

Monitoring of ocean farms is the only way to learn what the environment impacts are and these extensive (and costly) environment programs should in part be supported by public funds, not solely left to the companies involved in the development of the technology.

Extra information

Since the OSPAR request (June 2009) the following pertinent information has become available.

Seagen: www.seageneration.co.uk. Documents available include [requires registration to gain full access]:

- [Environmental Impact Assessment](#) [Environmental Impact Study \(Non Technical Summary\)](#): This report surmises the findings of the EIA and is available to non registered users.
- [Environmental Monitoring Programme](#): This report details the environmental monitoring that is being conducted pre-installation and will be conducted post installation.
- [Pre-Installation Baseline Report](#): This report details the environmental monitoring that is has been conducted pre-installation (April 2005 to July 2006).
- [SeaGen Biannual Report - February 2009](#): This report details the environmental monitoring that is being conducted
- [Environmental Action and Safety Management Plan 2008](#): This report details the perceived risks during installation, operation and decommissioning and provides proposals for mitigation [HSD Article 6 Assessment of MCT - February 2008](#)

H M Government (March 2010). Marine Energy Action Plan 2010. Executive Summary & Recommendations. Department of Energy and Climate Change. www.decc.gov.uk.

Environmental Effects of Tidal Energy Development: A Scientific Workshop. University of Washington, Seattle, Washington March 22-24 2010. [Final report not yet available]. Workshop Briefing Paper available at http://depts.washington.edu/nnmrec/workshop/docs/Tidal_energy_briefing_paper.pdf

Also:

Wilson, B., Batty, R. S., Daunt F., and Carter, C. 2007. Collision risks between marine renewable energy devices and mammals, fish and diving birds. Report to the Scottish Executive. Scottish Association for marine science, Oban, Scotland, PA37 1QA.

Annex I: Additional potential adverse effects and aspects for considerations

Managing the project

- Effects should be considered in combination.
- Close collaboration between regulator and developer.
- Engagement and liaison with local people (Aarhus Convention) e.g sailing clubs, anglers.
- Risk analysis based on key questions (see Annex II).
- Landscape and visual amenity.
- Contingency plan for adverse weather during installation.
- Avoid breeding seasons and over-wintering migratory bird sites.
- Marine archaeology.
- As regards Europe, advice should be given in the context of the Habitats and Species Directive (HSD) including assessment of alternatives.

Habitat and species effects

- Pre-installation baseline monitoring and assessment of existing conservation status (favourable, inadequate, poor).
- Landfall impacts.
- Restoration of on-shore contractor compound.
- Barrier to juvenile fish using estuaries and coastal areas as a nursery.
- Alien species introductions from installation plant.
- Impact of anti-fouling compounds.
- Potential accidental release of pollutants e.g. lubricants during routine maintenance.
- Non-use of oil-based drilling muds.
- Effects of cuttings if not removed from site for transport to safe disposal.
- Monitor noise level of turbines in operation.

Annex II: Examples of some of the key questions for a risk analysis

KEY QUESTIONS

Is the location in or likely to affect a Natura 2000 site?

Are there habitats or species of Community interest in or near the location of the installation?

Is marine mammal density and behaviour in the location significantly modified by the installation?

Does the installation have a significant effect on seal movements through the location?

Are marine mammals significantly excluded from foraging habitat or social areas within the location as a result of the installation?

Does operation of the the installation have a significant effect on marine mammal sightings within the immediate waters of the installation?

If deployed, how far way can the active sonar system detect marine mammals?

Can the turbine stop before the travel path of a detected marine mammal brings it into a zone of possible injury?

Does marine mammal activity increase or decrease during night time?

For all recorded stranding events, have any marine mammal mortalities occurred as a consequence of physical interaction with the installation?

Does the installation have a significant impact on seabird activities in the location?

Does the installation displace foraging diving birds from important areas within location?

Does the installation present a barrier effect to the free passage of fish through the location?

Is there a significant change in the broad benthic community structure that can be attributed to the installation?

Is there a significant change in abundance of dominant characterising benthic species that can be attributed to the installation?

Has the installation significantly modified the flow dynamics, scour patterns or turbulence character of the location?

If changes in the flow dynamics, scour patterns or turbulence do occur, have they caused a change in benthic community structure and function?
