

REPORT OF THE
**ICES Study Group on Information Needs
for Coastal Zone Management
(SGINC)**

**Esporles, Mallorca, Spain
5–7 May 2003**

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International Council for the Exploration of the Sea

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TABLE OF CONTENTS

Section	Page
1 TERMS OF REFERENCE.....	1
2 CURRENT ICZM PROGRESS	2
2.1 Canada	2
2.2 Denmark.....	2
2.3 Norway.....	3
2.4 Poland	4
2.5 Spain	4
2.6 Sweden.....	5
2.7 The Netherlands	5
2.8 The United Kingdom	6
3 LINKAGES TO ICES COMMITTEES AND GROUPS	7
4 LINKAGES TO OTHER RELEVANT ORGANISATIONS AND SCIENTIFIC PROGRAMMES	11
4.1 Relevant organisations	11
4.1.1 EU Commission.....	11
4.1.2 HELCOM	11
4.1.3 OSPAR	12
4.1.4 MON (OSPAR/ASMO/SIMA).....	12
4.2 Scientific programmes	12
4.2.1 The European Union for Coastal Conservation (EUCC)	12
4.2.2 The Water Framework Directive (WFD).....	13
4.2.3 EUROCOAST	13
4.2.4 ECSA (Estuarine and coastal sciences association).....	14
4.2.5 GESAMP	14
4.2.6 Programme for the Assessment and Control of Pollution in the Mediterranean Region (MED POL)	14
5 AVAILABLE INFORMATION AND GAPS OF KNOWLEDGE	15
6 NEW DATA PRODUCTS AND RESEARCH.....	18
7 POSSIBLE PARTNERSHIP.....	19
8 CONCLUSIONS AND FINDINGS.....	19
9 RECOMMENDATIONS	19
10 ADJOURNMENT OF THE MEETING	20
ANNEX 1: LIST OF PARTICIPANTS.....	21
ANNEX 2: AGENDA	23
ANNEX 3: LIST OF WORKING DOCUMENTS PRESENTED AT THE MEETING	24

1 TERMS OF REFERENCE

The first meeting of the ICES Study Group on Information Needs for Coastal Zone Management (SGINC) was held in Esporles, Mallorca, Spain, 5–7 May 2003 with 15 participants from Canada, Denmark, Norway, Poland, Spain, Sweden, the Netherlands, and the United Kingdom.

The Chair, J. Støttrup (Denmark), reviewed the background for the establishment of this Study Group. Many fisheries are dependent on coastal ecosystems, which function as areas for feeding and spawning and as nursery grounds. The production and utilisation of these marine, renewable resources cannot be sustained where the functional integrity of coastal systems is degraded. There is, however, a rapidly growing pressure on the coastal zone and evidence of increasing degradation of coastal waters around the globe due to a wide range of human activities. Examples are habitat alteration, eutrophication, toxic pollution and overfishing. Conservation of healthy and well functioning coastal ecosystems, to provide both goods and services to humanity in the future, calls for new sustainable management strategies. ICES addresses today many of the issues of biodiversity and marine habitat primarily within the realms of the Marine Habitat Committee, but also in other committees. Thus, many of the issues are represented in Working Group activities working towards a specific goal. The challenge still remains to compile all this knowledge and development of tools in a holistic manner in order to provide a working platform for Integrated Coastal Zone Management (ICZM). 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. These requirements will provide a framework for the ICES advice. Thus, this task should be considered of very high priority. The advice generated from this Study Group will contribute to the goal stated by the Marine Habitat Committee to “Develop procedures for integrated coastal zone management”.

The first meeting of the SGINC was opened by the Chair. E. Moksness (Norway) acted as Rapporteur, and the Agenda was adopted (Annex 2). Beatriz Morales-Nin, Director Department Natural Resources, IMEDEA, Spain, welcomed the group.

The terms of reference for 2003 (ICES C. Res. 2002/2E09) are to:

- a) review and report on activities of relevant ICES working and study groups to identify information pertaining to the coastal zone;
- b) review and report on the activities of other relevant organisations and scientific programmes which focus on coastal zone aspects (e.g., LOICZ, Estuarine and Coastal Science Association (ECSA), EU-Water Frame Directive, etc.), with respect to information relevant for ICES;
- c) evaluate the available information with respect to that required for the sustainable use and management of the coastal zone and identify gaps in knowledge;
- d) propose scientific data products and new research, which ICES could use as a basis for advice on, and in support of coastal zone management;
- e) identify possible working partnerships, which could complement ICES data products with a view to further developing and integrating knowledge for use in holistic advice for coastal zone management.

The terms of reference for 2003 (ICES C.Res. 2002/2E09) are addressed in the following sections of this report:

Term of reference	Section of this report
TOR (a)	3
TOR (b)	4
TOR (c)	5
TOR (d)	6
TOR (e)	7

2 CURRENT ICZM PROGRESS

Participants from each of the countries gave a review on the status and progress of Integrated Coastal Zone Management (ICZM) in their country, including updates on completed and ongoing projects and new initiatives. Available complete country reports are listed in Annex 3. Below is a summary for each country of the following topics related to the Coastal Zone: Definition, Scales (time and space), and Key issues.

2.1 Canada

Canada's Oceans Act, passed in 1997, gives the minister of the Department of Fisheries and Oceans (DFO) the responsibility to facilitate the development of integrated management plans. While the Act makes reference to coastal waters and marine waters, it does not define these two terms. In practice, the 12 nautical mile line (headland to headland) and the low-water mark bound the coastal zone. However the provisions of the Oceans Act are very broad and thereby DFO has an obligation to facilitate oceans management without regard to these borders.

Canada has the longest marine coastline in the world with almost one-quarter of its population living in coastal communities. The area of its territorial seas is two-thirds of the landmass. Given this vast area a hierarchical or nested approach is being used to define management areas starting with the large ocean management areas or LOMAs, e.g., Beaufort Sea, Central Coast of British Columbia, Scotian Shelf and Gulf of St. Lawrence. Within each LOMA smaller management areas, either ocean, OMAs, or Coastal Management areas, CMAs, may be needed. There will be a need for smaller management areas within a CMA.

To date there has been no discussion of temporal scales although it is understood that this will need to be addressed when monitoring programs and marine environmental quality objectives are defined.

The main goal for coastal zone management in Canada is the sustainable use of aquatic resources through integrated management and the application of the precautionary approach. DFO is being challenged to take an integrated approach in dealing with a number of current management and advisory issues. For the past 10 years sharply declining stocks of commercial groundfish have had severe impacts on the economies of coastal communities. The reasons for these declines are highly complex and poorly understood. But it has increased scrutiny on human activities including commercial fishing. The impact of mobile fishing gear such as trawls, drags and suction dredges on commercial fish habitat and prey species is being questioned. Concern is being expressed about the potential impact of offshore oil and gas exploration, development and production activity on fish stocks. A wide range of negative environmental impacts is being attributed to coastal sea cage culture of salmon and suspended culture of blue mussels. These impacts include the degradation of fish habitat, effects of escapees from farms and disease transmission to wild fish stocks. Residential development and recreational and tourism use of the coastal zone are often in conflict with mariculture and traditional fishing uses. Land-based sources of pollution continue to be an issue in the coastal zone particularly near larger urban areas.

In addition 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.

2.2 Denmark

Unlike many other countries, Denmark has defined a dividing line (the mean low-water line) between the sea and the land when dealing with management. The sea is managed by several ministries (Ministry of Environment, Ministry of Food, Agriculture and Fisheries, Ministry of Transport, etc.) and by the counties. The counties and municipalities manage the coastal land areas. All big cities are situated in the coastal zone and there is a long tradition for regulations and management of the area. The overall situation is that the terrestrial coastal zone is in a relatively good condition. Perhaps due to a long tradition of management of the coastal zone, Denmark has not adopted a formal definition of such a zone. In the *Protection of Nature Act* (1992), revised in 1994, a coastal protection zone is set within a 100 m from the beginning of continuous land vegetation in summer cottage areas and similarly within 300 m in rural areas. In 2002 a special commission terminated an eight-year process of defining a permanent coastal protection line according to the rules laid down in the act, with exceptions placing it closer to the coast. The *Planning Act* (2000) describes a coast-nearness zone—a coastal planning zone excluding urban areas—with guidelines on planning and management in the coastal zone; since 1993 defined as generally extending 3 km inland. This zone is neither a no-build nor a no-development zone, but development has to be planned carefully in harmony with nature and landscape.

The Protection of Nature Act can be applied within the entire fisheries zone and EEZ. According to the *Planning Act* from 2000 it is imposed on the county councils to elaborate and implement plans for the quality and use of coastal waters. These plans are, in part, based on the concept of "environmental quality objectives" as described in guidelines

on water quality planning from the Environmental Protection Agency (1983). According to these guidelines, all bays and fjords and, other coastal areas out to a depth of 6 m or at least within 1 n.m. from the shore are to be considered part of the counties responsibility regarding environmental protection and water quality.

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

Key issues of concern include:

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

Examples of Coastal Zone Management projects in Denmark are given in the complete report (see Annex 3).

2.3 Norway

In Norway the coastal zone (equal to the definition in the EU Water Framework Directive) covers an area of about 90,000 km² and extends about 57,000 km (including islets and islands).

Key issues are:

- Ecosystem structure and function, and effects of intervention. An important part of this is knowledge about life history in marine organisms and dispersal/spreading of marine organisms
- The environment's carrying capacity (including the significance of varying physical framework conditions and studies of species and system vulnerability)
- Species demand on the environment including suitability and vulnerability. How vulnerable are they to toxins, eutrophication (anthropogenic) influence?
- Local fish stocks, cod, herring, capelin and invertebrates such as bivalves, crustaceans and echinoderms, how large are they and what effect do they have on the local environment?
- Interaction between wild and reared organisms, sustainable multi-mariculture and interplay and interaction between wild species
- There is little knowledge today on the effect of rearing and stock enhancement on local spawning grounds for, e.g., cod, herring, capelin, etc., and areas for eggs, larvae and juveniles (cod, herring, etc)
- Long-term trends, both nature and community processes, and the interaction between them.
- Knowledge to avert and reverse unwanted processes, rehabilitation and environmental actions (habitat improvement in the form of, e.g., fertilizing and artificial reefs
- Rehabilitation of strained production environments
- Forming of cost-effective efforts/effort packs
- Coastal management has to find the balance between exploitation and protection issues in the coastal zone
- Risk Assessment Models should be made.

Two projects to organize our knowledge on the coastal zone and to make it available to managers and stakeholders are now being conducted in Norway. The aim of the first one is to organize all information on coastal resources and coastal use in maps. 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.

2.4 Poland

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

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

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

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

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

2.5 Spain

The National Shores Act, “Ley de Costas”, defines the coastal zone as the shore of the sea and its inlets between high- and low-water marks of equinoctial tides, or up to the limits reached by the waves of the major storms; along the river margins it extends as far as the effects of the tides are noticed. The coastal zone also includes all saltmarshes, lagoons, and, in general, all lowlands that can be flooded by the sea either through waves, tides or underground infiltration, the beaches and cliffs. The Act establishes a 100 m-wide area, “Servidumbre de protección”, extending along the landward side of the coastal zone where all human activities are strictly regulated; for some of them the regulated area extends to 500 m from the landward side of the coastal zone. The Territorial Sea extends from the sea side of the coastal zone to a distance of 12 nautical miles. Both the coastal zone and the territorial sea are public domain, cannot be owned by private parties and all activities and developments are done based on temporary permits or licenses granted by the different levels of the Government. Public domain of the coastal zone also means free, open access to it.

There is no nation-wide legislation specific for coastal zone management. The 1978 Constitution transferred most components of environmental and territorial planning to the regional governments, Comunidades Autónomas. Municipalities are responsible for producing land-use plans. Jurisdiction overlaps are the rule 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 Government and the private sector in the design of integrated strategies for sustainable development as a main goal.

EEDS identifies urban development and tourism, coastal erosion, pollution and overexploitation of fisheries as the key issues affecting the Spanish coastal zone. Urban development affected 5% of the surface of a 10 km-wide area along the coastline in 1990, and 30% of human population lived in coastal municipalities in 1995. Most (65%) of the Spanish industrial production is located in the coastal zone, and 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 mariculture is a fast-growing sector of Spanish economy and contributed 24% of total national fish production in 1998. 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., Balearic Islands).

2.6 Sweden

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

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

In the inshore areas of Sweden several problems threaten a sustainable use of the coastal resources (e.g., local overfishing, rapidly developing leisure fishing and tourism, conflicts between stakeholders with differing interests, increased use of ecosystem goods and services in coastal areas, poor economy in the commercial fisheries). Important areas relevant for coastal zone management are:

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

To obtain a long-term sustainable development the Swedish parliament has approved 15 national environmental quality objectives. One of them – “A Balanced Marine Environment, Flourishing Coastal Areas and Archipelagos” – specifically applies to the marine and coastal areas. To achieve this objective eight interim targets were decided in 2001 (<http://miljomal.nu/english/english.php>). The interim targets include actions such as: long-term protection of marine environments; action programmes for endangered species and fish stocks; control of catches so that fish stocks can recover, and reducing by-catch of mammals, birds and undersized fish to levels that do not have an adverse effect on the populations.

Sweden is running Europe's largest research programme on ICZM of marine resources, the Research Programme on Sustainable Coastal Zone Management of Marine Resources (SUZOZOMA, <http://www.sucozoma.tmbi.gu.se/>). It was started in 1997 and will finish its second phase in 2003. Among the programme deliverables are, for example, guidelines for integrated coastal management, principles and methods for management of coastal fisheries, and an analysis of how the EU Water Framework Directive can be integrated with the national coastal water quality management system.

2.7 The Netherlands

The coastal zone is the relatively small and dynamic zone between land and sea. It is defined as a strip of land and sea of varying width depending on the nature of the environment and management needs. It seldom corresponds to existing administrative or planning units. The natural coastal systems and the areas in which human activities involve the use of coastal resources may therefore extend well beyond the limit of territorial waters and many kilometres inland. The coastal zone system is an integrated complex of marine coastal and land sub-systems. The coast-subsystem includes the foreshore, the beach area and natural coastal protection systems such as dunes.

Natural ecological processes on the one hand, and socio-economic and political processes on the other hand, act on different temporal and spatial scales. Human activities as for instance dredging, sand-nourishment and recreation have their implications on a short-term scale of days to several years or even decades, while for instance habitat alteration and climate change have effects on larger time scales of decades to centuries. Local authorities are responsible for coastal defence and recreation, while fishing management is carried out within a European framework, and global warming for instance should be addressed on a global scale. An important question now arises concerning what

temporal and spatial scales information is needed on ecological processes to play a role in integrated coastal zone management.

The Dutch government developed by the end of 2002 the contours for integrated coastal zone policy. In accordance with the European recommendation, a national strategy must be ready by 2004 / 2005. This policy document, "Towards an Integrated Coastal Zone Policy – policy agenda for the coast", examines subjects of imminent importance, giving priority to safety policy. A number of safety and risk problems in the near future must be faced. Topping the policy agenda are the weak links in the coastal defences, which must be mitigated in time to continue to guarantee the safety of the hinterland. In addition to the weak links, risk management and quality boosts present a challenge for coastal towns. The coastal foundation zone concept illustrates the philosophy that sand is the basis of Dutch coastal defences and other functions in the coastal zone. Another duty of the national government is to ensure effective coastal zone policy and administration. With regard to communication and education the policy agenda takes consideration of the storm surge awareness. Finally, the policy agenda places great importance on shaping integrated coastal zone policy. It stimulates the development of the national government's vision of the coastal zone, which is based on the basic qualities of the coast: resilience, cohesion and horizon.

In October 2001, the European Environment Council made recommendations for integrated coastal zone management, stressing the strategic importance of coastal areas as residential areas and links in the trade and transport chain. Attention was drawn to the fact that these areas contain ecologically valuable habitats and are favourite holiday spots. However, a number of serious problems can be identified. Habitats are threatened and the coast is eroding.

On the basis of the three basic qualities of the Dutch coast, resilience, cohesion and horizon, the Dutch vision of the coastal zone includes the following with respect to ecosystems:

- To protect existing ecosystems, there should be sufficient space for natural processes (resilience) in the coastal area. The aim in respect to estuaries is to restore the natural freshwater/saltwater interfaces (cohesion). Human activities such as fishing should be carried out in a sustainable manner. Given the connection between the coast and the sea, the (ecological) quality must be ensured. An example is the development of a marine reserve to compensate for the loss of nature resulting from the development of an offshore industrial site in the North Sea.
- Space for the development of human activities is limited in the coastal areas. This requires special attention to spatial planning. Therefore, a growing search for space is thought to be found in the marine part of the coastal zone, for instance the planning of an artificial island to be used as a new airport and locations for wind turbine parks. A major concern is the minimal amount of ecological knowledge of the nearshore coastal areas, i.e., the sandy shores and surf-zone area, as well as the lack of instruments to integrate this ecological knowledge into integrated coastal zone management. The different temporal and spatial scales acting in both the natural environment and in the political and socio-economic planning need special attention.

2.8 The United Kingdom

The boundaries involved with UK coastal zone management are not clearly defined, however the Crown Estate manages the marine areas below Mean Low Water Springs (MLWS) out to 12 n.m. For planning purposes the Local Authority boundary's seaward limit is generally the MLWS mark. There is no statutory planning offshore, however the recent Water Environment and Water Services Act extended marine fish farming to local authority control in terms of planning permission. There is no official development setback line policy or protected zone for the coast. Recently, however, there have been several instances where an informal 5-metre contour line has been recognised, specifically in relation to dealing with coastal erosion and flood defence. The UK has a long and complicated coastline, which is summarised in Table 2.8.1.

Table 2.8.1. Total length in km of the coastline of Great Britain.

Geographical area	Length km	% GB coast
Great Britain total	18838	
England	5496	29%
Scotland (mainland)	6482	35%
Scotland (islands)	5295	28%
Wales	1562	8%

In England and Wales the key issues are:

- The development of urban infrastructure, ports and harbours and the substantial areas of tidal land that have 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.
- About 40% of UK manufacturing industry is also situated on or near the coast. Much of this industry, along with major cities, is located around large estuaries.
- Spatial issues regarding the distribution of resource exploitation in the coastal zone by inshore fisheries, aquaculture and recreation are also significant.
- Coastal defence: Climate change, sea level and isostatic sinking are more of an issue around the south and east of England. Therefore the threat from flooding and erosion are important factors.

The key issues for Scotland are the growing number of interests in the coastal zone leading to increased competition for space in many inshore sheltered locations. The main activities drawing resources in the coastal zone include creel fishing, game fishing, shellfish gathering, fish and shellfish farming, offshore oil and gas, shipping, recreation and tourism, small scale crofting. Also, most of the Scottish population lives within a few miles of the coast and on its many islands. Scotland has large inshore areas (within 12 miles of the coast) and its coastline is highly indented with rocky cliffs, firths and beaches. The diverse habitats such as seagrass beds and rocky reefs in the inshore zone are vital to Scotland's fisheries as they provide important spawning and nursery grounds for white fish and flatfish. The firths also provide rich feeding areas to several bird colonies.

Issues leading to a requirement for coastal zone management:

- Decline in inshore fish stocks due to overfishing and damage to benthic environments;
- Decline in runs of wild salmon and sea trout in many rivers;
- Fish farming (spatial reclamation, benthic impact, disease, escapes, algal blooms);
- Coastal water pollution threatening the collection and farming of shellfish as well as the local wildlife.

3 LINKAGES TO ICES COMMITTEES AND GROUPS

TOR (a)

This section contains reports from reviews on the activities of relevant ICES working and study groups related to the coastal zone. It is not a comprehensive study of all ICES working and study groups that work with coastal zone related issues.

Marine Habitat Committee

The Marine Habitat Committee, to which this Study Group reports, oversees the work of the following expert groups:

Expert Group	Nature of activities
Marine Chemistry WG (MCWG) Chair – Robin Law	Composed of 3 sub-groups – chemical oceanography, trace metals and organics. Deals with analytical problems for specific chemicals and contributes to EcoQOs related to contaminants.
WG on the Biological Effects of Contaminants (WGBEC) Chair - Ketil Hylland	Methods for biological effects measurements and ecological relevance of effects.
WG on Marine Sediments in Relation to Pollution (WGMS) Chair – Foppe Smedes	Monitoring methods, trend analysis, development of guidelines, bioavailability, etc.
WG on the Effects of Extraction of Marine Sediments on the Marine Ecosystem (WGEXT) Chair – Jon Side	Collate and analyse country reports, evaluate impacts of aggregate extraction on fisheries, develop guidelines, etc.
Benthos Ecology WG (BEWG) Chair – Heye Rumohr	Scientific research on benthic ecology, methods, taxonomy, development of EcoQOs.
WG on Marine Habitat Mapping (WGMHM) Chair – David Connor	Habitat classification and mapping methodology, technology development, application and interpretation.
WG on the Statistical Aspects of Environmental Monitoring (WGSAM) Chair – Rob Fryer	Statistical methods for the design and interpretation of monitoring programmes.

All of these groups undertake work that is of direct relevance to coastal zone management. However up to now these groups have not undertaken work directed specifically at information needs for coastal zone management. Most of these groups have access to relevant data but those data would have to be placed in the appropriate context and analysed in order to provide information of direct use to ICZM. Examples of available data include:

Expert Group	Relevant data
MCWG	Contaminant residues in the environment and biota in the coastal zone
WGBEC	Potential indicators of ecosystem quality.
WGMS	Contaminant residues in sediments
WGEXT	Sediment extraction activities and their biological effects
BEWG	Inventories of benthos
WGMHM	Habitat maps and classification schemes.

It should be noted that most databases are not comprehensive in spatial coverage. However these expert groups can provide a means of defining useful data and appropriate protocols for collection, quality assurance, storage and processing. WGSAM can offer important guidance on the proper design of baseline and monitoring projects.

Working Group on Ecosystem Effects of Fishing Activities (WGECO)

The Bergen Declaration agrees to implement an Ecosystem approach to the health of the North Sea ecosystems. It has listed a set of Ecological qualities (EcoQ), Ecological Quality Elements, and Ecological Quality Objectives (EcoQOs) as an initial step to fulfil its commitment. WGECO pursues its objective (initially started in 2001) of identifying, justifying and using the EcoQs, EcoQ elements and EcoQOs for provision of scientific advice required for an EcoQ-EcoQO framework. Some of the EcoQOs from the Bergen Declaration are relevant to the coastal zone. However, for the benefit of coastal zone management, additional coastal, intertidal species should be considered. WGECO revisited its previous work on the relative impact of fishing and other human activities on the marine ecosystem. Applying a new approach enabling them to compare the different impacts on the ecosystem, WGECO provided a detailed analysis of the extent of beam trawling and dredging in the southern North Sea and some quantification of benthos mortalities. Despite the North Sea focus of the analyses, they are of relevance to the coastal zone as these activities are also undertaken in inshore waters.

WGECO is developing their understanding of the response of ecosystems to fishing activity. As well as to provide advice on management issues, this knowledge is important for the development of ecosystem indicators. Their work has focused on the comparison of the behaviour of various metrics (diversity, trophic levels, size spectra and other size-based metrics) for a series of geographical regions. The analyses highlighted a variation in the response of some of the metrics potentially linked to differences in the dynamics of the various systems and the need for more research. This work does not specifically address the needs of SGINC since the areas studied in each region are quite extensive comprising coastal waters and open sea. However, the findings raise the question whether research of this type could also be carried out specifically in coastal waters in order to provide a better understanding of the behaviour of the analysed metrics in such ecosystems.

WGECO provides a matrix classification of sensitive habitats (taken from the OSPAR Threatened and Declining Habitats list) against fishing impacts including considered mitigation measures for each significant impact. The WG further proposes a decision tree to develop an evaluating process (which includes relevant ICES advisory bodies and WGs to provide the data and advice) as a decision-making tool to provide advice on such issues. This protocol is relevant to the SGINC as it can be applied in assessing and monitoring fishing impact on sensitive habitats in the coastal zone.

An effective ecosystem approach to the management of human activities has to consider the strong ecological linkages within the system (Predation, competition, habitat need). WGECO develops initial criteria for assessing the strength of particular ecological linkages and considers how to integrate this information into management advice. The coastal zone can comprise of feeding, spawning, nursery and over-wintering grounds. Ecological links in such systems are important; therefore the investigation and better understanding of them will be of great value to coastal zone management.

Also relevant to coastal zone issues is the work on assessing the data on which the justification of the habitats in the OSPAR Priority List of Threatened and Endangered Species and Habitats will be based.

Some of the habitats and species discussed are relevant to coastal zone. Also relevant is for example, the WGECO recommendation that ICES facilitates the production of comprehensive small-scale habitat maps for the ICES area/OSPAR regions.

Working Group on Environmental Interactions of Mariculture (WGEIM)

The area of responsibility for the Mariculture Committee (MARC), of which WGEIM is an expert group, is the biological, ecological and engineering aspects of mariculture systems. This includes the effects of humans on mariculture systems and the effects of mariculture on marine habitats. This group also covers the scientific aspects of stock enhancement, and the transport and introduction of non-indigenous species and stocks. Key tasks are:

- Evaluate the ecosystems of fishing, and of mariculture;
- Evaluate the potential impacts of intentional and accidental introductions of non-native species via mariculture, including genetically modified organisms, on marine ecosystems;
- Develop environmentally sound mariculture methods; and
- Develop procedures for integrated coastal zone management, including protocols for environmentally sound mariculture practices.

Information on technological changes in mariculture, including the utilization of new species, with particular emphasis on the consequences for production and the environment:

- *Changes in technology*: Growth of industry and competition for space (inshore fisheries and tourism) has led to requirements for new technology to move offshore and exploit more exposed locations.
- *Onshore controlled systems*: Re-circulation developments make on-shore production more viable and could enable sites to move away from the coastal zone. However more research is required and it still involves high capital investment. This is most viable for high value fish, e.g., turbot and halibut.
- *Offshore systems*: Increasing pressures on the coastal zone can mean that site acquisition for new sites will be difficult. Therefore this is a driving force behind the movement of structures offshore. Also, for environmental issues and impacts, offshore development is claimed to mitigate environmental pressures. This implies possible problems with oceanic system interaction (Fish attraction, modification of pelagic species behaviour). The new technologies involved are expensive and un-tested. Therefore there is a need for research and analysis of results from trials, e.g., Ireland.
- *Sea ranching and stock enhancement*: More research is required, e.g., for interactions with wild species, trophic compatibility, releasing strategies, tagging and capture.
- *Integrated systems*: Co-culture with algae and shellfish production can reduce nutrient enhancement effects. Also re-use of water in some systems can save energy. There is however a problem with chemotherapeutant uptake by shellfish co-production which should be investigated.
- *Technological improvements*: They have occurred regularly throughout the development of mariculture, however this is now driven more by ethics and product quality.
- *Floating cage technology*: Improvements in husbandry devices and techniques have reduced escapes, disease spread, effluents and over feeding. Changes in net design—conical designs for high exposure sites. Copper anti-fouling, not TBT.
- *Feed and Feeding*: Better knowledge of nutritional requirements, and automated feed systems have reduced the feed consumption. Fish meal can be replaced with vegetable proteins (50%) to improve the sustainability of feed production. PCB contamination also creates the need to replace fish meal. There are ongoing investigations into the impacts of carbon input to the seabed and eutrophication and plankton response to nutrient imbalances, etc. The global impact of fish meal acquisition on natural resources and sustainability issues are also being investigated.
- *Genetics*: Less than 1% of aquaculture depends on genetically altered strains. Escapes of domestic fish can lower local diversity, and result in loss of genes and loss of local species characteristics.
- *Animal Health*: Disease control, intensive cage culture, wild fish vulnerability, chemotherapeutants.
- *Current status in the development of new species*: New species can exploit new niches. WGEIM has recommended improved containment, research into interactions and environmental effects. Use of local stocks for genetic improvement.

New research and monitoring programmes, taking into account the proceedings of the 1999 ICES Symposium “Environmental effects of mariculture” and others as appropriate:

The group has identified that for coastal zone planning, regulation and monitoring of mariculture play a key part. Good information leads to proper formulation of mariculture needs and is essential for the acceptance of developments to other stakeholders. For ICZM- aquaculture methods, monitoring and assessment need to be acceptable to all stakeholders including fish farm developers. EQS/EQO- These are recommended as a way of obtaining transparent regulatory systems and for defining zones within the coastal zone with different allowable impacts. Monitoring programmes concentrate on main impacts that are:

- Relevant to all parties
- Convenient
- Provide information for EQOs
- Cost efficient.

The Water Framework Directive does not specifically mention aquaculture, however as it is a source of environmental pressure it will require operational monitoring with regard to impact on phytoplankton, benthos, native fish and hydrochemistry. It will also play a part in the definition of water bodies and the ecological status of a water body. MARAQUA evaluated principles underlying the environmental impact monitoring of aquaculture in Europe. It recognised that aquaculture requires a framework of regulations to ensure an environmentally acceptable industry and to minimise potential environmental impacts. Strategies for control and monitoring of systems in countries with different development histories are remarkably similar, therefore European/worldwide standards should be possible.

Monitoring activities and guidelines for the preparation of environmental impact statement/assessment documents for large-scale shellfish farm developments and appropriate monitoring programmes:

There are added problem of human health issues. EIA/EIS developments should possibly include interactive effects with other users of the area including other mariculture.

Issues of sustainability in mariculture including interactions between mariculture and other users of resources in the coastal zone:

WGEIM reiterates the need for cross-sectoral management approaches that link mariculture, fisheries, tourism, shipping, rural development and other disciplines to achieve ICZM objectives. However, the present structure of the ICES community does not seem well equipped to deal with multidisciplinary, non-biological management tasks and methodologies. In light of the need to prepare ICES for the required outreach and cross-linking, WGEIM reconfirmed the content of the ICZM chapter in the 1999 WGEIM Report (Appendix 9). Specifically, the Concept of Integrated Coastal Zone Management was addressed. Two major dimensions of the process were highlighted:

- vertical integration of governance in the form of policies, management arrangements from national to local levels of government, including community-based approaches, and
- horizontal integration of policies, management arrangements and development plans across national, district, or local levels of government as well as among different stakeholders with common interests in coastal areas and resources.

Shellfish and algae: Large sites produce significant quantities of faeces and other wastes but much of their environmental impact arises from physical disturbance associated with the lines, rafts and other structures, and these impacts can be evaluated only on a site-by-site basis. In addition, the importance of shellfish farms in depleting plankton levels that might otherwise be consumed by wild components of the ecosystem is very site-specific. Carbon flux models may be more useful in determining environmental effects of shellfish rearing. Macroalgal and planktonic farming can deplete nutrients, however there is no general model that can be used to assess how much these changes affect natural systems and be used to set threshold levels for development.

Benthic impacts: Changes in the benthos due to carbon loading (nutrients and physical disturbance are also significant causal factors, but are generally less important than carbon loading) are the most serious. While low levels of carbon loading can increase benthic productivity, the higher levels usually associated with fish farms generally lead to low biodiversity and a shift of benthic production to bacteria. This can create hypoxic or even anoxic conditions and possibly the production of hydrogen sulphide and other toxic gases immediately under the cages. A halo of increased productivity around this zone may to some extent compensate for the loss of production in the heavily impacted zone. Several models for the prediction of carbon loading exist, but they are all variants of the same basic underlying theory and are consistent with each other.

Nutrient loading: The effect of releasing nutrients into the water column is less well understood, in part because the rapid dispersion of dissolved substances generally makes this a regional rather than localised effect. The environmental impact is consequently more related to the effect on total production in the region (inlet, estuary, etc.) rather than that due to a single farm. This means that decisions about new licenses depend on how many sites and other sources of nitrification are in the region.

Models: The uses of DSS and GIS as tools for environmental assessment and management are being investigated.

WGEIM identified the various impacts of mariculture and made recommendations, which are highly pertinent for ICZM. These concern eutrophication, chemical contamination, habitat destruction, biodiversity, endangered species, impact on local biomass, changes in trophic structure, alien and introduced species, and interactions with other users of the coastal ecosystem. Within each of these impacts, reviews on the state-of-the-art, knowledge and information needs and possible management tools were identified. The compilation of data and identification of information needs are directly targeted at ICZM and thus the work within this WG is highly relevant for ICZM.

4 LINKAGES TO OTHER RELEVANT ORGANISATIONS AND SCIENTIFIC PROGRAMMES

TOR (b)

SGINC has reviewed activities of other relevant organisations and scientific programmes which focus on coastal zone aspects with respect to information relevant for ICES. The result is listed below.

4.1 Relevant organisations

4.1.1 EU Commission

The Commission of the European Communities presented A Strategy for Europe on integrated coastal zone management. The strategy recognises that coastal zones are of strategic importance to all Europeans, that they are home to a large percentage of the population, a major source of food, a vital link for transport, the location of some of our most valuable habitats, and the favoured destination for leisure time; ICZM is necessary for sustainable use of coastal zone resources. To achieve a European integrated coastal zone management, an integrated, participative territorial approach is therefore required to ensure that the use of Europe's coastal zones is environmentally sustainable, as well as socially equitable and cohesive. The Strategy aims to promote a collaborative approach to planning and management of the coastal zone, within a philosophy of governance by partnership with civil society. The Strategy is expected to lead to improved management of coastal zones. It is furthermore expected to improve the implementation of a wide range of EU legislation and policies in coastal zones. The Commission's Demonstration Programme on Integrated Coastal Zone Management (ICZM) has looked at the many inter-related biological, physical and human problems presently facing these zones. The basic biophysical problem in the coastal zones is that the development is not kept within the limits of the local environmental carrying capacity. Some of the most common manifestations of this problem are: widespread coastal erosion, habitat destruction, loss of biodiversity, decline of coastal and offshore fish stocks by damage to coastal spawning grounds, contamination of soil and water resources and problems of water quality and quantity.

4.1.2 HELCOM

From 1992, when the "new" Helsinki Convention was signed, coastal areas of the Baltic Sea have been covered by HELCOM Recommendations. Five important HELCOM Recommendations have been issued regarding protection of the coastal environment:

- i) Recommendation on protection of the coastal strip (Rec. 15/1).
- ii) Recommendation on establishing marine protected areas (Rec. 15/5), resulted in establishing 62 coastal Baltic Sea Protected Areas (HELCOM BSPA).
- iii) Recommendation concerning preservation of natural coastal dynamics (Rec. 16/3), which is applicable to protection of sediment transport along the coast (to preserve accumulation/erosion natural processes) and protection of coastal wetlands (e.g., against the drainage activities).
- iv) Recommendation on sustainable and environmentally friendly tourism in the coastal zone of the Baltic Sea (21/3), which should preserve areas subjected to strong tourism pressure, particularly those with limited carrying capacity.

- v) Recommendation concerning protection of heavily endangered or immediately threatened marine and coastal biotopes of the Baltic Sea (Rec. 21/4).

From 1992 until 1998, the coastal environment of the Baltic Sea was under consideration of the HELCOM Environment Committee, and the Working Group NATURE. In 1999 a new group was established: Nature Conservation and Coastal Zone Management, which also works on ICZMs.

4.1.3 OSPAR

The Convention for the Protection of the Marine Environment of the North-East Atlantic (“OSPAR Convention”) was opened for signature at the Ministerial Meeting of the Oslo and Paris Commissions in Paris on 22 September 1992.

The Convention has been signed and ratified by all of the Contracting Parties to the Oslo or Paris Conventions (Belgium, Denmark, the Commission of the European Communities, Finland, France, Germany, Iceland, Ireland, the Netherlands, Norway, Portugal, Spain, Sweden and the United Kingdom of Great Britain and Northern Ireland) and by Luxembourg and Switzerland.

The OSPAR Convention entered into force on 25 March 1998. It replaces the Oslo and Paris Conventions, but Decisions, Recommendations and all other agreements adopted under those Conventions will continue to be applicable, unaltered in their legal nature, unless they are terminated by new measures adopted under the 1992 OSPAR Convention.

4.1.4 MON

The Working Group on Monitoring (MON) covers monitoring temporal trends of contaminants/hazardous substances in biota and sediments. The WG started as an *Ad hoc* group in 1995. In 2001, it changed to a permanent group. New time series of analyses of hazardous substances were continued and biological effects monitoring was started in 2003. The WG works in close cooperation with ICES.

4.2 Scientific programmes

4.2.1 LOICZ – Land-Ocean Interactions in the Coastal Zone

LOICZ foci:

1. Effects of changes in external forcing or boundary conditions on coastal fluxes
2. Coastal biomorphology and global change
3. Carbon flux and trace gas emissions
4. Economic and social impacts of global change in coastal systems.

Although the objective of LOICZ is not to undertake coastal zone management, a clear goal is to provide a sound scientific basis for future integrated management of coastal areas (<http://www.nioz.nl/loicz>). The foci of LOICZ are relevant for several of the issues listed by SGINC, namely eutrophication, chemical contamination and habitat destruction in the coastal zone. For example, the extensive database of regional carbon/nitrogen/phosphorus data and budget models compiled in the LOICZ core project “Biogeochemical Budgets and Modelling” can fill an important function for coastal management in several regions.

ELOISE is the European Commission’s programme and initiative on Integrated Coastal Zone Management. It consists of 47 projects from EU Framework Programmes FP4 and FP5. The common base is the land-ocean interaction aspect. It was noted, however, that local and regional studies within core projects sometimes are very loosely organized. It was hoped that a more integrated approach would be taken in the future.

4.2.2 The European Union for Coastal Conservation (EUCC)

The EUCC (www.coastalguide.org) first proposed a European Code of Conduct for Coastal 1993, “as a means to provide practical guidance to public agencies, local authorities, coastal users, and others with regard to ecologically sustainable development in the coastal zone”. The European Code of Conduct for Coastal Zones was officially adopted by the Council of Europe Ministers in 1999. The Code of Conduct provides practical guidelines for the conservation of nature and biodiversity in coastal areas covering a range of key socio-economic sectors. It includes recommendations on how to deal with direct and indirect impacts.

4.2.3 The Water Framework Directive (WFD)

The WFD (<http://www.europa.eu.int/comm/environment/water>) of the European Commission was signed in December 2000, and agreed in May 2001 with the following objectives:

- To prevent deterioration of status of all surface water bodies
- To achieve good surface water status (15 years)
- For artificial and heavily modified waters (15 years)
- Reduce pollution from priority substances and cease or phase out emissions, discharges and losses of priority hazardous substances (Article 16.6 - Priority hazardous substances - appropriate timetable for cessation not exceeding 20 years after adoption of the WFD). The normative classification in WFD can be summarized as: high ≈ no or only minor deviations;
- good ≈ low levels of disturbance, but deviate only slightly;
- moderate ≈ moderate deviations and significant effects;
- poor ≈ major biological alterations and substantial deviation;
- bad ≈ severe biological alterations and large deviation, and contains both Ecological status and Chemical status. The Ecological status includes 5 classes (including quality elements): Phytoplankton
- Phytobenthos
- Zoobenthos + Fish fauna (transitional waters)
- Supporting Chemical and physical elements (including nutrients and oxygen).

The Chemical status contains two classes: Good and Failing to Achieve Good status. Quality elements: Hazardous Substances (HS) according to list of priority substances (to be agreed). Monitoring is required by the WFD. The surface water monitoring network should provide a coherent and comprehensive overview of ecological and chemical status, and ecological potential within each river basin and allow classification of water bodies to be shown on maps in a River Basin Management Plan (including Coastal water). It must have an acceptable level of precision and confidence and be operational within six years.

Quality elements for the classification of ecological status (Rivers, Lakes, Transitional waters, Coastal waters, Artificial and heavily modified surface water bodies). Normative definitions for high, good and moderate ecological status classifications in all water types and definitions for maximum, good and moderate ecological potential for heavily modified or artificial water bodies. Current national monitoring and assessment systems do not allow the formulation of indicators of Ecological and Chemical Status in terms of the Directive. These will be developed over time with the progressive implementation of the Directive. Intercalibration will be required between national systems and ETC/EEA indicators will accordingly be developed and refined over time. Deadlines of the Directive: 2003: National and regional laws to be adapted to the WFD

2004: Analysis of pressure and impacts on our waters to be completed

2006: Monitoring programmes to be operational

2008: River Basin Management plans presented to the public

2009: Publishing first River Basin Management Plans (including Transitional and Coastal Waters)

2015: Waters to meet "good status".

4.2.4 EUROCOAST

European Coastal Association for Science and Technology (EUROCOAST) was established in 1989 and has its secretariat in Cardiff, UK. It is an association of scientists and decision makers within the European community. There are eight member National Associations (Croatia, France, Italy, Poland, Portugal, Spain, Ukraine, UK) included. The objectives are:

- To create a European network for scientific and technical exchange, both within and outside Europe, on subjects relating to the protection, development and management of the coastal zone.
- To identify and promote multidisciplinary research and the synthesis of common themes between practitioners in different fields.
- To establish a database and reference library on all aspects of the coastal zone.
- To promote the wider dissemination of information on the above themes.
- To generally take all initiatives and actions which will advance the realisation of these objectives.

The main activities are the Biennial Littoral Conferences. The aim is to bring together experts from a wide range of backgrounds, natural and social scientists, engineers and other technical experts. Other activities include a recent international exchange between CoastNET (UK) and Eurocoast Ukraine, and the CORINE (coastal erosion project) supported by DGXI and generating a database for the coastline of the 11 member nations of the EC and CEO (Centre for Earth Observation) project, undertaken for DGXII of the EC. The next conference in 2004 will be in Aberdeen, Scotland. It will be the second joint conference between EUROCOAST and the EUCC – The Coastal Union. Papers presented at the biennial conferences indicate that ICES could be addressed on issues relating to integrated coastal zone management.

4.2.5 ECSA (Estuarine and Coastal Sciences Association)

ECSA is an academic organisation, with a worldwide membership, which promotes research and study of all aspects of estuarine and coastal regions. The Association was founded in 1971, as the Estuarine and Brackish-Water Biological Association, to promote production and dissemination of scientific knowledge and understanding of estuaries and coastal waters, in order to encourage resource management for the public benefit.

4.2.6 GESAMP

GESAMP is a multidisciplinary body of independent experts nominated by the sponsoring organisations. These include the United Nations (UN), the UN Environment Programme (UNEP), the Food and Agriculture Organization (FAO), the Intergovernmental Oceanographic Commission of UNESCO, the World Meteorological Organisation, the World Health Organisation, the International Maritime Organization (IMO), and the International Atomic Energy Agency. Its mission is to provide advice to the Sponsoring Organisations, at their request, on pollution and other problems that face marine and coastal environments. Each Sponsoring Organisation nominates one to four experts according to its interests in the substantive work for the session. Experts appointed to the Group should act in their individual capacities. The multidisciplinary composition of the Joint Group is agreed among the sponsoring organisations. Some experts are nominated to serve for a period of up to four years to provide a continuing nucleus, while others can be appointed as occasion demands, having in mind the particular subjects to be considered at each session of the Joint Group. In 1993 its role was extended to cover all scientific aspects on the prevention, reduction and control of the degradation of the marine environment to sustain life support systems, resources and amenities.

Among its activities, GESAMP has prepared several reports relevant to the coastal zone, including:

- “A Sea of Troubles”. This considers the degradation of coastal ecosystems and habitats, overfishing and fishing of so-called “under-utilised species”, threats from alien species, aquaculture as a source of environmental problems, pressure from tourism and a reduction of marine biodiversity.
- “Protecting the Oceans from land-based Activities”. This is a report on land-based sources and activities affecting the quality and use of marine, coastal and related freshwater environments. The report reviews, among others, available information on the input of nutrients, heavy metals and persistent organic pollutants (POPs) to the seas through the atmosphere.
- “Planning and Management for Sustainable Coastal Aquaculture Development”.
- “The contributions of science to Integrated Coastal Management”.

4.2.7 Programme for the Assessment and Control of Pollution in the Mediterranean Region (MED POL) United Nations Environment Programme-Mediterranean Action Plan (UNEP-MAP)

The Mediterranean Action Plan is an effort of 20 countries bordering the Mediterranean Sea and the European Union to meet the challenges of environmental degradation and to link sustainable resource management with development in the sea, coastal areas and land. The legal framework for this effort is the Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean which revised in 1995 the Convention for the Protection of the Mediterranean Sea against pollution of 1977. Six binding legal instruments (Protocols) addressing specific aspects of environmental protection have been produced. The Barcelona Convention is still under ratification by the contracting parties.

MAP focuses on four key fields of activity: curbing pollution, safeguarding natural and cultural resources, managing coastal areas, and integrating environment and development. MAP set up in 1996 the Mediterranean Commission for Sustainable Development (MCSDD) as advisory body on policies to promote the sustainable development in the Mediterranean Basin.

The Programme for the Assessment and Control of Pollution in the Mediterranean Region (MED POL) represents a key tool for the reduction of land-based pollution. MED POL was created in 1975 and has gone through two phases. The main goal of the first phase (1975–1980) was to enable all laboratories in the region to participate in MED POL activities and the main actions included training, the purchase and maintenance of analytical instruments, and inter-calibration exercises to ensure the quality of the data gathered. The second phase (1981–1995) aimed at the establishment of national monitoring programmes with full data quality assurance; during this phase the countries collected a large number of marine pollution data. MED POL III, adopted in 1996, continues the efforts on pollution assessment (trends in the levels of pollutants, biological effects of contaminants, inventory of pollution sources and loads) and monitors on a continuous basis the effectiveness of the action plans, programmes and measures for pollution control implemented by the Governments of the Mediterranean countries. In 1980 the Mediterranean states signed the Protocol related to the control of pollution from land-based sources (LBS Protocol), which was amended in 1996 to cover all the polluting human activities and obliges the countries to formulate and implement regional and national action plans to reduce and eliminate pollution at source. In 1997 the Strategic Action Programme to address pollution from land-based activities was adopted. SAP identifies, describes and analyses the main pollution land-based sources and activities, proposes remedial actions, costs them, and formulates target dates for their implementation. The MED POL programme is also in charge of the follow up of the Protocol regulating all dumping operations at sea (Dumping Protocol) and the Protocol related to the protection from pollution by trans-boundary movement from toxic wastes (Hazardous Wastes Protocol).

For additional information check <http://www.unepmap.org>.

5 AVAILABLE INFORMATION AND GAPS OF KNOWLEDGE

TOR (c)

Significant time was dedicated to discuss available information with respect to that required for the sustainable use and management of the coastal zone and to identify gaps in knowledge.

Integrated Coastal Zone Management requires the integration of information from a number of disciplines:

- Social
- Political
- Cultural
- Economic
- Environmental.

The role of ICES may most conservatively be perceived as providing the data and information concerning the marine environment. This could be provision of data, time series data, standard monitoring programmes and techniques, analysis of changes and development within ecosystems, human impact effects, etc. It may be argued that providing advice that balances resource uses with nature conservation without considering for example economic and social risks and consequences may fall short of the targeted holistic approach. The problem may be to identify at which level the merging of information is required to ensure integration and ecosystem management.

SGINC identified 8 key environmental issues related to the coastal zone and these are:

1. Eutrophication
2. Chemical contamination
3. Habitat destruction/restoration
4. Natural coastal dynamics
5. Biodiversity/endangered species
6. Change in trophic structure
7. Alien/Introduced species
8. Local living resources

Relationships were also identified between the key issues and natural processes and human activities (Table 5.1). Gaps in knowledge related to each key issue were identified and ICES WG/SGs with relevant expertise were noted (Table 5.2).

SGINC recognised that WGEXT activity is very relevant to interests and activities of SGINC. WGEXT is providing comprehensive advice on effects of extraction activities (as is reflected in WGEXT Reports and ICES Guidelines for the Management of Marine Sediment Extraction). The activities of WGEXT cover the broad range of potential impacts resulting from aggregate extraction including eutrophication, contamination, habitat destruction, biodiversity change, and impact on fish and fishery. SGINC also welcomes the WGEXT overview on habitat mapping techniques, which is being published in the ICES Journal of Marine Science. In relation to WGEXT activities on effects of extraction activities, SGINC discussed if it would be possible to study secondary effects of beach nourishment, e.g., effects of transport of nourished material along the coast (as an effect of coastal dynamics) which may impact spawning grounds and spawning periods.

The extraction of marine sediments for beach nourishment should be considered as a whole intervention, i.e., the evaluation of the effects of sediment redistribution. The extraction of sediment for beach nourishment in the Mediterranean is frequently done in the vicinity of seagrass meadows which may cause either direct, immediate seagrass loss or delayed loss due to increased sediment shortage and impaired rooting capacity of the plants. Sediment dumping can have either negative effects on seagrasses due to plant burial and/or increased water turbidity or positive effects on those seagrass meadows located in eroding coastlines (the extra supply of sediment will increase the capacity of seagrasses to root and stand wave/current action). Seagrass loss is a major agent driving biodiversity loss in the Mediterranean.

Based partly on the BEWG report the SGINC concluded that sampling and monitoring methods for benthic invertebrates, benthos, epibenthos and fish in the tidal and the coastal zone are both numerous and varied. In relation to impact studies and to studies in relation to Ecological Quality Studies standard methods are of greatest importance. No standard methods exist for the collection of data on *fish populations* in the coastal zone. Different gears have been used including trawls, push nets, traps and set nets (e.g., fyke nets). In the open sea standard trawling methods are used (i.e., the ICES International Bottom Trawl Surveys). One of the difficulties in the coastal zone is the large number of bottom sediment types, some of which make trawling impossible. Other methods than trawling have been used, among these are the use of a special set of nets with different mesh sizes (Denmark, Sweden). There is a need to establish standard fishing methods for collecting quantitative data on fish populations/distribution in the coastal and intertidal zone in order to ensure reliable and comparable data.

SGINC further concluded and recommended that:

- The natural physical landscapes as sea borders have been identified as important for preservation and interact “naturally” with natural physical processes. This includes coastal landscapes, wetlands and soft coastal defence.
- Marine protected areas (MPA) should serve as reference areas for scientific investigation.
- More structured collection of information is needed from individual countries specifically on environmental effects, harmful algal blooms, research, production trends and integration into coastal planning.
- Actions should be taken to evaluate the different methods and proposed standard methods of monitoring benthic flora and fauna in the intertidal zone.
- Guidelines for monitoring and assessment programmes for impacts of human activities related to coastal zone management should be evaluated.
- Standardisation of monitoring methods and tools for environmental assessment should occur, which need to be acceptable to all other users of the coastal area.
- Development is needed of integrated management areas, involving all farm operators and stakeholders.
- There is a problem with chemotherapeutant uptake by shellfish co-production therefore this process should be studied in more depth.
- Implications of perception of animal welfare on acceptance of aquaculture in coastal zone should be studied.
- More emphasis should be given to other coastal users on mariculture.
- Investigation should be made of new technologies to move farms away from the coastal zone, either offshore or inland.
- There is a problem with uptake by shellfish co-production of chemotherapeutants from finfish cage culture which should be investigated.

Table 5.1. Relation between the key issues and nature and human activities.

Natural Influences	Key Issues
Climate:	
Atmosphere/ Ocean	Habitat deterioration
Human Activities	Key Issues
1. Mariculture	Eutrophication Habitat deterioration/restoration Biodiversity/Endangered species Changes in trophic structure Impact on local biomass
2. Fisheries	Habitat deterioration/restoration Biodiversity/Endangered species Changes in trophic structure Impact on local biomass
3. Oil and gas	Eutrophication Chemical contamination Habitat deterioration/restoration Biodiversity/Endangered species
4. Mineral extraction	Chemical contamination Habitat destruction/restoration Impact on spawning/nursery habitat (critical/ essential habitat)
5. Tourism, recreation	Eutrophication Chemical contamination Habitat destruction/restoration Alien/ introduced species Impact on local biomass Impact on spawning/nursery habitat (critical/ essential habitat)
6. Transport	Chemical contamination Alien/ introduced species
7. Residential/ Urban development	Eutrophication Chemical contamination Habitat destruction/restoration Impact on spawning/nursery habitat (critical/ essential habitat)
8. Physical structures	Habitat destruction/restoration Impact on spawning/nursery habitat (critical/ essential habitat)
9. Land use practices/ Dams	Eutrophication Chemical contamination Habitat destruction/restoration Impact on local biomass Impact on spawning/nursery habitat (critical/ essential habitat)

Table 5.2. Relation between each key issue and gap in knowledge with relevant ICES WG/SG.

Key Issues	Gaps in knowledge	Relevant WG /SG
Eutrophication	Method and techniques to be adjusted for coastal zone conditions	MCWG, SGQAC, SGQAB
Chemical contamination	Study of processes, fluxes and effects	MCWG, SGQAC, WGMS, WGBEC
Habitat destruction/restoration	Mapping of fish spawning, nursery habitats	WGMHM, WGEKO
	Downscaling to coastal zone management needs	WGMHM, WGEKO
	Restoration: How, what, compensation	WGEKO, BEWG
	Impact of nourishment	WGEXT, WGEKO, BEWG
	Impact on spawning/nursery habitat (critical / essential habitat)	WGEKO,
Biodiversity/endangered species	Impacts, taxonomy	WGEIM, WGEKO, BEWG, WGITMO
Changes in trophic structure	Ecosystem function	WGEKO, BEWG
Alien/ introduced species	Impacts, taxonomy, interaction with native species	WGEIM, WGEKO, BEWG, WGITMO
Local living resources	Impact on local biomass	WGEKO, BEWG, WGSE, WGBEC
	Develop standards methods for sampling benthos, epibenthos and fish in the tidal and coastal zone	BEWG, SGQAB, WGEKO, WGEXT, WGEIM

6 NEW DATA PRODUCTS AND RESEARCH

TOR (d)

There was a long discussion on how to deal with coastal zone ecosystem-based issues and the group agreed that there is a:

- Need to establish quality indicators for coastal zone,
- Need to establish quantity indicators for coastal zone,

and a need to develop and integrate vulnerability indices into quality and quantity indicators which will couple human pressures with ecosystem parameters.

The SGINC identified scientific data products and new research, which ICES could use as a basis for advice on, and in support of, coastal zone management:

- Identify management need for information and advice. What kind of information is needed to improve ICZM? What kind of information is required by managers? Are Environmental Impact Assessments adequate for decision making? Are ecological risk scenarios required?
- There is a need for information on different levels since there will be communication with all stakeholders. The message has to be delivered in an understandable language.
- Develop Network of Excellence in the 6th Framework programme.
- Knowledge of area, risk and scenarios within a local context.
- Effect-impact, need to have knowledge of the processes.
- There is a need for data on the recreational fishery. This fishery is having a high impact in some coastal areas. It is often not managed or monitored.
- There is a need for tool boxes for ICZM, as a set of indicators, to be developed by ICES.
- ICES can provide assistance with monitoring, sampling and analytical protocols, data management models.

7 POSSIBLE PARTNERSHIP

SGINC identified the following possible working partnerships, which could complement ICES data products with a view to further developing and integrating knowledge for use in holistic advice for coastal zone management: EUCC, GESAMP, MAP(?), EPA (Environmental Protection Agency, USA), CSIRO (Australia), and ICLARM. The participants agreed that OSPAR, HELCOM, and the EU-Commission are already clients and should not be listed.

8 CONCLUSIONS AND FINDINGS

The following is a summary of the major conclusions and findings, as agreed upon by the meeting participants based upon reports presented and reviewed at the meeting, as well as upon substantive and extended discussion arising from the presentations. It should be noted that these conclusions and findings are of a preliminary nature since this is the first time this group has met. It is likely that significant changes in these conclusions may occur as the discussion matures intersessionally and at the final meeting of the SG next year.

Each country has its definition of coastal zone, and this definition may in fact vary for different activities. Therefore it will be necessary for each case to ensure that there is a common understanding of the terminology being used.

The coastal zone aspects are not addressed by ICES at present and need to be addressed in future with respect to preserving these natural resources and maintaining a sustainable use of these resources. In some areas there may be urgent needs for nature rehabilitation in order to provide reasonable coastal resources for the next generations.

There is a need for standard protocols. While ICES cannot expect to provide the information needed for every ICZM initiative, ICES can play an important role in developing and advising on:

- procedures for determining information requirements,
- procedures for sampling and analytical protocols to collect necessary data,
- data models to manage the data, and
- methods and models to analyse the data.

9 RECOMMENDATIONS

These recommendations focus on what information is needed from other ICES WG/SG and will be updated at the next and final meeting in 2004.

- a. Expertise in taxonomy is required for the assessment of biodiversity and ecosystem dynamics in the coastal zone.
- b. Decision Support Systems, as applied in decision making for the establishment of aquaculture farms, should be applied more generally for the coastal zone. This kind of tool helps in deciding what kind of data or information is required.

- c. The SG has identified the need for information on macrophyte systems focused on macroalgae as a resource and as habitat for other species, such as fish, and recommended the need for a future ICES expert group to provide advice on macrophytes.
- d. There is a need for information on fish spawning, nursery and feeding areas in the coastal zone. The WGMHM should be asked to consider the feasibility of mapping of these areas.
- e. The SG identified the need to review techniques for shallow-water mapping.
- f. The USA has an extensive coastal zone programme and every effort should be made to get representation from the USA to this SG intersessionally and at the next meeting.
- g. Update information on national or trans-boundary projects.
- h. This SG requires information from other relevant ICES expert groups prior to its next meeting. Specifically the SG needs to know:
 - Does this report cover all the important issues regarding the coastal zone contained in your WG terms of reference?
 - If NO, please list issues you feel have not have been included in this report
 - In our list of gaps of knowledge (Table 5.2), we have listed a number of relevant expert groups; is your expert group listed correctly?

The results will be compiled at the next meeting.

The Terms of Reference for the next and final meeting can be summarised as follows:

- a) update and report on activities of relevant ICES working and study groups to identify information pertaining to the coastal zone; evaluate information from other ICES expert groups on potential contributions to information for ICZM (results of recommendation h).
- b) update and report on the activities of other relevant organisations and scientific programmes which focus on coastal zone aspects with respect to information relevant for ICES;
- c) report on the available information with respect to that required for the sustainable use and management of the coastal zone and identify gaps in knowledge;
- d) finalise recommendations on scientific data products and new research, which ICES could use as a basis for advice on, and in support of coastal zone management;
- e) identify possible working partnerships, which could complement ICES data products with a view to further developing and integrating knowledge for use in holistic advice for coastal zone management.

10 ADJOURNMENT OF THE MEETING

A final review of the 2003 terms of reference was made shortly before the adjournment of the meeting by J. Støttrup on 7 May at 17.30 hrs. Final draft recommendations were discussed and approved by the SGINC participants followed by discussion on the venue and dates of the next meeting suggested to take place in Heraklion, Crete, Greece 19–21 April 2004.

Efforts will be made to increase participation from other European countries, USA, and persons involved with MERL, Narraganset Bay, University of Rhode Island (USA).

On behalf of the SGINC, Josianne Støttrup rendered thanks to Beatriz Morales-Nin and IMEDEA for the provision of excellent meeting facilities.

ANNEX 1: LIST OF PARTICIPANTS

Study Group on Information Needs for Coastal Zone Management (SGINC)

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ANNEX 2: AGENDA

1. Opening. Introduction of participants.
2. Appointment of Rapporteur.
3. Adoption of Agenda and Timetable.
4. Discussion of Meeting, Lunch and Transportation arrangements.
5. Review/status on country ICM progress. This should be short summary (for European countries, e.g., based on ICM progress report for the different countries located at www.coastalguide.org) lasting max. 10 min. followed by update since last status on ongoing projects/completed projects or other new initiatives.
6. Review of Terms of Reference.
 - 6.1. ToR (a). Review and report on the activities of relevant ICES working and study groups to identify information pertaining to the coastal zone.
(divide this between participants each covering a cttee/WG: MHC, MARC, WGEM, WGEXT)
 - 6.2. ToR (b). Review and report on the activities of other relevant organisations and scientific programmes which focus on coastal zone aspects (e.g., LOICZ, ECSA, EU Water Framework Directive, etc.), with respect to information relevant for ICES.
(make a list of these and ask different participants to report on the different activities. What should they focus on (i.e., relevant for ICES)? Or do we decide on this at the meeting?)
 - 6.3. ToR (c). Evaluate the available information with respect to that required for the sustainable use and management of the coastal zone and identify gaps in knowledge. (discussion at the meeting)
 - 6.4. ToR (d). Propose scientific data products and new research, which ICES could use as a basis for advice on, and in support of, coastal zone management.
 - 6.5. ToR (e). Identify possible working partnerships, which could complement ICES data products with a view to further developing and integrating knowledge for use in holistic advice for coastal zone management.
7. List ToR to be proposed for the final meeting in May 2004.
8. Site, timing and arrangements for 2004 Meeting of the SG.
9. Adjournment.

ANNEX 3: LIST OF WORKING DOCUMENTS PRESENTED AT THE MEETING

The Working Documents listed are not included in the present report. Copies of the Working Documents can be obtained by contacting the Rapporteur: E. Moksness (Norway).

- Paul D. Keizer (Canada): Integrated Coastal Management Canada – Country Report April 2003.
- Jakob Gjørseter and Erlend Moksness (Norway): The coast of Norway.
- Erik Hoffmann (Denmark). Integrated and developed coastal zone management plans.
- Clare Greathead and Joanna Martin (UK): Country report for the United Kingdom.