

# **Integrated Coastal Zone Management (ICZM) in Ireland, with particular reference to the use of Geographic Information Systems (GIS) and the EU ICZM Demonstration Programme.**

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## **Introduction**

The rapid expansion of the Irish economy is putting unprecedented pressure on the coastal marine area and its resources. Almost 60% of our total population resides in coastal areas (Department of the Environment and Local Government, 1997). In addition to marine resources, the coastal marine area provides economic, recreational, aesthetic and conservation benefits. The demands placed by densely populated coastal regions impose stresses on a finite system and its resources.

Over the past decade, and in particular in the past five years, there has been increasing pressure for the development of a framework for the management of our coastal and marine resources. There is also increasing pressure to provide greater amenity and recreation access to coastal and marine resources. This is in tandem with concern about the widespread loss of coastal and estuarine habitats and wetlands.

Management of the resources within the coastal marine area is a dynamic process, not an event. It is based on a thorough understanding of the ecosystems that determine the coastal marine biotope. Integrated Coastal Zone Management (ICZM) considers the dynamics of the biological and physical processes, natural features, practical and administrative criteria, local conditions, and it builds on the requirements, concerns and commitments of local people. The adoption of ICZM provides a strategic, innovative and integrated approach to the development and implementation of methods and tools that include the principles of sustainable development, the biodiversity action plan and the precautionary principle.

As we progress through the 21<sup>st</sup> century, Ireland faces a significant challenge to adhere to the principles of sustainable development of our coastal and marine resources, as agreed in Agenda 21 at the Earth Summit in Rio de Janeiro, 1992. Agenda 21, the global action plan for sustainable development, addressed the pressing environmental problems of the day and also aimed at preparing the world for the challenges of the future (Robinson, 1992). Sustainable development has been defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (The World Commission on Environment and Development, 1987). Chapter 17 of Agenda 21 reiterates that the

well being of coasts and seas is of global concern. Integrated management and sustainable development of coastal and marine areas is a key programme area of Agenda 21; coastal member states are required to provide for an integrated policy and decision-making process, including all involved sectors, to promote compatibility and a balance of uses in the coastal marine area (Robinson, 1992). However, there is, as yet, no national policy on ICZM in Ireland. In addition, Ireland is a signatory to the OSPAR Convention on protection of the North Atlantic Ocean, but we do not have a suitable forum to respond to OSPAR. This paper examines how far we have come towards developing policies to ensure sustainable development in the coastal marine area over the last ten years.

## **Issues within the coastal zone**

The issues within the coastal marine area have been categorised by the EU ICZM strategy according to two broad taxa: bio-physical problems, or human problems (European Commission 2000).

### *Bio-physical Problems*

Development is not kept within the limits of the local environmental carrying capacity. The following problems, evident throughout Ireland, highlight this:

- Widespread coastal erosion often made worse by inappropriate human infrastructure and development too close to the shoreline.
- Habitat destruction as a result of poorly planned building and land development, or sea exploitation. Loss of biodiversity, including decline of coastal and offshore fish stocks as a result of damage to spawning grounds.
- Contamination of soil and water resources as pollution from marine or on-land sources migrates to the coastline.
- Problems of water quality and quantity as demand exceeds supply or wastewater treatment facilities.

### *Human Problems*

The human problems facing the coastal marine area as intensity of human uses increases:

- Decline of traditional or environmentally-compatible sectors e.g. small scale coastal fisheries leading to unemployment and social instability.
- Competition between users for resources.
- Destruction of cultural heritage following uncontrolled development.
- Loss of property and development options as coast erodes.
- Degraded resources leading to lost opportunities for durable employment.
- Marginalization and emigration, compounded by a lack of appropriate infrastructure.

## Issues in Ireland

The following issues, summarised into 11 themes, cause widespread concern in Ireland:

- 1. *Lack of interaction between local authorities and DOMNR; complex legislative system.*** The land/sea divide is reflected in planning and legislation. Within this land/sea divide there is the further complication of legislation structured sectorally. There is a need for integration between landward and seaward authorities. There are also problems with defining the extent of the coastal zone, and the responsible agencies.
- 2. *Pressures of housing development.*** Urbanisation in the coastal area increased by 10.3% from 1991 to 1996, and will undoubtedly have increased further. The Resort Renewal Scheme has particularly impacted on peripheral coastal communities. The developments are often visually intrusive, as they are marketed as “with sea views”, or exclusive to non local purchasers, and distort the availability of housing to the local community. An area of setback from the shore, where development is restricted, is needed. Development of hard structures along the coastline restricts the ability of inter-tidal habitats to move landward as sea rises, resulting in “coastal squeeze”. The net effect is the gradual loss of inter-tidal habitats, with resultant over-focussing of any floods. Over development is also impacting on seascapes – landscapes, and is limiting traditional public access to the foreshore. Sites of conservation importance should be clearly identified so that they can be protected from development.
- 3. *Port developments.*** Demand for port expansion has resulted in loss of various habitats. There is increased competition between leisure activities and commercial shipping in ports. Maintenance dredging in ports can lead to disturbance and dispersal of contaminated sediments.
- 4. *Tourism.*** There is a need to introduce integrated planning and management of tourism developments, to quantify carrying capacities and to encourage sustainable destination development. Peaks of tourism during the summer season may strain the infrastructure of small coastal communities. Consideration could be given of development of Green Destinations. The possibility of using EMAS in management of tourism areas could be investigated. Tourism impacts are felt keenly regionally and locally, while policies are often determined nationally. The Resort Renewal Scheme provides case studies of regional impacts and national policy. Other issues include location and management of caravan parks (many of which pre-date planning legislation). Location of links golf courses, many of which prevent public access to shore, also result in increased pressure on adjacent areas; many are on ecologically important dune systems. There is over fragmentation of the coastal strip according to allocation of uses. Undocumented

and uncategorized use of coastal and marine areas may exclude less active and occasional amenity users. It may be necessary to limit access to certain environmentally sensitive areas.

5. ***Legislation for nature conservation is not tight enough; there is insufficient adherence to protection designations.*** The coastal marine area has extensive numbers of SPAs and SACs. Land use management plans should be developed where current use is not compatible with SAC, SPA, NHA designation. There is no requirement for EIAs on a large number of small operations which together are significant. Neff (1998) reported on impacts on coastal SAC: low impact effects were widespread, not well reported, insidious; resulted in the “death of a thousand cuts”. Designation of certain areas for conservation must not result in excessive development in other areas, which may also be important habitats. Lack of protection through appropriate designation can lead to loss of the asset, either through accidental or deliberate change.
6. ***Data availability.*** Problems of tracking and planning for changes in demography; need to agree common method of collecting statistics and definition of coastal zone throughout Europe to allow meaningful comparisons. This would also facilitate the development of meaningful indicators.
7. ***Public health of marine waters.*** Concern about pollution and discharges, including litter at sea and in the tidal zone; diffuse source pollution.
8. ***Seascape - landscape appreciation.*** Loss of seascape through recent developments, in particular those involving resort renewal scheme. Problems with aquaculture installations. In 1990 the LACOAST project documented that 55% of all land in the coastal area was agricultural; a new equivalent study is needed, in particular with regard to development on the east coast.
9. ***Aquaculture.*** This major economic resource located in the coastal marine area. Aquaculture activities are predicted to increase by 300% from 2000 to 2015. Developments in aquaculture need to be balanced with requirements for protecting coastal habitats. Designations in the coastal marine area such as Special Protected Areas (SPAs), Special Areas of Conservation (SACs) and Natural Heritage Areas (NHAs) restrict activities that may impact on birds or habitats.
10. ***Demands for aggregate extraction and offshore energy.*** Demands for sand and gravel for the construction industry have extended to offshore resources. The potential for wind farm sites is being considered, particularly off the east coast. There are potential conflicts with: herring spawning grounds, salmon migratory routes, migratory birds and cetaceans.

**11. Climate change and erosion:** It is anticipated that within Ireland, sea level will rise by 17-31cm over the next 30 years. Low lying lands will experience gradual inundation of estuaries, while an increase in frequency and intensity of storms is also expected. Impact would be greatest along the east coast. Increasing rates and spatial extent of erosion are already evident on the east coast. Wexford County Council has adopted a policy of restricting development within a setback zone of 50m from the shore.

## **The Current Administrative and Legislative Framework**

While no EU Directive or legislative measure applies exclusively to the management of the coastal marine area, there are various EU policies that have a direct impact on the coastal marine area. These policies include, *inter alia*, EU Structural Funds, the Common Agricultural Policy, the Common Fisheries Policy, the Fifth Framework Environmental Action Programme. The Habitats, Birds, Environmental Impact Assessment and Water Framework Directives are also central to issues in the coastal and marine area.

The Commission Communication 511/95 launched the EU Demonstration Programme (DP) on ICZM. The ICZM DP was devised in response to concerns with regard to the degradation of coastal land, waters and resources (Commission of the European Communities, 1995). Its aim was to show what practical conditions must be met if sustainable development is to be achieved in the European coastal marine areas. Specific ICZM problems in 35 representative areas across Europe were studied (two in Ireland: Bantry Bay and Donegal Beaches). Six thematic studies (examining legislation; participation; sectoral and territorial cooperation; information needs; technologies; and EU policies) were commissioned, to extract lessons learned from the 35 demonstration projects. In addition, national response workshops were held in each country; an islandwide workshop was organised by the universities associated with the two Irish projects, and its recommendations were forwarded to the Commission.

The EU ICZM DP identified the underlying causes of the problems in the coastal marine area as follows:

- Management of the coast has **lacked vision** and is based on a limited understanding of coastal processes and dynamics; research and data collection have been isolated from end-users.
- **Inadequate involvement of stakeholders** in formulating and implementing solutions to coastal problems.
- Inappropriate and **uncoordinated sectoral legislation and policy** have often worked against long term interests of sustainable management of coastal zones.

- **Rigid bureaucratic systems** and lack of coordination between relevant administrative bodies have limited local adaptability.
- **Lack of adequate resources** and political support from higher administrative levels have hindered local initiatives.

The much anticipated official announcement of a European Strategy for ICZM (Communication from the Commission to the Council and the European Parliament on Integrated Coastal Zone Management: a Strategy for Europe (COM/2000/547), adopted 27 September, 2000-12-10) was announced in September 2000. The structure of the EU ICZM strategy, and its priorities, were determined by the analysis of the DP projects, the thematic studies, and the national responses.

The strategy states that:

1. Our coastal zones are facing serious problems of habitat destruction, water contamination, coastal erosion and resource depletion.
2. There has been a lack of knowledge, inappropriate and uncoordinated laws, a failure to involve stakeholders, and a lack of coordination between the administrative bodies.

The strategy was designed to meet prior commitments to the sustainable management of the coastal marine area, including the EU's obligations under international agreements: Chapter 17 of Agenda 21; the Jakarta Mandate on Marine and Coastal Biodiversity under the Convention on Biological Diversity, and the FAO's Code of Conduct for Responsible Fisheries (article 10 of which is devoted to ICZM).

The strategy is designed to be flexible, and defines the *EU's role* as one of *leadership* and *guidance* to support the implementation of ICZM by Member States at local, regional and national levels. To encourage ICZM action the strategy includes a proposal for a European Parliament and Council Recommendation to the Member States. It has been reviewed and amended slightly by several Parliamentary Committees, and is due for ratification shortly by the European Parliament.

## **EU Water Framework Directive**

The EU Water Framework Directive (1000/60/EC) which came into force in December 2000, is regarded as the most important legal stimulus at EU level for integrated planning, both coastal and inland. The Water Framework Directive (WFD) establishes a new framework for Community action in the field of water policy. It is viewed by the EC as part of the mechanism within which to adopt ICZM. The Directive takes a holistic approach and allows a 15 year period to each Member State to ensure compliance.

Objectives of the Directive include:

- the protection and enhancement of the status of aquatic ecosystems (and terrestrial ecosystems and wetlands directly dependent on aquatic ecosystems);
- phasing out of discharges;
- establishing a register of areas designated for protection of habitats or species; and
- reviewing the impact of human activity on the status of waters.

The WFD is moving towards ecological quality by incorporating, within its environmental objectives, quality in biology, hydrology, morphology and chemistry. The WFD adopts the river basin as the natural unit for management, requiring the development of River Basin Management Plans. It uses biological communities as long term indicators water quality.

By applying to waters extending to one nautical mile offshore, the WFD goes some way to minimising the sectoral approach to water quality and biological quality management. The Environmental Protection Agency (EPA) is the regulatory body charged with competence in implementing the WFD in Ireland.

### **OSPAR Convention**

The OSPAR Convention, to which Ireland is a signatory, is designed for the protection of the N. Atlantic Ocean. As part of the convention, Ireland and the UK have cross-border responsibility for the Celtic Sea. In the UK, Coastal Zone Fora have been established at national level; these For a address some of the issues associated with OSPAR. However, there are no equivalent fora in Ireland with whom the UK fora can cooperate.

### **Irish Perspective on Framework for Implementation of ICZM**

Ireland's legislative and administrative framework in the coastal marine area is sectoral and complex, with a strong land/marine divide (Department of the Environment and Local Government, 1997). Government departments (Department of the Marine and Natural Resources - DOMNR; Department of the Environment and Local Government - DOELG; Department of Defence; Department of Arts, Heritage Gaeltacht and the Islands - DOAHGI), state agencies, local authorities, fisheries boards, harbour authorities, the Naval Service, the Coast Guard etc. have a role to play in the management of the coastal marine area. This sectoral approach to administration is characterised by a lack of an integrated approach to coastal planning; in addition there are both real and perceived weak linkages, most frequently expressed as inadequate consultation. The DOELG, in association with the local authorities, is responsible for the management, use, activity and development of the physical environment, up to mean high water mark (MHW). The DoMNR is responsible for all developments seaward of the MHW. The EPA is the only administrative body whose functions extend across the landward / seaward divide.

A discussion document on ICZM was produced in 1997 by the three government departments: DoELG, DoMNR and DoAHGI (Department of the Environment and Local Government, 1997). The document outlines options for implementing a national framework for ICZM, recommending a programme that progressively moves from an inter-departmental committee to an independent unit. The report was broadly welcomed as a form of recognition by local, regional and national authorities of a need for coastal zone management. The recommendations in the report have yet to be implemented.

### *Current Status*

Unlike other EU Member States, Ireland does not adopt a range of management strategies or plans for ICZM, from national to regional to local; in effect the county development plans and harbour development plans incorporate aspects of ICZM. The DOMNR has, in its strategy statement 2001 – 2003 (DOMNR, 2001), reiterated the need for a comprehensive integrated framework for the sustainable management and development in the coastal marine area. The strategy states that “the Department is committed to developing, as a priority, in cooperation with other relevant Departments, an integrated coastal zone management strategy and legislative framework.” One of its main strategies within the near future is “To put in place consolidated and streamlined systems for management of the marine coastal zone and natural resources”.

A draft report on ICZM within the context of a national spatial policy is in preparation. It will form part of a series of research papers which will contribute to the National Spatial Strategy. It is examining the status of current policies, and their implications, and the requirements for coastal zone management structures.

### **Examples of local ICZM initiatives in Ireland**

#### *ICZM Pilot Projects: Donegal Sand Dune Management; Bantry Bay ICZM Charter*

- The Donegal Sand Dune Management project dealt with problems with regard to beach and sand dune management, with particular reference to erosion and accretion of sediments. It worked closely with local communities.
- The Bantry Bay ICZM Charter dealt with issues arising from the use of resources by a variety of disparate stakeholder groups. The objective of the project was to inform stakeholder groups of the issues that direct the sustainable management of coastal and marine resources, through the development of a community based Geographic Information Systems (GIS) and the inauguration of thematic working groups.



□ At an all Ireland workshop, co-ordinated by both ICZM demonstration projects (September 1999), it was unanimously agreed by representatives from various state agencies that there is a need for Integrated Coastal Zone Management within Ireland, and that a cross-border initiative or an all-Ireland approach would be welcomed.

#### *Bannow Bay*

The Bannow Bay Coastal Zone Management Group was established in 1996 as a local voluntary initiative to encourage and assist the development of a coastal zone management plan for the bay. Bannow Bay is an SAC and hosts a wide variety of activities within its relatively small, sheltered estuarine environs. The group succeeded in bringing representatives of all the bay users together to create a forum where views could be shared and a mutual understanding be developed regarding the sometimes conflicting activities present.

The work of the Bannow Bay Group has laid the foundation for further development of ICZM in the local area. However, such work is hugely dependent on the personal commitment of a few local individuals and is unsustainable without adequate funding and government recognition.

#### *CLAMS*

In 1998 BIM introduced a system for coastal aquaculture management known as CLAMS (Co-ordinated Local Aquaculture Management Systems). The CLAMS initiative aims to produce tangible outputs in the form of: description of the bay (physical characteristics, history, aquaculture operations, future potential); integration of codes of practice for aquaculture; expansion of single bay management to species other than salmon; a development plan for aquaculture; and communication networks. Bannow Bay is one of three pilot areas successfully implementing the system; the others are in Roaringwater Bay and Killary Harbour.

### **Applying GIS to ICZM**

ICZM has specific information needs, which can be broadly arranged into seven inventory categories: biological; physical; socio-demographic; economic; human use; public perception; governance (Department of Fisheries and Ocean, Canada, 1998). GIS provides a means by which to archive, correlate and analyse the relevant georeferenced datasets. The use of GIS in research projects, such as those described in Appendix I, has increased dramatically over the past ten years; this may in part be attributable to the ability of GIS to input, store, edit, manipulate and output data. The functionality of off the shelf GIS packages (e.g. ArcView; ArcGIS; Mapinfo; Idrisi; GeoMedia and Autodesk) has improved, with new versions of software providing enhanced capabilities. Benefits of propriety software include the vast pool of expertise available to the user from support mechanisms such as the homepages of the software developers. Reduced costs of GIS software have made GIS much more accessible. Computers too have become more powerful. The combination of

improved software and hardware, has resulted in the increased use of GIS as a powerful analytic tool when dealing with spatial data. In Ireland, GIS users include: state and semi-state organisations; government departments; local authorities; environmental and engineering consultants; utility groups; and most universities and institutes of technology. Thus, in marked contrast to ten years ago, GIS is now commonplace across many sectors. GIS has widespread use in local authorities; however, its use is often limited to simple map overlay and visualisation techniques. In planning departments, GIS tends to be used for creating zonation maps for County Development Plans. Despite its ability to aid decision-making where a broad array of complex criteria must be considered, GIS has yet to be used as a fundamental component of resource management in the coastal marine area.

The contribution of GIS to coastal marine resource management includes:

- the ability to handle large amounts of data and to integrate data from a greater range of relevant information sources than might have been achieved by other methods;
- the ability to represent data dynamically at a range of scales providing the coastal zone manager with a more holistic view of the issues;
- the ability to produce customised presentation and display for the end user.

A recent sphere into which GIS marine applications have moved is in the ability to provide compendium of data, usually in the form of atlases. GIS is particularly suited to the production of atlases since it allows for rapid output of a variety of cartographic visualisation preferences. Examples designed specifically for coastal and marine applications include the United Kingdom Digital Marine Atlas Project (BODC, 2001); the General Bathymetric Chart of the Oceans (BODC, 2001); the Australian Coastal Resource Atlas (Government of South Australia, 2001); and the Cruise Data Tracking System and Extended EDMED for Ireland (Cahill *et al.*, 1999; Marine Data Centre, 2001). A comprehensive digital atlas of the Irish coastal marine area, which could be used as a tool for ICZM, has yet to be developed.

Major advances have been made in Ireland in the last ten years in the collection of coastal data. Remote sensing techniques, GIS and modelling have improved data acquisition and analysis. Projects such as BioMar, Integrated Coastal Analysis and Monitoring System (ICAMS), and the National Coastline Survey using Aerial Digital Photography, etc. have resulted in a significant amount of new data made available in digital format. An increasing number of historic datasets have been digitised so that they can be used alongside current datasets for analyses. New and existing data collected by current research projects will provide additional valuable information on the coast. For example, in the Environment Research Institute and the Coastal

Resources Centre, University College Cork, 20 research projects are underway which are concerned with improving knowledge of the coastal zone (Appendix I).

The application of GIS to the coast is complicated by the temporal, multi-dimensional, dynamic nature of the coastline (Goodchild, 1999). For example, mapping of the coastline requires consideration of the tidal range. As a result, the coastline is often defined and mapped differently by different agencies.

Other problems exist when applying GIS to ICZM, and these can often be attributed to the sectoral administrative approach to coastal marine resource management. A variety of agencies and institutions are involved in the collection of coastal and marine data; this results in a range of problems in relation to both data quality and metadata. The speed with which GIS users can access coastal data can be restricted by the data holder, in particular where data distribution protocols are not in place. There is also a problem in relation to using datasets generated by research groups, whose funding necessitates a project based approach to ICZM. Research groups work on a project for the duration of the funding; at the end of the funding, the datasets are not updated, and the GIS not maintained.

Systematic management of reliable coastal data is a prerequisite to improving our understanding of coastal resources. While the Marine Data Centre successfully manages a number of key baseline datasets, the type of information required in many coastal GIS databases (e.g. the use of coastal space; coastal activities; designated areas; land-cover etc.) must be obtained from other sources. The Chorley Report (DOE, 1987) emphasised the problems experienced by users trying to obtain and use spatial data. Accurate recording of metadata facilitates the movement of data amongst data users: however, comprehensive metadata of Irish datasets are often not available. Typical metadata for geographic data would include ownership details; lineage details; availability; cost; coverage; scale; update frequency etc. At present, many different kinds of metadata products and many different metadata standards for geographic information exist (e.g. CEN 287, ISO/TC211, Dublin Core, FGDC Content Standard for Geospatial Metadata etc.). The recently established Irish Sea Marine Information System (<http://www.irishsea-mis.org/>) is a successful demonstration project providing a single point of access to a wide variety of metadata on marine and coastal datasets in the Southern Irish Sea Interreg area. However, the majority of the datasets incorporated have been provided by research groups already working in the area, rather than by statutory agencies or national administration.

#### *Case Study - The application of GIS to ICZM in Bantry Bay*

The GIS in the LIFE funded Bantry Bay ICZM Charter project was intended to assist in the development of a consensual approach to the stakeholder charter. Many of the potential end users amongst the stakeholders in Bantry Bay were not accustomed to operating GIS software, so the GIS, incorporating over 120 datasets, was customised

at the final development stage to make it as user-friendly as possible. The project showed that the role of GIS in ICZM has potential as an effective method of communicating information to stakeholders. However, the Bantry Bay GIS has not been updated since the end of the project; the datasets contained in the GIS are quickly becoming out of date. There were also issues with regard to data acquisition and copyright. As a result of the plethora of agencies involved in the coastal marine area, there are many sources of information, and many standards of data available. Even with the support of Cork County Council, gaining access to relevant information was problematic. While GIS was not a tool that people found immediately usable, the web-based application provides an interface that is becoming much more familiar and intuitive to users. However, the web-based application was faced with issues of copyright with regard to data within the GIS. In the future, web enabled mapping will make this method of distribution potentially more suitable to developments in GIS for ICZM.

## Conclusions

Impacts on Irish marine and coastal areas can be classified as bio-physical or human problems. Biophysical problems include coastal erosion; habitat destruction; problems with water quality and climate change. Human problems are characterised by development, as the current expansion of the Irish economy is leading to greater development pressures in marine and coastal areas.

The EU DP on ICZM concluded that an integrated territorial approach would help to avoid conflict between multiple users and uncoordinated sectoral policies and ensure effective implementation of many EU sectoral goals.

A mismatch between concepts/regulations and their actual implementation is apparent; ICZM may be the way of making these concepts more effective.

There is an increased awareness of the need for ICZM at the European and national levels (European Strategy for ICZM, 2000; DoMNR Strategy Statement, 2001-2003). The EU's contribution to ICZM has been supportive rather than regulatory. The Water Framework Directive is expected to provide a key mechanism within which to adopt ICZM. However, this approach may not be satisfactory as the complexity of coastal issues may require a more comprehensive legislative framework.

The Irish legislative and administrative framework for ICZM is characterised by a complex sectoral approach with a strong land/marine divide. Despite the publication of reports such as the Draft Report for ICZM (Brady *et al*, 1999) there is, as yet, no national policy on ICZM in Ireland. It is unclear how and when the current Coastal Zone Management Draft Policy will translate into effective action guiding activities.

The implementation of a framework for ICZM has been limited to local initiatives such as the Bantry Bay Charter Project and the Bannow Bay Coastal Zone Management Group. Delays in taking a proactive approach to ICZM by adopting a national policy may have major implications on the marine and coastal area, particularly in light of current development pressures.

The use of GIS in ICZM is characterized by the dynamic multi temporal and multi dimensional nature of the coastal zone. There has been a huge increase in the number of GIS developers and users in Ireland over the last ten years. However, the application of GIS to ICZM is often limited to research projects, and not fully integrated into the management and planning framework of government departments and local authorities where it could be an effective coastal management tool. The future development of an Irish digital marine and coastal atlas would integrate many disparate data sources, thus providing a valuable source of information to decision makers. Key issues associated with Irish coastal data are: data availability, metadata documentation and data quality.

There is also a problem in relation to using datasets generated by research groups, whose funding necessitates a project based approach to ICZM. Research groups work on a project for the duration of the funding; at the end of the funding, the datasets are not updated, and the GIS not maintained.

The best aims of a rational system of coastal zone planning may not sit with the machinations of local politics. In some cases, agencies indicated willingness to adopt a policy for dealing with coastal issues within their remit, but requested guidance as to how best to do so.

## **Recommendations**

A national coastal marine resource management strategy is required to assist local authorities, harbour authorities and development agencies to advise on inclusion of ICZM in development plans.

A structure is needed to facilitate cooperation between local authorities, the DoMNR, state agencies, harbour authorities etc.

Coastal and marine fora should be established; they could advise on approaches to implementation of requirements of EU policy and OSPAR.

There is a need to carry out a proper analysis of the multiple uses of a particular coastal area; such analysis would include an assessment of conflicts and possible solutions.

There is requirement for greater adherence to the principles of ICZM, nationally, and at the local level, so that resources may be exploited beneficially and with minimal environmental impact.

A scientifically rigorous approach to the development of sound indicators of status of coastal and marine environmental quality should be established; only then will trends be accurately identified, allowing for more strategic planning.

An overview of existing data sets and information should be compiled. Information should be shared between authorities and agencies. A central policy on types of data that should be collected needs to be developed. Clear information paths to locate relevant data should be established.

Where coastal and marine GIS initiatives have been generated from research projects with funding limitations, there should be a national capacity to maintain and update the systems. This would ensure that the valuable information held within the system continues to be of relevance and available to responsible agencies and authorities.

Community participation should be recognised as an important contributory factor in the development of ICZM strategies.

A new LACOAST type project would document the percentage of agricultural land in the coastal area, and the percentage that is now developed; this would provide comparison with the results of the 1996 study. This is of particular importance on the east coast, where sea level rise is likely to cause further erosion and inundations. In addition, increased storminess, and associated flooding, is likely to impact on all of our major cities.

A policy of setback, to restrict development within a certain distance from the shore, should be adopted by each coastal local authority. Approach adopted by Wexford County Council should be considered.

A greater respect for and adherence to designations for protection of habitats. In addition, habitats that are not designated as SAC or SPA should be considered for national or local designations.