SCIENCE BASED INTEGRATED COASTAL ZONE MANAGEMENT IN THE BALEARIC ISLANDS

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INTRODUCTION

The Balearic Islands are an autonomous community of Spain located in the Western Mediterranean. In islands such as these, where 'sun and beach' tourism is the leading economic activity in the coastal zone, the competitiveness of the private sector and the health of marine and coastal environments are entirely interdependent. On a more fundamental level, the quality of life of the island's residents is inextricably intertwined with the fate of these environments. The recognition of Integrated Coastal Zone Management (ICZM) as a theoretical concept and tool for managing coastal areas is a relatively new phenomenon in Spain. A recent article in the journal *Coastal Management* highlighted the "failure of coastal management in the Spanish Mediterranean region," attributing it to lack of political will, low levels of public participation mechanisms, a loss of legitimacy of public policies and the fact that the Spanish political and administrative framework for ICZM is extremely complex (Suárez de Vivero and Rodríguez 2005).

The commitment of the Government of the Balearic Islands to reversing the trend highlighted above is evidenced by their collaboration with the IMEDEA, a well-established scientific research center on the island of Mallorca, through the Balearic ICZM Project (Phase I: 2005-2007). The overall objective of the project is to conduct scientific research to generate information that will help decision-makers in the Balearics to progress towards implementing ICZM and achieve sustainability in the coastal zone. The conceptual framework of the project reflects the three basic needs of integrated, predictive, and adaptive ecosystem management proposed by Ayensu et al. (1999). These include: Reliable, site-specific baseline data; information that will allow the public and private sectors to predict how biophysical changes will affect the production of ecosystem goods and services, and; integrated, regional models to aid policy makers in selecting appropriate management actions. Also in line with Ayensu et al. (1999), the Project recognizes the importance of local participation and of understanding the interactions between humans and ecosystems at different spatial and temporal scales.

BACKGROUND

The threats to environmental, socio-economic, and cultural resources posed by human activities in coastal areas of Europe have become increasingly evident in recent years. As the phenomenon of global change becomes more real, these threats are strengthening. In

recognition of this, in May 2002, the European Parliament and Council adopted the European Commission's Recommendation Concerning the Implementation of ICZM in Europe (2002/413/EC). This recommendation, which was fueled by the 1996-99 European Union's Demonstration Programme, represents the first significant regional and political movement towards ICZM in Europe.
The Mediterranean Sea is a small-scale ocean particularly suited to addressing scientific questions related to coastal interactions and global change. The area faces significant anthropogenic pressures including high levels of tourism, population growth, climate change, pollution and over fishing, many of which are exacerbated by the fact that it is a semi-enclosed sea. Ameliorating these threats is especially challenging given the large number of countries that border the sea. The Balearic Islands in particular represent an interesting environment for implementing ICZM. Despite the fact that the archipelago is a mature tourism destination receiving approximately 10 million tourists annually (CITTIB 2006), the islands still boast a high level of environmental and cultural protection. This in itself poses a massive challenge to coastal managers but, in addition, the coasts of the Balearics face a number of other imminent threats including pollution that leads to the deterioration of seawater quality, diminished sanitary conditions for swimming, and algal blooms, proliferation of invasive species, diminishing *Posidonia oceanica* meadows, loss of fishing areas, beach erosion, sand dune loss, and coastal urbanization (Tintoré et al. 2002). The natural, socio-economic, cultural and political diversity that exists among the different Balearic Islands themselves also creates an interesting and valuable environment for ICZM related research and policy development.

In addition to facing a series of threats that are characteristic of many coastal zones throughout the world, the Balearic Islands posses all the elements of insularity that challenge the implementation of ICZM. These include, among others, limited resources, waste management, and heightened sensitivity to environmental and socio-economic change. For example, scarcity of space on the islands, which was an issue of serious concern by the early 1990s, has resulted in the implementation of a series of highly restrictive regulations on construction. A 2002 study by the European Islands System of Links and Exchanges reports that this led to a 74% increase in housing prices between 1994-99 (compared with only a 25% increase on the mainland of Spain) and an additional 55.5% from 1998-2000. This made the Balearics the Spanish region with the highest housing price increase during this period and has resulted in the fact that many of the island's residents can not afford housing (ibid.). The susceptibility of the island's residents to the pressures of coastal development, loss of natural resources, and socio-political changes, necessitates an integrated, targeted approach to addressing these problems. The Balearics are particularly suited to address this challenge due to the combination among the strong scientific support provided by IMEDEA, significant political and financial support from the Government, and the evident recognition of civil

society that the success and competitiveness of local businesses are entirely dependent on the health of the natural environment and the sustainable use of natural resources.

METHODS

The challenges outlined in the previous section are being addressed by an interdisciplinary group of over 50 scientists at IMEDEA though the Balearic ICZM Project (2005-2010). Project activities fall under three major categories: (1) Targeted, disciplinary research aimed at addressing specific data needs and priorities to progress towards ICZM, (2) Interdisciplinary research aimed at addressing cross-cutting issues, and (3) The generation of technological and conceptual tools and models that will assist decision-makers to effectively manage the coastal zone and address specific issues related to ICZM. Congruent with this are activities to promote the involvement and collaboration of stakeholders and the continuous divulgence of information in useable, comprehendible format to decision-makers. The following section describes some of the most significant advances in the Balearic ICZM project to date.

RESULTS

In relation to the first category of research activities has been the development of 32 targeted research projects to address specific ICZM needs. These needs have been identified through prior, local research studies, consultations with stakeholders and, in the majority of cases, reflect well-established international priorities. As mentioned previously, tourism is the most significant anthropogenic activity in the coastal zone of the Balearic Islands. In the summer of 2006, a series of survey interviews were carried out with 1882 resident and 645 tourist beach users in six pilot sites on the island of Mallorca. The objectives of this research are, (1) to provide a socio-demographic, temporal and attitudinal profile of beach users, (2) to compare beach user perceptions of the beach experience, overcrowding and general satisfaction levels, (3) to identify conflicts between tourists and locals and between different types of tourists, and thus (4) to propose measures to better manage beach environments. Analysis of the data indicates that the pilot sites are all reaching a point of saturation that may be starting to have a negative effect on the visitor experience. This has necessitated the development of a proposal for a more extensive ethnographic study of tourism impact perceptions in coastal communities of the Balearics. The purpose of the research, which will be initiated on the island of Mallorca, will be to assess the socio-economic, cultural, and environmental effects of tourism in coastal communities based on the perceptions and characteristics of residents and tourists. The results will be used to generate a series of recommendations for sustainable tourism development. In the future, comparative assessments of tourism in the other Balearic Islands, including additional studies from economic and natural science perspectives will allow IMEDEA to build upon these findings and thus, through the provision of critical, much needed information, advance

towards a model that will help the private sector and government make informed, conscientious decisions about sustainable tourism development.

In addition to the tourism study outlined above, significant targeted research includes an extensive classification study of the coastal zone of the island of Mallorca through the use of aerial photographs and spatial data. The ultimate intent of this study has been to develop an ICZM zoning plan for the island, which includes the identification of coastal management units and key management areas. A related, more specific study includes a morphodynamic classification of the beaches in Mallorca (Gómez-Pujol et al. 2007). Having a clear picture of the morphological structure of the coastline and the various, interconnected factors that affect it (i.e. urban areas, sources of pollution, position of the aquifer, composition of the sediment etc.) are key elements of ICZM.

In relation to project activity category 2, namely, interdisciplinary research, the most significant product to date has been the development of a core list of indicators for assessing and monitoring ICZM in the Islands. This has been achieved through a full evaluation of international scientific standards and protocols for indicator development and also through a participatory, cooperative process in order to tailor such standards to the environmental-socio-economic reality of the Balearic Islands. The ultimate goal of this project is for the Government of the Balearic Islands to adopt and facilitate the implementation of the proposed set of indicators.

Two significant tools for ICZM decision-making (project activity category 3) include development of a Coastal Geographic Information System (GIS) Database and a proposal for a Coastal Ocean Observing System for the Balearic Islands. The Coastal GIS Database grants public access to environmental, oceanographic and socio-economic data from the coastal zone (http://www.imedea.uib. es/gis/). These data have been compiled from a variety of sources including, specific projects related to the Balearic ICZM Project, the European Union, the Government of the Balearic Islands, and additional international, regional and local sources. The data undergo a rigorous quality control process before they are incorporated into the Coastal GIS Database. A data management tool has also been established that facilitates access to external GIS databases to further aid with decision-making. Specifically, the data have been organized according to a categorical system that is in line with the environmental themes of the European Union's INSPIRE Directive (http://eu-geoportal.jrc.it/). Broad topic areas include the natural environment, the socio-economic and cultural environment and governance. With the creation of each new ICZM related project, new data are continually being added to the system.

The proposal for the Coastal Ocean Observing System (COOS) suggests the installment of a technological platform that, through the use of real-time observations and predictive

models, will allow for the collection of data that will help ICZM decision-makers to track ICZM efforts and the health of the coastal zone. On February 11th 2007, the proposal was included in the Balearic Island's Third Conference of the President's Technological Innovation and Development Investment Plan. This represents a highly important National scientific achievement and represents a significant scientific, technological and entrepreneurial challenge in terms of design and implementation. The installation of the COOS and the continued development of the Coastal GIS Database for the Balearics will allow decision-makers to make significant advancements towards implementing ICZM in the Islands that is based on viable scientific knowledge, thus helping to bridge the often evasive gap between science and policy.

FUTURE DIRECTIONS AND CHALLENGES

ICZM is a relatively new concept in Europe, particularly for Spain and the Balearic Islands. This has resulted in the fact that the Balearic ICZM Project essentially started from scratch two years ago with virtually nothing to build upon. Researchers are faced with limited sources of interdisciplinary coastal data, relatively few past experiences to learn from, little to no governance infrastructure supporting ICZM, and a minimal level of public understanding of the concept. This scenario continues to impose significant challenges to the project yet, with the continued support and commitment of the Government of the Balearic Islands and the substantial interest of civil society, IMEDEA is progressing towards the goal of establishing ICZM as the primary management tool for ensuring the continued balance between society and a health coastal environment in the Islands. Planned future project activities include, among others, the continued updating of the Coastal GIS Database, the implementation of the Coastal Ocean Observing System, continued, rigorous research related to sustainable tourism, the development of a human-ecosystem impact model for the Balearic Islands, and the routine evaluation of project activities through the use of the core set of indicators for monitoring and assessing ICZM in the islands. The final intended output will be to use this information and, in collaboration with the Government of the Balearic Islands and additional decision-makers, to develop an ICZM Management Plan for the Balearic Islands in 2010.

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