

## Ecological research for integrated coastal zone management: Introduction

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**Abstract.** Two Special Features on integrated coastal zone management, especially along the Mediterranean Sea, result from a MEDCOAST conference held in Hammamet (Tunisia), 20-25 October 2001. In this first Special Feature some papers are presented on ecological and biological research related to integrated coastal zone management. All over Europe coastal environments are threatened by human activities such as urbanization, industrial development, fisheries, aquaculture, recreation and tourism. Research has to be developed that can be applied to similar case studies in different countries. Methods of monitoring are necessary and baseline data have to be available in order to judge the significance of changes in the abiotic and biotic environment. Examples of studies included in this Special Feature are mainly from southern banks of the Mediterranean Sea but there is also an example from Estonia and one from the Canary Islands.

**Keywords:** Biodiversity; *Caulerpa*; Endemism; Invasive species; MEDCOAST; Mediterranean Sea; *Posidonia*; Sea-grass.

Mediterranean ecosystems are of major ecological importance as compared to other biogeographical zones of the biosphere, particularly in terms of biodiversity and endemism. Since 20 years, human activities, often environmentally harmful, have rapidly increased. The resulting ecological disturbance are mortgaging the future. Several disturbances concern the coastal zone. Indeed, as a zone of contact between sky, sea and land, the coastline is fragile and the inshore fringe is narrow. The numerous human activities, such as urbanization, industrial development, fisheries, aquaculture, recreation and tourism, are often antagonistic.

As a reaction, the concept of integrated coastal zone management (ICZM) was born; its aim is to develop sustainable development of the coastal zone and its resources. The *Journal of Coastal Conservation* has already paid attention to ICZM, notably in the Special Feature on integrated coastal management (Dronkers 1999).

The activities of the MEDCOAST network are based on the concept of integrated coastal zone management. The report in the *Journal of Coastal Conservation* on the earlier Second MEDCOAST conference (Özhan

1998) provides a good example of the interactions between research and management of coastal ecosystems in an ICZM context. The Fifth International Conference on the Mediterranean Coastal Environment, continued along these lines. This conference, held in September 2001 in Hammamet, was the first of this kind organized in Tunisia. Naturally, coastal research in the southern Mediterranean received more attention than in previous meetings. It was decided to publish both a selection of papers on biological and ecological research resulting from the Hammamet conference and a series of papers on management aspects in the *Journal of Coastal Conservation* and the following papers form the first series.

The first stage towards efficient management of coastal environments is the collection of information concerning the geographical distribution and the health of the resources to be managed. While the level of knowledge concerning terrestrial ecosystems is generally satisfactory, littoral coastal ecosystems have only scarcely been studied. It is also important to perform accurate inventories, achieved with methods shared by all European countries, such as the CORINE Land Cover system. The study of Ehrlich *et al.* (2002; this issue): "Land cover types and ecological conditions of the Estonian coast" is a good example. This work presents a detailed analysis of land cover type along the Estonian coast and enables comparisons with other European regions.

The study by Pergent *et al.* (2002; this issue) "Characterization of the benthic vegetation in the Farwà Lagoon (Libya)" is of similar interest. It presents a precise cartography of the major key species of the Mediterranean basin: *Posidonia oceanica*, which is included in the list of protected species of the Barcelona convention. It also provides information on the state of health of populations of this species.

We also need baseline studies as a basis for the description of changes in coastal ecosystems as a result of natural and anthropogenic influences, and to predict their future development upon restoration measures. An example here is the study by Shili *et al.* (2000a; this issue): "Seasonal dynamics of macro-algae in the South

Lake of Tunis". These types of studies permit more accurately to evaluate temporal changes, while differentiating between:

1. Changes due to the modification of environmental factors, as is the case in the study object of *Shili et al.* (2000b; this issue): "Benthic macrophyte communities in the Ghar El Melh lagoon (North Tunisia)". This work shows the transformations observed since the 1970s in the biodiversity and the spatial distribution of dominant communities.

2. Perturbations directly linked to human activities, as those identified in the survey of *Mzoughi et al.* (2002; this issue): "Inorganic mercury and methylmercury in surface sediments and mussel tissues from a microtidal lagoon (Bizerte, Tunisia)".

In the second stage methods and equipment should be available that permit the fast and reliable monitoring, quickly and reliably, of the ecological condition of coastal zones. Up till now, monitoring of and control programmes for the marine environment were mainly focused on the analysis of the physico-chemical status of coastal waters. More recently, an integrated approach was developed which concentrates on the use of plants and animals, particularly indicator species which are known to indicate specific environmental conditions and which respond to changes, natural or human-induced, in these conditions.

Living organisms are in fact the most appropriate indicators because they integrate the biotic and abiotic components of the ecosystems under monitoring. The study by *Casazza et al.* (2000; this issue): "The use of bio-indicators for quality assessments of the marine environment: Examples from the Mediterranean Sea" presents an example of the modern use of biological indicators and indices and represents the state of the art of this topic.

During the preparation of this Special Feature the paper by *Tuya et al.* (2000; this issue): "Impact of a marina construction on a seagrass bed at Lanzarote (Canary Islands)" was accepted by the *Journal of Coastal Conservation*. Since it fits well in this Special Feature we wished to include it in the Feature. It will be this type of development and its impacts that will keep coastal ecologists and marine biologists busy for the years to come.

Finally, the study by *Langar et al.* (2002; this issue): "Extension of two *Caulerpa* species along the Tunisian coast" introduces within the framework of this Special Feature the problem of invasive species and their impact on native species and Mediterranean biodiversity at large. The observations presented in this contribution also imply the multiplicity of the origin of introduced species.

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