NETWORK FOR SEAGRASS MONITORING AT THE CATALAN COAST

by Pere Renom & Javier Romero

Although environmental conservation has become a common concern, there is a chronic lack of public participation in environmental studies and management. Traditionally, scientists have been the only ones responsible for gathering knowledge about natural resources. This knowledge is often not properly transmitted to the public. Seagrass meadows are endangered ecosystems that have experienced a very clear decline in recent years. The Xarxa de Vigilància dels Alguers (Network for Seagrass Monitoring) was launched in 1998 and aims to obtain information of scientific relevance on the long term evolution of these coastal ecosystems; provide a basis to implement a sustainable management plan; and to stimulate the direct participation of the public in this study. During 1998, more than 70 organisations (including diving centres, schools, city councils, naturalist associations, fishing fraternities and many others) helped in collecting data from a total of 18 sites along the Catalan Coast (NE Spain).

Mediterranean seagrass meadows

Seagrass meadows form one of the most important communities of the Mediterranean sub-littoral ecosystems. These systems generally occur on sedimentary bottoms and are constituted by plants that, like terrestrial plants, have roots, leaves, a stem, flowers, fruits and seeds. There are about 60 species of seagrasses in the world but only four are found in the Mediterranean. Most meadows, including the largest ones, are formed by the species *Posidonia oceanica*, which only occurs in the Mediterranean Sea.

The seagrass meadows exhibit a high biodiversity as well as a high production, thus playing an essential role in the biology and ecology of the entire coastal zone. The leaves of the plant are an excellent substrate for many species of animals and algae. Seagrass meadows are important areas for spawning, feeding and sheltering for many fish and invertebrate animal species. An important part of the carbohydrates produced is exported to less productive areas in the form of dead leaves, contributing to the biological richness of neighbouring ecosystems. In addition, seagrass plays a role in protecting beaches against erosion (see box).

Unfortunately, the plants are very sensitive to environmental disturbances. Human activities,

Posidonia beds

The beds of *Posidonia oceanica* occur in linear fringes, between 0.2 and 40 m below sea level. It is included as a priority habitat in the EC Habitats Directive. These seagrass beds are the most important ecosystem of the Mediterranean Sea for a number of reasons:
they provide essential feeding and breeding grounds for sea turtles, waterfowl, cephalopods, crustaceans, shellfish and finfish;
they are of great economic importance for fisheries and tourism;
they protect coasts against erosion (a loss of 1 m of Posidonia bed may cause a shoreline regression of nearly 20 m).

Posidonia meadows are not rare. Nevertheless, they have suffered a progressive and irreversible regression throughout the Mediterranean due to:
sand extraction and development of infrastructure, harbours and artificial beaches, increasing turbidity and covering the beds with sand;
damming of rivers: changes in sedimentation in the littoral zone have led to either exposing or burying of habitat;
trawling and anchoring, especially destructive to exposed rhizomes;
eutrophication, aggravating algal blooms;
sewage and industrial waste discharge cause a complete loss of the habitat locally;
Caulerpa taxifolia (a tropical algae introduced in the French Mediterranean in 1984), which is progressively overwhelming Posidonia beds.

The situation in the Western Mediterranean is the most serious. Shoot density is rapidly decreasing, up to 50 % over a few decades. Along the French mainland coast habitat loss is estimated at 10 to 15 %, but taking into account the decrease of shoot density the overall decline of the resource will be between 30 and 40 %. This is probably a good estimate for most Western Mediterranean coastlines, although the situation around the islands and in the Eastern Mediterranean is better.

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Fig. 1. Situation and distribution of workstations during 1998 in Catalan coast.

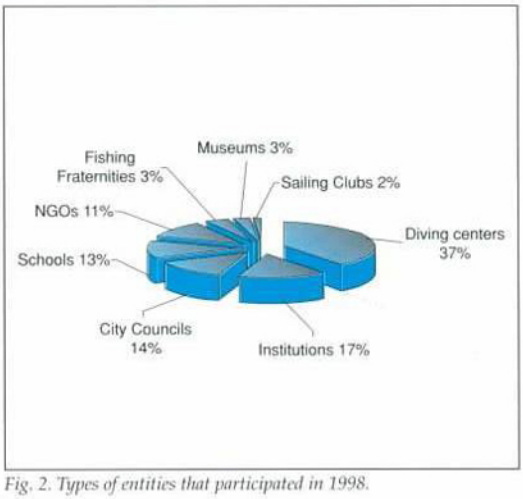

Fig. 2. Types of entities that participated in 1998.

mostly concentrated in a narrow sea-land interface, modify the natural conditions with dramatic outcomes for these ecosystems. Artificial beach nourishment, fish-trawling over seagrass meadows (which is illegal), damage from anchors of small boats and urban pollution are all detrimental to the meadows. *Posidonia oceanica* is a plant with a very slow capacity of recuperation, taking over a century to extend a surface of one hectare. Consequently, the conservation of these ecosystems appear as a major challenge for managers and a matter of public concern (see the box for more details). Paradoxically, how and to which extent the decline occurs, is only very poorly understood, which points to the need for a long term study that leads to a detailed analysis of the evolution and current state of this species.

The monitoring network

The Network for Seagrass Monitoring is an initiative of the Direcció General de Pesca Marítima (Directorate of Fisheries of the autonomous government of Catalonia), with the scientific and technical support of the Marine School of Badalona and the Department of Ecology of the University of Barcelona.

Volunteers counting Posidonia shoot densities in Mataró. (Foto: Josep Borràs, SPAS)

The plans for the first phase, scheduled for the period 1998-2000, include the establishment of the network along the Catalan Coast (NE Spain, see Fig. 1) to obtain information on the health and development of these ecosystems. All the tasks are to be performed by volunteer divers, adequately trained by University staff. This part of the work does not only include participation of individuals, but is supported technically and economically by a variety of organisations, such as diving centres, city councils, schools, museums, naturalist and ecologist associations and other NGOs. The cohesion and motivation

of all the participants is ensured by regularly organising meetings and conferences, maintaining a WEB page, submission of a newsletter, etc. The second phase extends to 2001-2010, and will mainly be focussed around the consolidation of the network. The tasks of the technical staff will then mainly be limited to the central collection, management and quality control of the data.

The biological and ecological parameters measured at each site are density (number of plants per square meter), cover (percentage of bottom occupied by plants) and burial (height of the plant in relation to sediment). In some cases attention is also paid to some qualitative aspects, such as the occurrence of fish species, invertebrates present (urchins, sea cucumbers, sea stars), type of sediment, degree of epiphytic colonisation (organisms fixed on to the plant leaves) and presence of rubbish. The placement of workstations is done according to geographical and ecological criteria, their representation is guaranteed, since regional and local variability is taken into account. The fieldwork is divided into the following steps: (a) Exploration, university staff and a few (1-2) local volunteers identify an appropriate site within a given area, and determine base features; (b) Marking, iron bars are planted on the meadows' boundaries; (c) Data collection, 10-20 volunteers, and at least one member of the scientific team dive in the selected site to gather data.
The annual results are published and distributed amongst all organisations and individuals that took part. Apart from the collection of data, a highly important feature of the project is environmental information and education of the public, directed towards the involvement of a variety of segments of society in the research and conservation of this relatively unknown part of our natural heritage.

Results

The results of the first year show that the data on density and cover are highly variable. Most of the variation in both density and cover can be explained by depth: shallow sites support large and denser meadows than deep sites. Those sites with lower values of cover and/or shoot density within a given depth are suspected to be in a more or less pronounced state of degradation (e.g. Coma-ruga 1, El Roc de St. Gaietà, and Aiguadolç). However, long-term data is needed to confirm this observation.
More than 65 entities and institutions participated in the network (see fig. 2). During 1998, 152 volunteers performed underwater tasks and at least 25 more participated indirectly. A post-diving questionnaire showed that the participants were very enthusiastic and, in general, felt rather satisfied by the work. In total 238 dives were carried out by volunteers and 59 by technical staff.

Posidonia oceanica meadow. (Photo: Albert Maria i Soliva)

Conclusions

The experience from this project has shown that large parts of this kind of scientific research can be carried out with the help of volunteers, delivering useful data that otherwise would be very costly in time and funding to obtain. Involving the public leads to an increase in awareness and 'ownership' of environmental conservation through this gathering of knowledge on the precious *Posidonia oceanica* ecosystems.

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Seagrass Monitoring Network website (mainly in Catalan):
http://www.gencat.es/darp/pesca/faneroga/cfanein.htm