MAPPING OF ASSEMBLAGES AND BOTTOM TYPES IN LITTORAL LAGOONS OF CORSICA : A FRAMEWORK FOR SETTING UP A MONITORING PROGRAM

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Abstract

The wetlands of the Mediterranean are now considered to be of major ecological and economic value. They are characterized by an exceptional productivity and biological diversity and appear to be increasingly threatened by anthropogenic activity. In light of this, and in order to implement monitoring programs in these ecosystems, an assessment must be made of the living resources present and of their distribution. To this end, the mapping of three Corsican lagoons was performed using image analysis. The results reveal extensive fluctuations over time, with the regression of phanerogam meadows and the spread of silt substrates. The reason behind these phenomena must be sough out and closely monitored.

Key words: western Mediterranean; mapping; aquatic phanerogams

Introduction

Wetlands are biotopes whose fragility is exacerbated by their presence along the Mediterranean coastline, narrow region which is the site of a great number of anthropogenic activities. Although they are included in the Ramsar Convention, the Mediterranean lagoons are rarely the object of efficient protective measures and remain very sensitive to the quality of the surrounding environment. They are characterized by a high productivity, which makes them ideal for fisheries and aquaculture activities (1). At present, the management of these zones necessitates the drawing up of a reference state with respect to the resources to be managed, in particular since very little data is available to aid the decision makers in their task of managing these environments. The objectives of the present study were thus to map, using image treatment, the three main/largest Corsican lagoons (Biguglia, Diana and Urbino) with a view to subsequently implementing a monitoring program.

Materials and methods

The most important/largest Corsican lagoons are located on the eastern coast. They are, from north to south, Biguglia, Diana and Urbino lagoons. These three lagoons are noticeably different in terms of both their typology and the anthropogenic pressures to which they are subjected (Table I). Image analysis was performed using photographs (scale of 1/10,000) taken in June 1999 (Compagnia Generale Ripresaeree®). These photographs (from 5 to 12 per lagoon) were digitized in order to obtain a pixel size of 2 m. Image treatment was performed using the Multiscope software (Matra Système et Information®; 3). Field observations were made in June 1999 and 2000 to identify the assemblages and bottom types, either from the surface when visibility was good, or by SCUBA diving. Each data was situated using a differential GPS.

Table I: Characteristics of the study sites. The scale used for salinity is that adopted by the Venice Committee/Commission (2).

Lagoon	Max. depth	Surface area (ha)	Salinity	Anthropogenic sources
Biguglia	1.8 m	1500	4 - 26 ‰ (Mesohaline)	Urban and industrial wastes Agriculture Leaching of watershed
Diana			26-44 ‰ (Euhaline)	Aquaculture activities Agriculture
Urbino	9.2 m	760	26-44 ‰ (Euhaline)	Aquaculture activities Agriculture

Results and discussion

Following image treatment, we obtained a map of the assemblages and bottom types for each of the lagoons, thus allowing us to identify four main biotopes : sand, silt, photophilous algae and phanerogam meadows (Table II). The type of phanerogams present differs from one lagoon to the next. Due to a low salinity, phanerogam meadows made up of *Ruppia sp*. and *Potamogeton pectinatus* dominate in Biguglia lagoon, the latter species being poorly represented (less than 10 ha versus over 177 ha for *Ruppia sp*). In Diana and Urbino lagoon, the phanerogam meadows are mainly made up of *Cymodocea nodosa*, with small formations of *Ruppia sp* in the north-western section of Diana and in proximity to the region of freshwater influx in Urbino lagoon. Small phanerogam meadows of *Zostera noltii* are also observed in this last lagoon. Regardless of the lagoon examined, the meadows are present mainly along the edge of the lagoon and occupy small surface areas as compared to the silt biotopes (Table II). The macrophyte formations are only present within the phanerogams, with the exception of Biguglia in which large sections of the lagoon are covered by photophilous algae, particularly in the northern reaches of the lagoon. In Biguglia lagoon, literature data reveal that a regression of the phanerogam meadows has been occurring over the past years. Indeed, in 1973 the meadows occupied almost all of the lagoon (4), whereas they only covered 50 % of the lagoon bottoms in 1992 (5). The dense *Zostera noltii* meadows

Table II: Surface area (expressed as a %) of the assemblages and bottom types in the Corsican lagoons of Biguglia, Diana and Urbino.

Biotope	Biguglia lagoon	Diana lagoon	Urbino lagoon
Sand	2.6	7.9	9.2
Silt	77.0	88.1	70.1
Photophilous algae photophiles	6.5		
Phanerogam seagrass beds	13.9	4.0	20.7

described in the northern section of the lagoon in 1994 (6) has completely disappeared. This decrease in phanerogam bottom cover is concomitant to an increase in the percentage of silt bottoms, which have gone from 43.7 % of the lagoon in 1996 (7) to 77 % (Table II). A regression of the meadows since 1970 can also be observed in Diana lagoon (4), with an apparent stabilization of the situation since 1996 (8), although this site tends to fluctuate from one year to the next. In addition, a decrease in the fine and conchiferous sand biotope is observed in the central portion of the lagoon (9), this biotope being replaced by silt. In Urbino lagoon, the situation appears comparable to that observed in 1990. The seagrass bed regressions observed in 1994, following exceptionally high rainfall values in November 1993, are no longer visible, although the location of the phanerogam meadows has changed somewhat, with a spread of the phanerogams in the central region of the lagoon and a regression in the northern and western regions.

Conclusion

The mapping efforts made have allowed us to identify the different assemblages and bottom types present in the largest Corsican lagoons, which include aquatic phanerogams. These phanerogams meadows are well represented in the lagoons of Biguglia and Urbino. Fluctuations in phanerogams bottom cover over time are observed in the three lagoons and extensive silting phenomena are detected in Biguglia and Diana lagoons. In light of their probable impact on meadows, these phenomena should be monitored and their origin determined in order to ascertain whether they correspond to limited and reversible meteorological events, or if they reflect a general silting up of the lagoons. The results obtained confirm the value of image treatment based on aerial photographs within the framework of littoral lagoon monitoring programs and demonstrate that such techniques could be generalized to the monitoring of other Mediterranean coastal lagoons.

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