MONITORING AQUATIC PHANEROGAM BEDS IN VARIOUS CORSICAN COASTAL LAGOONS

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Abstract
A monitoring system was set up in three Corsican lagoons, using phanerogams as a biological indicator of environmental quality. The species observed were *Ruppia sp., Zostera noltii Cymodocea nodosa*. The observations would tend to confirm the extensive temporal variability of macrophyte assemblages in term of repartition, biomass or density.

Key words : Lagoons, Monitoring, Phanerogams, Biomass, Density

Introduction

Coastal lagoons occupy 13% of the coastal area worldwide, and are often impacted by natural and anthropogenic influences (1). The Corsican coast possesses over fifty lagoons, which cover an area of close to 3,000 hectares. Aquatic phanerogams are major components of these lagoonal ecosystems with respect to their biomass and the role they play in these ecosystems. In light of this, a monitoring system was set up in three Corsican lagoons, using phanerogams as a biological indicator of environmental quality. The aim of this study was to monitor those parameters classically used to assess the overall health of these meadows, namely biomass, density, the organic matter content of the sediment and the mercury concentration in the shoots.

Materials and methods

Three sites were selected. These are, going from north to south, Biguglia lagoon, Urbino lagoon and Santa Guilia lagoon (Corsica, France). These three lagoons exhibit notable differences in typology, species diversity and levels of anthropogenic pressures (Table 1). Permanent monitoring structures were put in place in July 1997 to allow the evolution of the different seagrass beds to be followed. These structures consisted of a set of buoys and a transect for Biguglia lagoon, two transects for Urbino lagoon and one transect for Santa Giulia (2).

The overall condition of seagrass beds was seasonally evaluated at each station from January 1998 to July 1999. The samples were obtained using a cylindrical corer measuring 15 cm in diameter and 50 cm in height. Five replicates were taken for each of the parameters measured and for each species. The parameters examined were : (i) the density, (ii) the biomass of above-ground and below-ground tissues, (iii) the organic matter content of the sediment and (iv) the mercury concentration in the shoots (3).

Results and discussion

The *Ruppia sp* seagrass beds are found on sediments rich in organic matter (mean : 1.6 to 4.6 % DW). Their distribution was found to be highly variable from one season to the next in Santa Guila and Biguglia. In this last lagoon, for example, these formations almost completely disappeared between April and October 1998, followed by a recolonisation of the site beginning in April 1999. This marked regression would appear to be linked to the proliferation of macrophyted (Ulvophyceae), the decomposition of which lead to problems of anoxia that are detrimental to phanerogams (4). The density of *Ruppia sp* varied between 3,316 shoots/m^2 and 16,401 shoots/m^2. In Santa Giulia lagoon, there occurred a significant decrease in this parameter between July 1998 and Jule 1999. The total biomass of the *Ruppia sp*. seagrass beds in these two lagoons (35.2 to 391.13g DW/m^2) seems rather low compared with the literature values (5). Mercury concentrations were in the order of 125.0 ng.g^{-1} DW (mean for both lagoons). This value is identical to that recorded in the Berre lagoon, a site that is generally considered to be highly polluted (6). This would seem to imply that this species has a high capacity for mercury accumulation.

The *Zostera noltii* seagrass beds are relatively scarce. This is true in the lagoons of both Biguglia and Urbino where they are mainly located at shallow depths and in close proximity to the lagoon openings to the sea. Over the entire study period, a significant regression of the *Zostera noltii* seagrass bed lower depth limit was observed (a regression of 7 m from its initial position) in Biguglia lagoon, whereas these formations almost completely disappeared in Urbino lagoon. The parameters examined confirm a drop in *Zostera noltii* seagrass bed vitality, and this in particular in terms of (i) the above-ground biomass (range of values from 11 to 88 g DW.m^{-2}), which is fairly low (7) (ii) the shoot density, which decreased at both sites from 1998 to 1999, and this regardless of season (*e.g.* mean in April for Urbino: 13,186 ind/m^2 in 1998, 2,524 ind/m^2 in 1999). Mercury contamination levels were rather low for this species (mean : 74.9 ng.g^{-1} DW) and the values recorded were comparable for the two lagoons examined. *Cymodocea nodosa* seagrass beds are only found in Urbino lagoon where they exhibit a substantial bottom cover (8). Their distribution within this lagoon was stable throughout the monitoring. Seasonal variations in biomass and density were limited, which is in agreement with what is known of the biology of this species (9). Values for the latter parameter were higher than what has been reported in the literature (7, 9). Mercury contamination levels were low (mean of 73.2 ng.g^{-1} DW) and are comparable to those recorded for relatively unpolluted sites (10).

The above observations would tend to confirm the extensive temporal variability of macrophyte assemblages within coastal lagoons of the Mediterranean, in particular those which are characterised by shallow waters and a watershed that supports a variety of human activities, such as is seen for Biguglia lagoon. The long term monitoring of both the different parameters and permanent monitoring structures should provide a better understanding of the evolution of these lagoons.

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Table 1: Main characteristics of the sites examined.

Lagoon	Max. Depth	Area (ha)	Salinity	Species	Potential anthropogenic pressures
Biguglia	1.8 m	1500	4 - 26 ‰	*Ruppia sp.* *Zostera noltii*	Urban and agricultural effluent
Urbino	9.2 m	760	26-44 ‰	*Cymodocea nodosa* *Zostera noltii*	Aquaculture and agricultural activities
Santa-Giulia	1.5 m	26	5-18 ‰	*Ruppia sp.*	Tourism