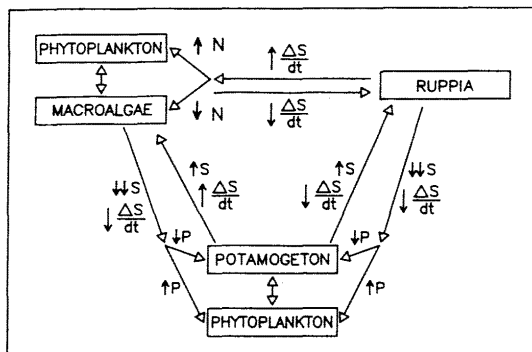


Mediterranean coastal lagoons show many types of salinity-temperature relationship. Because of climate conditions, the increase in salinity during the summer is a common feature under non-perturbed conditions. However, human influences can alter the hydrology of the lagoons, which can result in striking changes in the biological community living in the lagoons.

The coastal lagoons in the delta of the Ebro River have been affected by human agricultural practices for over a century. The consequence was a change in the hydrological regime: decreasing salinity (35-1 ppt) during May-October due to the discharge of freshwater from irrigated ricefields and increasing salinity (1-35 ppt) during November-April due to water exchanges with the sea (COMIN, 1984). Biological populations adapted to these seasonally fluctuating conditions include submerged rooted macrophytes (*Potamogeton pectinatus* and *Ruppia cirrhosa* which developed every year in the lagoons according to these salinity-temperature fluctuations (MENENDEZ & COMIN, 1989). In highly eutrophic lagoons, submerged rooted macrophytes disappeared after the water column became very turbid, because of phytoplankton blooming (COMIN *et al.*, 1990). These results obtained comparing different coastal lagoons in the Ebro Delta were used to propose a simple model of competition between primary producers (phytoplankton *versus* submerged rooted macrophytes). Light and nutrients were the key factors for the result of the competition. Cultural eutrophication, increasing freshwater discharges to the lagoons containing huge amounts of nutrients, favoured phytoplankton proliferation, which in turn increased light extinction in the water column and prevented submerged rooted macrophyte development. No data are available on the influence of other factors, such as biocides used intensively for agriculture and changes in the characteristics of the sediments.

However, this model is too simple considering the variety of plants which can contribute to primary production in coastal lagoons and the range of environmental conditions affecting the same coastal lagoon through time. Floating macroalgae developed a huge population in a coastal lagoon in the Ebro Delta (Tancada) in two years (1990-91) after water management practices prevented freshwater inputs to the lagoon. The water of the lagoon became hypersaline during summer (conductivity 65 mS cm⁻¹, while it had ranged between 50 and 5 mS cm⁻¹ in previous summers). At the same time, the nitrogen concentration in the water changed from relatively low nitrate (1-8 µg-at l⁻¹) and high ammonium (1-50 µg-at l⁻¹) before 1990 to relatively high nitrate (1-30 µg-at l⁻¹) and low ammonium (0-1 µg-at l⁻¹) during 1990. Again, relatively low nitrate and high ammonium concentrations were observed during 1991. No significant changes were observed in the phosphorus concentrations. During these two years, phytoplankton biomass did not increase significantly and both the area covered by *Ruppia cirrhosa* and its biomass per area decreased compared to previous years. As floating macroalgae (*Ulva rigida*, *Chaetomorpha linum*, *Cladophora* sp.) did not develop large populations in previous years, a more realistic model of competition between primary producers in coastal lagoons is proposed here (Fig. 1).

Fig. 1.- Schematic representation of the model of competition between primary producers in coastal lagoons. Arrows between boxes indicate the changes of populations dominating the primary production. (N-Nitrogen, P-Phosphorus, S-Salinity, delta S/dt-rate of salinity change. Upward arrows: increase, downward arrows: decrease).



The substantial proposal of this new model is the contrast between the nutrients through which the control of competition between primary producers is exerted. Phosphorus at low salinity and nitrogen at high salinity would be the key nutrients. In both cases, phytoplankton would take the lead at high nutrient concentration while macroalgae having a high affinity for nitrogen would decrease nitrogen concentration in the water, as in 1990, and would proliferate. In any case, phytoplankton and macroalgae can bloom rapidly because of their high growth rates, accumulating huge biomasses in the water column and limiting available light available for submersed rooted macrophytes.

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L'espèce *Atherina boyeri* (RISSO, 1810) est considérée par de nombreux auteurs comme constituant un complexe polymorphique (KIENER et SPILLMAN, 1969, 1972; KARTAS et TRABELSI, 1990).

Résistante aux fortes variations de température et de salinité, cette atherine est capable de coloniser les eaux douces mais son domaine de prédilection reste toutefois la frange côtière marine et surtout les eaux saumâtres lagunaires.

Dans le bassin de Thau, l'analyse statistique du nombre de vertèbres (v), de rayons aux nageoires pectorales (Pe) et de branchiospines (Br) a permis de distinguer deux populations: l'une occupant la zone marine de ce bassin (n=100; v=45,780, s=0,917; Pe=15,050, s=0,539; Br=35,550, s=1,149) et l'autre la partie lagunaire (n=100; v=44,510, s=0,859; Pe=14,210, s=0,656; Br=26,090, s=1,026).

Dans l'étang de Mauguio, seuls des individus présentant les caractéristiques de la population lagunaire de Thau sont présents (n=100; v=44,510, s=0,798; Pe=14,180, s=0,657; Br=26,330, s=1,215).

Une approche mettant en oeuvre les techniques d'électrophorèse des protéines musculaires a été entreprise dans le but de chercher si les divergences morphologiques mises en évidence se retrouvent au niveau biochimique.

L'étude a porté sur l'analyse électrophorétique des parvalbumines présentes dans des extraits musculaires d'athérines. Ces protéines constituent un bon critère d'identification en raison de l'existence de plusieurs isoformes et de leur grande spécificité (FOCANT *et al.*, 1988, 1990, 1991).

Les électrophoréogrammes de la figure résument la répartition des isoformes des parvalbumines présentes. Celles-ci correspondent aux isoformes III, IV et V de la carpe.

La comparaison des différents extraits musculaires révèle une certaine diversité qualitative et quantitative :

- L'isoforme IV est présente aussi bien chez les athérines à affinité marine (Thau) que lagunaire (Thau et Mauguio).

- Les différences observées entre les populations de ces deux milieux portent sur les isoformes III et V. La première (PA III), quand elle existe, se trouve exclusivement, mais en proportions variables, chez les poissons à affinité lagunaire. La seconde (PA V) s'observe uniquement chez les athérines à affinité marine.

Les divergences biochimiques enregistrées confortent, dans l'ensemble, les résultats fournis par la méthode biométrique, à savoir la présence sur les côtes du Languedoc de populations marines d'*Atherina boyeri* distinctes de populations inféodées aux milieux lagunaires.

Ces différences traduisent la malléabilité de ce poisson et font de lui un excellent bio-indicateur du milieu.

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