The unusual nature of the water supplying a coastal wetland (La Albufereta de Pollença, Mallorca, Balearic Islands)

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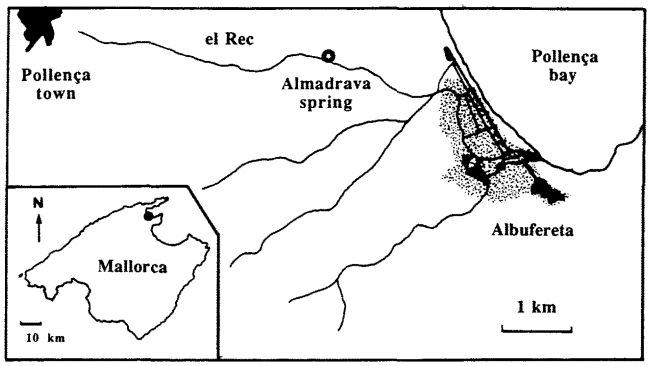
La Albufereta de Pollença is a wetland coastal zone located in the North of Mallorca (see figure). It is separated from the sea by a narrow (50-100 m) belt of dunes which is traversed by a road (12 m wide). By area (approximately 150 Ha), La Albufereta is the second largest wetland of the island. In common both with the most Mediterranean coastal wetlands, the zone experience constant environmental pressures (VELEZ, 1979).

Three main areas may be distinguished in La Albufereta: small shallow lakes, channels which are mostly artificial and a vegetated zone (represented mostly by the *Phragmition australis* and *Arthrocnemion fruticosi* alliance). General characteristics of the zone (including flora, fauna and human influence) are described by CERDA *et al.*, (1986).



The most distinctive feature is the contribution made by water, mostly by "torrentes" (temporal streams) as in the rest of the island. The average annual volume of water which flows through the zone amounts to some 24 Hm^3; although the Torrente el Rec with less than a third part of the catchment area, alone supplies around 75% of the total inflow. This is due to a spring (Almadrava) which contributes 17 Hm^3 annually, the outflow from which varies from 20 and 30 l s^{-1} during the summer months to a maximum of 5 m^3 s^{-1} (SERVEI HIDRAULIC, 1987). The continual presence of water throughout the year in el Rec between Almadrava and La Albufereta means that it is covered almost thoughout its whole length by macrophytes: *Potamogeton pectinatus, Zanichellia palustris, Zanichellia palustris* var. *gramen, Ruppia maritima, Enteromorpha intestinalis, Chaetomorpha capilaris, Ulva curvata* and *Cladophora* sp. are the most prominent species.

From 1987, samples of the torrent water have been taken at irregular intervals from between the environs of Pollença to La Albufereta. The monitoring of the chemical parameters has been carried out using standard methods (GOLTERMAN *et al.*,1978; APHA, 1981). Maximum, average and minimum values for ten locations between Almadrava and La Albufereta (A), and for four locations between Pollença and Almadrava spring (B) are presented in the table.

		A			B	
pH	8.11	7.27	6.55	8.25	7.80	6.59
CONDUCTIVITY ($mS\ cm^{-1}{}_{20^o}$)	20.00	10.82	2.00	5.52	1.35	0.72
ALKALINITY (meq l^{-1})	6.70	3.63	0.60	12.60	5.15	1.45
CHLORIDE (g l^{-1})	9.33	3.73	0.82	0.18	0.12	0.04
SULPHATE (mg l^{-1})	978.50	635.83	273.90	224.63	97.07	52.21
CALCIUM (mg.l^{-1})	400.00	277.05	160.00	232.00	156.00	72.00
MAGNESIUM (mg l^{-1})	447.00	220.20	72.90	38.80	12.29	4.86
PHOSPHATES (µg-at l^{-1})	2.53	0.62	0	165.74	83.32	8.81
SILICATES (µg-at l^{-1})	154.17	82.38	32.29	289.58	152.78	38.40

In group B most of the samples are from water left in hollows in el Rec since there is only occasional water flow. The results show the water to be fresh with high phosphate content, reflecting human influences. The major alkalinity variations result from either production or consumption of oxygen which depends on the sample point locations and time of the year.

The Torrente el Rec water from La Almadrava (A) is supplied by the spring and is brackish. It has a high chloride, sulphate and magnesium concentration. Although the aquifer supplying the spring is still not properly understood (SERVEI HIDRAULIC, 1987), the absence of gypsum in the rocks of the catchment and the continuity of flow of the spring throughout the year suggests a clear marine influence.

La Almadrava spring, due both to its outflow volume and its chemical make up, is unusual and unique in Mallorca.

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Inestability of the meromixis in the Coastal Lagoon of Cullera

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The variation of some limnological parameters in the lagoon of Cullera (Spain), an elongated coastal lagoon with estuarine water circulation (Fig. 1), was studied during the annual cycle of 1987. Although the lagoon showed a sharp picnocline during the whole year, which oscillated between 1 and 2 m of depth depending on the interactions between sea and freshwater, an oxycline was only present from May to October (Fig. 2, C). In this period vertical gradients of light, sulfide, conductivity and nutrients determined the presence of dense populations of green phototrophic bacteria, mainly *Chlorobium phaeovibrioides*, which developped a plate located around 2 m of depth Its density distribution along the year is shown by the isopleths of bacteriochlorophyll *e* (Fig. 2, D).

This lagoon, as many others coastal lagoons, is subjected to great fluctuations, thus the annual cycle of 1987 was very different from that recorded some years ago (MIRACLE and VICENTE, 1985; ROJO and MIRACLE, 1989). In 1980, this lagoon was described as showing ectogenic meromixis, because it had a permanent sea water wedge, that only disappeared after the flood which took place in autumn 1982. During those years a steep picnocline divided two water layers: a flowing oligohaline water layer above a saline anoxic layer. Because of the destruction of the sand bar in that flood, the lagoon did not show more a permanent meromixis and was like an estuary. In this study the halocline is much more superficial and the lagoon has a strong marine influence. This influence causes the oxygenation of the deepest waters, reaching progresively more superficial waters towards the oxycline arriving to contact with the epilimnetic oxygenated waters. This fact together with the effect of a new flood which occured in November 1987 disturbed completely the summer column structure and the phototrophic bacteria population totally disappeared after this date.

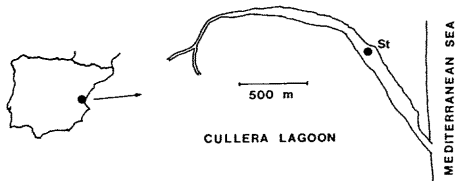

Figure 1. Geographical situation and outline of Cullera lagoon. St: Sampling station.

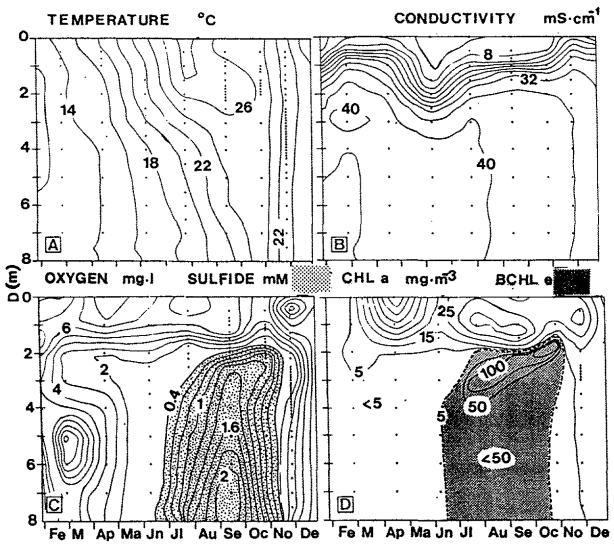

Figure 2. Isopleths representing depth and temporal distributions of some limnological parameters in the lagoon of Cullera. **A**: Temperature; **B**: Conductivity; **C**: Oxygen and sulphide; **D**: Algal chlorophyll *a* and bacteriochlorophyll *e* from *Chlorobium phaeovibriodes*.

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