

Relationships between physico-chemical characteristics and planktonic communities in the Bay of Alcudia (Majorca)

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The physico-chemical characteristics and planktonic communities of the Alcudia Bay have been monitored throughout 1991. Monthly samples were taken from seven stations located along a radius starting from the innermost part, adjoining the coastal marsh *Albufera de Mallorca*, to the outer bay (four stations), with three stations along the coast. Samples were taken from surface to bottom, with 5 m intervals. Results show that there are significant relationships between physicochemical characteristics (salinity, N/P ratio), phytoplankton biomass expressed as chlorophyll *a* and particulate matter, basically zooplankton, collected with a 100 µm mesh net.

The Bay of Alcudia has an input of brackish water from the *Albufera de Mallorca*. This coastal aquatic habitat exports part of the nutrients it takes in from tourist and agricultural activities (MARTINEZ TABERNER *et al.*, 1990). The lower density water arriving in the bay stays at the surface and creates an inverse salinity and nutrient gradient in the water column. The intensity of this gradient and its incidence in the outer bay depend on the water flow from the *Albufera*, water density, nutrient load and S and SE wind action; all these parameters may vary over the year.

Nutrient concentrations display great temporal and spatial heterogeneity (horizontal and vertical). Nitrate values are always high at the surface in the area near the *Albufera*. In the rest of the Bay values are high at certain moments of the year. Phosphorus concentrations are generally low, with very localized peaks in both time and space. Due to this variability N/P values are greatly dispersed around the 16/1 quotient considered optimum for phytoplankton growth (GOLDMAN *et al.*, 1979).

Chlorophyll *a* concentrations exhibit a pattern of variation dependent on the N/P ratio. Maximum values of chlorophyll *a* coincide with ratios above 16/1, while minimal concentrations of chlorophyll *a* are associated with very low N/P ratios. This behaviour suggests that at certain moments of the annual cycle and at certain points in the bay, N and/or P are limiting factors for phytoplankton growth. The annual phytoplankton dynamics is modified by the entry into the bay of brackish water rich in nutrients. This surface enrichment is the cause of significant phytoplankton development, fundamentally of small flagellates (Cryptophyceae and Chrysophyceae) during spring and autumn.

The annual variation of zooplankton, expressed as mg organic matter m⁻², is closely linked with changes in phytoplankton biomass as mg chlorophyll *a* m⁻². The zooplankton biomass/chlorophyll *a* concentration ratio ranges from 12.03 to 53.67, with a mean of 28.77 and standard deviation of 13.76. Maximum values correspond to situations where the phytoplankton is mainly made up of nanoplankton species (small flagellates) with low chlorophyll *a* concentration per cell. As in similar latitudes (NASSOGNE, 1972; FERNANDEZ DE PUELLES & GARCIA BRAUN, 1989) in these cases the nauplii of copepods found were dominant in the zooplankton.

The minimum, maximum, mean and standard deviation (in brackets) shown in the table express the range of variation of the parameters discussed in this contribution. Salinity: extreme values for all levels sampled. N/P ratio: integrated means for each station. Chlorophyll *a* concentrations: total chlorophyll *a* per unit surface for each station. And zooplankton biomass (> 100 µm): as organic matter concentration per unit surface in any station.

	SALINITY ‰/‰	N/P	Chl <i>a</i> mg m ⁻²	ZOOPLANK (>100 µm) mg m ⁻²
JANUARY	24.65-37.22	7.14-35.83 16.77 (9.05)	1.39-7.09 3.17 (2.00)	-
FEBRUARY	8.52-37.20	8.53-46.40 27.58 (12.89)	3.31-15.20 8.14 (4.04)	47.10-153.75 113.31 (47.20)
MARCH	32.56-37.31	1.38-21.89 8.74 (7.05)	0.55-4.08 2.12 (1.08)	9.75-291.00 83.16 (120.03)
APRIL	17.10-37.44	3.05-48.00 20.04 (14.81)	1.63-4.53 2.64 (1.01)	65.50-270.00 141.70 (76.94)
MAY	7.71-37.29	3.40-196.75 47.79 (64.48)	1.41-5.38 3.60 (1.29)	14.50-368.00 159.22 (129.36)
JUNE	12.46-37.41	3.14-51.80 21.22 (17.22)	1.93-3.33 2.61 (0.47)	16.70-143.80 86.65 (47.00)
JULY/10	26.22-37.34	2.16-81.00 26.17 (28.17)	0.83-4.18 2.21 (0.93)	15.00-98.60 45.30 (31.75)
JULY/24	29.87-37.35	1.11-334.38 50.21 (116.01)	3.38-6.03 4.88 (1.50)	33.35-176.00 79.51 (56.45)
AUGUST	23.50-37.50	2.93-88.63 24.06 (28.19)	1.85-3.35 2.51 (0.85)	-
SEPTEMBER	36.50-37.50	2.20-174.20 41.09 (57.01)	0.65-7.33 3.64 (2.85)	-
OCTOBER	21.40-37.29	3.20-51.30 21.43 (18.57)	0.97-9.58 4.66 (3.06)	17.95-170.80 83.64 (55.20)
NOVEMBER	24.03-37.41	63.58-207.50 115.88 (45.87)	0.63-6.13 3.13 (1.80)	17.60-63.20 37.65 (18.59)
DECEMBER	29.87-37.35	2.63-97.60 32.82 (33.73)	0.78-5.50 3.28 (1.74)	24.10-275.00 120.30 (95.50)

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