



Coupling phytoplankton and hydrography in Alfacs Bay using principal component analysis and empirical mode decomposition

C. Llebot (1), M. Delgado (1), A. Turiel (1), M. Fernández-Tejedor (2), J. Diogène (2), J. Camp (1), J. Solé (3) and M. Estrada (1)

(1) Institut de Ciències del Mar, CSIC , Psg. Marítim Barceloneta, 37–49, 08003 Barcelona;

(2) Centre d'Aqüicultura, IRTA. Ctra. Poble Nou, Km5.5 43540 St. Carles de la Ràpita. Spain;

Xarxa de referència en Aqüicultura;(3) Inst. Mediterrani d'Estudis Avançats, CSIC–UIB,

Miquel Marqués 21, 07190 Esporles, Spain.

Els Alfacs is a shallow estuarine bay within the southern part of the Ebro Delta where algal blooms are a common occurrence. In some cases, the responsible microalgae are toxic and can cause severe problems to the aquaculture industry in the bay.

We have analyzed six years of weekly monitoring data collected at Els Alfacs, consisting of phytoplankton counts and physical water properties. Principal Component Analysis (PCA) and Empirical Mode Decomposition (EMD) have been used to analyze the relationships between physico-chemical and biological variables.

The first Principal Component, (10.57 % of the variance), showed a clear seasonal behavior, with high positive values in late winter or early spring. *Dinophysis sacculus*, *Prorocentrum micans* and *Scrippsiella spp.* were characteristic species of these maxima. Minimum values were reached in autumn, with *Thalassionema nitzschioides*, *Cylindrotheca closterium* and *Lioloma pacificum* as the most relevant species. The second Principal Component, (9.83 %), more irregular, reflected the appearance of phytoplankton biomass maxima. EMD revealed not only periodic annual modes, but also an interannual oscillation with a two-to-three year period. It appeared to be associated with the Quasi Biennial Oscillation of stratospheric temperature, which has been found to be weakly correlated with the Western Mediterranean Oscillation index.