



Biochemical characterization of the physiological state of the microplankton communities during the stratification and spring bloom periods in the NW Mediterranean

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Two multidisciplinary cruises were performed in open sea waters of the NW Mediterranean, in the area of influence of the Nor-Balearic Front (NBF) and the surrounding boundary water masses. At surface (above 200 m), this front separates recently advected Atlantic waters (salinity < 37.2, temperature > 13°C, density < 28.1 kg·m⁻³) from a denser (28.1 kg·m⁻³) and saltier (38.0-38.2) old Atlantic water. The objectives of the field work were to identify, quantify and establish relationships between the physical and chemical conditions, the structures of the planktonic communities and the biogeochemical fluxes in that area over different seasonal periods. The cruises were conducted in two contrasting situations: during the summer stratification (September 2004) and during the spring bloom (April 2005) periods. Among many other parameters, we performed estimations of physico-chemical (temperature, salinity, inorganic nutrients), biological (phytoplankton pigment composition, bacterial numbers, primary and bacterial productions) and biochemical indicators (protein/DNA and RNA/DNA ratios) of the physiological state of the microbial communities.

In September 2004, the whole sampled area was clearly stratified with nutrient exhaustion at the surface layers. Physico-chemical properties were fairly homogeneous at the two side of the NBF. The stratification period extended until december. The following winter was unusually cold and dry, and caused unusual surface salinity and

temperature distribution over the region. The intense column mixing supplied nutrients at surface and after certain degree of stability, the phytoplankton bloom developed already in January and extended in most open sea waters of the NW Mediterranean (as shown by satellite images). Subsequent relatively mild weather started at the end of March, so that in April 2005, stratification was already observed at the south of the NBF, with low nutrient concentrations at surface.

Overall, the two cruises identified three key situations of the microbial communities which tracked the seasonal physico-chemical variability in the area. First, the spring bloom was still present at the North of the NBF in April 2005, with the highest phytoplanktonic (contributed mainly by diatoms, chlorophyll range $1 - 7 \mu\text{gL}^{-1}$) and total ($25-250 \mu\text{gL}^{-1}$ protein and $0.5 - 7.5 \mu\text{gL}^{-1}$ DNA) biomasses measured and distributed mostly above 100 m. The microbial community was active, as indicated by high ($0.5 - 2$) RNA/DNA ratios, significantly correlated with primary production at surface and with bacterial production in general. In contrast, all the biochemical parameters were significantly lower at the South of the NBF in April 2005, where deep chlorophyll maxima ($< 1 \mu\text{gL}^{-1}$) and a phytoplankton community dominated by small organisms (e.g. green algae, *Prochlorococcus*), suggested a post-bloom situation. This second situation could constitute a transition step towards the third, oligotrophic one. Indeed, the lowest biochemical values and phytoplankton organisms typically indicative of oligotrophy were observed in the September 2004 cruise. The oligotrophic status of the system would constitute the most extended situation in time in the whole area.