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Bacterioneuston vs. bacterioplankton dynamics along a trophic gradient

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The seasurface microlayer (SML) plays an important role in the exchange of gases and material across the air-sea interface and is inhabitated by specific organisms, the neuston. This environment has been mainly studied in coastal areas and in lakes. Information on the SML of the open sea and under different trophic conditions is generally scarce particularly on bacterioneuston. Bacteria along with some basic physicochemical parameters were studied in the SML and the underlying water layer (UWL) along a trophic gradient from the Mauritanian upwelling area to the subtropical Atlantic gyre system, and in an anticyclonic eddy in the western Mediterranean Sea.

Inorganic (phosphate, ammonium, nitrate and nitrite) and organic (dissolved organic nitrogen, DON, and phosphorus, DOP) nutrients were found to be enriched in the SML as compared to the UWL. A distinct pattern of decreasing concentrations along the trophic gradient was observed for nitrite, phosphate and DOP. Concentrations of ammonium and DON were remarkably constant in the UWL, and more variable in the SML.

Bacterial abundance and the percentage of high nucleic acid content (HNA) cells also decreased towards the oligotrophic regions. Bacterioplankton production was higher in the upwelling area and decreased towards the gyre system. In contrast, bacterioneuston production increased towards oligotropic conditions, approaching an enrichment factor (SML/UWL) of 1. These dynamics together with the decreasing DOP concentrations leads to an apparent paradox, with higher bacterioneuston production at lower DOP concentrations in contrast to the bacterioplankton production. The dynamics of bacterial production recorded in the Mediterranean eddy resembled that from the stations close to the subtropical Atlantic gyre.

The percentage of highly active cells (CTC+ cells) was higher in bacterioplankton than in –neuston and not related to the trophic state. Diel cycles in bacterioneuston activity (% of CTC+ and HNA cells) were observed both in the Mediterranean Sea and along the trophic gradient in the subtropical Atlantic with usually decreasing percentages of active cells around noon. From our results we conclude that the trophic conditions have a greater impact on the bacterioplankton than on bacterioneuston.