SEASONAL AND SPATIAL PATTERNS OF BACTERIAL PRODUCTION, RESPIRATION AND GROWTH IN THE E. MEDITERRANEAN AND THE MARMARA SEA.

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Abstract

Bacterial production (BP), respiration (BR) and growth efficiency (BGE) were investigated in the upper 150m along a transect from Ionian to the Marmara Sea including the Dardanelles, during the SESAME cruises in early spring (March 2008) and late summer (September 2008) and the Alliance_TSS08 cruise (September 2008). Bacterial growth efficiency was highly variable, suggesting that several factors (DOC and inorganic nutrients) control BGE. The largest amount of carbon taken up by bacteria (85-99%) was not used for biomass production and was respired as CO2.

Keywords: Bacteria, Eastern Mediterranean, Marmara Sea

Bacterioplankton play a central role in the biological transfer of carbon in the ocean through the microbial loop [1], however bacterial processes have poorly been studied in the E. Mediterranean. In this study we report results from bacterial production (BP), respiration (BR) and growth efficiency (BGE) along a transect from Ionian to the Marmara Sea, including the Dardanelles straits. North Aegean is the area where Black Sea waters (BSW) of low salinity and low temperature enter the Mediterranean through the Dardanelles straits and intense interaction of different water masses, within a relatively small area, takes place [2]. Samples were taken on board the R/V Aegaeo and Alliance, in early spring (March 2008) and late summer (September 2008) covering 15 stations at the oligotrophic seas of the E. Mediterranean (Ionian, Cretan, Libyan and Aegean Sea), 2 stations at the Dardanelles straits and 4 stations at the Marmara Sea. BP and BR were measured by 3H-leucine incorporation, conducted at saturating (20nM Leu) concentrations [3] and by an automated Winkler titration method respectively. BGE was calculated using the formula BP/(BP+BR), assuming RQ=1 [4]. BP ranged 0.13 - 52.82 ngC l^{-1} h^{-1} in the E. Mediterranean and increased in March at the Aegean stations, with peak values at the surface layers of North Aegean, as influenced by the Black Sea water. In September BP values varied between 0.79 to 73.08 and 0.5 to 97.42 ngC l^{-1} h^{-1} at Dardanelles straits and the Marmara Sea, while the increased surface values were not detected at the N. Aegean water (Fig 1).

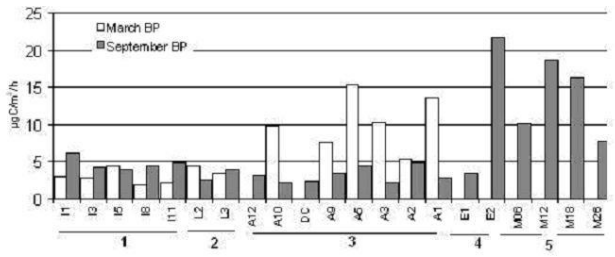

Fig. 1. Mean depth integrated values of bacterial production (BP) along the transect from Ionian (1), Libyan (2), Aegean Sea (3), to Dardanelles straits (4) and the Marmara Sea (5), in March and September 2008

Dissolved organic carbon (DOC) ranged 50-155 μmol l^{-1}. High values of DOC were encountered in Black Sea waters outflowing the Dardanelles Strait and occupying the surface layer of North Aegean (92-155 μmol l^{-1} in March and 81-132 μmol l^{-1} in September). Simultaneously in September increased values of DOC were recorded at the surface layer of Dardanelles straits and Marmara Sea (162-213μmol/l) (Zeri C., unpublished data). Bacterial respiration ranged 0.40 – 36.56 μM O_2 h^{-1}, the amount of carbon respired was 0.23 – 9.97 μM C d^{-1}. Using both these BR and BP values, we calculated the BGE and it ranged from 1%– 19% (Fig 2).

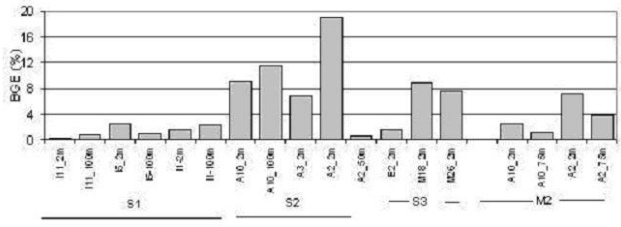

Fig. 2. Bacterial Growth Efficienty (BGE) at selected stations and dephts from Ionian to Marmara Sea. S=September, M=March, 1=Ionian Sea, 2= Aegean Sea, 3=Dardanelles Straits and Marmara Sea

Bacterial growth efficiency was highly variable, suggesting that several factors (DOC and inorganic nutrients) control BGE. The largest amount of carbon taken up by bacteria (85-99%) was not used for biomass production and was respired as CO2. Thus bacteria act more as a 'sink' of organic carbon to higher trophic levels. E. Mediterranean is a complex marine environment and bacteria biomass and growth are controlled by several factors. Studies which used BGE values of 30% would have significantly underestimated the carbon flux through bacteria.

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