FIRST DATA ON MICROBIAL BIOMASS AND ACTIVITIES IN THE TYRRHENIAN SEA (MEDITERRANEAN SEA)

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Abstract
First estimations of microbial biomass and activities in the water column of the Tyrrhenian basin in association with the main Mediterranean water masses, are reported. Exponential decrease with depth of biomass and activities was registered assessing the predominant weight of export production in the basin and the scarce advection of preformed organic matter within the water masses. Important seasonal changing patterns occurred for respiration and primary production more than for biomass. The evaluation of the carbon budget by microbial community showed PP/R ratios close to 1 in July, and a clear productive metabolism in December.
Keywords : Plankton, Biomass, Open Sea, Hydrology, Tyrrhenian Sea.

Introduction
Microbial community (phototrophs and heterotrophs) has great potential for predicting the effect of climate change at the biological level because it is responsible for the assimilation of greenhouse gases at surface layers and it remineralized the produced organic matter to CO_2 by respiration 1. Notwithstanding its importance in the biogeochemical processes, few data are available on microorganism biomass and activities for pelagic areas of the Mediterranean Sea.

Materials and Methods
Two multidisciplinary surveys (CIESM-SUB1 and CIESM-SUB2) were performed with the aim of studying the role of microbial community in the C biogeochemistry. The studied data set covered hydrological parameters, microbial abundances and biomass (picoplankton, picophytoplankton, fractionated chlorophyll *a* and phytoplankton). Morphometric analysis, cell biovolumes and carbon content were determined. Moreover, Primary Production (PP) and Respiration (R) were studied with the aim of defining the community metabolism and C budget.

Results and Discussions
A simple hydrological structure was identified: Modified Atlantic Water (MAW), Levantine Intermediate Water (LIW) and Transitional Deep Water (TDW). The most important hydrological differences were concentrated in the surface layer where the atmospheric forcing modify the thermohaline characteristics (summer-MAW and winter-MAW). Slight differences between the two seasonal periods were recorded for the picoplankton abundances, that resulted generally in the order of 10^5 cells ml^{-1}. In July, abundances resulted similar between s-MAW and MAW and a decreasing pattern occurred with depth. In December, the highest counts in w-MAW and similar values in MAW and LIW were registered. TDW showed an abrupt decrease of cell abundances. Differently, noticeable cell size increases were observed with increasing depths, particularly in December. In July, high value of Cell Carbon Content (CCC) in s-MAW was detected, decreases in MAW and LIW and a subsequent increase in TDW. In December, an increasing trend with depth (also if with similar values in w-MAW and MAW) occurred. Distribution of biomass in the different water masses was comparable to abundances, with exception in December in TDW, where the biomass values increased owing to great cell volumes. As consequence, the locally achieved conversion factors varied in relation with water masses, depths and seasons (9-29 and 10-33 fg C $cell^{-1}$ in July and December, respectively).
Picophytoplankton abundances confirmed previous data from pelagic oligotrophic waters. Their presence below the photic zone, already observed in the deep Ionian sea, was totally lacking in the Tyrrhenian Sea. Phytoplankton abundances and carbon content appeared to be similar to those reported for other Mediterranean sites 2. The total microbial biomass was higher in summer than in winter (mean values 13 and 7 μg C l^{-1}, respectively) but the percentages of heterotrophs, phytoplankton and picophytoplankton were constant in both periods (about 62, 22 and 15 %, respectively). Primary production showed different trophic condition between the two seasons: low rates in summer (mean value 0.25 ± 0.08 mg C m^{-3} h^{-1}) and high rates in winter (mean value 0.65 ± 0.25 mg C m^{-3} h^{-1}) were measured. The pico-sized fraction contribution to total PP was high in both the seasons (50 % in July, 91 % in December).
ETS activity and respiratory rates greatly varied in the two seasonal periods. In July, two times higher values as well as wider distributions than in December were detected, particularly in the surface samples. A general decreasing trend with depth in both periods was observed with the lowest values in TDW.
The general decreases of biomass and activity with depth assessed the predominant weight of export production in the basin and the scarce importance of lateral advection in circulatory patterns.
The evaluation of the carbon budget driven through microbial community 3 showed PP/R ratios ranging between 0.78 and 3.52 in July, while a clear productive metabolism (PP/R ratios >6) in December occurred. In the studied area, the scenario seems prevailingly to turn towards a positive budget, indicating that in such surface area the microbial communities act as C sink.

References

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