Dynamics of bacterial-phytoplanktonic systems influenced by eutrophication

G. TSIRTSIS, M. GIOKA, E. PANAGOPOULOU and P. VOUROS

Department of Environmental Studies, University of the Aegean, MYTILINI (**Greece**)

The fluctuations of heterotrophic bacterial number depends on the availability of organic matter resulting from sewage effluents and planktonic excretions (1). The study of such relationships in the marine ecosystem is complicated and therefore the use of microcosm systems can be useful in understanding heterotrophic processes. In the present work, the interactions between phytoplankton, heterotrophic bacteria and dissolved organic matter (DOM) was studied in the laboratory.

The marine alga *Dunaliella tertiolecta* was used for the experiments. Methodological details have been given in a previous work (2). The cultures were enriched during the exponential phase with sewage effluent after filtration and sterilization. Phytoplankton cell number, heterotrophic bacterial cell number, COD and organic nitrogen were measured every three days for two weeks.

Table 1: Phytoplankton-bacterial division rate (r) and carrying capacity (k) (cultures in 2 replicates)

Treatment	r (divisions/day)		k (cells/ml x 10^5)	
	Phyt.	Het.bact.	Phyt.	Het.bact.
Control culture	1.2 ± 0.4 1.1 ± 0.6	1.1 ± 0.5 0.9 ± 0.8	36 ± 2 37 ± 3	600 ± 70 560 ± 30
Add. of sew.eff.	1.2 ± 0.4 1.2 ± 0.5	2.1 ± 0.7 1.3 ± 0.7	42 ± 8 41 ± 7	870 ± 80 480 ± 30

FIGURE 1

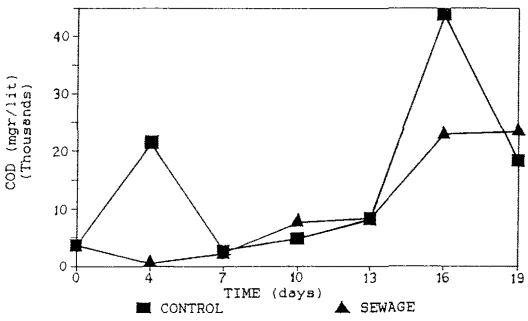
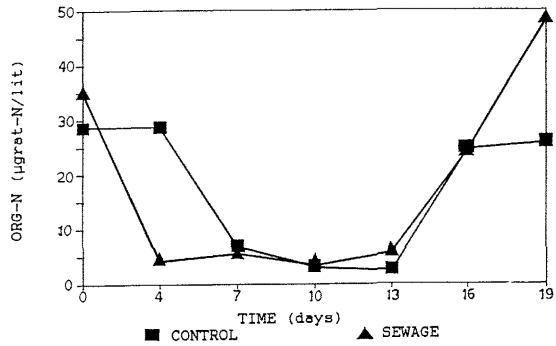


FIGURE 2



It was observed that division rates in heterotrophic bacteria were higher in the presence of sewage effluent (Table 1). The algal carrying capacity was also found increased in the presence of the effluent. COD showed an increase after the 13th day of growth (Fig. 1). The trend observed in organic nitrogen was different (Fig. 2); the available organic nitrogen was decreasing during the first week probably due to the bacterial uptake. The logarithms of heterotrophic bacterial number and organic nitrogen were highly correlated until the 13th day of the culture, with a negative correlation coefficient of 0. 77 for the control and 0. 90 for the other treatment. The low organic nitrogen levels (7th-13th day) were followed by an increase which may be associated with the senescence of the algal culture. The logarithms of phytoplankton and heterotrophic bacterial cell numbers were highly correlated with a linear relation. The correlation coefficient was found 0. 96 for the control and 0. 98 for the other treatment.

The dynamics between organic nitrogen and phytoplankton-bacterial growth is being investigated using mathematical modelling.

Acknowledgement

The present work was supported by a WHO/UNEP grant (ICP/CEHO42).

REFERENCES

1. WOLTER K., 1982.- Bacterial incorporation of organic substances released by natural phytoplankton populations. *Mar. Ecol.* 7:287-295.
2. CORSINI M. and KARYDIS M., 1990.- An algal medium based on fertilizers and its evaluation in mariculture. *Jour. of App. Phycology* 2:333-339.