Heterotrophic Plankton dynamics in the stratified water column in the Gulf of Trieste (Northern Adriatic)

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The classical view of planktonic food chain changed with the realization that bacterioplankton is a major pathway in the flux of organic material and energy in pelagic marine ecosystems. Nanoflagellates are important bacterivores, and appear to be regulated through predation by larger protozoa (Wikner & Hagström, 1988). Rapid remineralization of organic matter channeled through bacterioplankton and the prozoan predator-prey chain can cause the release of nutrients.

The field population dynamics based on abundances of bacterioplankton and those organisms presumed to be their predators was followed in the coastal waters of the Gulf of Trieste during summer in 1988 and 1989. Standard methods were used for collection of the samples. Epifluorescence microscopy was used to count bacteria and nanoflagellates in formalin preserved and stained samples, and live cyanobacteria in green excitation light. Bacterial production was measured by the incorporation of ^{3}H-thymidine (Fuhrman & Azam,1982). Microzooplankton (< 200 µm) was enumerated in formalin preserved samples, using a Wild inverted microscope. The quantitative counts of net zooplankton (10 Standard net, 200 µm mesh size) were made on aliquots of the formalin sample.

A seasonal study showed the dominance of autotrophic cyanobacteria, and an increase of heterotrophic bacterial biomass and production during the period of stratification (Fig.1-A,B). The biomasses of heterotrophic bacteria and cyanobacteria were high in July and August, with abundances of 9.1-14.0*10^8 cells l^{-1}and 2.6-5.6*10^7 cells l^{-1}, respectively. A peak of bacterial production up to 5.4*10^4 cells l^{-1} h^{-1} was observed in August.

A bloom of nanoplankton and picoplankton developed in late July-August presumably due to low abundance of main predators, and direct microbial utilization of the fraction ungrazed by higher levels. The seasonal dynamics of protozoa and metazoa (Fig.1-C,D) support this presumption. After a peak of 1.4 *10^6 cells l^{-1}, flagellate number decreased through the summer, while abundance of ciliates increased at the end of August, which coincided with bacterioplankton sharp decrease. Total microzooplankton abundance varied from 56 to 669 ind./l, with the dominance of oligotrichous ciliates such as Aloricates (*Strombidium* and *Tontonia*) and the tintinnid *Helicostomela subulata*. Other tintinnids (*Eutintinnus* spp., *Tintinnopsis* spp., *Dictyocysta* sp., *Favella ehrenbergi*, *Stenosemella* spp., and *Steenstrupiella*) were encountered rarely with low abundance.

Copepods with dominant neritic species (*Acartia clausi*, *Clausocalanus* spp., *Ctenocalanus vanus*, *Paracalanus* sp., *Temora longicornis*, *Centropages typicus*, *Oithona* spp., *Oncaea* spp.) were not important in the stratified pelagic system and showed clear peaks of abundance in May and October. On the contrary, cladocerans (dominant species *Penilia avirostris*) showed a large pulse of abundance in August, and similar seasonal pattern has been observed also for Appendicularia (dominant species *Oikopleura dioica* and *O. longicauda*).

Bacteria and cyanobacteria are actively consumed and metabolized by a variety of micrograzers depending on individual feeding capability and efficiency. Similar trophic interaction and the role of predators in regeneration of nutrients in the pelagic food web have been observed also in other environments (Rassoulzadegan & Sheldon, 1986; Wikner & Hagström, 1988).

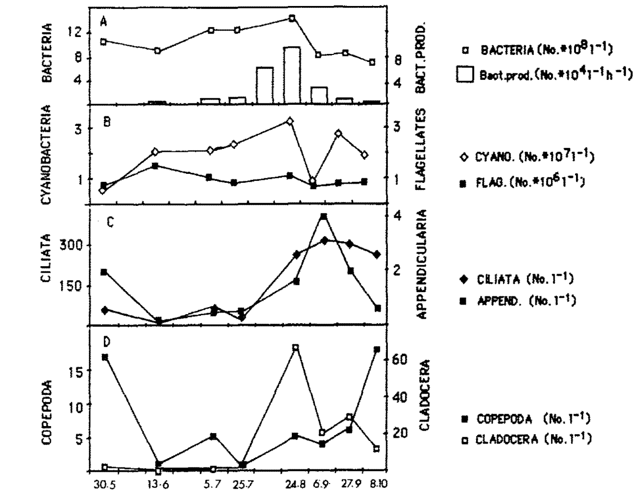

Fig. 1. Seasonal dynamics of bacterioplankton (A,B), microzooplankton and net zooplankton (C,D)in the Gulf of Trieste in the stratified water column during summer 1989.

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Rassoulzadegan, F. and R.W. Sheldon. 1986. Predator-prey interactions of nano-zooplankton and bacteria in an oligotrophic marine environment. Limnol. Oceanogr. 31 (5): 1010-1021.