
Communications

Diurnal dynamics of bacterioplankton in the Gulf of Gdańsk in Spring 1987

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This work is part of an ecological Soviet–Polish programme on *Spatial and time variability of ecosystem parameters in the Gulf of Gdańsk*, carried out in the Gulf from April 21 to May 11, 1987. The aim of this work was to find out the aspects of quantitative studies of bacterioplankton development in the Gulf of Gdańsk.

Studies were carried out at three stations: in the deeper area of the Gulf of Gdańsk (Station G-2, 110 m of depth), in the central area (Station Z, 67 m of depth), and in the coastal area (Station ZN-2, 15 m of depth) (Fig. 1).

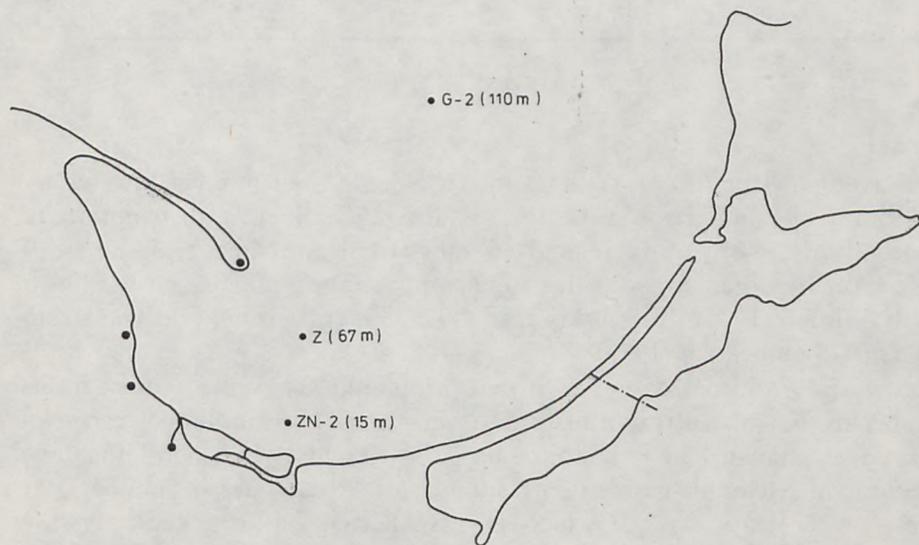


Fig. 1. Location of the sampling sites

Water samples were taken from the following depths: 0, 5, 10, 30 m. The total number of bacteria was obtained by direct counting (Rodina, 1965). Water samples of 20 ml were passed through a membrane filter *Synpor* No 7 (pore size 0.23 ± 0.03 μ m). After 24 hours staining with erythrosine, the bacteria were counted under a light microscope at a 10×90 magnification. The biomass of bacterioplankton was determined according to the total amount of bacteria and their average volume (Rodina, 1965).

The analysis of the total number and biomass of bacteria reveals unequal distribution of microflora in the aquatorium both vertically and horizontally (Table 1). The largest amounts and biomass of bacteria were observed in the

Table 1. Total number [mln cells/ml] and biomass [mg/l] of bacteria in the Gulf of Gdańsk in Spring 1987

Station	Depth [m]	Layer [m]	Total number of bacteria		Biomass	
			Fluctuation	Average	Fluctuation	Average
G-2	110	0	1.618–2.81	1.146	0.084–0.472	0.298
		5	0.013–1.341	0.806	0.004–0.402	0.245
		10	0.231–1.450	0.705	0.069–0.435	0.235
		30	0.02–0.845	0.395	0.007–0.253	0.119
Z	67	0	0.026–2.050	0.960	0.008–0.615	0.314
		5	0.139–2.250	1.410	0.042–0.675	0.376
		10	0.540–2.310	1.400	0.209–0.693	0.303
ZN-2	15	30	0.25–0.799	0.320	0.009–0.239	0.135
		0	1.96*		0.588*	
		5	2.20*		0.660*	
		10	1.76*		0.528*	

* singular samples

surface layer (0–10 m deep). With an increase depth their number lowered by 1.5–4 times in comparison with the surface layer. Such a distribution of microorganisms is obviously related to substantial enrichment of the trophogenic layer by organic matter due to decomposition of algae, as was shown earlier by Zlobin (1976), Jurkovskis *et al* (1979, 1982), Larsson and Hagstrom (1979) and Rheinheimer (1983).

The study of diurnal dynamics of bacterioplankton revealed considerable variability in the concentration of bacteria in water. The amount of bacterioplankton may change 1.5–8 times in a day (Figs. 2 and 3). In general, the daily fluctuations in bacterial biomass correspond to their changes in numbers. At the deep water station (G-2) which is less affected anthropogenically, the fluctuation was most distinct in the surface layer (0–10 m). At a depth of 30 m the variations in numbers were not so marked (Fig. 2). The trend of an increased

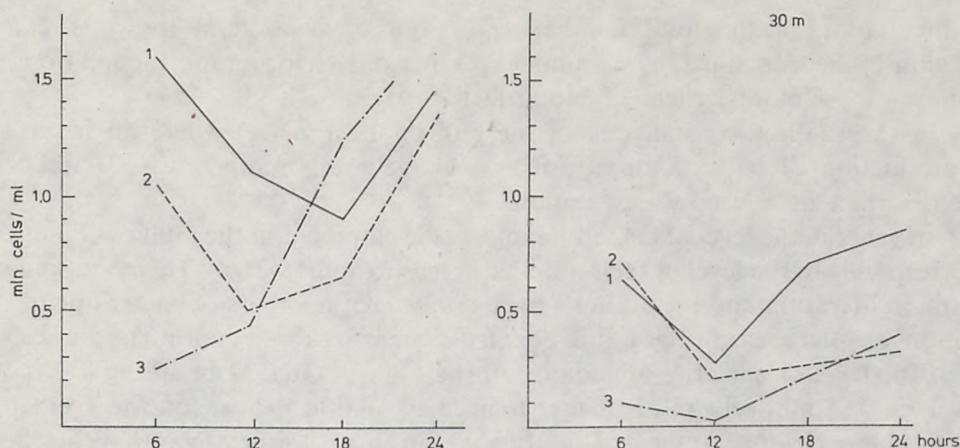


Fig. 2. Diurnal changes of the bacterioplankton abundance at Station G-2
1—the first day, 2—the second day, 3—the third day

total number was more marked in the evening hours and that of lowered numbers in the midday. These data are consistent with those of the microbiological studies in the open Baltic and the Black Sea (Tsyban *et al.*, 1981). The other station (Z) was situated in the centre of the gulf. The average total amount of bacteria was 1.3 times higher than at the deep-water station. The diurnal fluctuations in the number of bacterioplankton become less regular in that area. Peaks of maximum numbers on one day were replaced by low minima on another day in terms of the environmental effect (Fig. 3). Such

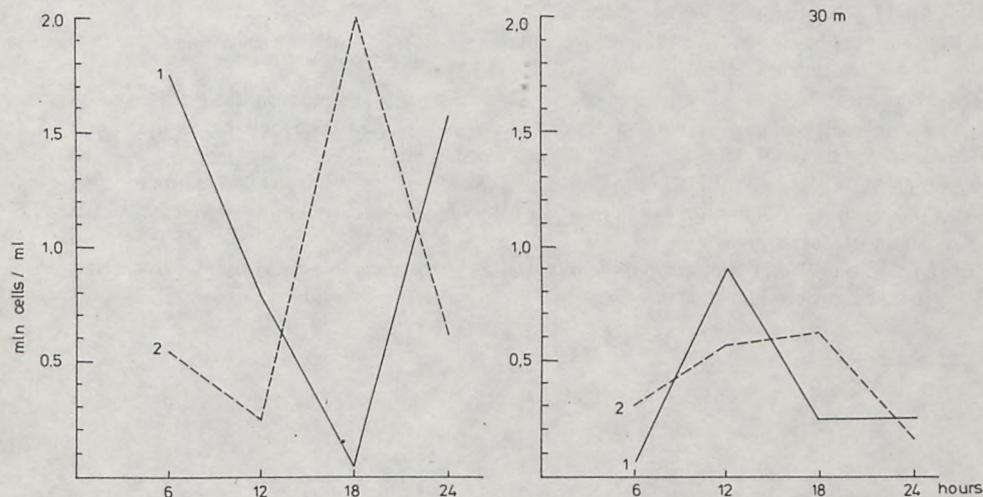


Fig. 3. Diurnal changes of the bacterioplankton abundance at Station Z
1—the first day, 2—the second day

a fluctuation of the total number and biomass of bacteria in water can obviously be explained by a number of reasons: hydrographic conditions, inflow of pollutants, effect of biotic factors *etc.*

In the shallow coastal area of the gulf (Station ZN-2) where an intense reproduction of bacteria occurs, their average total number was 2.6 times higher than at a deep-water station.

In general, the level of bacterioplankton development in the Gulf of Gdańsk corresponds to the level of their number in mesotrophic waters. There are some data, in literature and the author's own, on average numbers of bacterioplankton in various areas of the Baltic Sea. By comparing these data it can be seen that the level of bacterial abundance in the Gulf of Gdańsk in spring (on the average 0.88 mln cells/ml) is higher than in the Baltic Proper (on the average 0.194 mln cells/ml; Apine, unpublished), but it is lower than that in the Southern and Central Baltic in summer (on average 1.53 and 1.20 mln cells/ml, respectively—Tsyban *et al.*, 1981). The fluctuations in bacterioplankton numbers of the Gulf of Gdańsk (0.013–2.31 mln cells/ml), compared with those of the Gulf of Riga in autumn (0.08–2.36 mln cells/ml; Apine, 1984), show similarity

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