On the horizontal distribution of phytoplankton in relation to sewage-derived nutrients.

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Abstract

The temporal and spatial distribution of phytoplankton was studied by means of a horizontal transect along a nutrient environmental gradient. The significance of domestic sewage as an important component of the nitrogen and phosphorus budget of this area was examined and its influence on the spatial variations of algal growth was discussed.

Introduction

Studies on the phytoplankton spatial distribution have shown that differences in the physical and chemical properties in an area should create different spatial patterns (RICHERSON et al., 1978). In this paper, the temporal and spatial distribution of phytoplankton was studied along a nutrient environmental gradient.

Materials and Methods

Three sampling stations were located in Saronicos Gulf at a distance of 4 Km (St. S_3), 9 Km (St. S_2) and 15 Km (St. S_1) from the Pireus sewage outfall. Water samples were collected monthly from 1, 10 and 20 m depth during January-December 1979. Phytoplankton enumeration, chlorophyll a, $P\text{-}PO_4$, $N\text{-}NO_2$, $N\text{-}NO_3$, $Si\text{-}SiO_2$ (STRICKLAND & PARSONS, 1968) and $N\text{-}NH_3$ (LIDDICOAT et al., 1976) were performed for each sampling depth. Coefficients of variation were calculated by using the form "standard deviation/mean".

Results and Discussion

Table 1 shows the integrated annual mean values of chlorophyll a, phytoplankton cell concentrations and nutrients at the three stations.

Table 1. Annual integral means of chlorophyll a, phytoplankton concentration and nutrients in three statios of Saronicos Gulf during 1979.

Station	Chl.a (mg/m^2)	Phytopl. ($cells/m^2$)	$P\text{-}PO_4$	$N\text{-}NO_2$	$N\text{-}NO_3$	$N\text{-}NH_3$	$Si\text{-}SiO_2$
			($ug\text{-}at/m^2$)				
S_1	16.30	$5.33x10^9$	$3.8x10^3$	$2.0x10^3$	$10.5x10^3$	$9.6x10^3$	$118.3x10^3$
S_2	35.38	$3.50x10^{10}$	$8.5x10^3$	$4.5x10^3$	$16.6x10^3$	$18.9x10^3$	$98.9x10^3$
S_3	57.66	$4.50x10^{10}$	$21.9x10^3$	$8.7x10^3$	$36.9x10^3$	$75.1x10^3$	$123.8x10^3$

The results showed that variability between stations could give rise to coefficients of variation ranging 45-141 % for $P\text{-}PO_4$, 30-127 % for $N\text{-}NO_2$, 28-78 % for $N\text{-}NO_3$, 38-103 % for $N\text{-}NH_3$ and 3-46 % for $Si\text{-}SiO_2$. The overall variation (mean coefficient of variation) for $P\text{-}PO_4$ (74 %) and $N\text{-}NH_3$ (79 %) was higher than the mean coefficient of variation for $N\text{-}NO_2$ (67 %), $N\text{-}NO_3$ (58 %) and $Si\text{-}SiO_2$ (16 %). The coefficients of variation between stations for chlorophyll a varied from 2 to 115 % with a mean of 53 % , and for cell concentrations varied from 21 to 120 % with a mean of 57 %.

The qualitative analysis of phytoplankton species composition showed that there were differences in community organization between stations with diatoms predominating in station S_1 and flagellates in S_3. Station S_2 was influenced in species composition and dominance by the communities of both S_1 and S_3.

The results suggested that:

1. The sewage effluents enriched the sea water mainly with ammonia and phosphorus and shifted the coefficient of variation between stations for these nutrients to higher levels.

2. The between station variation in phytoplankton biomass and species composition might be mainly due to the variation of ammonia and phosphorus.

3. The sewage effluents were diluted at a distance of 15 Km from the outfall to levels influencing the community structure.

References

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