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Fate and distribution of plankton in the Sea of Marmara

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ABSTRACT

In order to acquire a knowledge on the actual state and fate of marine plankton bimonthly water samples were collected from the Sea of Marmara, starting effectively in September 1985 till January 1987.

INTRODUCTION

There is a relative paucity of information concerning the composition and distribution of plankton in the near Bosphorus region. There exist some general background data on the phytoplankton species lists assembled by HRI (1974) for the Bosphorus region.

MATERIAL and METHODS

Plankton sampling was performed at 21 stations in the Bosphorus junction of the Sea of Marmara. Water samples were collected from three different depths (Surface, 10 and 30 m) with the aid of Nansen bottles and filtered on board through a net of 55 µm mesh size. Filtrates were then conserved using 4 % seawater-formalin solution. Enumeration and identification of planktonic organisms were made under an inverted microscope.

RESULTS and DISCUSSION

Remarkable variations both in the species composition and abundance of diatoms were observed throughout the research. Maximum diatom bloom observed in January 1986 followed by a second but relatively weak one in late summer during the first year. With the extension of sampling period to January 1987 a third but less abundant bloom than the first one was observed in October 1986. Among the three different sampling depths 10 m formed the most abundant layer in terms of diatom dominancy. In case of 30 m depth least abundant cells were found due to adverse effects emerging from the overlaying halocline.

Centric diatoms were found to predominate over the pennates (except in January 1986) throughout the sampling period. Relatively high levels of nutrients in the euphotic zone in January 1986 (BASTURK *et al.*, 1986) allowed *pennates* predominate over *centrics*. The marked reduction in phosphate (from 0.46 to 0.22 µg-at/l) occurred during January-March 1986 period associated with the concurrent diatom outburst. The relative contribution of centric diatoms to diatoms in general reached its maximum (92.3 %) in September 1985 and decreased to minimum (47.6 %) at surface in January 1986. Almost 75.7 % of the diatom species were found in their centric forms. Among the constants the two most important species were *Nitzschia seriata* CLEVE and *Rhizosolenia setigera* BRIGHT. For the vernal-serotinal species *Asterionella bleakeleyi* W.Sm., could be given. Among the serotinal species the major species were *Rhizosolenia fragilissima* BERGON and *R. styliformis* BRIGHT. In case of hiemal species *Rhizosolenia setigera* and *Nitzschia seriata* were found to be the most numerous and widely distributed species. In addition to the foregoing classification, *Chaetoceros affinis* LAUD., *Coscinodiscus centralis* EHR., and *Rhizosolenia stolterfothii* PERAG., can be given among the autumnal species.

Both the species richness D (Margalef's index) and species diversity H' (Shannon-Wiener diversity index) were found relatively high in March (2.30-3.06) and in October 1986 (2.23-2.97) whereas the proportional representation J (Pielou's evenness function) was found relatively low (0.96-0.91). In contrast, besides lower values of D and H' (1.33-2.56) a higher value of J (1.11) was obtained in November 1985.

Maximum levels of similarity were obtained in October 1986 between the depths of Surface-10 m (Jacc. coeff. = 0.8), 10-30 m (Jacc. coeff. = 0.78) and surface-30 m (Jacc. coeff. = 0.68). This phenomenon is also observed within adjacent water masses formed by the Sea of Marmara, the Bay of Izmit, Bosphorus and Golden Horn (UYSAL 1987).

Significant positive correlations (both of the variables exhibiting similar trends) were observed between phytoplankton - zooplankton (P<0.05) (as abundance), phytoplankton - plankton dry-weight (P<0.01), zooplankton - dry-weight, chlorophyll- dry-weight (P<0.05) and NO_3+NO_2 - $P\text{-}PO_4$ (P<0.01). Negative correlations were also found between chlorophyll - $P\text{-}PO_4$ (P<0.01) and $P.PO_4$ - humic matter (P<0.05). In addition to these, highly significant (P<0.01) negative correlations have been obtained for zooplankton (as abundance) versus $P\text{-}PO_4$ and NO_3+NO_2 with depth. It is also observed that temperature, salinity and dissolved oxygen display a major role in the vertical distribution of zooplankton in the region. Significant correlations were also observed in this sense.

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P-I10

A multiple regression model to determine abundance of Diatoms in a polluted area (Izmir Bay, Aegean Sea)

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ABSTRACT :

A density and nutrient based multiple regression model was developed to determine diatom abundance of polluted zones of Izmir Bay. The diatom abundance has been estimated by the model at 70 % success.

INTRODUCTION :

In pelagic ecosystems, variations in primary productivity basically depends on light, nutrients, water column stability and grazing by herbivores (BROWN and FIELD, 1986). However, when community structure of phytoplankters has begun to be affected negatively or positively by sewage and/or riverine inputs, the natural balance easily disappears.

Diatoms, which constitute an important portion of primary productivity and have been represented with many members in the groups of micro- and nanoplankton, often reach excessive amounts in favourable circumstances such as rich nutrient resources of eutrophicated areas and may cause secondary pollution by sedimentation of blooming materials especially in shallow bays. In such cases, increases of biomass in water body usually built upon a couple of dominant species. Interestingly, this situation has supplied an advantage for determining the relationships between diatom quantity and water quality parameters that are more pronounced than oligotrophic areas.

In the present study, the relationships between diatom biomass and physico-chemical parameters were investigated in a polluted area and a multiple regression model was developed to estimate the diatom abundance in certain conditions.

MATERIAL AND METHODS :

The samples examined were collected seasonally and vertically (down to 15 m., maximum depth of the sampling area) with a universal series water sampler from polluted zones of Inner bay between the years 1982-84 (FAO/UNEP,TR-7).

Temperature, salinity, pH, secchi disc, dissolved oxygen were measured in situ. The nitrogenous nutrients, phosphorus and silica were determined through use of the methods of STRICKLAND and PARSONS (1972).

Following species identifications and counts (CUPP,1943) product moment r and non-parametric Kendall's τ were estimated between cell counts and physico-chemicals. The multiple regression analyses were only applied to the parameters between which were found statistically significant relationships (SNEDECOR and COCHRAN,1967).

Tablo I : The results of multiple regression analysis.

i	β_i	± 95 %C.I.	tcal	H1	Xi
1	-0.9217	0.2782	6.577	+	SIGMA-t
2	-0.6492	0.3074	4.192	+	lnN/P (µg-at/l)
3	-0.0221	0.0304	1.443	+	Si (µg-at/l)
n= 100 Y=lnDIA (cells/l) α=37.3716 SUCCESS= % 69.85		σ_y= 2.230 $\sigma_{y'}$= 1.230 Fcal(reg)= 77.447 Fcal (R^2)= 57.481		R^2 =0.708 ttab (96 df)= 1.985 Ftab (reg)= 2.7 Ftab (R^2)= 2.46	

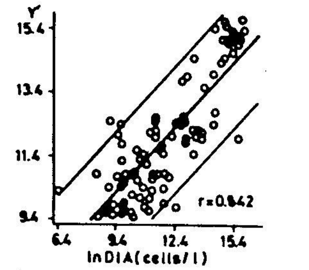

Figure 1: The relationship between observed and expected values (Y'= 0.708Y+3.536±0.203).

RESULT AND DISCUSSION :

Four minute diatom species, Nitzschia closterium (Ehrenberg) W.Smith, Leptocylindrus minimus Gran, Phaeodactylum tricornutum Bohlin and Thalassiosira rotula Meunier have played major role in the total biomass of diatoms at the polluted zones of Izmir Bay.

As summarized in Table I, there exist statistically significant linear relationships between treated nutrients, density and diatom quantity. In the model, σ_t, N/P and Si (may be neglected) may represent diatom abundance in the environment with 70 % success. The rest portion of 30 % most probably has changed with grazing by zooplankton and other unknown effects of pollution on the biota.

In Fig.1, deviations between observed and expected values to be obtained by the function of ln (Diatoms-cell/l)=-0.9217 σ_t-0.6492 ln (N/P)+0.0221 Si+37.3716 are plotted.

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