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C-11

CORRELATION BETWEEN THE NUTRIENT ($N\text{-}NO_3^-$, $P\text{-}PO_4^{3-}$, $Si\text{-}SiO_4^{4-}$) CONCENTRATION OF THE DANUBE WATER AND THE RIVER DISCHARGE RATE

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The data concerning the concentration of the $N\text{-}NO_3^-$, $P\text{-}PO_4^{3-}$, and $Si\text{-}SiO_4^{4-}$ anions in the Danube water at the Sulina mouth during 1979-1983 period have been presented in a previous paper (1). Suplemented with the results obtained in 1984, this data set have been statistically processed in order to obtain a quantitative evaluation of the correlation between the above mentionned concentrations and the Danube discharge rate.

The annual and quarterly samples consist in monthly averages of the daily measurements of both river discharge and ion concentrations. For each of the five data sets, a linear dependence on the discharge rate has been fitted using the least square method and corresponding correlation coefficients have been computed (Table 1).

Table 1 - Correlation coefficients and linear regression equation between the nutrient concentration of the Danube water and the river discharge rate

Samples	correlation coefficients	t-value for r	regression line parameters a	regression line parameters b	t-value for a	t-value for b
			$N\text{-}NO_3^-$			
annual	-0.293	2.54	1151.2	-0.04680	8.58	2.53
I st	-0.443	1.98	1582.3	-0.08698	4.72	1.98
II nd	-0.314	1.32	1505.7	-0.07360	2.89	1.32
III rd	-0.640	3.33	1692.1	-0.16380	7.06	3.98
IV th	-0.642	3.35	1400.8	-0.11603	6.52	3.05
			$P\text{-}PO_4^{3-}$			
annual	-0.473	2.15	130.7	-0.01006	8.09	4.54
I st	-0.461	2.08	188.7	-0.01540	3.35	2.08
II nd	-0.473	2.15	94.8	-0.00610	3.58	2.15
III rd	-0.401	1.75	93.1	-0.00830	3.74	1.94
IV th	-0.634	3.28	199.3	-0.02100	5.48	3.25
			$Si\text{-}SiO_4^{4-}$			
annual	0.145	1.22	1583.2	0.0354	7.58	1.23
I st	0.345	1.47	1182.2	0.1235	1.85	1.47
II nd	0.065	0.26	1463.6	0.0114	5.94	0.27
III rd	0.484	2.21	909.4	0.1009	3.79	2.45
IV th	0.626	3.21	1090.2	0.0201	3.08	3.20

The negative correlation coefficients for the $N\text{-}NO_3^-$ and $P\text{-}PO_4^{3-}$ concentrations prove an inverse dependence on the Danube discharge (Table 1). The correlation coefficient for the $Si\text{-}SiO_4^{4-}$ concentration has positive values, showing a direct relationship with the discharge rate.

The statistical significance of the correlation coefficients as well as of the regression line parameters has been tested using the Student criterion (2). For the correlation coefficients, the computed values of the t-variable (Table 1) are above the significance level for the global samples of the $N\text{-}NO_3^-$ and $P\text{-}PO_4^{3-}$ concentrations and also for their third and fourth and, respectively, second and fourth quarterly samples. For the $Si\text{-}SiO_4^{4-}$ concentration, the correlation is significant only for the third and fourth quarterly samples.

By removinging the effect of the linear trend in all the variables (which accounted for 0.3% to 9.1% of the total variance), the correlation coefficients slightly diminished except for the $Si\text{-}SiO_4^{4-}$ concentration, for which a slight increase occured, but the coefficient for the annual regression is still below the confidence limit.

Using the z-transform (2), the statistical significance of the differences between the correlation coefficients for all the pairs of the quarterly sample has been tested at the 5% level. For all the cases, the observed differences had to be considered as statistically irrelevant.

It may be concluded that a correlation, between the nutrient concentration and the Danube discharge rate, though weak, does exist for all the analysed samples and its intensity is statistically the same for all the seasons.

REFERENCES

1. DOROGAN L.,et al., 1985 - Rapp.Comm.int.Mer Médit., 29, 7.

2. YULE G.U., KENDALL M.G., 1965 - An introduction to the theory of statistics. Charles Griffin & Co., London.

C-12

DISTRIBUTION OF NITROGEN AND PHOSPHORUS IN THE MEDITERRANEAN WATERS OFF THE NILE DELTA

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Abstract: The distribution of different nitrogen and phosphorus forms in the pelagic waters overlying the continental shelf off the Egyptian Mediterranean coast was studied during February 1986.

Introduction

The sharp decline of the biological productivity of the S.E. Mediterranean waters off the Egyptian coast following the cessation of the Nile flood since 1965 has been explained as due to the lack of nutrient salts available for primary production . In the last 20 years,no reliable assessments of nutrient concentrations in the S.E.Mediterranean were made. The present work entails data on levels of inorganic and organic forms of N & P and phytoplankton biomass in the area during the winter season.

Material and Methods

During February 1986,20 stations arranged in 6 sections perpendicular to the coast were sampled from the area between Agami and Tena bay (Figure 1). This area receives annually about $17.7 \times 10^9 m^3$ of fresh and brackish water from several sources of land runoff .At each station surface & descrete water samples were collected from standard depths down to 200m. Determinations of inorganic nutrient salts and chlorophylla (Strickland & Parsons,1972), TN & TDN (Valderrama,1981) and TP & TDP (Koroleff,1977), were made.

Results and Discussion

The absolute values of surface temperature ranged between 17.0° and 19.2°C. The whole water column was nearly homothermal indicating effective vertical mixing during this season. The surface salinity was remarkably high probably due to off shore water influxes. The effect of fresh and brackish water discharge is mostly confined to the circumcoastal zone between Rosetta and Port Said (Figure 1).The tongue of comparatively low salinity opposite to El-Gamil opening (Figure 1) represents further extention of mixed water from Lake Manzalah.

The average values of reactive phosphorus fluctuated between 0.072 & 0.04ug at/l in the inshore and offshore waters respectively. The low values observed infront of Rosetta branch (0.014 ug at/1) are probably due to intensive uptake by phytoplankton as well as to its adsorption on the large amounts of suspended particles (average 0.37 mg/1). Reactive phosphorus constitutes only about 5% of TP while the percentage of DOP was much higher constituting 91-97% of TDP. PP forms 48-80% of TP with high values infront of Rosetta branch. The concentration of TP in surface water varied between 0.75 & 1.98 ug at/1, the highest values occurred in inshore waters.

The average concentration of DIN amounted to 2.14 ug at/1 with nitrate as the dominant component. A significant increase of nitrate concentrations was recorded at depths below 100m probably suggesting regeneration from the bottom sediments by active

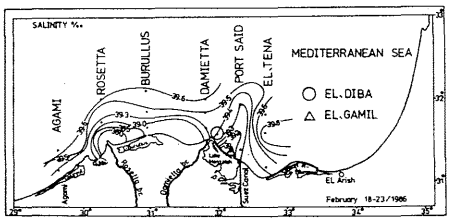

Figure 1. The study area,stations sampled & horizontal disribution of S‰during February 1986.

vertical mixing prosses during this season. On the other hand, the concentration of DON was much higher than DIN , constituting 78%-91% of TDN. The maximum concentration of DON recorded in the inshore stations was 23.15 ug at/1. As in phosphorus PN constituted 61%-67% of TN at the stations studied.

It seems that the levels of nutrients present during this season are able to sustain relatively high phytoplankton crop. The average chlorophyll a biomass varied between 0.71 mg/m^3 in the inshore waters and 0.22 mg/m^3 in the offshore waters ,with subsurface maximum at 25 or 50m.

Table 1 shows the N:P ratio for the different nitrogen and phosphorus forms.Considering the comparatively low concentration of DIP, it may be concluded that phytoplankton growth in the area would be mostly limited by phosphorus than nitrogen.

Table 1. N:P ratio in the surface water of the study area.

LOCATION RATIO	Inshore	Middle	Offshore
DIN/DIP+	38.5	37.9	52.2
NO3/DIP+	17.7	17.2	25.6
DON/DOP*	35.1	-	35.6
TDN/TDP*	36.9	-	38.1
TPN/TPP*	25.3	-	43.9
TN / TP*	31.3	-	41.6

+= Average surface water for the whole area.
*= Surface values for El-Gamil inshore station & Damietta offshore.

References

Koroleff,F. (1977) In : Grasshoff,K. Report of the Baltic Intercalibration Workshop , Annex Intern. Commission for the protection of the environment of the Baltic Sea.

Strickland,J.D.H. & T.R. Parsons (1972) Fish. Res. Bd. Canada ,Bull. 167,2nded.310pp.

Valderrama,J.C. (1981) Marine Chemistry,10,109- 122.

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