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Eutrophication assessment based on frequency distribution patterns of some environmental variables

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Fitting physical and chemical variables to frequency distributions may prove to be a powerful tool in the management of coastal waters. If the probability distributions of variables related to eutrophication is established, an assessment of the occurence of nutrient/phytoplankton values above cetain levels will be a procedure carried out on a routine basis from existing bodies of data. In the present paper the fitting of some environmental variables characterising the quality of coastal waters to a number of probability distributions is attempted and the possibility of these to be of use in water quality assessment is discussed.

Sampling was performed monthly from 10 Stations, spaced along the coastal area of the city of Rhodes (Period of sampling: May 1983 - April 1984). The water samples were collected from surface waters and dissolved oxyzen, chlorophylls, phosphate, silicate, nitrate, nitrite and ammonia determinations were carried out (Strickland and Parsons, 1968). Fitting of the data was performed on lognormal and gamma distribution functions (Heyman at al 1984). The goodnes of fit was tested using the Kolmogorov -Smirnov test on the pooled data.

The lognormal frequency distributions of oxyzen, chlg, phosphate, nitrate, ammonia and total inorganic nitrogen are given in Fig. 1. The distribution of oxyzen values is rather symmetrical

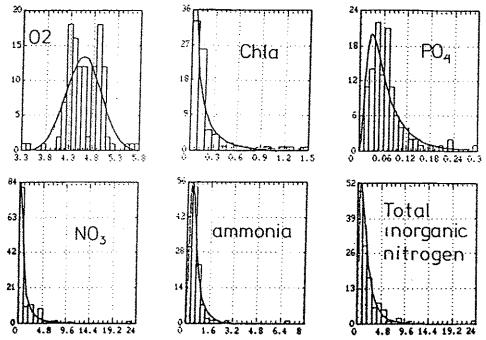

Fig. 1. Frequency distributions of dissolved oxygen, chla and nutrient variables fitted to lognormal distribution.

and good fit was also shown to the normal distribution pattern. The remaining variables follow more skewed distributions. Nitrate, ammonia and total inorganic nitrogen show very short right-hand tails. Phosphate show a distribution pattern more "normalised". The distribution parameters and the goodness of fit are shown in Tab. 1. All parameters showed very good fit to the lognormal distribution. Gamma distribution is only applicable to oxyzen, phosphate and silicate whereas, nitrite showed a better fit to gamma rather than to the lognormal distribution.

Tab. 1. Probability distributions of dissolved oxyzen, chla and nutrient concentrations. Parameters a and b as well as the goodness of fit (K-S test) are given.

Probab. distr.	Para-meter	O2	Chla	PO4	SiO2	NO3	NO2	NH3	TOT N
Log-normal	a	4.60	0.23	0.07	12.87	1.55	0.08	0.61	2.13
	b	0.36	0.45	0.06	6.12	3.35	0.16	0.48	2.38
	K-S*	0.08 **	0.17 *	0.01 **	0.06 **	0.10 **	0.15 *	0.08 **	0.08 **
Gamma	a	155.33	0.52	2.02	3.12	0.32	1.55	0.80	0.60
	b	33.75	2.61	30.24	0.24	0.21	23.72	1.27	0.28
	K-S*	0.08 **	0.25 *	0.11 **	0.13 *	0.28 *	0.09 **	0.26 °	0.23 °

K-S: Estimated Kolmogorov Statistic, ** Not rejected at 95% level
* Not rejected at 99% level, * Rejected at the 99% level.

The results presented above indicate the following:

1. The oxygen distribution pattern is symmetrical and therefore this variable can be considered as being conservative (Heyman et al, 1984).

2. Nutrient and chla distributions are highly skewed with pronounced rihgt-hand tails

3. Lognormal distribution seems to be more satisfactory for assessing the concentration levels of environmental variables.

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A comparative study on the nutrients, anionic detergents and environmental parameters in Izmir Bay (Aegean Sea)

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ABSTRACT

In all 10 stations were selected for this study. Primary ecological factors nutrients levels and anionic detergent concentrations were recorded from the polluted towards the non-polluted areas of the bay. The results show that, there is a decrease steadly in the pH, temperature, nutrient levels and detergent concentrations, starting from the inner stations towards the outer ones. The transparency (Secchi disc),oxygen levels and salinity values have increased from in the same direction. However, a fluctuation in the parameters studied was observed due to the seasonal variations in the coastal discharge.

INTRODUCTION

Due to a gradual increase in the volume of effluents from industry, urbanisation and agricultural practices, pollution is effecting the İzmir Bay to a large extent like other bay in the coast of Turkey. The effluents come form different sources 98 discharge points and 7 streams. As such, an important rate of contamination by toxic substances and this is of seen especially during summer months in the bay vital importance for public health.

As indicated in our previous studies (GELDİAY and UYSAL,1978;YARAMAZ and TUNCER, 1985) toxicity of the pollutants effects the biological activity. Both the larval development as well as the oxygen transport are inhibited by 0.1 gr/m³ detergent concentrations in the marine environmet. On the other hand nitrate and phosphate ratios too have been raported to produce toxic effects on the algaes and plancton after certain levels (TOPHING,1976) In view of this, the studies in this direction are being continued.

MATERIALS AND METHODS

Fig. 1 : The locations of the sampling stations in the Izmir Bay.

The locations of the 10 selected sample stations, staring from the inner bay towards the outer, are shown in Fig.1.Samples of water were collected from the different depths using Hydro-Bios water samplers. The sampling was done seasonally during 1986. The analysis of the samples were made by methods described by STRICLAND and PARSONS (1972), WOOD (1975).

RESULTS AND DISCUSSION

The results obtained are given in the tables 1 and 2. In order to give a clear picture of our finding the results have been covered in the figures 1 and 2 too. A persual of these tables and figures shows that, there is a gradual decrease in the levels of nutrients (NO_2^- - N, 1.34-0.03 ; NO_3^- - N, 2.14 - 0.63 ; NH_4^+ - N, 21.24-3.89; PO_4^{-3} - P , 3.32-0.17 ; SiO_4^{-2} - Si, 9.72-3.32 ; ug.at/l; anionic detergent concentrations (4.34-0.42 mg/l); Temp. (18.50-18.13 °C) pH (7.74-7.68) and an increase in the trancparency (Secki-disc 1.93 m - 13.65 m) , DO (5.03-7.25 mg/l), Salinity (‰ 35.60-38.32) as we move from the inner towards the outer bay. On the other hand, a increase in the parameters studied was observed due to the effects of Gediz river discharges.

These results are expected to effect the fauna and flora of the bay to a large extent (KOCATAŞ,1981) the prohibitive steps taken during the last 5 years by the İzmir Municipality seems to have played a great pole in this direction. The Çakalburnu and Ragıp Paşa fishing areas are still inactive due to the pollution effects. If steps are not strenghtened more than the present situations Homa area will too suffer the same fate. It is possible that these strong steps against pollution revive the above mentioned areas too in near future. It appears to us that untill the time the grand Canal Project around tha bay of İzmir is completed there will be an increas in the posphate and nitrate levels, because of the use of phosphate rich detergents in our area. However, this problem could be overcome to some extent by prohibiting the use of said detergents and suggesting the use of NTA detergents.

We believe that, prohibitive steps taken towards the cleaning of some of the polluting sources should be spread over all other sources. A completion of all these steps will revive the marine life in the bay of İzmir.

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