A.O.U.:N:Si:P Ratios in the waters of the North Euboikos Gulf, Greece

N. Friligos

Institute of Oceanographic and Fisheries Research,
GR 166 04, Aghios Kosmas-Hellinikon, Athens, Greece.

ABSTRACT

This paper gives the ratios A.O.U.:N:Si:P in the North Euboikos Gulf. A clear deficiency of nitrate to the available oxygen was observed in the upper layers. The regeneration of nutrients was related to the consumption of oxygen and only the relationship of inorganic nitrogen released to AOU was similar to the ratio found in the open ocean.

INTRODUCTION

Almost all studies of nutrients, dissolved oxygen and their interrelationships concerned oceanic areas, rather than semi-enclosed or tidal basins. No analysis of the relationships between nutrients and oxygen were made in the North Euboikos Gulf, a tidal area in the southwest of the Aegean Sea.

Approximate relationships between nutrients and dissolved oxygen, based on values observed in the North Euboikos Gulf, will be examined in this paper.

MATERIALS AND METHODS

The locations of the stations are shown in Fig. 1. Samples of water were collected from depth of 1, 5, 10, 15, 20, 30, 50, 75, 100, 200, 300 and 400 m, using Nansen reversing water samplers. The sampling was done during August 1983. Measurements of dissolved oxygen and inorganic nutrients were made by methods described by Friligos (1982).

RESULTS AND DISCUSSION

Redfield et al (1963) arrived at the average atomic ratios in oceanic waters of C:N:Si:P =106:15:16:1. The relationship between oxygen consumption and carbon dioxide production was assumed by them to be 276:106 by atoms. The relations were obtained from studies of water masses and theoretical considerations. The relationships in water, obtained from the slope of the regression curve picturing the nutrient concentrations as a function of the apparent oxygen utilization, gave

Table 1. Nutrient relationships

Water layer (m)	Component	Number of observations	Minimum and maximum values	Mean concentration (µg-at/l)	Mean concentration ratio (by atoms)	Ratio of c
	P	134	0.04 - 1.20	0.12	N:P = 10.42	ΔN:ΔP =
0-75	N	134	0.26 - 11.02	1.37	Si:P = 32.33	ΔSi:ΔP =
	Si	134	1.79 - 19.70	3.88	Si:N = 2.83	ΔSi:ΔN =
					NO_3:P = 5.42	ΔNO_3:ΔP =
	P	27	0.06 - 0.78	0.41	N:P = 15.34	ΔN:ΔP =
	N	27	3.48 -11.60	6.29	Si:P = 50.78	ΔSi:ΔP =3
	Si	27	8.92 -37.09	20.82	Si:N = 3.31	ΔSi:ΔN =
75-400					NO_3:P = 13.93	ΔNO_3:ΔP =
	a.o.u.	27	140 - 264	216		a.o.u.:ΔPO_4
						a.o.u.:ΔNO_3
						a.o.u.:ΔSiO
						a.o.u.:ΔN

almost the same ratios.

Those ratios varried very often and were usually lower in the coastal areas. Cooper (1938) found exceptionalty high values of this ratio in the waters of the Mediterranean. Also, Vukadin and Stojanoski (1974) reported higher ratios than the standard oceanographic ratios and concluded that P was the factor governing the biological productivity in the Adriatic. In the case of the Aegean, Friligos (1980) reported nutrient ratios close to normal values.

Chemically, the North Euboikos Gulf can be divided into three layers. The upper photic and sub-photic layers, usually from the surface to about 75 m and the layer below, from 75 m to the bottom. From Table 1, it can be seen that, in the 0-75 m layer, only the N:P and $\Delta N:\Delta P$ ratios approached normal values and were closely correlated. However, the NO_3:P and $\Delta NO_3:\Delta P$ ratios were lower, because of ammonium being the major dissolved nitrogen constituent in the upper layer. This did not occur in the 75-400 m layer, as nitrate was the major form of nitrogen. Owing to enhanced silicate levels, the ratios Si:P and $\Delta Si:\Delta P$ were in general high in the whole water column.

Also, Table 1 shows the slope of the plot of the inorganic nutrients vs apparent oxygen utilization (a.o.u.) at all stations when omitting all the values from the photic layer and assuming oxidation there to be negligible as compared to the total oxidation processes.

Of the ratios displayed, only that of A.O.U.:ΔN=18.7 and, to a smaller extent, that of A.O.U.:ΔNO_3=27.1 come close to the normal values (Redfield et al., 1963). The normal ratios indicated that there had been complete oxidation of the organic nitrogen during remineralisation.

REFERENCES

- Cooper, L.H.N., (1938): Redefinition of anomaly of nitrate-phospate ratio. Journ. of the Mar. Biol. Assoc. of the United Kingdom, 23, 171-179.

- Friligos, N., (1980): Nutrients in Greek waters. Journées Etud. Poll., 5, 1025-1034.

- Friligos, N., (1982): Some consequenses of the decomposition of organic matter in Elefsis Bay, an anoxic bas in Mar. Poll. Bull., 13, 103-106.

- Redfield, A.C., Ketchum, B.H. and Richards, F.A., (1963): The influence of organisms on the composition of seawater. In the Sea, vol. 2, pp 26-27 (Hill, M.N., ed.). Intercience, New York.

- Vucadin, I. and Stojanoski, L., (1974): C:N:Si:P ratio in the waters of the middle and south Adriatic C.I.E.S.M. Congress, Monaco.