

TROPHIC STATE AND NUTRIENT RATIOS IN A HELLENIC COASTAL MARINE ECOSYSTEM AFFECTED BY AGRICULTURAL ACTIVITIES

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Abstract

Nutrient concentrations and their ratios in the north Lakonikos Gulf, a coastal marine environment affected mainly by agricultural activities, were used in order to describe the ecosystem and to characterize it as an oligotrophic area. The agricultural activity in the adjacent plain, the Evrotas River discharges as well as the small streams inputs in the area seems to have insignificant impact in the marine environment. Nitrogen limitation was observed in the study area.

Keywords: Coastal Systems, Nutrients

INTRODUCTION

Measuring nutrient concentrations is a topical concern in many coastal systems, since the anthropogenic nutrient enrichment may result in a change of the trophic state of an ecosystem [1]. Excess nutrients (N and P) discharged from anthropogenic activities have been identified as one of the major pollution point sources leading to eutrophication in the coastal waters.

The coastal area of Lakonikos Gulf (36°44.06' N and 22°34.96' E) (Fig. 1) is mainly used for agricultural purposes, with a few small towns and tourist sites located along the coastline. Fishing activity is also developed in the area. The industrial activities in Lakonikos Gulf are very few, thus in terms of pollution sources, the aforementioned agricultural activities and untreated domestic effluents are the most important. Nutrient samples were collected from a grid of 29 sampling stations in the northern sector of the Lakonikos Gulf during June 2008, in order to present the nutrient concentrations and their ratios in Lakonikos gulf and to determine the trophic state in the area.

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References

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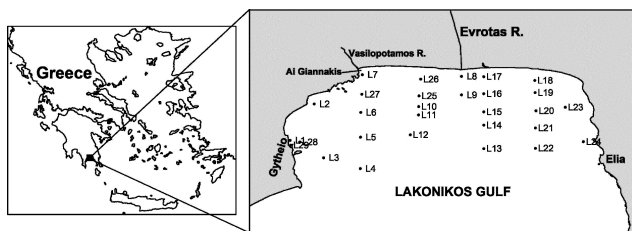


Fig. 1. Study area location and sampling stations grid

RESULTS AND DISCUSSION

Low nutrient concentrations were measured in the study area (0.100 μM for phosphate; 0.207 μM for nitrate; 1.274 μM for silicate; 0.051 for nitrite; 0.258 for ammonium). To determine the trophic state in the area, a concentration scale proposed by Karydis [2] was used, dividing the area into 4 different trophic levels: oligotrophic (<0.07 μM , phosphate; <0.62 μM , nitrate; <0.55 μM , ammonium), lower mesotrophic (0.07-0.14 μM , phosphate; 0.62-0.65 μM , nitrate; 0.55-1.05 μM , ammonium), upper mesotrophic (0.14-0.68 μM , phosphate; 0.65-1.19 μM , nitrate; 1.05-2.20 μM , ammonium) and eutrophic (>0.68 μM , phosphate; >1.19 μM , nitrate; >2.20 μM , ammonium). Inorganic phosphorus at stations L04, L05, L07 and L17 corresponded to an oligotrophic state according to the Karydis concentration scale, whereas at all the other stations inorganic phosphorus corresponded to a lower mesotrophic state. The nitrate concentrations measured in the study area showed higher mesotrophic waters only for the deeper layers of stations L12 and L13 and oligotrophic for all the other sampling stations. In general, higher nitrate concentrations were observed in deeper water layers. Ammonium concentrations showed lower mesotrophic water type for station L23 and oligotrophic water type for all the other stations. The mean N:P ratio ranged between 1.49 and 11.8 with a mean N:P ratio of 5.27. The mean Si:P ratio calculated 12.7 and the mean Si:N ratio calculated 3.26. It is noteworthy, that the N:P ratio is significantly declined due to very low nitrate concentrations at the upper layer of the water column. According to Justic et al. [3], three criteria have been applied for P-limitation, N-limitation and Si-limitation as follows: a) P-limitation, if Si:P>22 and N:P>22; b) N-limitation, if N:P<10 and Si:N>1; c) Si limitation, if Si:P<10 and Si:N<10. 83% of our data indicated N-limitation whereas, 27% indicated Si-limitation. P-limitation was not found. According to these results, nitrogen controls the functioning of Lakonikos marine ecosystem. In general, the study area was characterized as an oligotrophic area indicating that the agricultural activity in the adjacent plain, the Evrotas River discharges as well as the small streams