DISTRIBUTION OF NUTRIENTS AND CHLOROPHYLL-A IN THE COASTAL AREA OF THE BOSPHORUS (TURKEY)

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Abstract
The aim of this paper was to establish the annual variations in nutrient and chlorophyll-a concentrations. Samples were collected from June 2003 to May 2004 at five stations in the coastal waters of the Bosphorus. Nitrate+nitrite, phosphate and silicate concentrations in winter were higher than other sampling periods. Chlorophyll-a concentrations ranged between 0.54 and 6.13 µg l .
Keywords: Nutrients, Chlorophyll-a, Bosphorus

The Bosphorus is located at the northern part of the Turkish Straits System [1]. It is a narrow natural channel carrying the highly polluted waters of the Black Sea to the Sea of Marmara. Its upper layer waters have an average salinity of 16.5-18.5 ppt, and the lower layer an average salinity of 38 ppt. Such conditions are very likely to create density currents that can strongly affect the biogeochemical cycle of the system [2]. Nutrients are the essential chemical components of life in the marine environment. Phosphorus and nitrogen are incorporated into living tissues, and silicon is necessary for the formation of the skeletons of diatoms and radiolaria [1]. In the sea, most of the nutrients are present in sufficient concentration, and the lack of some of them limits the growth of phytoplankton [3]. The studies on this subject in the Bosphorus are still very limited. The aim of this paper was to establish the annual variations in nutrient and chlorophyll-a concentrations. This study was carried out in the coastal waters of the Bosphorus at five stations between June 2003 and May 2004 (Fig. 1). Nitrate+nitrite (NO3+NO2-N) concentrations were analyzed by cadmium reduction method on a Skalar autoanalyser [4]. Phosphate (PO4-P), silicate (SiO4-Si) and chlorophyll-a analyses were detected by the methods described by Parsons et al. [5].

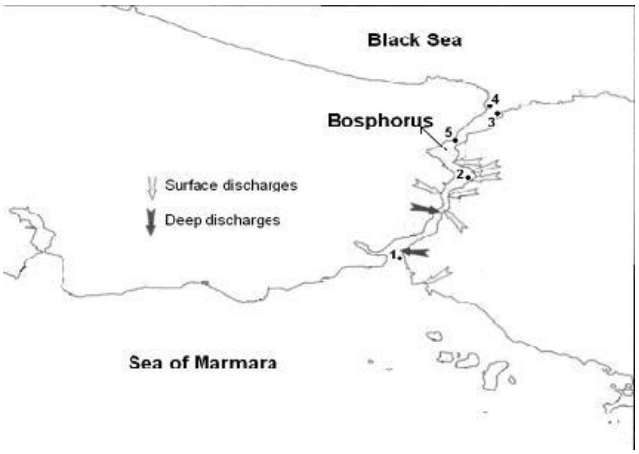

Fig. 1. Research stations in the Bosphorus

Nutrient and chlorophyll-a concentrations are shown in Table 1. The amounts of nitrate+nitrite, phosphate and silicate were 0.26 (November)-42.50 µg-at l-1 (January), 0.24 (September)-7 µg-at l-1 (December) and 1.97 (January)-84.26 µg-at l-1 (December), respectively. Chlorophyll-a concentrations, as an indicator of phytoplankton biomass, ranged between 0.54 (September) and 6.13 µg l-1 (November).

In the present study, nutrient levels in winter period were generally higher than those in spring, summer and autumn. Especially, the highest values were recorded in the untreated domestic waste water discharge point. As Balkis [6] pointed out, there is an increase with time nutrient concentration of the Bosphorus. According to chlorophyll-a based assessments [7], chl-a values in this study showed that the area is generally eutrophic in nature.

Tab. 1. Variations of nutrient and chlorophyll-a concentrations at the research stations

	NO_2+NO_3-N (µg-at l^{-1})			
	Summer	Autumn	Winter	Spring
Stations	Min-Max	Min-Max	Min-Max	Min-Max
1	2.31-6.72	2.23-4.50	3.47-7.37	2.95-3.96
2	3.21-4.69	1.09-3.69	1.21-4.33	2.15-2.96
3	0.71-1.12	0.26-1.52	0.85-1.90	0.73-0.97
4	0.96-2.23	0.85-10.76	6.11-42.50	8.66-9.66
5	2.55-4.87	2.04-10.93	5.25-37.76	21.15-27.3
	PO_4-P (µg-at l^{-1})			
	Summer	Autumn	Winter	Spring
Stations	Min-Max	Min-Max	Min-Max	Min-Max
1	0.61-1.01	0.45-0.49	0.27-0.55	0.25-0.33
2	1.14-3.04	0.53-1.26	0.36-0.41	0.31-0.46
3	0.28-0.32	0.24-0.32	0.27-0.36	0.16-0.33
4	0.28-0.41	0.24-1.26	0.91-4.05	0.55-0.85
5	0.97-1.58	0.61-2.96	5.00-7.00	3.85-4.61
	SiO_4-Si (µg-at l^{-1})			
	Summer	Autumn	Winter	Spring
Stations	Min-Max	Min-Max	Min-Max	Min-Max
1	8.93-12.09	8.93-12.64	2.95-5.17	2.61-3.01
2	4.94-8.79	5.49-7.83	4.55-7.63	3.84-3.97
3	9.07-15.38	7.42-8.52	1.97-14.88	11.21-12.15
4	3.30-14.29	4.94-20.05	26.69-84.26	16.41-21.17
5	7.69-16.48	9.48-21.29	6.89-53.26	33.44-41.10
	Chl-a (µg l^{-1})			
	Summer	Autumn	Winter	Spring
Stations	Min-Max	Min-Max	Min-Max	Min-Max
1	3.35-4.11	1.10-1.77	1.17-5.48	1.56-2.01
2	0.88-1.67	0.99-1.45	1.22-4.85	1.09-1.88
3	0.88-1.92	0.54-6.13	1.44-5.56	1.05-1.78
4	1.56-1.99	1.10-2.58	1.32-5.55	1.63-3.49
5	1.21-2.19	0.90-3.57	1.00-2.44	1.12-1.63

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