VERTICAL PARTICLE FLUX IN A BRACKISH WATER LAGOON, KÜÇÜKÇEKMECE LAKE, IN NORTHWESTERN TURKEY

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Abstract

Vertical particle fluxes are relatively high in this brackish water region. In the upper 10 m the daily flux varied between 5.7 - 21.3; 3.4 – 4.5 and 0.7 – 2.9 g m^{-2} d^{-1} for total mass, organic matter and carbonate, respectively. The highest particle flux was recorded during April and June. Concentrations of Zn and ^{210}Po in sinking particles were found to be 10764 μg g^{-1} d.w. and 1746 Bq kg^{-1} w.w. for particles > 1μm.

Key-words: particle flux, metal, polonium, brackish water

Introduction

Küçükçekmece Lake, a lagoon containing brackish water, is located on the western outskirts of Istanbul . The geographical position of the lake is 41°00' N – 28°43' E and it has a 15 km^2 surface area with a maximum depth of 20 m. Some physical and chemical parameters, measured at different stations in the lake, indicated that Küçükçekmece Lake is eutrophic (1). Furthermore, some papers have been published previously concerning heavy metal and radioactivity levels in biota and sediment samples from the lake (2,3). The collection of sedimenting material in aquatic environments using different types of sediment traps is a method frequently employed by many scientists for different purposes (4-6). It is well known that studies of vertical particle flux have adequately explained the differences with regard to the quantity and quality of the particulate matter exported from the upper layers as well as seasonal and inter-annual differences (6). A literature review of various types of sediment traps and brief survey of applicable sedimentological concepts have been previously published by Blomqvist and Hakanson (7).

Our objectives in this study were (a) to measure mass, organic matter and carbonate fluxes, (b) variability of flux during different seasons under brackish water conditions and (c) to determine some metal and ^{210}Po concentrations in the sedimenting particulate material.

Materials and methods

Vertical flux of particulate mater was determined using a Hydro-Bios model (Saarso), cylindrical trap with 14 cm diameter and 56 cm height. The trap had a conical bottom which ended in a 280 ml sample jar. We have regularly monitored particle fluxes at one station (12 m depth) in the lake from September 1998 to July 1999. The depth of deployment was 10 m and the duration of the deployment was 24 h for each collection. Upon arrival at the laboratory, sediment trap samples were separated from larger organisms by sieving through 1500 μm and 600 μm mesh sizes, and then the wet sample was split into 1/4 aliquots using a rotary splitter. Three 1/4 aliquots were filtered through precombusted and preweighed 47 mm Whatman polycarbonate filters of 1 μm and 0.2 μm pore size. After that the filters were rinsed with 250 ml prefiltered distilled water. The filters were than dried at 60°C for 24 h and weighed. The mass, organic matter and carbonate fluxes were determined using the methods of Puskaric *et al.* (4). Determinations of metal and ^{210}Po concentrations in the particulate matter were similar to that previously described (8-9).

Results and discussion

The highest sedimentation fluxes of mass, organic matter and carbonate were recorded in April and June (Fig.1). Our results indicated that these high fluxes were related to phytoplankton and zooplankton abundances. The Secchi disc depth and suspended matter values in the surface water of the lake were found to be 0.3 and 0.5 m and 18 and 21 mg l^{-1} in April and July, respectively (1). In contrast, the highest Secchi disc and the lowest suspended matter values were noted in October and December. In the lake's surface waters, BOD5 ranged from 0.86 to 9.10 mg l^{-1} with the higher values observed in April and July (1). This observation also indicates a rapid degradation of biogenic materials. Examining the results in detail, it can be seen that the smallest mass flux represented ~40 %, of the total particulate material with the exception of the January samples. This suggests that natural planktonic bacteria also play a significant role in the mass flux. Furthermore, the organic matter flux was much greater than carbonate flux in this brackish water environment. The metal concentrations in sediment trap water and particulate materials are shown in Table 1. The sediment trap material (> 1μm) contained a higher concentration of Cr, Sc, Zn and Co than in the other fractions examined. The Cr, Fe, Zn and Co levels in sediment trap material (>1 μm) are higher when compared with the deep sediment samples of Küçükçekmece lake (2-3). The highest ^{210}Po natural activity in sedimenting particles from the brackis lake was recorded during May 1998 (1746 Bq kg^{-1} in the > 1 μm fraction) (Table 1). Our preliminary results on vertical particle fluxes show that it is necessary to have more ancillary data (e.g., nitrogen flux, lithogenic flux, fecal pellet flux, chlorophyll a equivalent flux) in order to better understand the transfer and transport processes affecting chemical pollutants and natural radionuclides in this unique brackish lake which is heavily influenced by man's activities.

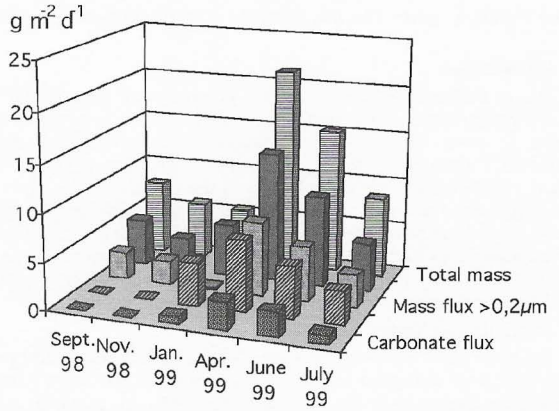

Fig. 1. Vertical particle flux in a brackish lagoon measured over 24h with a sediment trap.

Table 1. Metal and 210Po concentrations

Metals µg g-1 d. w. June 1998	Sediment trap water	Sediment material >1µm	Sediment material > 0.2 µm
Br	1208±245	938±290	284±177
Th	0.38±0.18	7.43±1.15	3.67±1.41
Cr	15.6±2.5	123.4±22.1	47.4±23.7
Sc	0.41±0.03	7.73±0.43	1.09±0.12
Fe	2013±139	30019±862	4002±845
Zn	3345±220	10764±519	1868±114
Co	1.09±0.16	16.43±1.11	5.61±1.13
Radionuclide			
^{210}Po Bq kg^{-1} w. w.			
January 1998	-	587±17	-
May 1998	-	1746±83	983±115
June 1998	-	405±29	491±54
July 1998	-	134±12	

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