Copper, Chromium and Manganese in Water and Sediment of Kali Estuary, Karwar

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Copper, chromium and manganese concentrations in the water and sediment samples along with some physico-chemical parameters were determined at four stations of Kali estuary. The mean concentrations of Cu, Cr and Mn in water were 0.11, 0.044 and 0.327 ppm respectively. The corresponding values for sediment were 7.022, 14.13 and 185.66 ppm on dry weight basis. In the spatial sequence, the variation in trace metals concentration of sediment exhibited a clear increasing trend from the estuarine mouth towards upstream. Range in temperature, salinity and dissolved oxygen were 27.30 - 34.00°C, 0.14 - 29.04‰ and 3.88 - 6.70 ml/l respectively.

Some of the trace metals are of great biological significance. Deficiency of these metals sometimes seriously impair the physiological processes. Also, it is known that certain trace metals when exceed the natural levels, become toxic, e.g. Cu. Bryan (1976) has reviewed the importance of trace and heavy metals to marine biota, while Wolfe (1975) has modelled the distribution and cycling of metallic elements in estuarine ecosystems. Concentration of each metal in the aquatic system is influenced by biogeochemical cycles of metals and also by pollutants. The physiochemical parameters however, determine the bioavailability and toxicity of respective metals. Hence, it is essential to have a baseline information on the concentration of these metals, before evaluating their toxic effect to the biota.

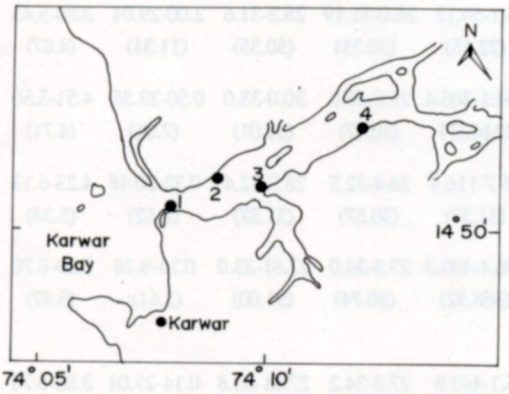

Fig. 1. Position of stations in Kali estuary

In the present study, concentration of three trace metals (Cu, Cr & Mn) were determined in water and sediment of Kali estuary from July to November 1987 at four stations (Fig. 1). These metals were selected on the basis of their relative biological importance and role played in biogeochemical cycles of estuaries.

Materials and Methods

Water and sediment samples were collected with maximum care to avoid contamination. The plastic bottles and glasswares used in collection and analysis of samples were washed with 1N HCl and rinced with double distilled water and dried at 55°C. All the chemicals used for analysis were of analar grade.

Surface water samples were collected for determining temperature, salinity and dissolved oxygen by following standard methods (Strickland & Parsons, 1975). Acid washed 250 ml plastic bottles were used for collecting water for trace metal analysis. 2 ml each of concentrated HNO_3 was added to water samples immediately after collec-

tion. Sediments were collected in clean polythene bags, mixed with 5 ml chloroform and brought to the laboratory. All the samples were analysed for Cu, Cr and Mn (Anon, 1980) using Atomic Absorption Spectrophotometer (GBC-902). The values were expressed in ppm dry weight for sediment and in ppm for water samples.

Results and Discussion

Table 1 shows the range and mean values of Cu, Cr and Mn in water and sediment, along with physicochemical parameters at four stations of Kali estuary. The values reported for water are the total concentration. Fig. 2 depicts the trend in variation of trace metals (average of all stations) during different sampling periods, spread through monsoon and postmonsoon months.

Zingde & Singbal (1983) have observed 1.5 - 8.7 ppb of Mn and 0.8 - 3.5 ppb of Cu in Binge Bay of Karwar waters. Qasim & Sengupta (1980) have reported 7.7 - 16.6 ppb of Mn and 2.5 - 19.9 ppb of Cu in the waters of Arabian sea. Shanmukhappa (1984) has reported 0.2 - 10 ppm of Cu and 2.2 - 11.2 ppm of Mn in sediments of Vellar estuary. The present values are considerably higher both in water and sediment, since the study area is influenced by riverine flow, which carry these metals from the upstream into the estuarine zone. Besides, the local flora and fauna also contribute significant amounts of trace metals to the system. For e.g. Bhosale (1979) has reported 32.2 - 158.7 ppm of Mn and 4.1 - 9.1 ppm of Cu in various species of mangrove leaves, the decay of which contribute these metals to the surrounding aquatic systems.

The metal concentrations of both water and sediment exhibited a high degree of variation over the months of study (Fig.2), which might be due to sorption and desorption of these metals between sediment and water. Further, metals like Cu and Cr have a greater affinity to organic matter and their concentration is generally higher in sedi-

Table 1. *Range and mean values of trace metal concentration in water (ppm) and sediment (ppm dry weight) and physicochemical parameters*

Station No.	Water			Sediment			Physicochemical parameters			
	Cu	Cr	Mn	Cu	Cr	Mn	Temperature (°C) Water	Temperature (°C) Sediment	Salinity ‰	Dissolved oxygen (ml/l)
1.	0.107-0.158 (0.122)	ND-0.147 (0.054)	0.136-0.258 (0.186)	0.85-5.50 (2.83)	1.25-6.60 (4.97)	5.1-50.15 (22.15)	28.0-31.19 (30.35)	28.2-31.6 (30.35)	2.00-29.04 (11.34)	3.88-5.43 (4.87)
2.	0.062-0.176 (0.099)	0.004-0.174 (0.057)	0.138-2.105 (0.470)	36.00-9.50 (5.2)	11.2-15.8 (12.44)	154.1-308.4 (244.37)	29.0-33.0 (30.47)	30.0-33.0 (31.01)	0.50-23.35 (7.01)	4.51-5.50 (4.71)
3.	0.035-0.527 (0.125)	ND-0.086 (0.040)	0.025-1.200 (0.264)	4.4-18.6 (8.93)	15.1-23.6 (20.31)	76.7-116.4 (31.57)	28.4-32.5 (30.57)	28.7-32.4 (31.57)	0.32-20.48 (8.62)	4.23-6.13 (5.38)
4.	0.069-0.124 (0.088)	ND-0.043 (0.017)	0.093-1.197 (0.383)	4.0-12.7 (7.57)	11.5-21.4 (17.07)	306.4-493.3 (388.92)	27.3-34.0 (30.74)	27.61-33.0 (31.00)	0.14-8.28 (2.61)	5.29-6.70 (5.82)
	0.035-0.527 (0.11)	ND-0.174 (0.044)	0.025-2.105 (0.327)	0.85-18.6 (7.022)	1.25-23.6 (14.13)	5.1-493.3 (185.66)	27.3-34.2 (30.53)	27.61-33.8 (30.90)	0.14-29.04 (7.47)	3.85-6.70 (5.20)

ND - Not detectable

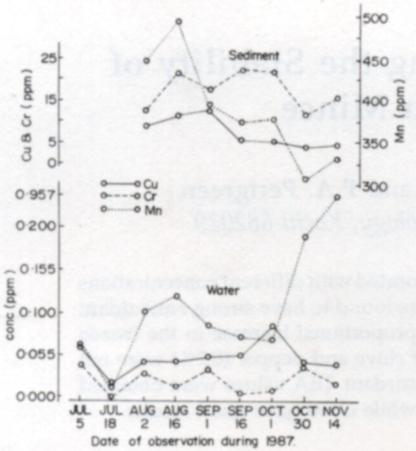

Fig. 2 Average concentration of trace metals in water and sediment

ments when the same is low in water due to desorption of these metals from water column (Moore & Ramamurthy, 1984).

The study period comprised both monsoon and postmonsoon months (July to November) resulting in a high range in the observed salinity values (0.14 - 29.04‰) at the study stations. Dissolved oxygen varied between 3.88 and 6.7 ml/l. The temperature of water (27.3 - 34.0°C) and sediment (27.67 - 33.8°C) did not vary much (Table 1). The above parameters does not seem to have any influence on the variation of trace metals.

The Cu concentration in the water seems to be higher than natural levels. But, the toxicity and bioavailability of any metal is dependent on free metal ion (Moore & Ramamurthy, 1984) and not on the total metal. In the present study, higher concentration of trace metals, specially Cu observed may be found in organically or inorganically bound form. Hence, the possible toxic effect due to high concentration of Cu is not observed in these waters. There is no major industry (which release trace and heavy metals) situated near the study site, but a small scale mining activity is seen at the upper reaches of the Kali river. Possibly, due to precipitation and leaching, the present area might have received higher concentration of trace metals during certain months.

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