Trace metals contamination in surface water, sediment, some fishes and sea foods in the coastal area, Bangladesh

○Mohammad Raknuzzaman [1], Mohammad Raknuzzaman [1], Md Kawser Ahmed [2], Md Saiful Islam [3], Md Habibullah-Al-Mamun [1], Shigeki Masunaga [1]

[1] *Graduate School and Faculty of Environment and Information Sciences, Yokohama National University, Japan*, [2] *Department of Oceanography, University of Dhaka, Dhaka 1000, Bangladesh,*

[3] *Department of Soil Science, Patuakhali Science and Technology University, Dumki, Patuakhali 8602, Bangladesh*

[Introduction]

Accumulation of trace metals in aquatic ecosystems has become a great problem throughout the world, especially in developing countries like Bangladesh. Trace metals contamination in sediment has been regarded as a critical problem of marine ecosystem due to their toxicity and bioaccumulation (Chapman et al., 1998). In recent, the trace metals contamination in fish and sea foods have also become an important and severe issue to human health risk (Cid et al., 2001). The increased unplanned industrialization, urbanization, huge population growth and overall trans-boundary rivers problem accelerate the coastal water pollution in Bangladesh. The concerned authorities and general people have not been aware and no complete study carried out so far regarding this issue that makes vital public health problem in near future. Thus, the aim of the study is to determine the concentrations of certain trace metals (Cr, Ni, Cu, Zn, As, Cd and Pb) and their distribution in surface water, sediment, some fishes and sea foods in the Bangladeshi Coastal area.

[Methods]

Four coastal sampling sites; Cox's Bazar (St1), Chittagong (St2), Meghna Estuary (St3) and Sunderbans (St4) with three different stations of each were investigated **Fig. 1**. The water, sediment, fish and sea foods composite samples were collected in August, 2013. The surface water samples were collected in 100 ml polyethylene bottles previously washed with dilute nitric acid and deionized water. Coastal bed sediment (top to 5 cm) was collected by Ekman grab sampler. Sub-samples were oven dried at 105°C for 24 hour. Fish samples were rinsed in deionized water to remove surface adherents. About 100 g of fish muscle were taken for freeze drying and stored in polypropylene Ziploc bag. Heavy metals were analyzed by ICP-MS (Agilent 7700, USA).

[Results and discussion]

Metal concentrations in water samples are shown in **Fig. 2**. Among the sites, the Cox's Bazar hatchery showed the highest levels of Zn (1392), Cu (510) and Pb (109 µg/L). It might be due to huge discharge of different salts and chemicals from hatcheries through the underground pipeline to the beach area. Metal concentrations in different fish and see foods are shown in **Table 1** where significantly higher metal concentration was observed in crabs than in fishes. Crabs may be considered as an absolutely discrepant aquatic species and represent a totally different bioaccumulation pattern (Ololade et al., 2011). Arsenic (As) concentration was remarkably high in Cox's Bazar fish and crab samples **(Table 1)** due to illegal operation of hatcheries and other industries near

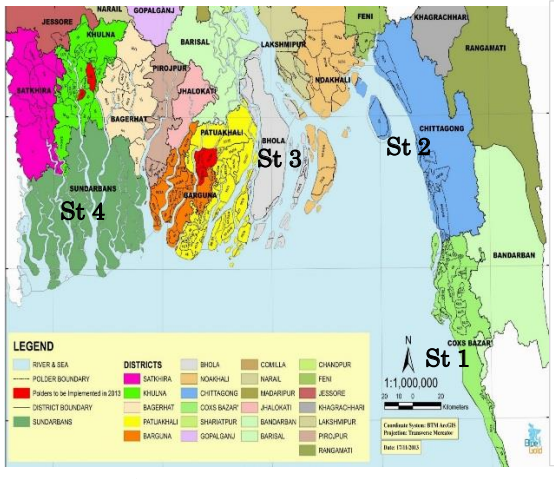

Fig. 1: Map showing sampling sites in the coastal area of Bangladesh

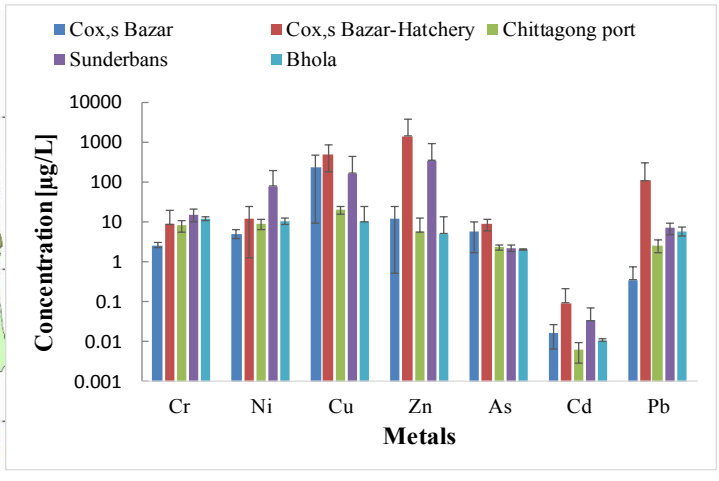

Fig. 2: Mean (± SD) values of metal concentrations (µg/L) in water.

beach area. Interestingly, remarkable high concentration of Zn was observed in every fish and sea foods. Metal concentrations of sediment samples are shown in **Fig. 3**. Among the sites, the Chittagong ship breaking area showed the highest levels of Cr (56), Ni (37) Cu (28) and Pb (41 mg/kg dw) which exceeded the Canadian Sediment Quality Guidelines **Table 2**. It might be due to huge ship breaking and different activities of chemical industries.

Table 1: Mean metal concentrations (mg/kg wet-weight) in fish and sea foods.

Sampling sites	Species	Cr	Ni	Cu	Zn	As	Cd	Pb
Cox's Bazar	Fish (n = 9)	2.2	0.56	14	138	13	0.075	0.63
	Shrimp (n =18)	1.1	1.30	13	131	2.5	0.086	0.38
	Crab (n = 9)	29	43	400	1480	53	8.3	68
Chittagong port	Fish (n = 9)	1.1	0.51	5.9	53	2.7	0.06	0.51
	Shrimp (n = 18)	1.0	1.40	22	107	2.0	0.12	0.31
	Crab (n = 9)	14	34	305	902	34	4.2	79
Sunderbans	Fish (n = 9)	0.15	0.10	1.3	31	1.1	0.033	0.07
	Shrimp (n = 18)	0.34	0.49	63	53	0.92	0.022	0.10
	Crab (n = 9)	0.48	1.40	80	157	1.3	0.094	0.49
Bhola	Fish (n = 9)	0.32	0.28	1.6	34	0.76	0.051	0.25
	Shrimp (n =18)	0.27	0.77	52	114	0.30	0.097	0.13
	Crab (n = 9)	0.29	0.81	111	137	1.5	0.19	0.24

Table 2: Guidelines levels of metals in marine sediment described in the literature and range of concentrations (mg/kg dw) found in the studied area.

International Standard	Cr	Ni	Cu	Zn	As	Cd	Pb	References
Range of concentration	14−56	20−37	3−28	20−54	2−4	0.003−0.07	8−40	Present study
Canadian Sediment Quality	52.3	15.9	18.7	124	7.24	0.7	30.2	*ISQG

*ISQG: Interim Marine Sediment Quality Guidelines, Canadian Sediment Quality Guidelines for the Protection of Aquatic Life. Summary tables, 2001. ISBN 1- 896997-34-1.

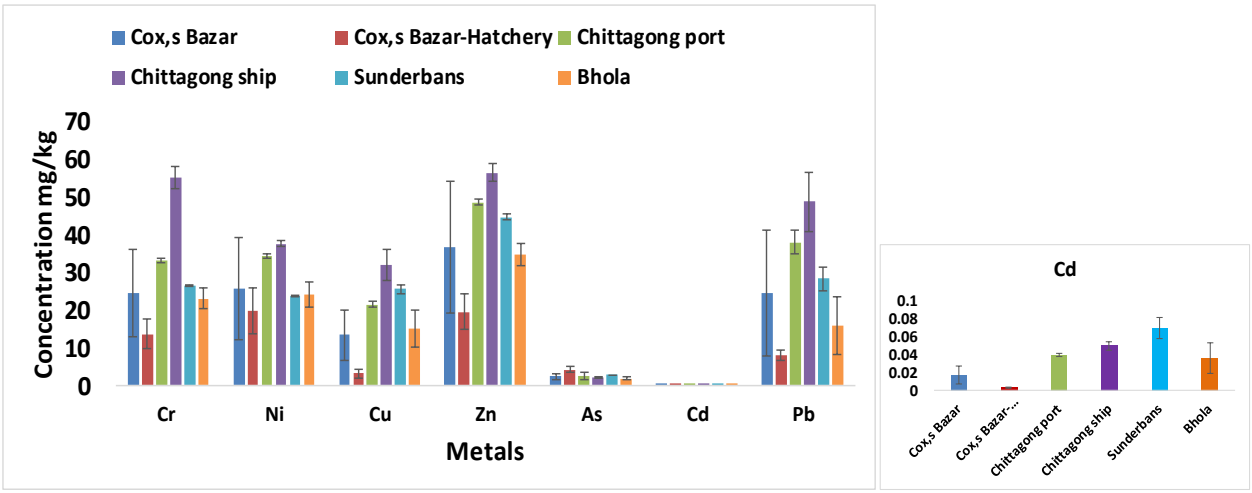

Fig. 3: Mean (± SD) values of metal concentrations in sediment for each sampling site (n=18, mg/kg dw).

[Conclusion]

Cox's Bazaar hatchery water was more contaminated by the metals. Crab and Sole (benthic fish) were more susceptible to possess high metal accumulation than other fishes. Arsenic (As) and Zink (Zn) concentration was remarkably high in Cox's Bazar fish and crab. Metal concentrations in sediment were also very high in Chittagong ship breaking area. The high concentration of metals in this coastal ecosystem is highly affecting the aquatic life and increasing the ecological risk in the coastal area of Bangladesh that must be continued taking into account and remediating.

[References]

Cid et al (2001), Food Chemistry, 75, 93-100.
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