Pollution may impair water, food, ecosystems, health and livelihoods

Trace/heavy metals are cadmium (Cd), cobalt (Co), chromium (Cr), copper (Cu), iron (Fe), mercury (Hg), manganese (Mn), nickel (Ni), lead (Pb), uranium (U), and Zinc (Zn). Metals pollution can be caused by direct discharge of effluents from mining, agriculture, aquaculture, fertiser factories, ship breaking yards, tanneries, sewage and city wastes, landfills, paper mills, dyeing industries, textile mills, and oil refineries. Contamination of aquatic ecosystems and rivers, estuaries and coastal areas with metals may cause water unsuitable for human drinking, irrigation, recreation, aquaculture, agriculture, livestock framing, biodiversity (fish).

Fig. 1. ‘Artificial mussel’ device used in trace/heavy metals monitoring in Bangladesh (Kibria et al., 2012).

In order to assess risks of metals pollution (time and space scale) in aquatic environment, it requires frequent water sampling and analysis, which is not cost effective. To overcome this problem, we have used an innovative continuous metals monitoring tool called ‘Artificial mussels (or AM) in our study (AM developed and trialled by our groups previously in other countries such as in Australia, Hong Kong, Portugal, Russia, Scotland, South Africa, South Korea). Artificial mussel (AM) (60 mm x 25 mm) (Fig. 1) is a passive sampling device that accumulates metals through a diffusion barrier onto a sorbent medium. One of the major advantages of AM is that the device can be used to monitor pollution in a range of situations (non-polluted to much polluted environment where oxygen level could be almost nil and where there are no aquatic life due to severity of pollution) (Fig. 2).

Using AM, we have identified eleven metals pollution “hot spots” in the estuary and coastal area of the Bay of Bengal, Chittagong, Bangladesh during 2013 monsoon and post monsoon seasons. They are Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, U, and Zn. Some of the metals detected in our study are highly hazardous to biota, food security and human’s health as explained below: Hg, Ni, Pb, U are toxic to biota (fish, shrimps/prawn, amphibians and mammals) (can cause lethal and sub-lethal effects on organisms); Cd, Hg, Pb can accumulate in crops and seafood, therefore, can be transferred to humans via food chain pathway (consumption of contaminated fish, crops/vegetables or from growing of crops/vegetables in contaminated lands or from irrigating crops with metals contaminated water); Cd, Hg, Pb, Zn may cause disruption of endocrine/hormone systems in fish and wildlife and Cd, Cr, Ni, Pb are known carcinogen (cancer causing).

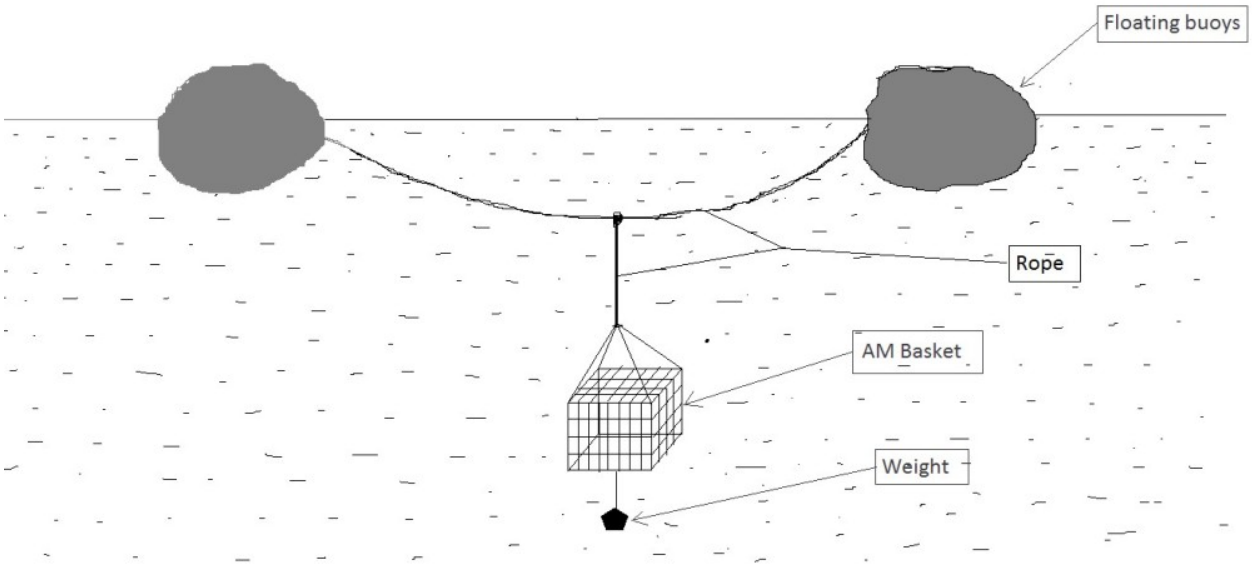

Fig. 2. AM. AM deployed in coastal sites in Bangladesh by anchoring onto floating buoys and passing a strong nylon rope in between.

Our results demonstrate that the Karnafuli River-estuary and adjacent coastal area of the Bay of Bengal, Chittagong, Bangladesh are highly polluted by hazardous metals. Agricultural, untreated domestic, industrial and city wastes directly discharged into the waterways have been identified as the main causes of metal pollution in Bangladesh. The identified pollution “hot spots” possess significant ecological values since these waterways support commercial fisheries, recreational activities, natural breeding and nursing grounds of native fish, prawn/shrimp and other ecosystem goods and services including rural livelihoods. The identification and detection of hazardous metals in the studied areas, therefore, may pose a risk to environmental water quality, ecosystems, aquatic biodiversity, seafood security, and human health and livelihoods of people. There is a need for regular monitoring to ascertain that local water quality with respect to metal levels are within

acceptable levels to safeguards both environmental health and public health.

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Publication

Trace/heavy metal pollution monitoring in estuary and coastal area of Bay of Bengal, Bangladesh and implicated impacts.
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