935/E2/Poster

Concentrations of six heavy metals in water, sediment and benthic snails of the Bolgoda lagoon network

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Anthropogenic inputs from industries have resulted in the rise of heavy metal levels in the Bolgoda river system, which nourishes the Bellanwila – Attidiya Sanctuary, one of the last remaining urban freshwater wetlands in Sri Lanka. This wetland supports many species of flora and fauna. The majority of the studies carried out have focused on examining the levels of heavy metals in selected fish species and water samples while attempts to correlate levels in different abiotic and biotic media are scarce. The assessment of heavy metals in benthic sediments in particular, as they act as a sink for heavy metals in water bodies, is important to ascertain the risks to a wide range of fauna, especially to those inhabiting the water. The present study aimed to ascertain the levels of six heavy metals (Cd, Cr, Pb, Ni, Cu and Zn) in water, sediment and benthic fauna (snails) and to identify the association between these components for any of these metals. A total of 75 locations in the Bolgoda river network were sampled for each abiotic component, whilst benthic fauna were collected from 21 locations. The levels of selected heavy metals were analyzed using Flame Atomic Absorption Spectrophotometry. The study revealed that the ranges of the recorded levels in water were Cd: ND - 0.044 mg dm^{-3}, Cr: ND- 0.10 mg dm^{-3}, Pb: ND - 1.6 mg dm^{-3}, Ni: ND -0.26 mg dm^{-3}, Cu: ND - 0.069 mg dm^{-3}andZn: ND -1.5 mg dm^{-3}). The heavy metal levels at most of the locations exceeded safety values for aquatic species (Cd: 0.25 µg dm^{-3}, Cr: 11 µg dm^{-3}, Pb: 2.5 µg dm^{-3}). Additionally the ranges for sediments (Cd: ND - 2.3µg g^{-1}, Pb:21.9 – 148 µg g^{-1}, Ni: ND – 481 µg g^{-1}, Cu: 7.20 – 196 µg g^{-1}, Zn: 26.8 – 575 µg g^{-1}) have shown to be toxic to aquatic fauna according to the United States Environmental Protection Agency. The benthic snails also accumulated high levels of the toxic elements (Cd: 1.14 – 6.89 mg dm^{-3}, Cr: ND- 12.6 mg dm^{-3}, Pb: 17.4 -72.4 mg dm^{-3}).A significant correlation was however, obtained only for heavy metal levels in sediments and snails, and only for Cr ($r = 0.92$, $P < 0.05$), although an inverted hormetic response was observed for Ni. The results obtained show that the Bolgoda river system is contaminated by toxic heavy metals such as Cr, Cd and Pb. Furthermore, accumulation levels in snails indicate possible dangers for other benthic species, such as earthworms and detritivorous fish.

Keywords: Benthic fauna, benthic sediments, lagoon network, heavy metals

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