

Relationship of metal distribution with salinity gradient in brackish water lagoon

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Chilika, the largest brackish water lake in Asia, is intricately affected by terrestrial runoff (northern sector: NS) and seawater influx (outer channel: OC) besides the perturbations caused by fishing and tourism activities; all of which affect the behavior of metals in this aquatic system. Lake floor sediments from 22 fixed stations were collected from NS and OC during pre-rainy, rainy, and post-rainy seasons and were analyzed for major and trace metals concentrations and grain size distribution to understand the metal distribution pattern in relation to the salinity gradient of the lake. In-situ measurement of physicochemical parameters (electrical conductivity and pH) of lake bottom water indicate fresh-brackish water condition in NS due to high fresh water discharge from rivers and saline condition in OC due to incursion of sea water from the Bay of Bengal. The river discharge makes the sediments rich in metal concentrations in its proximity, which decrease towards the sea mouth except at few stations. During rainy season, concentrations of Al, Ca, K, and Mg are higher in river proximal region, which gradually taper to become constant, except for two stations. During post-rainy season, the concentrations of metals become quite uneven due to their mobilization, which attains stability during pre-rainy season. Fe and Mn show higher concentrations in low salinity region and gradually decrease towards the high salinity region. The fine grain sediment has both higher metal accumulation and retention in NS during all the seasons. The strong positive correlations between fine grain sediments with metal concentrations suggest accumulation, retention, and remobilization modulated by grain size pattern of lake floor sediments. As per Sediment Quality Guidelines [1], it is observed that Cr, Cu, and Pb exceeds the specified probable effect level and effect range low benchmark and indicate occasional adverse biological effect on the lake ecosystem, which is high in NS as compared to OC. Thus, metal concentrations are affected by the salinity of the lake irrespective of their terrestrial or lithogenic origins.

[1] Sarkar (2018). Trace Metals in a Tropical Mangrove Wetland, Springer, doi:10.1007/978-981-10-2793-2