

Bioaccumulation of heavy metals/metalloids and associated health risk assessment in *Scylla serrata* and *Penaeus* spp. from the Negombo estuary, Sri Lanka

W. A. S Fernando¹, K. A. D. D. Sakunthala², W. P. R. T. Perera^{2,3}, W. A. P. J. Premaratne^{1,2}, J. A. Liyanage^{1,2*}

¹College of Chemical Sciences, Institute of Chemistry Ceylon, Rajagiriya 10107, Sri Lanka

²CKDu Information and Research Centre & Department of Chemistry, Faculty of Science, University of Kelaniya, Sri Lanka.

³Department of Indigenous Medical Resources, Faculty of Indigenous Health Sciences and Technology, Gampaha Wickramarachchi University of Indigenous Medicine, Sri Lanka.

*janitha@kln.ac.lk

The Negombo estuary is an economic hub for shrimp and crab fisheries, serving as an important source of protein. However, its proximity to industrial zones has led to heavy metal/metalloid contamination that poses toxicity risks to consumers. This study quantified selected toxic elements in popular crustacean species and assessed consumer health risks. Samples of two commercially important crustacean species, *Scylla Serrata* (mud crab) (n= 12, average weight= 198.20 g) and *Penaeus* spp (shrimp) (n= 12) were collected from approximately 2 km distance from the Kirillagahawatta region. Shrimp were categorized as juvenile (average weight = 0.70 g) and sub-adult (average weight=2.30 g) based on size. Concentrations of Pb, Cd, Cr, and As were determined using Inductively Coupled Plasma-Mass Spectrometry, following microwave digestion. The Target Hazard Quotient (THQ) was evaluated to determine the non-carcinogenic health risk. *Scylla serrata* species had the highest concentrations of toxic elements (Cr=1.73 ± 0.00 mg/kg, As=1.08 ± 0.42 mg/kg, Cd=1.45 ± 0.82 mg/kg, Pb=2.10 ± 0.87 mg/kg) with its hepatopancreas being the most contaminated tissue. Across all samples, total ranges and means (mg/kg) were Cr=1.38 -1.88 (mean=1.648 ±0.170); As=0.29-

1.08 (mean= 0.652 ±0.225); Cd= 0.01-1.45 (mean= 0.316 ±0.367); Pb=0.64-2.10 (mean=1.31 ±0.85). Concentration of heavy metals/metalloids increased from juvenile to sub-adult stages of *Penaeus* spp. The highest THQ is observed for As (11.95 ± 4.72) in *Scylla serrata* hepatopancreas, which is about 12 times higher than the threshold. Carcinogenic risk for *Scylla serrata* hepatopancreas was acceptable for Pb (5.0×10^{-5}) but exceeded thresholds for Cr (2.90×10^{-3}) and As (0.5×10^{-3}). Notably, Cd levels in the *Scylla serrata* hepatopancreas posed an even greater concern (2.94×10^{-2}). Thus, chronic exposure imposes significant carcinogenic and non-carcinogenic risks such as renal and endocrine dysfunction. Environmental regulation is essential for ensuring ecosystem conservation and consumer safety.

Keywords:

Health-risk assessment, Negombo estuary, *Scylla serrata*, *Penaeus* spp