



Evaluation of heavy metal pollution and ecological risk of surface sediments in a tropical mountainous River-Estuary-Shelf Continuum system: A case study of the Selangor River, Malaysia

Aijun Wang^{a,b,c,*}, Chui Wei Bong^{d,e,**}, Shuqin Tao^{a,b}, Xiang Ye^a, Boyu Liu^{d,e},
Haoshen Liang^a, Xinqing Zheng^{a,c,f}, Yi You Wong^{d,e}, Kar Hoe Loh^e, Haiqi Li^{a,g},
Keliang Chen^{a,h}, Siew Huah Limⁱ, Choon Weng Lee^{d,e}

^a Third Institute of Oceanography, Ministry of Natural Resources, Xiamen, 361005, China

^b Fujian Provincial Key Laboratory of Marine Physical and Geological Processes, Xiamen, 361005, China

^c Observation and Research Station of Island and Coastal Ecosystem in the Western Taiwan Strait, Ministry of Natural Resources, China, Xiamen, 361005, China

^d Laboratory of Microbial Ecology, Institute of Biological Science, Faculty of Science, Universiti Malaya, 50603, Kuala Lumpur, Malaysia

^e Institute of Ocean and Earth Sciences, Universiti Malaya, 50603, Kuala Lumpur, Malaysia

^f Fujian Provincial Station for Field Observation and Research of Island and Coastal Zone in Zhangzhou, Zhangzhou, 363216, China

^g College of Marine Science, Shanghai Ocean University, Shanghai, 200090, China

^h Xiamen Ocean Vocational College, Xiamen, Fujian, 361100, China

ⁱ Department of Chemistry, Faculty of Science, Universiti Malaya, 50603, Kuala Lumpur, Malaysia

ARTICLE INFO

Keywords:

Heavy metal pollution
Ecological risk
Surface sediment
River-Estuary-Coastal Shelf continuum
Selangor River
Malaysia

ABSTRACT

As human activities continue to increase, the global production of pollutants has increased significantly, with the majority of pollutants being transported to the ocean via rivers, resulting in intensified pollution in estuaries and coastal areas. To maintain a healthy marine ecological environment, it is necessary to consider rivers, estuaries, and coastal seas as integrated systems and implement pollution management based on the concept of land-ocean integration. In this study, heavy metal elements in the surface sediments of Selangor River-Estuary-Coastal Shelf Continuum were collected and analysed to assess their pollution levels and potential ecological risks. The results show that the heavy metal content is high in the downstream and estuarine regions, with a general decreasing trend observed from nearshore to offshore in the coastal shelf area. The heavy metal pollution assessment indicates that the surface sediments of the Selangor River-Estuary-Coastal Shelf continuum were contaminated, with the most severe pollution occurring downstream and within the estuary. The pollution levels gradually decrease after exiting the estuary. The ecological risk associated with heavy metal pollution in rivers, estuaries, and southeastern coastal areas was classified as moderate to serious, whereas other areas exhibited only slight ecological risks. Specifically, As causes serious pollution in the river and estuary, with moderate-to-serious pollution in the coastal shelf area and moderate-to-serious ecological risks, mainly originating from mining within the river basin. Pb causes moderate pollution in the river, estuary, and coastal areas, with slight ecological risks due to mining within the river basin and inputs from nearby rivers, ports, and industrial activities. Other heavy metals cause minor pollution and pose minimal ecological risks.

1. Introduction

Pollution in marine and coastal environments is a serious global issue that has received significant attention due to its environmental

persistence, biogeochemical cycling, ecological security, and potential human health risks (Meijer et al., 2021; Naik et al., 2023). Approximately 85% of global marine pollution originates from human activities on the land surface and 90% of inland anthropogenic pollutants are

This article is part of a special issue entitled: EBERCA published in Marine Environmental Research.

* Corresponding author. Third Institute of Oceanography, Ministry of Natural Resources, Xiamen, 361005, China.

** Corresponding author. Laboratory of Microbial Ecology, Institute of Biological Science, Faculty of Science, Universiti Malaya, 50603 Kuala Lumpur, Malaysia.

E-mail addresses: wangaijun@tio.org.cn (A. Wang), cwbong@um.edu.my (C.W. Bong).

<https://doi.org/10.1016/j.marenvres.2025.107017>

Received 21 January 2025; Received in revised form 9 February 2025; Accepted 13 February 2025

Available online 13 February 2025

0141-1136/© 2025 Elsevier Ltd. All rights are reserved, including those for text and data mining, AI training, and similar technologies.