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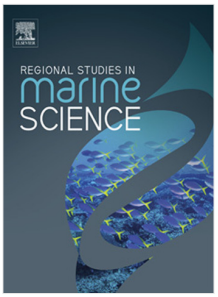

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Biomagnification of total mercury in the mangrove lagoon foodweb in East coast of Peninsula, Malaysia

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Abstract

The combined analyses of total mercury (Hg) and stable isotopic ($\delta^{13}C$ and $\delta^{15}N$) ratios were conducted to describe the food web pathways of dietary Hg, from basal food sources to benthic invertebrates and higher trophic level fish, and to determine if biomagnification of Hg is a persistent process in the food web in a mangrove creek in Setiu Lagoon. The study showed that Hg concentrations were relatively low in mangrove litter and sediment, but elevated gradually in higher trophic level consumers. Based on $\delta^{13}C$ values, the variation of gastropod Hg concentrations are likely correspond with local dietary sources of Hg in sediments, while variations in bivalve Hg reflect their exposure to low Hg concentrations in the water body. The combination of depleted $\delta^{13}C$ values and high Hg concentration in gastropods suggest that microbially produced Hg sources in mangrove sediments play an important role in benthic biotransfer pathways. The isotopic compositions of crustaceans demonstrate the importance of feeding behaviour in Hg bioaccumulation. High bioaccumulation of Hg occurred consistently in carnivorous fish species, particularly piscivorous *Caranx ignobilis*. The enriched $\delta^{13}C$ of fish species reflects a small contribution of mangrove-derived organic carbon to the fish food web in the mangrove creek, accordingly the fish community may intake dietary sources of Hg via trophic relay or bioadvection, however further studies are needed to elucidate such factors. A positive relationship was found between Hg concentration and trophic level (derived from $\delta^{15}N$, trophic magnification factor of 1.5) even at low Hg concentration in the base of the food web, providing evidence for Hg biomagnification in the mangrove food web of Setiu lagoon. Whilst Hg concentrations in fish and commercial crabs did not present a risk for human consumption, the Hg concentration of *Caranx ignobilis* approached the official permitted level. In the future, there is a need for Hg biomonitoring designed to assess carnivorous fish in order to comprehensively assess the potential effects of human activities and land use around the upper reaches of the Setiu ecosystem.

Keywords: Mercury, biotransfer, stable isotope, health risk, mangrove, food web

INTRODUCTION

Mercury (Hg) is a potentially toxic metal when released into the environment by natural or anthropogenic sources. Atmospheric deposition is among the main routes by which Hg enters aquatic ecosystems (US EPA, 1997). Recently, the Hg emission from combustion of industrial and municipal solid waste has been of great concern, and because of long-range atmospheric transport and deposition, elevated levels of Hg are being observed even in remote areas and pristine habitats (Chen et al., 2013; Wiedinmyer et al., 2014; Fitzgerald et al., 1998). The toxicological concern regarding Hg bioaccumulation has given rise to extensive surveys of Hg concentrations and speciation in