Borneo Journal of Resource Science and Technology (2018), 8(1): 30-40

Assessment of Heavy Metals in Water, Fish and Sediments of the Baleh River, Sarawak, Malaysia

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ABSTRACT

This paper reports the heavy metals content in water, sediments and in fish of the Baleh River, in order to evaluate the contamination status of metals. Water and sediment samples were obtained from seven stations located upstream of the Baleh River. Fish species were collected using netting and three species were recorded. Samples were digested and subjected to metal analysis. The findings indicate that there is low risk of metal contamination in water and sediments. Nonetheless some stations were characterized by higher levels of Fe, Al and Mn in water, likely due to accelerated sediment runoff. The acid extractable metal content reported in this study represents the dissolved and weakly-sorbed metals on particulates. For fish, accumulation of heavy metals was found to be more pronounced in the gills, compared to dorsal and ventral muscles. The concentration of Fe, Mn and Al were particularly high in the gills, as these elements were abundant in water. Hg on the other hand was consistently higher in dorsal and ventral muscles. Generally, concentrations of heavy metals in fishes of the Baleh were well within the permissible limit of Food and Agriculture Organization.

Keywords: contamination status, metal analysis, Fe, Mn, Al

INTRODUCTION

The popular writer O'Hanlon (1984) describes Baleh as the Heart of Borneo; this part of Sarawak is covered with tropical forest that is home to numerous species of flora and fauna. However, the natural forest has been extensively converted into timber concessions. In 2010, massive debris was carried downstream, causing a major logjam (Sibon, 2010). A subsequent study evidenced that logging activities had affected the water quality of the Baleh River, especially after rainfall events (Ling *et al*., 2016). Despite the intensive logging activities, the contamination status of the Baleh River, with specific regards to its heavy metal contents is little known. Heavy metals are naturally occurring elements; however, they can also be introduced into the environment *via* various anthropogenic activities including mining, processing of metals and agriculture (Boudet *et al*., 2011; Taweel *et al*., 2011; Raeisi *et al*., 2014). When heavy metals are released into the aquatic environment, they are likely to be dissolved in water or bound to particulate matter that eventually settle down and are integrated into the sediment. They can reach a level that is potentially toxic and subsequently, bioaccumulated in different components of the environment, being controlled by various mechanisms (Raeisi *et al*., 2014). The aim of this study is to report the metals present in water, sediments and in fishes of the Baleh River. The results obtained from this study will serve as baseline data for benchmarking and future monitoring.

MATERIALS AND METHODS

Study Site

A total of seven stations were selected from upstream of the Baleh River. The sampling stations are indicated in Figure 1 and the