

Organic Matter, Nutrients and Trace Metals of Serin River

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Abstract: Animal and fish farming may lead to water quality deterioration. Water quality of the Serin River was assessed at seven selected stations over six sampling trips. The tributary with animal farm discharge had the lowest DO (2.2 mg/L), highest BOD₅, phosphorus (P), ammonia-nitrogen (TAN), organic-nitrogen (org-N), TKN and Cu and second highest in nitrate-nitrogen (NO₃-N) and Ni. The station with fish culture recorded the highest Ni, Cd and DO (5 mg/L) and third highest in Inorg-P, Org-P and Pb. Near the village and school, Cr was the highest and Org-P was second highest. Stations by the road and bridge recorded the highest zinc, lead and second highest in copper attributable to vehicles. Downstream of animal farm discharge with discarded e-waste, old tires and glass also recorded high Zn, Pb and Cd. The station near crop farming showed highest NO₃-N, second highest in BOD₅, Inorg-P, TAN and Ni and third in Cd and Cr attributable in inorganic fertilizers. Trace metals complied with the USA drinking water criteria except Cd at the tributary receiving animal farm effluent and Pb at all stations. Principal component analysis showed classification of heavy metals according to sources. Effluent from animal and fish farms need to be treated, solid waste need to be recycled and stormwater need to be treated to protect the water quality of the river.

Key words: Agriculture · Nutrients · Trace metals · Serin River · Malaysia

INTRODUCTION

Serin River is located in the state of Sarawak, Malaysia. It supplies drinking water to the nearby residential and commercial areas. Therefore, it is necessary to ensure that the quality of the river water is suitable for such purpose. Human activities identified in the watershed include animal farming, agriculture and waste disposal. Animal farm effluent is an environmental concern as it contains high solids, organic matter, nitrogen (N) and phosphorus (P) which results in high biochemical oxygen demand (BOD) and low dissolved oxygen (DO) levels [1- 5]. Moreover, trace metals are often associated with animal farm effluent which may affect the water quality of the Serin River. Zn, which is often used as a feed additive in swine diets to control scours in pigs [6] and to improve feed efficiency; mostly ends up in the farm wastewater [3]. Pb and Ni concentrations in contrast were reported to be typically less than 5 mg/kg dm in compound and home-mix swine feeds as well as in pig manures [7]. One mineral supplement sample however was

found to contain 12.9 mg/kg dm Pb while several slurry samples were found to contain more than 10 mg/kg dm Ni which are considered high concentrations [7].

Fish farming practices on the other hand often include the use of feed and fertilizers to promote fish production and usually only 25 - 30% of N and P in the feed and fertilizers are recovered in fish at harvest [8]. As such, fish pond effluents contain higher concentrations of nutrients, organic matter, suspended solids and plankton that may adversely affect the receiving water body when it is discharged during harvest [8, 9]. Crop production similarly poses an environmental concern as agricultural runoff is associated with increased P loading in receiving waters [10]. The elevated nutrient content can accelerate eutrophication in the stream which will potentially affect the Serin River in terms of decreased oxygen and water clarity, pH fluctuations and increased algae growth including toxin-releasing blue-green algae [11]. Due to the potential environmental concerns associated with the Serin River, this study aimed to assess its water quality.