

Research Article

Water Quality Assessment of Tributaries of Batang Baleh in Sarawak Using Cluster Analysis

Teck-Yee Ling ¹, Chen-Lin Soo ¹, Teresa-Lee-Eng Heng,¹ Lee Nyanti ¹,
Siong-Fong Sim ¹, Jongkar Grinang,¹ Karen-Suan-Ping Lee,² and Tonny Ganyai²

¹Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia

²Research and Development Department, Sarawak Energy Berhad, 93050 Kuching, Sarawak, Malaysia

Correspondence should be addressed to Teck-Yee Ling; teckye60@gmail.com

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Assessment of river water quality is essential as it provides the knowledge required to make informed decisions. Therefore, water quality was determined at 15 tributary stations located along the Batang Baleh, Sarawak. Results of the study indicate that all tributaries were well-aerated (≈ 7.7 mg/L) with pH (≈ 7.3) and conductivity (≈ 37.3 μ S/cm) values falling within acceptable ranges. However, there were tributaries that showed very high turbidity (> 1000 NTU) and suspended solids (> 800 mg/L) which were contributed by the soil erosion from logging activities in the watershed. Tributary stations associated with logging activities also showed significantly higher total phosphorus and organic nitrogen. Cluster analysis demonstrated that water quality at tributary stations along the Batang Baleh exhibited a longitudinal variation from upstream to downstream regions, particularly, dissolved oxygen, five-day biochemical oxygen demand, and nitrite-nitrate nitrogen, which were found higher in upstream region and steadily decreased towards the downstream region. Two stations located at Sg. Serani and Sg. Melatai were distinct from the other stations with the highest concentrations of turbidity, total suspended solids, organic nitrogen, and total phosphorus. Thus, there is an urgent need to reduce the pollutants in the tributaries of Batang Baleh for the health of the sensitive aquatic organisms.

1. Introduction

Batang Baleh is one of the main tributaries of the Rajang River (551 km) which is the longest river in Malaysia. These rivers flow through the Kapit Division which is a forested mountainous region. The area is characterized as dipterocarp forest and has been subjected to logging activities for decades. Logging activities have been known to increase suspended solids and nutrients [1–6]. As annual rainfall measured at Kapit is among the highest in Sarawak which exceeds 5000 mm in most years, the impact of logging activities could be more severe in the area due to the surface runoff which contains high suspended solids and nutrients from logging sites [7, 8].

Water quality deterioration has a great influence on the aquatic biota and the ecosystem of a river. The increase in suspended solids limits the light penetration which has major impacts on algae and macrophytes while nutrient enrichment

can lead to the depletion of oxygen and subsequently fish kill [9–11]. Exposure to high turbidity and suspended solids impacts fish growth and increases the mortality of fish [12–16]. Hence, water quality monitoring is important in order to evaluate the quality of the river for the health of sensitive aquatic organisms. The baseline data is also useful in management decision for improving and protecting the environment.

Although the nutrient content of water draining forested watersheds is generally lower than domestic and agricultural runoff [17], the potential impacts of the high suspended solids and nutrients from the logging activities to the rivers cannot be overlooked. Deteriorated water quality has been reported at other tributaries of major rivers in Sarawak [8, 18]. Water quality monitoring of those tributaries tends to generate a large set of data. Application of multivariate statistical analysis is useful in analyzing the spatial variation of water quality in the study area. Hence, this study aimed to