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ASSESSING WATER QUALITY AND AQUATIC INSECTS AS BIOINDICATORS WITHIN SELECTED ORANG ASLI SETTLEMENTS IN TAMAN NEGARA PAHANG AND ROYAL BELUM PERAK

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ABSTRACT

This research evaluates water quality and the efficacy of aquatic insects as bioindicators within selected Orang Asli (OA) settlements in Taman Negara Pahang and Royal Belum Perak. Water samples were collected from Sungai Sat in Pahang, Sungai Kampung Klewang in Royal Belum Perak and Sungai Kampung Bongor Hilir in Royal Belum Perak. The water quality was assessed using two distinct indices, which are the Malaysian Water Quality Index (MWQI) and the Simplified Water Quality Index (ISQA). The parameters utilized in the MWQI include pH, dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS) and ammoniacal nitrogen (AN). In contrast, the ISQA parameters include temperature, BOD, TSS, DO, and conductivity. Water analyses followed the protocols established by the 2023 American Public Health Association (APHA) guidelines. Aquatic insects were sampled using an Aquatic D-net and identified at the family level. Both water and aquatic insects were sampled twice, with all measurements performed in triplicate. These three rivers serve as settlements for the Orang Asli, providing valuable insights into the health and cleanliness of the water through the observation and identification of insect species inhabiting the water. The water quality in all three rivers generally falls within Class II, according to the MWQI, with values ranging from 79.06 to 88.53%. In contrast, the ISQA water quality index ranges from good to excellent, with values between 81 – 88% and 92 – 100%, respectively. Ephemeroptera was the most abundant aquatic insect in Sungai Sat Pahang, accounting for 49.5% (361 individuals) of the total samples, while Coleoptera was the least abundant at 2.6% (19 individuals). In Sungai Kampung Klewang and Sungai Kampung Bongor Hilir, Hemiptera was the most collected aquatic insect, representing 85.2% (224 individuals) and 87.4% (327 individuals), respectively. The presence of aquatic insects correlated with specific water quality parameters, notably DO (8 – 10 mg/L) and TSS (below 40 mg/L), as most insects were found in Class I of the MWQI and at excellent rates in the ISQA. The MWQI is considered more accurate due to its narrower range of values than to the ISQA, which encompasses a broader range of measurement values for each class. These findings underscore the efficacy of aquatic insects as bioindicators for monitoring water quality, particularly for DO and TSS values, offering a cost-effective and efficient environmental assessment method.

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".. *And He is the Most High, the Most Great…*"

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CHAPTER 1
INTRODUCTION

1.1 Research Background

Water resources are crucial for human survival and the existence of all living things and significant ecosystems on Earth. The three basic categories are surface water (lakes, rivers, and seas), groundwater, and source water protection. Over 70% of the Earth is estimated to be submerged in saline water, with only 2.5% constituting freshwater [1]. Freshwater is scarce despite being a renewable resource since it only covers 3% of the world's water supply. Approximately 4.4 billion individuals worldwide still do not have access to safe drinking water [2, 3].

The term "water quality" implies the state of the water, including its chemical, biological, and physical attributes and its appropriateness for various uses, including drinking, swimming, and car washing [4]. In addition, Malaysia's Department of Environment (DoE) reported that 29 rivers, which account for approximately 4% of the 672 monitored rivers in the country, were classified as polluted in 2022 [5]. Rapid urbanisation in Malaysia attracts more residents and businesses, raising the need to develop clean water supplies. As a result, if freshwater sources are not effectively managed and preserved, water issues will persist and impact freshwater availability for drinking water. Furthermore, rivers' water quality is characterised by a high degree of variation in time and space due to the diversity of the surrounding terrain. In addition to practical methods for limiting contaminant supplies, this makes it challenging to identify water habitats and sources of pollution, both of which are necessary for effective pollution control [6].

According to previous studies, the concentrations of heavy metals, specifically Iron (Fe) and Manganese (Mn), in water samples from the Perak River, Malaysia, were found to exceed the permissible limits set by Malaysia's National Water Quality Standards (NWQSM). For Class I rivers, the allowable concentrations for Fe and Mn are 1.0 mg/L and 0.1 mg/L, respectively [7]. However, levels of Fe and Mn in the Perak River were recorded at 5.55 mg/L and 0.25 mg/L, respectively, significantly surpassing these thresholds [8]. These elevated levels suggest serious pollution issues linked to industrial activities and agricultural runoff. Discharges from nearby agricultural