

Impacts of Aquaculture on the Water Quality of Santubong River, Sarawak

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Abstract

Shrimp and fish aquaculture are important industries in Sarawak as they provide the necessary protein for the growing population. The Santubong River is an important river located in Kuching. Not only it provides a means of transportation, it also accommodates shrimp farming and cage culture activities. However, there were no previous studies on the impact of these activities on the water quality of this river. Therefore, the objective of this study was to evaluate the impacts of aquaculture on the water quality of the Santubong River. In-situ parameters and water samples were collected at 20 stations. Ammonia-nitrogen (NH₃-N) obtained from the results showed that the concentration ranged from 0.16 mg/L to 3.5 mg/L whereas nitrate (NO₃-N) ranged from 0.08 mg/L to 1.00 mg/L. Concentration of nitrite (NO₂-N) falls in the range of 0.004 mg/L to 0.085 mg/L. Phosphorus (PO₄³⁻-P) were found to range from 0.02 mg/L to 0.38 mg/L. NH₃-N was found to be the highest at Station 6. For NO₃-N, NO₂-N and PO₄³⁻-P, the highest concentration was found at Station 5. The high concentration of nutrients at Station 5 and 6 is most likely due to the discharge of shrimp farm. Chlorophyll-*a*, which ranged from 1.5 mg m⁻³ to 238.2 mg m⁻³ was the highest at Station 5. The high concentration of chlorophyll-*a* at Station 5 indicates that the tributary that received shrimp farm effluent contained high nutrient concentrations that supported the bloom of phytoplankton. Cage culture also gives an impact on the water quality of Sungai Santubong as indicated by the low dissolved oxygen (DO) (<3.00 mg/L) at Station 7. Both PO₄³⁻-P and NH₃-N values exceeded the maximum allowable value of Class V according to INWQS. It can be concluded that water quality at the tributaries that received the shrimp aquaculture discharge, cage culture activities, urban residential and construction areas has elevated nutrient concentrations.

Keywords: shrimp aquaculture; cage aquaculture; water quality; river; Santubong River

1. Introduction

Shrimp and fish aquaculture has become an attractive business in terms of investment for both the government and private sectors in Malaysia. With the increase of population in Malaysia, fresh shrimp and fish and their products are main sources of protein. Shrimp farming first started in Sarawak in the year of 1992 [1] and had grown rapidly over the years [2]. According to the Malaysian Shrimp Industries Association (MSIA), shrimp production in Malaysia can rise up to 100,000 tonnes in 2008 barring disease problems [3] and the production is exported mostly to Singapore, Japan, United States and Europe [4]. The Santubong River, located in East Malaysia is one of the rivers suitable for aquaculture activities. Fish cages are suspended approximately 3 km along the river downstream of the Santubong Bridge. Shrimp farm was constructed at the estuary having the pond effluent entering into two different river tributaries. Without proper management, shrimp aquaculture can give rise to environmental deterioration as reported

by [5], [6] and [7]. This is due to wastewater discharges from shrimp pond which contains high loads of nutrients and suspended solids [5, 8, 9]. The presence of high phosphorus and nitrogen in the shrimp pond effluent will promote the growth of phytoplankton. High abundance of phytoplankton will lead to poor oxygen condition which may eventually contribute to eutrophication and the loss of aquatic life [10, 11, 5]. For cage culture, studies by [12] shows that nitrogen and phosphorus loadings into the river originated from fish feed and faeces. Waste and wastewater resulting from these activities may bring negative impact to the receiving waters. However, there were no recent studies on the impact of these activities on the water quality of this river. The objectives of this study were to determine the water quality around the areas of shrimp farm wastewater discharge and cage aquaculture and compare it with areas without aquaculture activities in the Santubong River.