

Research Article

Seasonal Changes and Spatial Variation in Water Quality of a Large Young Tropical Reservoir and Its Downstream River

Teck-Yee Ling,¹ Norliza Gerunsin,² Chen-Lin Soo,¹ Lee Nyanti,¹
Siong-Fong Sim,¹ and Jongkar Grinang³

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

²Universiti Teknologi MARA, Kota Samarahan Campus, Jalan Meranek, 94300 Kota Samarahan, Sarawak, Malaysia

³Institute of Biodiversity and Environmental Conservation, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia

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

Received 18 January 2017; Revised 18 May 2017; Accepted 19 June 2017; Published 26 July 2017

Academic Editor: Wenshan Guo

Copyright © 2017 Teck-Yee Ling et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

This study examined the water quality of the large young tropical Bakun hydroelectric reservoir in Sarawak, Malaysia, and the influence of the outflow on the downstream river during wet and dry seasons. Water quality was determined at five stations in the reservoir at three different depths and one downstream station. The results show that seasons impacted the water quality of the Bakun Reservoir, particularly in the deeper water column. Significantly lower turbidity, SRP, and TP were found during the wet season. At 3–6 m, the oxygen content fell below 5 mg/L and hypoxia was also recorded. Low NO_2^- -N, NO_3^- -N, and SRP and high BOD_5 , OCN, and TP were observed in the reservoir indicating organic pollution. Active logging activities and the dam construction upstream resulted in water quality deterioration. The outflow decreased the temperature, DO, and pH and increased the turbidity and TSS downstream. Elevated organic matter and nutrients downstream are attributable to domestic discharge along the river. This study shows that the downstream river was affected by the discharge through the turbines, the spillway operations, and domestic waste. Therefore, all these factors should be taken into consideration in the downstream river management for the health of the aquatic organisms.

1. Introduction

The creation of a large-scale dam and its associated reservoir often has significant negative impacts on the hydrological, biological, and chemical processes of the reservoir, upstream, and downstream of the dam [1–9]. The Bakun hydroelectric dam, which was impounded from 2010 to 2012 on the Balui River in Malaysia, produced these effects. The dam which is one of the tallest concrete rock filled dams (205 m) in the world created a reservoir covering a surface area of 695 km². A few pre- and postimpoundment studies on the physicochemical parameters of the Bakun Dam reservoir have been performed [10–12]. However, the reservoir water quality is likely changing as the reservoir is receiving loads of pollutants from adjacent anthropogenic activities during its operation [13, 14]. Water quality deterioration is a common

problem in reservoirs surrounded with anthropogenic activities receiving high loads of suspended solids, organic matter, and nutrients [15, 16].

The water quality of reservoirs has been observed to vary seasonally in tandem with changes in temperature and rainfall [17–19]. The low and high precipitation during dry and wet seasons in a tropical country like Malaysia can greatly change the water quality of the reservoir. The high precipitation during the wet season can either decrease the pollutant concentration by dilution or deteriorate the reservoir water quality due to increased surface runoff from anthropogenic activities. Reference [20] demonstrated that the levels of total phosphorus in Batang Ai Reservoir during the rainy season and high water levels were lower than those observed during the dry season and low water levels. Besides, high volume of inflow following heavy rainfall promotes mixing and disturbs stratification in the reservoir. The increase of bottom