

Research Article

Physicochemical Parameters and Fish Assemblages in the Downstream River of a Tropical Hydroelectric Dam Subjected to Diurnal Changes in Flow

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The downstream river of the tropical Batang Ai Dam is experiencing diurnal flow fluctuation due to power generation operation. Three samplings were conducted to collect the water quality and fish assemblage data and one sampling was conducted to study the hydrological characteristics of the downstream river. The results show that the downstream river is extremely shallow and moves slowly when the power generation is halted and no water is discharged from the powerhouse. Significant correlations between river flow and pH, dissolved oxygen (DO), total suspended solids (TSS), and five-day biochemical oxygen demand (BOD₅) indicated that those parameters were influenced by the water discharge regulation. Fish abundance was low in upstream segment but it gradually increased as distance from the dam increased and was significantly correlated with DO. Fish diversity in the downstream river was influenced by the river depth and chlorophyll *a* concentration. The most abundant fish species, *Cyclocheilichthys apogon*, exhibited a negative allometric growth pattern, while *Hampala macrolepidota* and *Hemibagrus planiceps* exhibited an isometric growth pattern. Fulton's condition factor (*K*) values for 89.4% of *H. planiceps* were ≤ 1 , indicating poor to extremely poor conditions.

1. Introduction

Impoundment of a river often causes dramatic changes in the physicochemical characteristics and biological structure of its downstream river [1–5]. Studies have shown that connectivity disruptions coupled with erratic flow pattern change the morphology and physicochemical characteristics of a river [6–11]. Domination of fish species that is well adapted to the new environment and elimination of sensitive species could alter the composition of fish assemblages and lower the fish diversity in the downstream river [12, 13].

In Malaysia, about 80 dams have been built and hydropower dams are the most common in the state of Sarawak [14]. As more hydroelectric dams are being planned in the state of Sarawak, there has been an increased effort to understand the impacts of hydroelectric dams on the tropical aquatic ecosystem. It is also of scientific importance to

investigate and evaluate the hydrological and physicochemical characteristics of a downstream river induced by river impoundment and operation of hydroelectric dam, which could have an impact on the fish community. In addition, knowledge on fish assemblages in the regulated downstream river of a dam coupled with growth pattern and well-being of fishes in the stream is also crucial for ecosystem conservation and management.

The Batang Ai Dam is the oldest dam built for electricity supply in the state of Sarawak, Malaysia. The reservoir has been impounded for more than 30 years. Several studies on water quality of the reservoir have been conducted [15–18]. However, knowledge on its downstream river below the powerhouse is scarce. The influence of the impoundment and the erratic discharge of the reservoir water during power generation on its downstream river remain unknown. Hence, this study aimed to establish the baseline data on hydrological