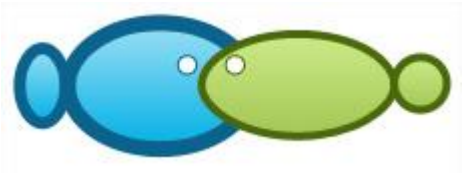

Spatiotemporal profiles of water quality at a new large tropical hydroelectric dam reservoir

[1]Teck Y. Ling, [1]Kong S. Phang, [2]Chen L. Soo, [1]Lee Nyanti, [1]Siong F. Sim, [1]Jongkar Grinang

[1] Faculty of Resource Science and Technology, Malaysia Sarawak University, Kota Samarahan, Sarawak, Malaysia; [2] Institute for Tropical Biology and Conservation, Malaysia Sabah University, Jalan UMS, Kota Kinabalu, Sabah, Malaysia. Corresponding author: T. Y. Ling, tyling@unimas.my

Abstract. The building of the Murum hydroelectric dam resulted in the formation of a reservoir in the year 2014. The newly formed reservoir can also serve as a cage aquaculture site in addition to fisheries. Therefore, it is important to determine the spatiotemporal profiles of water quality in the new reservoir and assess its suitability for fisheries and aquaculture. Water quality of riverine inflows and depth profiles of water quality in transitional and lacustrine zones were studied. Four samplings were conducted in 2017 at two stations each in the riverine and transitional zones, and three stations in the lacustrine zone. Results of the year-long study indicate that the riverine zone serves as the main input of suspended solids and organic matter to the reservoir which affected the pH and conductivity depth profiles particularly in the transitional zone due to anthropogenic activities in the river basin. Thermal stratification was apparent and consistent in the lacustrine zone throughout the year; whereas it was less consistent in the transitional zone and varied between stations receiving different riverine inflows at different times of the year. The colder sediment-laden inflows from the rivers influenced the depth profiles of the transitional and lacustrine zones especially after rainfall events. The DO values in transitional zone remained high due to the oxygenated riverine inflows. However, it dropped below the limit of 5 mg/L at the thermocline, and developed an anoxic condition at the deeper water column in the lacustrine zone throughout the year. A decrease in pH and an increase in conductivity, turbidity, TSS, CO_2, BOD_5, COD and TAN with depths were also observed in the lacustrine zone which are associated with the decomposition of organic matter and sedimentation. Since the depth of water column that contained healthy DO value of at least 5 mg/L for healthy life of aquatic organisms at the lacustrine zone was less than 1 m to 5 m coupled with the acidity of the water, it is not suitable for sensitive aquatic organism yet. At the riverine zone, even though DO is high, the high turbidity, TSS, and low pH render the water unsuitable for sensitive aquatic organisms. It is recommended that inputs of sediment and organic materials to the reservoir be reduced not only for the sustainability of the hydropower generation but also for fisheries and aquaculture development in the future.

Key Words: aquaculture, Murum dam, thermocline, oxycline, sedimentation, stratification.

Introduction. Even though dams are built across rivers to tap the hydropower from nature, the reservoirs formed could be sites for fish cage aquaculture (Costa-Pierce 1997) especially in developing countries like Malaysia (Abery et al 2005; Ling et al 2013; Ling et al 2018). However, the water quality of a reservoir has to be assessed for suitability for aquaculture development. In addition, good water quality is essential for reservoir fisheries as well. A number of factors potentially affect the water quality of a reservoir. Due to the accompanying infrastructure development and thus accessibility, land-based agriculture is developed and the extraction of timber continues in the river basin may continue both of which may impact the water quality of the new water body. The building of a dam itself alters the ecosystem from lotic to lentic typically resulting in a change in water quality (Ling et al 2017). In the reservoir, stratification pattern is a unique characteristic in reservoirs which plays a great role in several aspects of ecology (Agostinho et al 2008; Santos et al 2015). The thermal or chemical stratification appears in the water column soon after the reservoir is filled (Nyanti et al 2012; Ling et al 2016; Sapis et al 2017). This usually happens when the open surface water warms up and becomes less dense which renders it unable to mix with cold dense bottom water.