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Physicochemical Parameters of Bakun Reservoir in Belaga, Sarawak, Malaysia, 13 Months after Reaching Full Supply Level

(Parameter Fizikokimia Takungan Bakun di Belaga, Sarawak, Malaysia, 13 Bulan selepas Mencapai Tahap Bekalan Penuh)

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ABSTRACT

Determining the water quality of Bakun Reservoir 13 months after it operates at full supply level is crucial for better understanding of changes in the physicochemical parameters, which may enable the prediction of its effects on the survival of aquatic life in the reservoir. This study determined 13 physicochemical parameters at six stations within the reservoir at fixed depths. The results showed that the minimum 5 mg/L of dissolved oxygen (DO) required for sensitive aquatic organisms was recorded at 6 m depth. However, DO was not detectable at depths exceeding 7 m. The water was acidic at depths of more than 10 m. Turbidity and total suspended solids increased corresponding with depth. Inorganic nitrogen were predominantly in the form of ammonia-nitrogen, creating an unhealthy environment for aquatic life. Concentration of Chl-a was significantly higher at the subsurface water than 30 m depth in four out of six stations. The present study shows changes in water quality as compared to the pre-impounded period and 15 months after the filling phase, in particular, stratification of dissolved oxygen, thermocline conditions and alkalinity. The changes varied according to the distance from the dam and may have been influenced by existing land developments within the area such as the construction of the Murum Hydroelectric Dam, oil palm plantations and timber concessionares. Though the water quality might have deteriorated, further study is needed to determine if this condition will prolong.

Keywords: Impoundment; Murum; new reservoir; stratification; tropical reservoir

ABSTRAK

Menentukan kualiti air Empangan Bakun 13 bulan selepas ia beroperasi pada tahap bekalan penuh adalah penting untuk lebih memahami perubahan dalam parameter fizikokimia, yang membolehkan ramalan tentang kesannya terhadap kewujudan hidupan akuatik dalam takungan. Kajian ini menentukan 13 parameter fizikokimia di enam stesen dalam takungan pada kedalaman yang tetap. Keputusan menunjukkan bahawa minimum 5 mg/L bagi oksigen terlarut (DO) diperlukan oleh organisme akuatik sensitif dicatatkan pada kedalaman 6 m. Walau bagaimanapun, DO ini tidak dikesan pada kedalaman melebihi 7 m. Air adalah berasid pada kedalaman lebih daripada 10 m. Kekeruhan dan jumlah pepejal terampai meningkat sejajar dengan kedalaman. Nitrogen bukan organik yang kebanyakannya dalam bentuk ammonia-nitrogen, mewujudkan persekitaran yang tidak sihat untuk hidupan akuatik. Kepekatan Chl-a adalah lebih tinggi pada air subpermukaan daripada kedalaman 30 m di empat daripada enam stesen. Kajian ini menunjukkan perubahan dalam kualiti air berbanding dengan tempoh prapembendungan dan 15 bulan selepas fasa mengisi, khususnya, penstratuman oksigen terampai, keadaan termoklin dan alkalin. Perubahan ini berbeza mengikut jarak dari empangan dan mungkin dipengaruhi oleh pembangunan tanah sedia ada dalam kawasan seperti pembinaan Empangan Hidroelektrik Murum, ladang kelapa sawit dan konsesi perkayuan. Walaupun kualiti air mungkin semakin merosot, kajian tambahan diperlukan untuk menentukan jika keadaan ini akan berpanjangan.

Kata kunci: Murum; pembendungan; stratifikasi; takungan baru; takungan tropika

INTRODUCTION

Hydropower is an alternative source of energy to fossil fuel. It is considered a renewable source of energy which is reliable and efficient (USBR 2005). Therefore, many countries have constructed hydroelectric dams to meet the energy demands for use in economic development. The Malaysian government has also explored this resource due to the depleting oil and gas reserves (Choy 2005). In Sarawak, the resource is explored under the Sarawak Corridor of Renewable Energy (SCORE) to generate energy needed for development of the State (RECODA 2014). Of the twelve hydroelectric dams that have been planned in Sarawak (SEB 2013; SIWRM 2008), two had been fully commissioned, namely, the Batang Ai Hydroelectric Dam and Bakun Hydroelectric Dam with Bakun Dam being the largest, 695 km^2 in surface area and 44000 MCM in gross storage (SIWRM 2008). The dam impoundment commenced on 13th October 2010 and reached the full supply level on 9th March 2012 (Nyanti et al. 2012).