Reservoir Thermal Structures in Kinbasket Reservoir

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Abstract

Fish entrainment is partially a function of reservoir forebay thermal characteristics and therefore it is important to understand how hydropower operations can affect the temperature stratification within a reservoir. This presentation will focus on the thermal regime of Kinbasket reservoir upstream of Mica dam. Field studies in 2011 were undertaken, where thermal stratification was measured for 6 months in the dam forebay. A review and analysis of collected water temperature profile data was completed. Spectral analysis of thermistor time series was undertaken to determine dominant periods of oscillation. Longer periods (11.3 days, 6.7 days, 5.6 days, and 2.6 days) and shorter periods (8 hours, 12 hours, and 20 hours) at several vertical modes were found. In order to understand the natural reservoir dynamics, theoretical calculations of seiche periods was undertaken. Wave like solutions were achieved from the component equations of two dimensional motions. Two reservoir lengths were used, a main reservoir length (150 km) and a local reservoir length (14.6 km, smaller arm where dam was located). Results indicated that longer internal seiche periods were due to the main reservoir, while shorter internal seiche periods were due to the local reach. Further analysis was undertaken on the effects of dam operations on the thermal stratification. A covariance analysis of the thermistor time series and ~24 hour cycling dam operations revealed both positive and negative relationships, with the deepest thermistors being most severely affected. Both natural and dam induced fluctuation trends were identified in recorded temperature stratification plots throughout the year.