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Relationship between critical depth and residence time as controlling factors to retention and release of nutrient

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Generally, nutrient cycle within river system could be easily affected by impoundments and natural lakes due to retention by biogeochemical process. Capacity of nutrient retention depends on depth and residence time. Once impoundments start to receive nutrient into own water bodies, the capacity would be decreased due to its getting shallow. Someday, impoundments would turn sink to source beyond turning point. In this study, we defined the turning point as the Critical Depth. The objective of this research is to clarify the relationship between critical depth and residence time as controlling factor to retention and release of nutrient using numerical model. The study site is the Hayata reservoir which is located in the Takaya watershed, western Japan. It has the depth of 1.5m, the volume of 2.1 x $10^4 m^3$ and the residence time of approximately 2days. Numerical estimation were conducted in 4 scenarios with deferent depth (0.5m, 1m, 2m and 3m) using 1D eco-hydrodynamics model which is developed by CRW, the University of Western Australia. The results indicate that nitrogen has trapped only 3% of total inflow in the scenario of 0.5m while 41%-48% of total inflow in other scenarios (1-3m). Though phosphorus has trapped 23%-31% of total inflow in three scenarios (1-3m), has released 113% of inflow in the scenario of 0.5m. Consequently, the critical depth was conducted to 0.33m and 0.59, nitrogen and phosphorus, respectively. The results also suggested that there is a relationship between critical depth and residence time.

Keywords: Nutrient, Reservoir, Critical water depth, Retention, Release