THE LIMNOLOGY AND ECOLOGY OF TWO SMALL MAN-MADE RESERVOIRS IN ZIMBABWE

By

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ABSTRACT

This study investigated the limnology of two small dams (< 5ha) built in series on Munwahuku river. Very little is known about the ecology of such small water bodies and the hydrological regime of these dams is that they undergo severe fluctuations in water levels. Rainfall is seasonal but water demand for irrigation and potable water persist throughout the year. The theoretical mean water residence time was 9 days for the Upper dam and 3.6 days for the Lower one while the water level in the Upper dam fluctuated more than the Lower one. Thermal stratification established during summer in the dams but was weak during winter. Stratification was poorly established during the main rainy season (Jan-April) and this could be the result of throughflows causing disruptions. Oxygen stratification patterns were similar to those of temperature and deoxygenation sometimes occurred in summer. Seasonal trends were related to changes in solar radiation income and the corresponding changes in air temperatures. The Lower dam was less stable during summer than the Upper one and this could largely be a result of short water residence time which influenced development of thermal stratification. Diurnal stratification of temperature and oxygen occurred in both dams during summer but was less established in winter. The shallow nature of small dams suggests that they are more vulnerable to external fluxes such daily changes in temperature, wind runs and any other disturbances and hence the prevalence of diel stratification because of low stability. The water and aspects of sediment chemistry of the dams was investigated in relation to influence of the hydrological regime. The two small dams were not significantly different in water chemistry but their sediment chemistry showed some differences. Seasonal fluctuations in conductivity, TDS, TSS and Secchi disc transparency were strongly linked to the hydrological regime to the effects of the first rains while increases in BOD and COD suggested increased organic matter at low water levels. There were no dramatic seasonal variations in pH, alkalinity, nitrate, nitrite, ammonia and total nitrogen although the latter tended to be higher in the Upper dam. Short water residence time was attributed as the main factor resulting in small differences in the water quality of the two dams. In the Upper dam, sediment silt content was higher in the drawdown zone while clay was significantly higher in the permanently inundated zone. There were no major seasonal variations in nitrogen, phosphorus and carbon content in the zones but their values were consistently higher in the deeper zone. In contrast, clay, nitrogen, phosphorus and carbon content were significantly different between the two zones in the Lower dam and were higher in the drawdown zone except clay. The community structure of zooplankton and phytoplankton populations was studied. Zooplankton abundance was not very different between the two dams with peaks during the late dry season attributed to a sudden abundance of rotifers. A similar pattern was observed for phytoplankton abundance and biomass with peaks around October 2000 but generally higher abundance was measured in the bottom dam. There was a complete shift in the dominant zooplankton and phytoplankton taxa in both dams after October 2000. A major factor influencing plankton abundance was washout during the main rainy season whilst water transparency, suspended solids, water temperature were factors identified by CCA analysis as important for zooplankton community structure in both dams. CCA analysis revealed that physico-chemical variables were not significant in determining phytoplankton communities in both dams perhaps superseded by hydrological processes. The effects of grazing on phytoplankton by zooplankton and predation on zooplankton by fish were not assessed but could be factors influencing community dynamics. Six fish species were caught in both dams during the entire sampling. The dominant species numerically was *B. paludinosus* and *C. gariepinus* in either dam but *C. gariepinus* contributed the greatest proportion of the total catch weight at most times. The cyprinids *B. lineomaculatus* and *B. trimaculatus* were caught in small numbers and so were the cichlids, *O. mossambicus* and *T. sparrmanii.* This species composition is perhaps largely determined by the fish community in the river and the shallow nature and frequent fluctuations in water level do not allow for specialized habitats to develop in small dams hence promoting diversity. Water retention is very short in these dams and so they could be little difference with the main river. The highest proportion of breeding *B. paludinosus* was during the rainy season and consequently relative fecundity was highest at that time. Migration, spawning events and recruitment events were not easily discernable in the fish populations of either dam. The high turbidity when water levels were low did not appear to have adverse effects on the fish community in either dam.

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