# Abstract

Reservoir water level fluctuations (WLFs), are known to influence littoral fauna. Also, as WLFs influence nutrient levels, plankton communities are expected to be impacted. In the present study, influence of hydrological regimes on macro-benthic invertebrate and plankton communities was investigated in selected irrigation reservoirs in the Kala Oya river basin, Sri Lanka. Studies were carried out from September 2014 to April 2015, and the study period was divided into two distinct phases namely the drained period, and the inundated period depending on the reservoir water level. Benthic macro-invertebrates and plankton were sampled from littoral and limnetic zones of reservoirs, respectively. Water quality parameters and sediment characteristics were measured following standard protocols. Rainfall data (from Meteorological Department) and hydrological data (from Irrigation authorities) were also obtained. Three hydrological indices *viz.* relative reservoir level fluctuation (RRLF), hydraulic residence time (HRT) and mean exposure area (MEA) were determined for each reservoir. Data related to macrobenthos, plankton, molluscs and physico-chemical parameters were analysed using appropriate statistical and numerical data analyses. A macro-invertebrate based integrity index (RB-MII) was determined for the reservoirs studied. Cluster analysis of hydrological indices revealed that the reservoirs belonged to hydrological stress groups; HSG1 and HSG2. Of the 3 hydrological indices, only the RRLF was significantly different between these two groups ($p < 0.05$). The macrobenthic diversity indices varied significantly between HSG1 and HSG2 reservoirs during the drained and inundated periods ($p < 0.05$). The macrobenthos could also be assigned into five different functional feeding groups namely scrapers, collectors-gatherers, filter feeders, predators, and others that included the ectoparasitic species. Scrapers were the dominant functional feeding group both in the HSG1 and HSG2 reservoirs. However, these functional feeding groups differed between these HSG1 and HSG2 reservoirs during the inundated and drained periods. The ratio of phytoplankton density/ zooplankton showed a significant positive linear regression relationship with the RRLF ($R^2 = 0.695$ and $P < 0.05$) indicating that the reservoirs with high RRLF favour high phytoplankton abundance. The gastropods were the most abundant (96.5%) and diverse molluscan taxon with ten genera and two bivalve genera were recorded. The gastropods with large shell sizes were widely distributed in reservoirs and headwater streams in the river basin. Also, the highest mollusc density was recorded in habitats with sandy bottoms than in other soil types ($p < 0.05$). RRLF was found to be the major confounding hydrological factor that affected the diversity of macroinvertebrates and plankton in these reservoirs. It was found that upstream reservoir with low HRT were characterized by low RB-MII, while registering downstream impaired reservoirs with high RB-MII. As such, present study highlighted the importance of hydrological regimes and their influence on benthic macro-invertebrate and plankton communities for reservoir water quality monitoring.



**Keywords**: Benthic macro-invertebrates, irrigation reservoirs, phytoplankton community, relative reservoir level fluctuation, water quality monitoring.