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ORIGINAL ARTICLE

Effects of hydrological regimes and limnological parameters on plankton community properties in tropical irrigation reservoirs: A Sri Lankan case study

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Abstract

Water-level fluctuations are reported to be key processes influencing ecosystem structure and functions in lentic aquatic ecosystems such as reservoirs. The plankton community structure in reservoirs, being useful monitoring tools as reservoir trophic status indicators, are influenced by water quality parameters and water-level fluctuations. The present study tested the hypothesis that plankton community properties in irrigation reservoirs are influenced by hydrological regimes and physical and chemical parameters. Accordingly, the effects of physical, chemical and hydrological parameters on plankton density and taxa richness were investigated for 10 selected irrigation reservoirs of Sri Lanka. The relative reservoir level fluctuation (RRLF), an index of the magnitude of water-level fluctuation in relation to mean depth, had a positive influence on phytoplankton density. Because the RRLF positively influenced phytoplankton density, this index appeared to favour eutrophy in reservoirs. Canonical correspondence analysis (CCA) indicated both the phytoplankton and zooplankton community structure in the study reservoirs was influenced by physical and chemical characteristics. CCA also indicated the plankton taxa abundance and water quality parameters could be used for the trophic classification of irrigation reservoirs. The results of the present study highlight the need for examining attributes based on hydrological regimes in the context of reservoir water quality management.

KEYWORDS
physicochemical parameters, plankton community, relative reservoir level fluctuation, taxa richness, tropical reservoirs

1 | INTRODUCTION

Reservoir construction is a worldwide enterprise, resulting in continuous changes in the landscapes of the tropical belt (Fernando & Holčik, 1991; Marmulla, 2001). Because reservoirs are productive biological systems, they are often utilized for fisheries development (Welcomme, 2001). They also are constructed for other diverse purposes such as irrigation, municipal water supply, hydropower generation and flood control. Reservoirs also substantially alter freshwater fluxes on the land surface and impact surface water storage through water management activities. On a global scale, water from reservoirs supplies an estimated 30%–40% of irrigated areas (World Commission on Dams, 2000). Seasonal water-level fluctuations, attributable mainly to water releases for their primary intended purposes (e.g. irrigation; hydroelectricity generation) are the characteristic feature of these lentic ecosystems. The seasonal pulses of water levels carry nutrients from associated rivers and surrounding terrestrial environments, enhancing the trophic status especially of shallow reservoirs (Geraldes & Boavida, 2005; Wantzen et al., 2008).

