

Original Article

Macrophytes as indicators of the ecological status of a tropical rehabilitated wetland ecosystem: Application of multivariate statistics and Ecological State Macrophyte Index (ESMI)

Dimuthu Wijeyaratne, Aravinda Bellanthudawa*

Department of Zoology and Environmental Management, University of Kelaniya, Sri Lanka.

Abstract: The present study used the Ecological State Macrophyte Index (ESMI) and the multivariate statistical methods to assess the ecological status and the variation of macrophytes in a tropical wetland system. Six sites were selected from rehabilitated and non-rehabilitated areas of an urban tropical wetland and the water quality parameters (water pH, temperature, conductivity, total dissolved solids (TDS), dissolved oxygen (DO), visibility, biological oxygen demand 5 days after incubation (BOD₅), chemical oxygen demand (COD), nitrate, chlorophyll-a and total phosphorus concentrations), sediment quality parameters (pH, organic matter content, percentage sand, silt and clay content) and abundance of aquatic macrophytes were measured. Shannon Weiner diversity index, percentage vegetation under anthropo-pressure, macrophyte settlement rate and ESMI were calculated. Significant variations in the water and sediment quality parameters were observed and ten species of aquatic macrophytes were recorded. *Salvinia melosta* and *Cypreus iria* were recorded only from the non-rehabilitated sites. Although there was no significant difference in the percentage anthropo-pressure among study sites, the rehabilitated sites were displayed low anthropo-pressure. The sites in the non-rehabilitated area showed a significantly lower macrophyte settlement rate. ESMI and macrophyte abundance showed significant correlations with water quality parameters. Based on the results, it can be recommended that applications based on ESMI and multivariate statistics can be used to assess the ecological status of tropical wetlands.

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Introduction

Aquatic macrophytes are important components of wetland ecosystems. They can grow as rooted emergent, rooted submerged or floating vegetation in wetlands and play a major role in wetland communities by performing direct and indirect ecological functions. Aquatic macrophytes are important in nutrient cycling, maintenance of water quality, prevention of sediment re-suspension and providing food and habitats for many other wetlands associated organisms (Gidudu et al., 2011). A healthy macrophyte community is an indicator of a healthy wetland ecosystem. As the rooted macrophytes are rooted in the soft muddy bottoms of wetland ecosystems, they are able to integrate long term changes in water and sediment quality, making them ideal indicators of assessing the changes in wetland

environments for several seasons or several years (Murphy et al., 2003; Lee and McNaughton, 2004).

Several studies have been conducted to investigate effect of environmental characteristics on the changes in macrophyte community in various types of wetland ecosystems. These studies have shown that, the physical and chemical properties of the water and sediments can determine the composition of the aquatic macrophyte community, thereby influencing the health of the ecosystems (Lee and McNaughton, 2004; Lacoul and Freedman, 2006; Henry-Silva et al., 2008; Fu et al., 2014). Concentration of nutrients in both water and sediments and light penetration were recorded to be the strongest predictors of macrophyte distribution (Bini et al., 1999; Henry-Silva et al., 2008). In addition to these major predictors, variation of conductivity, Mg, Ca and Na concentrations,

*Correspondence: Dimuthu Wijeyaratne
E-mail: dimuthu.wijeyaratne@kln.ac.lk