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Assessment of Plankton Diversity in Madunagala Hot Water Springs, Sri Lanka

Batugedara, B.D.I.M.^{1,2}, Manage, P.M.¹, Senanayake, S.A.M.A.I.K.^{1*}

¹*Centre for Water Quality and Algae Research, Department of Zoology, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*

²*Faculty of Graduate Studies, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*

*indunil@sci.sjp.ac.lk

Abstract

Hot water springs present unique ecological niches due to their elevated temperatures and distinctive chemical compositions. This study aimed to investigate the plankton diversity of Madunagala hot water springs, one of the major hot springs in the Hambantota district, Sri Lanka. Plankton samples were collected using a 55µm standard plankton net from the surface waters of three interconnected wells (n=6) during July and August of 2023. In addition to that, temperature, pH, electrical conductivity (EC), Total Dissolved Solids (TDS), salinity, and Dissolved Oxygen (DO) were measured using portable meters at the site itself. Standard methods were used to determine the Total hardness (TH), nitrate (N-NO₃⁻), and orthophosphate concentrations at the laboratory. Plankton were morphologically identified to the nearest possible taxonomic level. There were 15 phytoplankton taxa and 22 zooplankton taxa which were identified at least to the genus level, and some of the observed plankton species remained unidentified. Identified phytoplankton belonged to cyanophyta, bacillariophyta, euglenophyta, and chlorophyta; chlorophyta was the dominant phytoplankton group. *Pediastrum* spp. was identified as the most diverse one, reporting three species, including *P. simplex*, *P. duplex*, and *P. tetras*. Copepoda, rotifera, and microcrustaceans were reported as zooplankton groups. The average zooplankton density (40×10⁴ individuals/m³) was higher than the average phytoplankton density (29×10⁴ individuals/m³). The calculated Shannon-Wiener Diversity index value (H) and Simpson's index of Diversity (SID) values ranged from 2.6 to 3.1 and 0.6 to 0.8, respectively, indicating moderate to high diversity levels of plankton in Madunagala hot water springs. H and SID values were not significantly different among the wells (p>0.05). The average value for temperature was 43.2±1.2 °C while pH, EC, TDS, Salinity, and DO were reported as 7.98±0.11, 5.13±1.10 mS/cm, 2.57±1.23 ppt, 3.1±0.2 ppt, 2.13±1.12 mg/L respectively. TH was reported as 982±24 mg/L as CaCO₃. The N-NO₃⁻ and orthophosphate were reported as 0.8±0.1 mg/L and 0.2±0.1 mg/L respectively. There were no significant differences in any parameter among the wells (p>0.05). The plankton species that have been identified can be considered temperature tolerance species, which are found in water above 42° C. These plankton might have specialized adaptations to high-temperature conditions, including heat resistance, metabolic versatility, etc.

Keywords: Madunagala hot water springs, Plankton diversity, Temperature tolerance species, Shannon-Wiener Diversity Index, Simpson's index of diversity