RESCON 2025 LS 19

SEASONAL DYNAMICS AND ENVIRONMENTAL CORRELATES OF ANTIBIOTIC-RESISTANT BACTERIA IN SURFACE AND GROUNDWATER OF THE KELANI RIVER BASIN, SRI LANKA

A.K.M.M.K. Meddage[1,2], G.Y. Liyanage[2,3], F.S. Idroos[2] and P.M. Manage[2]*

[1]University of Sri Jayewardenepura, Nugegoda, Sri Lanka.
[2]Centre for Water Quality and Algae Research, Department of Zoology, University of Sri Jayewardenepura, Nugegoda, Sri Lanka.
[3]Department of Aquatic Bioresources, University of Sri Jayewardenepura, Nugegoda, Sri Lanka.
*pathmalal@sjp.ac.lk

Antimicrobial resistance (AMR) is one of the most pressing threats to global health and development. Many studies indicate that climate change exacerbates this issue by promoting the spread of infections and pharmaceutical residues, thereby creating environmental conditions conducive to the proliferation of AMR. This study aimed to investigate the seasonal occurrence, spatial distribution, and environmental correlates of antibiotic-resistant bacteria (ARB) in surface and groundwater within the Kelani River Basin, Sri Lanka. A total of seventy-one water samples were collected during both wet and dry seasons, representing the entire river basin. Furthermore, ten commonly used antibiotics were selected for ARB screening: Ciprofloxacin (CIP), Cefuroxime (CXM), Cloxacillin (CLOX), Amoxicillin (AMX), Co-Amoxiclav (CO-AMX), Tetracycline (TET), Azithromycin (AZT), Erythromycin (ERM), Sulfamethoxazole (SMX), and Gentamicin (GEN). Water quality parameters were analysed according to the APHA standard methods. ARB isolation was conducted using the standard pour plate technique. A total of 1,050 ARB was isolated. Out of which, 611 were isolated during the wet season and 439 during the dry season. The highest frequency of antibiotic resistance was detected for CLOX (20.79% in the wet season; 19.82% in the dry season). In contrast, the lowest resistance was recorded for TET (2.62% – wet; 2.51% – dry) and (2.13% – wet; 1.59% – dry). Spatially, the upper-middle catchment region showed the highest ARB contamination. Total coliform levels showed significant contamination ($p < 0.05$) throughout the river, with the highest concentrations observed in the meandering zone. Spearman's correlation analysis revealed significant associations between ARB prevalence and selected water quality parameters, including water temperature (both seasons), total phosphorus (wet season), and nitrogenous compounds (both seasons; $p < 0.05$). The findings of the present study revealed that seasonal variability plays a significant role in emerging the distribution and abundance of ARB in the Kelani River Basin. Therefore, integrated water quality management strategies are urgently required to efficiently mitigate the risks associated with antibiotic resistance in aquatic environments.

Financial assistance from the Research Council of University of Sri Jayewardenepura, Sri Lanka (Grant No. RC/URG/SCI/2024/34), and Hayleys Fabric PLC, Sri Lanka, is acknowledged.

Keywords: Amoxicillin, Antibiotic resistance, Kelani river, Seasonal variation, Tetracycline