

Spatiotemporal Variations in Water Quality in Koggala Lagoon, Sri Lanka under Natural and Anthropogenic Influences

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Coastal lagoons are shallow transitional ecosystems that, despite their ecological significance, frequently serve as conduits for the transfer of terrestrial pollutants to marine environments. Koggala Lagoon, located in the Southern Province of Sri Lanka, holds both ecological and economic importance. This study aimed to assess the impact of natural and anthropogenic processes on the health of this ecosystem by monitoring the water quality in the Koggala Lagoon. To achieve this objective, physicochemical parameters, heavy metalloids, and microbiological parameters were measured in the lagoon at monthly intervals over a one-year period at ten sampling stations, and spatiotemporal variations were analyzed. Certain parameters were tested in situ using portable meters, while others were analyzed in the laboratory using standard methods. The results revealed that the pH remained slightly alkaline, averaging 7.76 ± 0.30 . The dissolved oxygen concentration remained relatively stable with a mean of 6.69 ± 0.68 mg/L, while organic loading was indicated by the highest recorded biochemical oxygen demand of 6.6 mg/L. Salinity demonstrated a wide estuarine gradient, averaging 16.21 ± 6.73 PSU. Mean ammoniacal nitrogen and orthophosphate concentrations were 0.22 ± 0.30 mg L⁻¹ and 0.05 ± 0.06 mg/L, respectively. Maximum orthophosphate (0.42 mg L⁻¹) and ammonia (1.27 mg L⁻¹) concentrations, associated with anthropogenic inputs, exceeded the ambient water quality standards (2019). The detection of fecal coliforms and *Escherichia coli* at levels reaching the upper reporting limit of 1800+ MPN/100 mL indicates fecal contamination and associated risk of pathogens. During the southwest monsoon season, heavy metals were analyzed, revealing low levels of Arsenic (≤ 0.002 mg L⁻¹) and Cadmium (≤ 0.001 mg L⁻¹), while Mercury (< 0.0005 mg L⁻¹) and Lead (< 0.01 mg L⁻¹) were below the detection limit. Although the average water quality in the lagoon remains favourable to fish and aquatic life, notable seasonal variations emphasise the necessity for sustainable water resource management to ensure the long-term resilience of this coastal ecosystem.

Keywords: Koggala Lagoon, Coastal water quality, Aquatic pollution, Spatiotemporal analysis