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Environmental Impacts of Point and Non-Point Source Pollution in Krishnagiri Reservoir: A Case Study in South India

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Abstract : Reservoirs are being contaminated all around the world with point source and Non-Point Source (NPS) pollution. The most common NPS pollutants are sediments and nutrients. Krishnagiri Reservoir (KR) has been chosen for the present case study, which is located in the tropical semi-arid climatic zone of Tamil Nadu, South India. It is the main source of surface water in Krishnagiri district to meet the freshwater demands. The reservoir has lost about 40% of its water holding capacity due to sedimentation over the period of 50 years. Hence, from the research and management perspective, there is a need for a sound knowledge on the spatial and seasonal variations of KR water quality. The present study encompasses the specific objectives as (i) to investigate the longitudinal heterogeneity and seasonal variations of physicochemical parameters, nutrients and biological characteristics of KR water and (ii) to examine the extent of degradation of water quality in KR. 15 sampling points were identified by uniform stratified method and a systematic monthly sampling strategy was selected due to high dynamic nature in its hydrological characteristics. The physicochemical parameters, major ions, nutrients and Chlorophyll a (Chl a) were analysed. Trophic status of KR was classified by using Carlson's Trophic State Index (TSI). All statistical analyses were performed by using Statistical Package for Social Sciences programme, version-16.0. Spatial maps were prepared for Chl a using Arc GIS. Observations in KR pointed out that electrical conductivity and major ions are highly variable factors as it receives inflow from the catchment with different land use activities. The study of major ions in KR exhibited different trends in their values and it could be concluded that as the monsoon progresses the major ions in the water decreases or water quality stabilizes. The inflow point of KR showed comparatively higher concentration of nutrients including nitrate, soluble reactive phosphorus (SRP), total phosphors (TP), total suspended phosphorus (TSP) and total dissolved phosphorus (TDP) during monsoon seasons. This evidently showed the input of significant amount of nutrients from the catchment side through agricultural runoff. High concentration of TDP and TSP at the lacustrine zone of the reservoir during summer season evidently revealed that there was a significant release of phosphorus from the bottom sediments. Carlson’s TSI of KR ranged between 81 and 92 during northeast monsoon and summer seasons. High and permanent Cyanobacterial bloom in KR could be mainly due to the internal loading of phosphorus from the bottom sediments. According to Carlson’s TSI classification Krishnagiri reservoir was ranked in the hyper-eutrophic category. This study provides necessary basic data on the spatio-temporal variations of water quality in KR and also proves the impact of point and NPS pollution from the catchment area. High TSI warrants a greater threat for the recovery of internal P loading and hyper-eutrophic condition of KR. Several expensive internal measures for the reduction of internal loading of P were introduced by many scientists. However, the outcome of the present research suggests for the innovative algae harvesting technique for the removal of sediment nutrients.

Keywords : NPS pollution, nutrients, hyper-eutrophication, krishnagiri reservoir
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