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Assessing the Ecological Impact of Aquatic Pollution in a Rural Environment: Risk Assessment, Indicators or Multivariate Statistics?

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Abstract

Rural aquatic ecosystems are simultaneously subjected to multiple sources of contamination such as pesticides and nutrients associated with agriculture, as well as bacteriological contamination associated with livestock and sewage effluents discharge. In the present study, pesticide, metal, and bacterial aquatic contamination were evaluated together with the trophic state in the Pergamino River (Buenos Aires province, Argentina) in order to study the anthropogenic impacts on the water quality of the river. The Pergamino River flows through productive fields dedicated mainly to extensive crop production and livestock pastures. The river also crosses through the City of Pergamino. Four sites were sampled along the river in November 2021 and March 2022. Two of the sites were located upstream from the City of Pergamino, while the two other sites were located downstream from the city, so as to compare the impacts of agriculture and urbanization on water quality. Forty-four different pesticide molecules were detected in surface water samples, the herbicides saflufenacil and atrazine, and the fungicide carbendazim were detected in all water samples tested. Other frequently detected pesticides were triadimefon, tebuconazol, and cyproconazol, which were present in more than 80% of the samples. The Trophic State Index had values above 80 in all sampling sites, indicating hypertrophic conditions. The water concentrations of Cu, Pb, Hg, Mn, Cr, and Al frequently surpassed water quality criteria's. Biological and chemical oxygen demands as well total coliforms values were greatly elevated in sites downstream from the municipal wastewater outlet. The potential impacts of these findings on aquatic life are evaluated according to different approaches such as environmental risk assessment, indicators or multivariate statistics. Overall, results obtained point out the pervasive impact of the anthropogenic activities (agriculture and urbanizations) on the water quality of the Pergamino and the potential negative effects on the aquatic life.