MACROINVERTEBRATE DIVERSITY AND PHYSICOCHEMICAL FACTORS

AS INDICATORS OF WATER QUALITY WITHIN NZOIA SUGARCANE

COMPANY NUCLEUS IN WESTERN KENYA

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DECLARATION

This thesis is my original work and has not been previously presented for a degree in Masinde Muliro University of Science and Technology or in any other University. The work herein has all sources of information supported by relevant references.

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APPROVAL

The undersigned certify that they have read and hereby recommend for acceptance of Masinde Muliro University of Science and Technology a thesis entitled 'Macroinvertebrate diversity and physicochemical parameters as indicators of water quality within Nzoia sugar ecosystem in Western Kenya'.

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ABSTRACT

Sugarcane production is important in our day to day life though it causes water pollution which reduces the water quality. Despite its threat to water quality, not much is known about the impacts of agronomic inputs on macroinvertebrates in Nzoia sugar Company Nucleus ecosystem. Nzoia sugar company nucleus receives water from Kuywa River which is a tributary of Nzoia River and discharges a diverse array of pollutants to the river. Studies on Nzoia sugar company nucleus to determine the physicochemical parameters and macro-invertebrate diversity as indicators of water quality are limited. This study therefore, assessed agro-industrial activities within the Nzoia Sugar Company nucleus plantations on the water quality and macroinvertebrate diversity. Surface water from canals and River Kuywa within Nzoia Sugar Company nucleus was collected from 23 sites and analyzed for pH, electrical conductivity, nitrates, ammonia and Ortho-phosphates according to standard methods. Aquatic organisms were collected using fish nets and sweep nets. Larger aquatic organisms were immobilized using chloroform while smaller animals were immobilized in absolute alcohol and kept in sampling bottles and preserved in 70 percent alcohol. The data was analyzed using descriptive and inferential statistics using SPSS version 18 and Statistica version 10. Shannon Weiner diversity and evenness indices were calculated for macro-invertebrate communities and macroinvertebrate populations correlated with physicochemical parameters. Student-Neuman-Keuls test for turbidity, salts and pH was computed. A total of 1591 macro-invertebrates comprising 18 genera were collected: 826 during long rain season (May-August 2011), 299 during short rain season (September-November 2011) and 466 during dry season (December 2011-February 2012). The class Insecta was the most abundant. There were significant differences in all water quality parameters between seasons except temperature. Nitrites, soluble reactive phosphates, total phosphates were higher during long rainy season. Total nitrates, ammonia, and conductivity were higher in the short rainy season while total salts and total dissolved solids were high during dry season. Total nitrites, soluble reactive phosphates and total phosphates showed a positive correlation ($r = 0.2332$, 0.5067 and 0.1771, respectively) with macroinvertebrates during long rainy season but they all gave a negative correlation in both short rain and dry seasons ($r = -0.2383, -0.1678$ and -0.1178, respectively). Shannon Weiner diversity index of 0.44 was recorded. There is significant differences ($p<0.05$) in nitrates, total nitrogen, conductivity, total dissolved solids and temperature levels between control and experimental sites. Based on the findings of this study, it can be concluded that agricultural and industrial activities have significant impacts on water quality in irrigation canals in Nzoia Sugar Company Nucleus in Western Kenya. This is shown in this study by the high nitrogen and phosphate content in the runoff from sugar cane agricultural fields that drain into water canals in the nucleus estate.