BUSITEMA UNIVERSITY

FACULTY OF NATURAL RESOURCES AND ENVIRONMENTAL SCIENCES

DEPARTMENT OF GEOINFORMATION, EARTH OBSERVATION, PHYSICAL AND LAND RESOURCES

EFFECT OF INDUSTRIAL EFFLUENT ON PHYSICO-CHEMICAL PARAMETERS AND MACRO-INVERTEBRATE COMMUNITY IN NAPOLEON GULF, LAKE VICTORIA

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A DISSERTATION SUBMITTED TO THE FACULTY OF NATURAL RESOURCES AND ENVIRONMENTAL SCIENCES IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF A DEGREE OF BACHELOR OF SCIENCE IN FISHERIES AND WATER RESOURCE MANAGEMENT, BUSITEMA UNIVERSITY

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DECLARATION

I **Mulowoza Alex** do hereby declare that this dissertation on the "*Effect of industrial effluents on the Physico-Chemical water parameters and benthic macro-invertebrate community in Napoleon Gulf, Lake Victoria*" is my original piece of work; and that it has never been submitted for any award in any University or higher Institution of learning.

Signed: ..... Date: 05 /06/ 2019

APPROVAL

This is to certify that **Mulowoza Alex** carried out this study on *Effect of industrial effluents on the Physico-Chemical water parameters and benthic macro-invertebrate community in Napoleon Gulf, Lake Victoria"* under my supervision and this report has been submitted to Busitema University with my approval

Signed: ..... Date: 05th/06/2019

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DEDICATION

I dedicate this piece of work to my parents, sisters, brothers, friends and above all, the Almighty God who navigated me through the hard situations of this study.

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LIST OF DEFINITIONS

Inshore: Referred to the transect/line close or closer to the shore of the lake at the study area. In this study, the inshore was estimated at 0m to the shore.

Mid-shore: Referred to transect between the inshore and offshore of the lake and it was estimated at 400m from the shore.

Offshore: In this study, it referred to transect in the open of the lake estimated at 800m from the shore.

Community: An association of different species in a particular area.

Community structure: refers to kinds of different species in a community along with things like their abundance and relative abundance.

Species richness: Number of species in a community

Species evenness: relative abundance of each species

Bivalves: Are aquatic mollusks which have a compressed body enclosed within a hinged shell, such as oysters, mussels, and scallops

Gastropoda: Is large class of molluscs which includes snails, slugs, whelks, and all terrestrial kinds. They have a large muscular foot for movement and (in many kinds) a single asymmetrical spiral shell.

Species abundance: Is the number of individuals of a particular species in a given area.

Annelids: Refer to a segmented worm of the phylum *Annelida*, such as an earthworm or leech.

Ephemeroptera: Is an order of insects that comprises the mayflies, insects etc

Diptera: Is a large order of insects that comprises the two-winged or true flies, which have the hind wings reduced to form balancing organs

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LIST OF ACRONYMS

μgL^{-1}	microgram per litre
µscm-1	micro siemen's per centimeter
ANOVA	Analysis of Variance
BOD_5	Biological Oxygen Demand after five days of incubation
CO_2	Carbondioxide
DO	Dissolved Oxygen
DO_f	final Dissolved oxygen after sample incubation of five days
DO_i	Initial Dissolved oxygen before sample incubation for five days
EC	Electrical Conductivity
EPT	Ephemeroptera, Pleocoptera and Trichoptera
H'	Shannon Wiener Diversity index
H_2S	Hydrogen sulphide
mgL^{-1}	Milligrams per litre
NaFIRRI.	National Fisheries Resources Research Institute
NTU	Nephelometric Turbidity Units
^oC	Degree Celsius
R^2	Spearman's rank correlation value
TEPs	Tradable Emission Permits
TN	Total Nitrogen
TP	Total Phosphorus
WHO	World Health Organization

ABSTRACT

The study assessed the *effect of industrial effluent on the physicochemical water parameters, macro-invertebrate abundance, composition and diversity in Napoleon Gulf, Lake Victoria.* Selected physico-chemical water characteristics at selected sampling points were determined *in-situ* while as nutrients (TN & TP) and Biological Oxygen Demand were determined in the laboratory using standard methods (Wetzel *et al,* 2000). Triplicate macro invertebrate sample at each sampling point were collected using a ponar grab, identified based on morphological appearance using identification keys.

Physico-chemical results revealed that Dissolved oxygen was high at offshore transect with a mean value of 7.09 ± 0.17mgL^{-1} in March, low at inshore in February with a mean value of 3.63 ± 0.92mgL^{-1}, pH was generally alkaline at all transects with mean values ranging from 7.06 ± 0.02 to 9.12 ± 0.05. BOD_5 was high at inshore in April with a mean value of 13.73 ± 1.80mgL^{-1} and low at offshore in March with 6.35 ± 1.01mgL^{-1}.TN and TP was high at mid-shore with mean values of 2905.08 ± 2156.3 µgL^{-1} (April) and 194.89 ± 26.38 µgL^{-1} (Feb) respectively.

A total of five (5) taxa of benthic macro invertebrates identified to family level were recorded. Of which Annelida recorded 76.6% with *Hirudnea spp* (1008 ± 558m^{-2}) and *Oligochaete spp* (154 ± 61m^{-2}) were numerically dominant and abundant, no Dipteran was recorded at inshore. Bivalvia taxa dominated mid-shore transect with 39.2% i.e. *Byssanodonta spp* (976 ± 149m^{-2}) and *Sphaerium spp* (938 ± 209m^{-2}) while Ephemeroptera *(Povilla adusta spp,* 154 ± 85m^{-2}) was the least with only 3.2% . At offshore, Ephemeropterans were not recorded while Annelids (78.3%) were the most dominant with *Hirudinea spp* (2451 ± 641m^{-2}) and *Oligochaete spp* (2190 ± 1106m^{-2}). Hence, low abundances at inshore indicated that its less polluted compared to offshore and mid-shore transects.

Conclusively, most of the macro-invertebrates recorded during the study were those tolerant to pollution. Therefore, the management authorities should put up abatement policies and standards to protect aquatic ecosystems from pollution by humans.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Lake Victoria is a freshwater body, second largest on a global scale and largest in Africa covering an area of 68,000km^{2} [0]. It is shared by three East African countries i.e. Kenya, Uganda and Tanzania, covering6%, 43% and 51% respectively.

Lake Victoria is relatively shallow with an average depth of 40m and maximum depth of 79m with a volume of 2,760km^{3} (Muyodi *et al*, 2010; Scheren *et al*, 2003). The lake shoreline is long (about 3,500km) enclosing innumerable small, shallow bays and inlets, many of which are swamps and wetlands i.e. Kirinya East Wetland in Jinja Municipality. These have led to an influx of the pollutants and contaminants into the lake leading to a resultant change in abiotic factors such as dissolved oxygen etc, and macro-invertebrate species diversity, composition and distribution (Muggide *et al*, 1993). These changes have been partially attributed to the industrial and domestic sewage discharges which have continued to enrich the lake with nutrients such as nitrates, phosphates and high loads of heavy metals such as chromium (Mugidde, 1992, 1993; Hannington et al., *2008*).

In addition, fisheries production enhancement practices such as cage fish farming also contribute to lake pollution leading to notable changes in species composition and diversity, and physico-chemical parameters in Napoleon Gulf (Egessa *et al*, 2018).). Variations in benthic macro-invertebrate communities are used as indicators of pollution in aquatic ecosystems, due to changes in richness and evenness as a result of tolerance towards pollution. Jorgehsen (1993) noted that systems with moderate and optimum levels of abiotic components, for example, 4mg/L of dissolved oxygen, the fauna usually have high species richness, abundance and taxa.

Previous studies on benthic macro-invertebrates structure in Napoleon Gulf are mainly limited to the impact of aquatic weeds, cages on their abundance and diversity (Wanda, 1997; 2001). This study aimed to study the effect of industrial effluent on physico-chemical parameters and macro-invertebrate community in Napoleon Gulf, Lake Victoria".

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