
INDUSTRIAL DISCHARGE AND WATER QUALITY IN KALANGALA DISTRICT: A CASE STUDY OF LAKE VICTORIA

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ABSTRACT

The major objective of this study lied in finding out whether there was a relationship between Industrial Discharge and Water Quality of Lake Victoria in Kalangala District. Other objectives included: To establish the level of Industrial Discharge into Lake Victoria, Kalangala District and to find out the extent of Water Quality of Lake Victoria, Kalangala District.

With the help of Solvin's formula, the study used a descriptive and epidemiological method of inquiry and a simple random chance method of sampling to collect data from a sample of eighty participants near Lake Victoria in the Kalangala District. Given that there was a substantial positive correlation between industrial emissions and water quality ($r = 0.994$), and that the sig. value (.000) was much lower than the threshold level of significance of 0.01, which was necessary to declare a significant connection between industrial discharge and water quality, this suggested that industrial discharge had a significant impact on the water cleanliness of Lake Victoria.

The study's conclusion on this goal was that there is very little water quality overall, which is caused by a high rate of industrial discharge into Lake Victoria's waters. The third goal is to determine the connection between industrial discharge and Lake Victoria's water quality in Kalangala District. The link between industrial discharge and water quality is highly positive. The study came to the conclusion that individuals in this region engage in numerous practices that cause water quality issues, such as disposing of human waste, sewage, and plastics straight into Lake

Victoria, which causes nutrient enrichment of water bodies and a decline in BOD. The researcher recommended the government to provide close supervision to industries in order not to dispose of industrial wastes directly into water bodies.

Key words: industrial discharge and water quality

Background of the study

Water is a vital component of all life forms and makes up between 85 and 97 percent of the weight of all plants, animals, and humans. The majority of illnesses in humans and animals are caused by water when its physical and chemical qualities are altered beyond a critical point. Groundwater contamination is caused by a variety of actions taken by humans and industries. High nitrate concentrations in drinking water are a result of chemical fertilizers, animal waste disposal, and septic tank systems. Metal manufacturing plants, semiconductor companies, and glass manufacturers release fluoride ions into the surroundings, which then enter the human body through food (Liu et al., 1983; Cheng, 2000).

Significant quantities of industrial wastewater are produced in urban areas all over the world as a result of the ongoing global expansion of industry and urbanization (Dutta et al., 2021). For instance, 44 million cubic meters of water from industrial operations were discharged each day in India in 2014 (Ranade et al., 2014). When a significant amount of industrial wastewater is released into the atmosphere, it will not only damage groundwater as well as surface waters but also put human health at risk by spreading diseases including schistosomiasis, malaria, and diarrhea (Owodunni et al., 2021).

In terms of growing water demand, increasing industry, increasing agriculture, expanding growth and development, and ultimately expanding eutrophication, the increasing human population near Lake Victoria offers a challenge (Cavalli et al.,

2009).

Statement of the problem

The problem lied in finding out whether there was a relationship between Industrial Discharge and

Water Quality of Lake Victoria in Kalangala District.

Specific objectives

- 1. To establish the level of Industrial Discharge into Lake Victoria, Kalangala District.*
- 2. To find out the extent of Water Quality of Lake Victoria, Kalangala District.*
- 3. To find out the relationship between Industrial Discharge and Water Quality of Lake Victoria in Kalangala District.*

Research questions

- 1. What is the level of Industrial Discharge into Lake Victoria, Kalangala District?*
- 2. What is the extent of Water Quality of Lake Victoria, Kalangala District?*
- 3. What is the relationship between Industrial Discharge and Water Quality of Lake Victoria in Kalangala District?*

Methodology

Research design

The study involved both qualitative and quantitative approaches during data collection. Qualitative approach enabled the researcher to give a complete, detailed description of phenomenon about the study for in-depth data gathering while

quantitative approach enabled the researcher to construct statistical models in an attempt to explain the findings. Quantitative approach also provided comparisons and statistical aggregation of data.

Study population

In this study, participants were chosen using stratified sampling. According to each person's occupation in the research region, the population is divided into smaller groups (referred to as strata). The study population in Kalangala District that the investigator took into account included boat builders, fisherman, and civil servants including the district fisheries officer and LC1.

A pretesting/pre-survey is a stage in survey research, as defined by Sletto & Katz (1940), where questionnaires and surveys are tested on members of the target community/study population, in order to assess the accuracy and dependability of the instruments used for the study prior to their final dissemination.

Sampling procedures

Sampling procedure refers to choosing part of a population to use to test hypotheses about the entire population (Jowin, 2003). The procedures included simple random sampling and purposive sampling and was used to select respondents in the study.

Sample size

A sample is a small subset of the total population (George & Mallery, 2003).

The study sample comprised of 80 respondents out of 100 of the total population where 40 respondents were Fishermen, 22 were Boat makers, 18 were civil servants (These included District Fisheries officer and LC 1 chairperson).

Sampling techniques

Ahuja Ram (2010), defines sampling as the act or process of selecting a suitable

sample of the population for the purpose of determining parameters of characteristics of the whole population, and these can be either probability or non-probability sampling techniques.

Simple random sampling

Farmers, residents of the neighborhood, the LC5 Chairperson, and the district environmental officer were among those who participated in this survey. Key responders for the study included a District Fisheries Officer and the Chairperson of LC1. Selecting participants from the group of fishermen, boat builders, and civil servants involved simple random selection. For the study, a total of 40 fishermen, 22 boat builders, and 18 civil servants were chosen using simple random sampling techniques

Men and women respondents from both sexes were made sure to be included in the survey.

Purposive sampling

The units in the sample that included LC1 were chosen using a purposeful sampling strategy.

The District Fisheries Officer and the chair. This method is founded on the study's goal and the distinctive features of a population. This method was employed by the investigator because it is extremely helpful in circumstances when you must quickly achieve a specified sample and where sampling for symmetry is not the major issue. Only those people who are pertinent to the research design are chosen through purposeful sampling, which is less expensive, more easily available, and more comfortable. In addition, there is no way to guarantee that the group being studied is actually accurately representing the population, therefore the investigator's

ability to evaluate the population's constituent parts is given additional weight.

Data collection methods and instruments

According to Syed Muhammad Sajjad Kabir (2016), data collection is the procedure of acquiring data and analyzing information on relevant variables in a predetermined systematic way that allows one to respond to specified research questions, test hypotheses, and assess results. The researcher will utilize both secondary and primary data methods to gather information about qualitative as well as quantitative information. In order to gather data, various techniques including questionnaires and interviews were used. These were used to gather information from all Kalangala District fishermen, manufacturing workers, government employees, and boat builders.

Data analysis

The statistical package for social science (SPSS) tool was used by the investigator to compute proportions, frequency, and tabulate responses, as well as to employ a variety of qualitative and quantitative types of data. To find and correct mistakes made by respondents, data was modified. The responses to the questions were then coded into several categories. The data were analyzed using descriptive statistics like distributions of frequencies and proportions. The submissions were all grouped according to their theme categories and the information they contained were evaluated for qualitative data using content analysis. Presentation materials included tables, charts, and figures. Software from the Statistical Package for Social Sciences (SPSS) was employed to assist in data analysis.

RESULTS

Response rate

Questionnaire return rate

All the 80 questionnaires were given out, 50 were returned, thus representing 63%

response. The study was considered good because according to Peil (1995), questionnaire return rate above 50% is considered good for a study.

Personal information of respondents

Information regarding to the personal background of the respondents included their age, gender, marital status, occupation, and education level

Age of the respondents

Information regarding the age of the respondents was added to questionnaires during the piloting process. The following information regarding the ages of the respondents was analyzed using SPSS Software and presented in form of grouped data as shown in the table 1

AGE OF RESPONDENTS

	Frequency	Percent	Valid Percent	Cumulative Percent
0-10	3	6.0	6.0	6.0
10-20	8	16.0	16.0	22.0
20-30	8	16.0	16.0	38.0
Valid 30-40	20	40.0	40.0	78.0

Therefore, based on the mean (4.2200), it was determined that 40.0% of participants who took part in the study were from the elderly group, meaning they were between the ages of 30 and 40. Such individuals within that age range are mature enough to be capable of carrying out fishing-related activities as well as industrial work like managing machinery and packaging. This led to the conclusion that the researched adult brains were responsible for the correctness and dependability of the

information that was gathered. Also, from the table 1, the researcher found out that 16.0% of the respondents in Kalangala District were aged between 10-20 years, 16.0% of the respondents were aged between 20-30 years and 14.0% were aged between 40-50 years, 6.0% were aged between 0-10 years and 8.0% were aged 50 years and above. The range was 32.00 and Std. Deviation was 4.35323. The median is 4.0000.

Gender of Respondents

The study investigated the gender of the respondents and the findings were as shown in the table

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GENDER OF RESPONDENTS

	Frequency	Percent	Valid Percent	Cumulative Percent
MALE	33	66.0	66.0	66.0
Valid FEMALE	17	34.0	34.0	100.0
Total	50	100.0	100.0	

From table 2, it was found out that, majority of the respondents were males with 66.0%

compared to females with 34.0%.

Occupation of the respondents

Information regarding the occupation of the respondents in Kalangala District, around Lake

Victoria was collected and presented in table 3

OCCUPATION OF RESPONDENTS

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid FISHERMAN	18	36.0	36.0	36.0
CIVIL SERVANT	5	10.0	10.0	46.0
BOAT MAKER	18	36.0	36.0	82.0
INDUSTRIAL WORKER	9	18.0	18.0	100.0
Total	50	100.0	100.0	

From table 3, it was found out that majority of the respondents who participated in the study were fishermen (36.0%) and Boat makers (36.0%), civil servants were 5 (10.0%) and 18.0% were industrial workers.

Marital status

Information regarding the marital status of the respondents in Kalangala District was collected and presented in table 4

MARITAL STATUS OF RESPONDENTS

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid SINGLE	15	30.0	30.0	30.0
MARRIED	31	62.0	62.0	92.0
DIVORCED	4	8.0	8.0	100.0
Total	50	100.0	100.0	

From table 4, it was found out that, majority of the respondents were married with 62.0%, 30.0% were singles and 8.0% had divorced.

Educational level of the respondents

Information regarding the academic background of respondents in Kalangala District was obtained and tabulated as shown in table 5

EDUCATION LEVEL OF RESPONDENTS

	Frequency	Percent	Valid Percent	Cumulative Percent
PRIMARY AND BELOW	15	30.0	30.0	30.0
O. LEVEL	5	10.0	10.0	40.0
A. LEVEL	7	14.0	14.0	54.0
CERTIFICATE	6	12.0	12.0	66.0
DIPLOMA	4	8.0	8.0	74.0
NONE	13	26.0	26.0	100.0
Total	50	100.0	100.0	

From table 5, it was found out in an analysis of interviews and questionnaire that majority of the respondents (30.0%) had completed primary level of education and never continued with their further studies, 14.0% had completed their A' Level of education, 12.0% had finished their certificate level of education, 10.0% had completed their ordinary level of education, 8.0% had completed their diploma and 26.0% had not attended any level of education in their lives. From the statistics, it's indicating that the Education of Kalangala District is lacking and needing.

Table 6: The level of Industrial Discharge into Lake Victoria, Kalangala District

This Section describes the independent variable (Industrial Discharge). The independent variable was addressed in Section B of the questionnaire for respondents.

LEVEL OF INDUSTRIAL DISCHARGE INTO LAKE VICTORIA

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid LOW	10	20.0	20.0	20.0
MEDIUM	9	18.0	18.0	38.0
HIGH	31	62.0	62.0	100.0
Total	50	100.0	100.0	

The responses were interpreted as follows, 20.0% of the respondents revealed that the level of industrial discharge into Lake Victoria is low, 18.0% of the respondents revealed that the level of industrial discharge into Lake Victoria is medium and 62.0% of the respondents revealed that the level of industrial discharge into Lake Victoria is high.

Table 7: Effects of Industrial Discharge into water

EFFECTS OF INDUSTRIAL DISCHARGE

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Reduction in BOD	20	40.0	40.0	40.0
Eutrophication	22	44.0	44.0	84.0
Change in water quality	8	16.0	16.0	100.0
Total	50	100.0	100.0	

From table 7, industrial discharge causes reduction in BOD (40.0%), 44.0% of the respondents revealed that industrial discharge causes eutrophication and 16.0% of the respondents revealed that industrial discharge causes change in water quality.

The findings were also in line with the study conducted by Mugidde (1993), who found out that in Lake Victoria, eutrophication has been the result of increased inflow of nutrients particularly nitrogen and phosphorus. During the period under review, the concentration of total phosphorus rose markedly in the deeper lake waters and total nitrogen and total phosphorus rose in the near shore areas. Stimulated by these nutrients algal growth increased and its composition shifted towards domination by heterocystous blue-green Cyanobacteria

Table 8: Constituents of industrial discharge

CONSTITUENTS OF INDUSTRIAL DISCHARGE

	Frequency	Percent	Valid Percent	Cumulative Percent
Sewage	12	24.0	24.0	24.0
Faeces	15	30.0	30.0	54.0
Valid Plastics	10	20.0	20.0	74.0
Polyethenes	13	26.0	26.0	100.0
Total	50	100.0	100.0	

From table 8, it was found out that majority of the respondents (26.0%) revealed that industrial discharge consists of Polyethenes, 24.0% revealed that industrial discharge consists of sewage and 20% revealed that it consists of plastics.

Under this first objective, the researcher went ahead to ask respondents using the 5 style Likert scale and the responses were analyzed using SPSS and presented in table 4.3.4 below.

Table 9: Industrial discharge causes water pollution

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid STRONGLY AGREE	8	16.0	16.0	16.0
DISAGREE	6	12.0	12.0	28.0
NEITHER AGREE NOR DISAGREE	5	10.0	10.0	38.0
AGREE	11	22.0	22.0	60.0
STRONGLY AGREE	20	40.0	40.0	100.0
Total	50	100.0	100.0	

From the table 9, it was found out that 16.0% of the respondents strongly disagreed that Industrial discharge causes water pollution in this area, 12.0% disagreed, 10.0% neither agreed nor disagreed, 22.0% agreed and 40.0% strongly agreed that Industrial discharge causes water pollution in Kalangala District.

Table 10: The extent of Water Quality of Lake Victoria, Kalangala District

This Section describes the dependent variable (Water Quality). The dependent variable was addressed in Section C of the questionnaire for respondents. Information regarding the extent of water quality of Lake Victoria, Kalangala District was collected from respondents and analyzed using SPSS Software and the results were presented and tabulated in table 10 below.

Statistics**EXTENT OF WATER QUALITY OF LAKE VICTORIA***Valid*

50

*N**Missing*

0

EXTENT OF WATER QUALITY OF LAKE VICTORIA

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid SMALL	25	50.0	50.0	50.0
MEDIUM	15	30.0	30.0	80.0
HIGH/LARGE	10	20.0	20.0	100.0
Total	50	100.0	100.0	

The responses were interpreted as follows, 50.0% of the respondents revealed that the extent of water quality of Lake Victoria is small/low, 30.0% of the respondents revealed that the extent of water quality of Lake Victoria is moderate and 20.0% of the respondents revealed that water quality of Lake Victoria is high.

The findings were in line with the study conducted by Ochumba & Kibaara (1989), it was found out that increased algal growth caused de-oxygenation of water, increased sickness for humans and animals drawing water from the lake, clogging of water intake filters, and increased chemical treatment costs for urban water supplies (World Bank, 1996).

Table 11: Strategies to combat Water Quality problems

Statistics**Strategies to combat water quality problems**

Valid		50
N		
Missing		0

Strategies to combat water quality problems

	Frequency	Percent	Valid Percent	Cumulative Percent
Prevention of pollution	19	38.0	38.0	38.0
Treatment of polluted water	12	24.0	24.0	62.0
Valid Safe use of waste water	12	24.0	24.0	86.0
Restoration and protection of ecosystem	7	14.0	14.0	100.0
Total	50	100.0	100.0	

The responses were interpreted as follows; 38.0% of the respondents revealed that prevention of pollution should be done to combat water pollution, 24.0% revealed treatment of polluted water and safe use of waste water and 14.0% revealed that restoration and protection of ecosystem should be done to combat water quality problems.

Pollution prevention strategies focus on the reduction or elimination of waste at the source. Prevention is widely regarded as the cheapest, easiest and most effective way to protect water quality. In industry, solution includes reformulating products so that they produce less pollution and require fewer resources (including water) during their manufacture.

Relationship between Industrial Discharge and Water Quality

Table 12: Showing Pearson Correlation between Industrial Discharge and Water Quality

Correlations

		Industrial discharge	Water Quality
Industrial Discharge	Pearson Correlation	1.00	.994
	Sig. (2-tailed)		.000
	N	50	50
Water Quality	Pearson Correlation	.994	1.00
	Sig. (2-tailed)	.000	
	N	50	50

**** Correlation is significant at the 0.01 level (2-tailed).**

Source: SPSS output page

Table 12 indicates that there is a very strong positive relationship between Industrial Discharge and Water Quality at $r = 0.994$ and since the sig. value (.000) was far less than 0.01, which is the maximum level of significance required declaring a significant relationship between Industrial Discharge and Water Quality, this implies that industrial discharge greatly affects the water quality of water in Lake Victoria.

Conclusion of the findings

The researcher concluded on this objective from the findings that the level of industrial discharge is high and this is because many beverage industries are located near water bodies due to high need for water as a raw material. These industries release untreated sewage directly into water bodies hence lowering the water quality.

There is a high positive correlation/relationship between Industrial discharge and water quality. The researcher concluded that people in this area practice a lot of

activities that leads to pollution of water like dumping faeces, sewage and plastics directly into Lake Victoria, this leads to eutrophication of water bodies and the reduction in BOD of the water.

Recommendations of the study

The researcher recommended the government to provide close supervision to industries in order not to dispose of industrial wastes directly into water bodies.

The researcher recommends the fishermen to always use good and conserving fishing methods like use recommended fish nets and also to avoid pouring homestead wastes into the waters.

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