UNIVERSITY OF DAR ES SALAAM



SCHOOL OF AQUATIC SCIENCE AND FISHERIES TECHNOLOGY

(SOAF)

DEPARTMENT OF AQUATIC SCIENCE AND FISHERIES TECHNOLOGY

AQ 339: RESEARCH PROJECT

RESEARCH PROPOSAL

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REGISTRATION NO: 2020-04-05087

TITLE: INFLUENCE OF NUTRIENTS IN CHLOROPHYLL-A AT MSIMBAZI RIVER.

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**Table of contents**

[List of figures i](#_Toc175165145)

[List of abbreviations i](#_Toc175165146)

[CHAPTER ONE 2](#_Toc175165147)

[INTRODUCTION 2](#_Toc175165148)

[1.1General introduction 2](#_Toc175165149)

[1.2 Statement of Research Problem 4](#_Toc175165150)

[1.3 Objectives of the research 5](#_Toc175165151)

[1.3.1General objective 5](#_Toc175165152)

[1.3.2Specific objective 5](#_Toc175165153)

[1.4 Hypotheses 5](#_Toc175165154)

[1.4.1 Significance of the study 5](#_Toc175165155)

[1.5 Literature Review 6](#_Toc175165156)

[1.5.1 Introduction 6](#_Toc175165157)

[1.5.2 River Pollution 6](#_Toc175165158)

[1.5.3 Nutrients 7](#_Toc175165159)

[1.5.4Total Nitrogen: A Measure of Nutrient Enrichment 7](#_Toc175165160)

[1.5.5 Total Phosphorus: A Measure of Nutrient Enrichment 9](#_Toc175165161)

[1.5.6 How Nutrient loading in river affect the pristine ecosystem and human being. 9](#_Toc175165162)

[1.5.7 Chlorophyll a; A Measure of river Productivity 10](#_Toc175165163)

[1.5.8 Water quality indicators 11](#_Toc175165164)

[1.5.9 Dissolved Oxygen 12](#_Toc175165165)

[1.5.9 PH 12](#_Toc175165166)

[CHAPTER TWO 13](#_Toc175165167)

[MATERIALS AND METHODS 13](#_Toc175165168)

[2.1 Study site or area 13](#_Toc175165169)

[2.2 Sampling design and analytical methods 14](#_Toc175165170)

[2.3Preparation of equipments prior to sampling and sample storage. 14](#_Toc175165171)

[2.4 Sampling checklist 14](#_Toc175165172)

[2.5 Data collection 15](#_Toc175165173)

[2.6 Laboratory analytical methods 15](#_Toc175165174)

[2.4 Data analysis 16](#_Toc175165175)

[CHAPTER THREE 17](#_Toc175165176)

[OTHER RELEVANT INFORMATION 17](#_Toc175165177)

[3.1 Work plan or Timeframe 17](#_Toc175165178)

[3.2 Budgeting and Financial arrangements. 18](#_Toc175165179)

[REFERENCES 19](#_Toc175165180)

# List of figures

[Figure 1 To show flooding at Jangwani residents and a map showing Jangwani floodplain respectively 2](#_Toc175032192)

[Figure 2 a hypothetical watershed showing the linkages among streams, lakes and coastal zones pollution sources for nitrogen and phosphorus. 9](#_Toc175032193)

[Figure 3 a map showing the catchment area and tributaries of Msimbazi River. 12](#_Toc175032194)

List of tables

[Table 1 below showing sampling methodology and preservation 15](#_Toc175032296)

[Table 2 above shows the schedule of the whole project 16](#_Toc175032297)

[Table 3 above shows an overview of the overall costs and its distribution in the project at glance. 17](#_Toc175032298)

# List of abbreviations

DO-Dissolved oxygen

EC- Electric conductivity

GPS-Global Positioning System

TDS-Total dissolved solids

TSS-Total Suspended Solids

TN-Total Nitrogen

TP-Total Phosphorus

WQI-Water Quality Index

# CHAPTER ONE

# INTRODUCTION

## 1.1General introduction

Rivers are large and often winding stream which drains a landmass, carrying water down from higher areas to a lower point, ending at an ocean or in an inland sea. Rivers are recognized as important traits in the landscape that provide numerous useful services for people, fish and wildlife (citation??). They are among the most important ecosystems on Earth and considered unique because of their hydrology and their function interact between terrestrial and aquatic ecosystems(Smith at el., 2003).

The Msimbazi River is an intermittent river that flows across Dar es Salaam and Coastal regions. The river originates from higher areas of rolling hills Kisarawe in the Coastal region and discharges into the Indian Ocean in Dar es Salaam. The river serves as an important water source as its adjoining fertile floodplain provides a good area for farming and animal grazing. However, the increasing human activities and changing weather patterns, have caused this perennial river to become seasonal one.

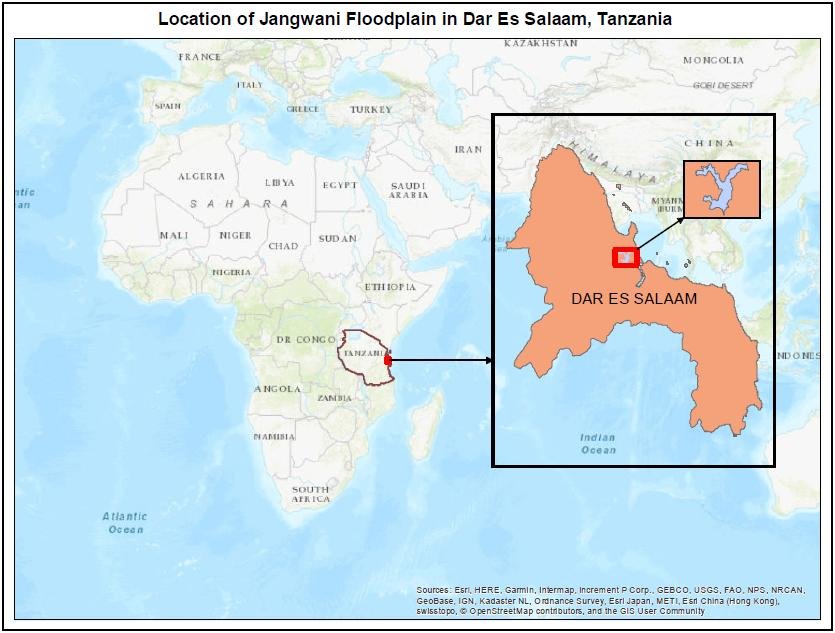


Figure 1 To show flooding at Jangwani residents and a map showing Jangwani floodplain respectively

The water quality of the Msimbazi River has an impact to the healthy of the surrounding ecosystems. The riveris severely degraded and it is under intense environmental pressure due to widespread discharge of human and industrial wastes such as raw sewage from pit latrines, pollution from the industries, untreated sewage and open defecation (citation??). These have made the water in the river toxic infested with bacterial infection. Studies show that, Msimbazi River is the major source of waterborne diseases such as diarrhoea, cholera and dysentery (Ahmed at el., 2021).

Dar es Salaam is the fastest growing city with 70% of its inhabitants living in squalid conditions in informal settlements (citation). The city is prone to flooding which results towater pollution and diseases outbreaks. **Only 10% of Dar es Salaam residents are connected to sewage system (citation)**. Investigations conducted by Anadolu Agency revealed high levels of heavy metal in the river run off from local industry and a waste dump near the Vingunguti area, leaking sludge into the river (citation???).

This study has established that, while there has been concern over the Msimbazi River Valley as a disaster-prone area, no legal steps or procedures have ever been taken to declare the area to be hazardous. (Calijuri at el., 2019). Because only 10% of Dar es Salaam residents are connected to the city’s sewage system, the majority use pit latrine and sceptic tanks that produce a huge volume of unsafely managed fecal sludge that often end up in this river.

Investigations further revealed a local abattoir is discharging wastes into the river causing the colour of the water to turn to brown-red. According to the country’s 2004 Environmental Management Act, man-made water pollution is prohibited “This neighbourhood is not planned, local residents do not have the means to dispose of wastes from their toilets, as a last resort they direct it to the river,” said Khalid Mazimbo, “The quality of the river’s water has sharply declined and it is no longer safe for domestic use, even for irrigation,”

General comments in introduction

When explain the introduction, focus on the main issues present in your title; the nutrient and chl-a. You may also focus on the study site but very briefly. Details on study sites should be described in the study site section not in introduction as you did. You need to show what other people’s reaches on your main issues, what their relationship are, what they got from their study and what conclusion they made. When you are explaining you need to provide references and cite where necessary.

Remember that, each paragraph should carry the single message, and there should be cohesion between one paragraph and the next para. Put you document in a good flow so that it is attractive to the reader

## 1.2 Statement of Research Problem

Nutrient levels are increasing in many river catchments in Tanzania due to human influence (Wurtsbaugh at el., 2019). . This leads to eutrophication in the aquatic ecosystemsdue to higher nutrient loads (Calijuri at el., 2008). Thus, it is important to identify the sources of nutrients in catchments in order  
to manage and prevent eutrophication. So there is a need to determine the relationship between nutrients concentration and chlorophyll-a in the Msimbazi River because chlorophyll a is identified as a major photosynthetic pigment in a lot of phytoplankton and trophy index in aquatic system also changes with nutrients and environmental factors so to know about effective factors on chlorophyll a concentration is very important for ecosystem management and to know environmental regulation to curb nutrient loading and especially non point sources in urbanizing areas.

## 1.3 Objectives of the research

### 1.3.1 General objective

The aim of this study is to explore the influence of nutrients in chlorophyll-*a* concentration at Msimbazi River.

### 1.3.2 Specific objectives

* To determine the concentration of phosphate levels at the upper, middle and lower part of the Msimbazi River
* To identify the concentration of nitrate levels at the upper, middle and lower part of the Msimbazi River
* To assess the concentration of chlorophyll-*a* at the upper, middle and lower part of the Msimbazi River

## 1.4 Hypotheses

1. There is no significant difference in concentration of phosphate in the upper, middle and lower part of the Msimbazi river
2. There is no significant difference inconcentration of nitrate in the upper, middle and lower part of the Msimbazi River
3. There is no significant difference in chlorophyll-*a* concentration the upper, middle and lower part of the Msimbazi River

### 1.4.1 Significance of the study

**To the nation**

This study will contribute to the understanding and account of the current physico-chemical status of water at the selected areas /sites of Msimbazi River in Tanzania and based on the findings of this study which will be presented in this paper will aid in monitoring of immunological characteristics of aquatic ecosystem in general.

**To the community**

This study will help the individual and the entire community members to have positive minds on the recognizing the importance of the rivers to different stake holders especial those who live inside or outside the river basin through stop polluting the streams.

**To the students**

This research will help the scientific community add the knowledge of influence of nutrients on chlorophyll-*a* at Msimbazi river.

## 1.5 Literature Review

Rivers are large natural stream of water emptying into an ocean, lake or other bodies of water and usually fed along its course by converging tributaries. They contain only 0.0001% of the total amount of water in the world at any time (Ashwani and Anish 2009). A river ecosystem includes river channels and its floodplains and form a diverse habitats upon which countless species of aquatic animals and plants depend for survival. They provide a plethora of services for humans including a source of water for domestic and industrial uses, a source of food, a means of waste disposal, a means of transportation activities, power production, and sites for the pursuit of leisure activities (Howarth at el., 2000). Yet, they belong to the most threatened ecosystems on earth.

Major threats to river ecosystems include habitat degradation, water pollution, flow modification, overexploitation, and invasion by invasive species (citation). This is especially true for developing countries where intensification of land-use for agriculture and poor disposal of untreated waste have markedly degraded rivers and associated floodplain ecosystems. Nevertheless, a proper understanding of ecosystem functioning and biological diversity is lacking in the society so there should be some efforts that is needed to bride this knowledge gap. There for investigation on different factors that explain biodiversity and ecosystem quality in (afro) tropical river systems and associated temporary pool ecosystems in northeastern-Tanzania is important. (Baird, at el., 2012)

### 1.5.2 River Pollution

Water pollution is a growing global crisis, threatening humans and wildlife. From piles of garbage to invisible chemicals, a wide range of pollutants end up in rivers and eventually into the ocean. The loading of nutrients from waste waters and metal contaminants is high, according to the Journal of Scientific Research and Reports, the soil around Msimbazi is infested with high concentrations of lead, chromium and copper (citation). This is due to discharge of heavy metals from manufacturing and processing factories, strong alkalis from textile mills steel, paint dye and food processing from both point and non-point water pollution into freshwater bodies (citation/reference). The higher levels of these pollution which exceed the waste assimilative capacity have become a threat to the ecology of different aquatic ecosystems (citation).

However few studies have improved the knowledge about global riverine inputs and relatively little information have been published about African rivers environmental  
qualities of some important water resources in developing countries of the sub-Saharan region  
like Tanzania are not well investigated, probably owing to, for example, lack of modern  
analytical tools to assist in the monitoring programs, despite the contamination risks **(**Barakat, at el., 2016). In the Klamath River in California increased water temperature, excessive nutrient levels, low dissolved oxygen concentrations, high pH, potential ammonia toxicity, increased  
incidence of fish disease, an abundance of aquatic plant development, high chlorophyll-a levels  
(both planktonic and periphytic algae), and high concentrations of potentially toxigenic  
blue-green algae, particularly in the impounded reaches, lower the quality and quantity  
of suitable habitat for fish and aquatic life, and have disrupted traditional cultural uses of  
the river by resident people. These conditions contribute to the non-attainment of beneficial users. <http://www.epa.gov/waterscience/standards/about/>visits the site for more information.

### 1.5.3 Nutrients

Nutrients are chemical elements and compounds found in the environment that plants and animals need to grow and survive. For water-quality investigations, the various forms of nitrogen and phosphorus are the nutrients of interest. The forms include nitrate, nitrite, ammonia, organic nitrogen (in the form of plant material or other organic compounds) and phosphates (orthophosphate and others). Nitrate is the most common form of nitrogen and phosphates are the most common forms of phosphorus found in natural waters. High concentrations of nutrients in water bodies can potentially cause eutrophication and hypoxia. Eutrophication is a process where water bodies, such as lakes, estuaries or slow-moving streams, receive excess nutrient that stimulate excessive plant growth (algae, periphyton attached to algae and nuisance plant weeds). When a surface water body becomes nutrient rich, is biologically productive and able to support high levels of algal or macrophytic growth. Atique at el., 2019.

### 1.5.4Total Nitrogen: A Measure of Nutrient Enrichment

Nitrogen is an essential plant nutrient found in fertilizers, human and animal wastes, yard waste, and the air. About 80% of the atmosphere is nitrogen gas. Nitrogen gas diffuses into water where it can be “fixed” (converted) by blue-green algae to ammonia for algal use. Nitrogen can also enter lakes and streams as inorganic nitrogen and ammonia. Because nitrogen can enter aquatic systems in many forms, there is an abundant supply of available nitrogen in these systems. The three common forms of nitrogen are:

Nitrate (NO3-) – Nitrate is an oxidized form of dissolved nitrogen that is converted to ammonia by algae under anoxic (low or no oxygen) conditions. It is found in streams and runoff when dissolved oxygen is present, usually in the surface waters.

Ammonia (NH4+) – Ammonia is a form of dissolved nitrogen that is readily used by algae. It is the reduced form of nitrogen and is found in water where dissolved oxygen is lacking such as in a eutrophic hypolimnion. Important sources of ammonia include fertilizers and animal manure. In addition, ammonia is produced as a by-product by bacteria as dead plant and animal matter are decomposed.

Organic Nitrogen (Org N) – Organic nitrogen includes nitrogen found in plant and animal materials and may be in dissolved or particulate form.

Total nitrogen (TN) is the sum of nitrogen from nitrates, ammonia, and organic forms. We began sampling for TN in 2018. TN is determined from the same sample taken for total phosphorus (TP). TN and TP are the most common nutrient measures used by environmental managers to determine nutrient enrichment.

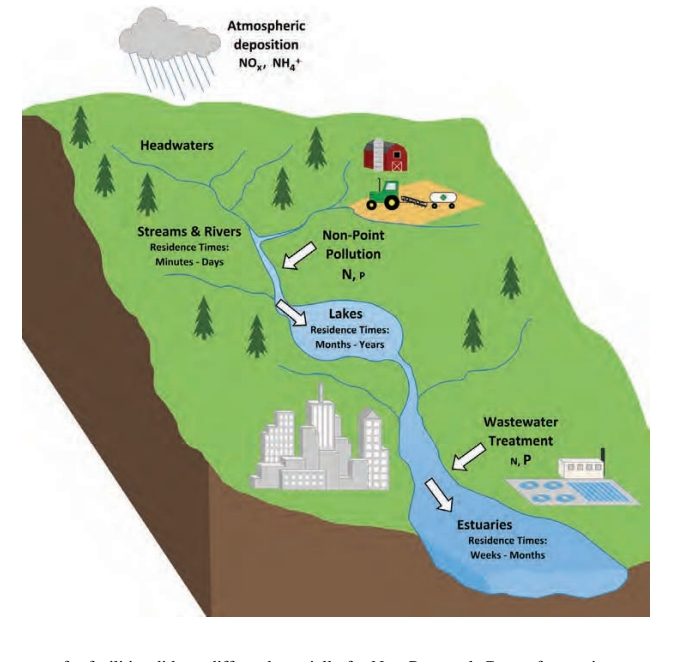


Figure 2 a hypothetical watershed showing the linkages among streams, lakes and coastal zones pollution sources for nitrogen and phosphorus.

### 1.5.5 Total Phosphorus: A Measure of Nutrient Enrichment

Phosphorus is often the key nutrient in determining the amount of phytoplankton (algae) in a lake. In comparison to other nutrients, phosphorus is usually the first element to limit biological productivity. Most of the phosphorus in lakes occurs in two forms: dissolved phosphorus and particulate phosphorus. The determination of dissolved phosphorus is a measure of the inorganic form of phosphorus available to algae. The determination of total phosphorus is a measure of all forms of phosphorus potentially available to algae.

Phosphorus enters a lake from rainfall, incoming streams, overland runoff, groundwater, and direct discharges. Phosphorus is also contributed to lakes from decomposition of organic matter and the erosion of soils. Phosphorus in the lake sediments may be released into the water under anoxic (no oxygen) conditions. Phosphorus is contributed to a lake by human activity in the watershed, direct discharge of wastes, runoff from agriculture, or poorly maintained septic systems.

Phosphorus is often the limiting nutrient in freshwater systems because it is unavailable from the atmosphere and rapidly recycled and converted to forms unavailable to algae. As the limiting nutrient, any addition of phosphorus can stimulate more algae growth.

To sample for total phosphorus, a water sample is collected every month throughout the growing season in a specially cleaned bottle and then analyzed in the laboratory.

### 1.5.6 Effects of nutrient in the river ecosystem

Aquatic environment account for more than 80% ofthe total-land based nitrogen load and 50% of the phosphorus load (Kronvang et al., 1996). In many other developed countries, diffuse loss of nitrogen and phosphorus from the rural landscape also comprises the major cause of surface water and groundwater pollution (Ansari., el 2010). As a result of the considerable loss of nutrients, eutrophication of the open water bodies (lakes, estuarine areas, rivers and marine waters) is still one of the main global problems affecting the ecological quality and hence biodiversity of aquatic ecosystems (Ansari at el., 2010). The development and introduction of control and management programmes for combating diffuse pollution have, therefore, been given high priority during the last decade (Dodds., 2016). In Denmark and other countries, restoration of ‘naturally’ functioning river and floodplain systems is one of the means introduced to increase their ‘self purification’ potential by increasing water transit time and thereby increase the potential for sediment storage and denitrification. Nutrient criteria consist of several narrative criteria for controlling biostimulatory substances, nitrate and phosphate levels. (Lyimo et al. 2016, Kitalika et al. 2017). Although phosphorus (P) is an essential nutrient for biological productivity, it can cause Fresh water degradation when present at fairly low concentrations. Monitoring studies using Continuous sampling is crucial for documenting P dynamics in freshwater ecosystems and to reduce the risk of eutrophication. However, the presence of high TP can be of geological reason due to the nature of surrounding rocks. Also, dead animals buried in soil such as birds may contribute to elevated levels of phosphates. Additionally Water quality impacts associated with high chlorophyll in the rivers include extreme diurnal in DO and pH, Low DO conditions due to the decay of organic matter resulting from algal blooms and aesthetic impacts, by increased likelihood dominance of toxigenic blue-green algal species at higher concentration of chlorophyll a. (Dodds at el., 1998)

### 1.5.7 Chlorophyll-*a*

Chlorophyll-*a* is the photosynthetic pigment that causes the green color in algae and plants. It is a constituent of most algae and a widely used indicator of algal biomass (citation). Most water body authorities has a chlorophyll a standard between 15 μg/l. - 40 μg/l(micrograms per liter) for lakes, reservoirs and slow-moving waters. Light, temperature, substrate, existing water chemistry and biological communities play a role in the nuisance level of algae and macrophytes within a water body. Algal blooms and macrophytes often interfere with aesthetic and recreational uses, cause taste and odor problems in drinking water supplies and can even become toxic depending upon the type of algal growth. (Wurtsbaugh at el., 2019) Chlorophyll a.The concentration of chlorophyll α present in the water is directly related to the amount of algae living in the water. Excessive concentrations of algae give lakes an undesirable “pea soup” appearance. The water quality characteristics of a lake largely determine which types of algae will be present. Lakes with high nutrient enrichment will tend to support larger numbers of algae than lakes with low nutrient enrichment. Other factors such as water temperature, depth, pH, and alkalinity also influence the species and numbers of algae found in aquatic systems.

### 1.5.8 Water quality indicators

To determine the quality of a water body, the chemical, biological and physical conditions of a water body must be measured. Chemical measurements, biological surveys, and visual observations (physical) provide a “big picture” of what’s happening in a water body (citation). The following is a list of indicators (physical, chemical and biological) that are often measured to assess the quality of water (Ruth at el,. 2021). These parameters are the one which is applied in the calculation of Water quality index (WQI)

1. Physical indicators; Some physical indicators of the quality of a water sample from any source include, Temperature - Electrical Conductivity - Taste - Total Suspended Solids (TSS), Turbidity - Odor - Color - Total Dissolved Solids (TDS)
2. Chemical indicators; Some chemical indicators of the quality of a water sample from any source include, pH – Biochemical Oxygen Demand (BOD) – Chemical Oxygen Demand (COD), Dissolved Oxygen (DO), Total Hardness, Phosphates, Pesticides, Nitrates, Surfactants and heavy metals.
3. Biological indicators; Some biological indicators of the quality of a water sample includes, Bacteria- (fecal coliform, Escherichia coli, Cryptosporidium, Giardia lamblia). Viruses - Fungi protozoa - Parasitic worms - Pimephales promelas (fathead minnow) -Americamysis bahia (Mysid shrimp) - [Benthic](mhtml:file://C:\Users\MDLOFFICIAL\AppData\Local\Temp\WPDNSE\%7b87AC0E20-0000-0000-0000-000000000000%7d\Application%20of%20Water%20Quality%20Index%20for%20the%20Assessment%20of%20Water%20from%20Different%20Sources%20in%20Nigeria%20_%20IntechOpen.mhtml!https://www.intechopen.com/chapters/Benthic) macroinvertebrates (Ephemeroptera or mayfly, Plecoptera or stonefly and Trichoptera or caddisfly, Sea Urchin, Mollusca (Bivalve mollusks – *Americamysis bahia* (Mysid shrimp)

Therefore Local water quality can be used to identify the sources and fates of toxic contaminants and pollutants either from ecology, geology, and [anthropogenic activities](mhtml:file://C:\Users\MDLOFFICIAL\AppData\Local\Temp\WPDNSE\%7b87AC0E20-0000-0000-0000-000000000000%7d\Application%20of%20Water%20Quality%20Index%20for%20the%20Assessment%20of%20Water%20from%20Different%20Sources%20in%20Nigeria%20_%20IntechOpen.mhtml!https://www.intechopen.com/chapters/anthropogenic%20activities) (industrial processes, runoff from agricultural farms etc) in the area. Identifying the source (s) of contamination and developing appropriate management strategies are essential to minimizing potential public health risks. Moreover, data obtained via assessment and monitoring water quality provides empirical evidence to assist health and environmental decision making. In water management practices, water quality values serve as useful and sensitive indicators of changes in the physical, chemical or biological composition of the overall water status

### 

General comment on literature review

Try to be as brief as possible. Do not put a lot of unnecessary information on the section. Focus only on the major issues related to your study. Add references or citation as this section need a visit of different literatures

# CHAPTER TWO

# MATERIALS AND METHODS

## 2.1 Study site

Msimbazi River is the second longest river in Dar es Salaam originating in Pugu hills and discharging into the Indian ocean .it has a length of around 32 km and catchment area of about 289m2. ( Kizito Makoye .,2021). The river it located at around latitude -6.8o to ----- and longitude 39.2667o to ----.

The main tributaries of this river are Sinza (Ng’ombe), Luhanga, Ubungo, and Kinyerezi River. Where by Sinza (0km), Msimbazi River (0km), Makulamula (5.9km), Minyonyoni (5.9km) ,Mborohadi (5.9km) Ubungo (9.3km), Luhanga River (9.3km), Kimanga (9.3km), KijitoNyama (12.4km) , Mgigawa (13.1km) and Mulalakuwa (14.9km). source of information obtained from

There will be three study sites at the upper zone of the river ( upstream) at around Kisarawe, the middle zone at Ubungo, and the lower zone at the river mouth around Salender bridge.

Add the paragraphs from introduction section which I pointed out that fit here



Figure 3 A map showing the catchment area and tributaries of Msimbazi River.

**2.2 Sampling design and analytical methods**

All parameters that will be covered in this study are includes: quantitative water quality parameter-physical (temperature, conductivity/salinity, turbidity, Suspended solids (TSS), and TDS) will be measured directly using multiparameter and chemical (pH, total phosphate, chlorophyll a, electric conductivity and nitrogen as well dissolved oxygen) will be done following standard methods (APHA 2012).

At each study site water sample for nutrients and chl-*a* will be collected ….. for a period of three months.

Comments

In this section explain the design of your study especially during data collection. When will you satart collecting data, how often you will be collecting the data—is it daily, weekly, monthly, twice a week or a month, in the morning, evening or night all of those information should be present. Lastly explain for how long the data will be collected.

These are the only information needed in this section

## 

## 2.5 Data collection

The sampling will be conducted within three months. Sampling methodology, preservation and analytical methods Samples will be taken in the lower, middle and upper part of the river of the river to represent the distribution of nutrients along the whole river. Techniques for sample collection and preservation of water will be adapted from the APHA 2012

## 2.6 Laboratory analytical methods

Persulphate method/digestion methods will be used, with the following procedures

1. 10mls of water sample will be added into the digestion bottle
2. 10mls of oxidation reagent followed by putting stoppers into the digestion bottle
3. Then autoclaving for 30minutes then loose the bottle to allow cooling

**For TP**

About 5mls of upper clear sample will be placed into the cuvette then put it in the spectrophotometer for measurement with the wavelength set at 220nm.

**For TN**

About 5mls of upper clear sample placed into the test tube, then add 0.5mls of color reagent and wait for 20minutes followed by putting the sample into the cuvette ,place it into the spectrophotometer ad adjust the wavelength at 700nm.

**chlorophyll*a***

1. About 150mls of water samples will be filtered in a filter unit using GF/filter membrane then the membrane is taken into a test tube containing 99% of keton with distilled water .the mixture will be left in refrigerator overnight for spectrophotometer measurement at wave ) in order to extract chlorophyll a from the membrane
2. The mixture in its test tube was removed from refrigerator and transferred to water bath for five minutes and then was removed followed by removing the filter membrane in the test tube
3. Then absorbance will be read at wavelength 665nm and 750nm without acid followed by addition of 0.1 ml of dilute hydrochloric acid solution (HCL) in each sample and reread the absorbance in the respective wavelength.

**For TSS**

Procedures; drying and labeling of each station on the filter membrane then measuring and record the weight of the membrane using a digital beam balance, a volume of 150mls of water sample will be filtered followed by removing the f. membrane using forceps and put it in the oven for 1hour then the sample will be taken to the desiccators for 10minutes. After a while remove the membrane and re weight. Therefore TSS will be obtained through calculating the difference between wet and dry membrane.

Table 1 below showing sampling methodology and preservation

|  |  |  |  |
| --- | --- | --- | --- |
| Parameters | Container | Volume (ml) | Max.preservation duration |
| pH | Plastic or grass | - | Analyze immediately |
| Temperature | Plastic or glass | 1000 | Analyze immediately |
| Do | Plastic or glass | - | Analyze immediately |
| TP | Plastic or glass | 1000 | After 2 days |
| TN | Plastic or glass | 1000 | After 2 days |
| Chl. A | Plastic or glass | 1000 | After 2 days |
| salinity(mg/l) | - | - | Analyze immediately |
| Turbidity | - | - | Analyze immediately |
| TDS | - | - | after 2 days |

## 2.4 Data analysis

Statistical software and Microsoft Excel 2007 will be used for data analysis.

For interpretation of differences in chemical and physical water quality data set, among and within the sampling stations the following statistical analysis will be applied, descriptive statistics (range, mean and standard deviation) correlation analysis will be used to evaluate the relationship between individual nutrients concentration and chlorophyll a. a non-parametric test for two independent variables (Man Whitney test) at 95% confidence level will be employed.

# OTHER RELEVANT INFORMATION

## 3.1 Work plan or Timeframe

The time period for accomplishing the research requirements

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Activity | sept  2022 | Nov  - | Dec  - | Jan  2023 | Feb  - | Mar  - | Apr  - | May  - | June  - | July  2023 |
| |  | | --- | | Submission of title | |  |  |  |  |  |  |  |  |  |  |
| |  | | --- | | Proposal preparation | |  |  |  |  |  |  |  |  |  |  |
| |  | | --- | | Proposal presentation and defence | |  |  |  |  |  |  |  |  |  |  |
| |  | | --- | | Proposal submission | |  |  |  |  |  |  |  |  |  |  |
| |  | | --- | | Experiment al set up | |  |  |  |  |  |  |  |  |  |  |
| |  | | --- | | Sample and data collection | |  |  |  |  |  |  |  |  |  |  |
| |  | | --- | | Laboratory analysis | |  |  |  |  |  |  |  |  |  |  |
| |  | | --- | | Data analysis | |  |  |  |  |  |  |  |  |  |  |
| |  | | --- | | Presentation of-data | |  | |  |  |  |  |  |  |  |  |  |  |
| |  | | --- | | Report writing | |  |  |  |  |  |  |  |  |  |  |
| |  | | --- | | Report submission | |  |  |  |  |  |  |  |  |  |  |

Table 2 above shows the schedule of the whole project

## 3.2 Budgeting and Financial arrangements.

|  |  |  |
| --- | --- | --- |
| Item | Description | Cost ( in TSH) |
| preliminary study | Visiting the site and inspection for familiarization | **10,000** |
| Lab materials | Chemicals and reagents | **30,000** |
|  |  | **5,000** |
| Emergence expenses | Any less in the items | **10,000** |
| Total travel expenses |  | **20,000** |
| Stationary | Printing, binding & lamination | **15,000** |
| Total cost |  | 90,000 |

Table 3 above shows an overview of the overall costs and its distribution in the project at glance.

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