

**WATER QUALITY OF HANUMANTE RIVER WITH SPECIAL
REFERENCE TO BENTHIC MACROINVERTEBRATES
(FROM HANUMANGHAT TO NAREPHANT)**

BY

SWORNIMA SHRESTHA

T.U. REGISTRATION NO. : 5-2-37-662-2003

EXAMINATION SYMBOL NO. : 345

BATCH NO. : 2063/64



**A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE
REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE
CENTRAL DEPARTMENT OF ZOOLOGY
INSTITUTE OF SCIENCE AND TECHNOLOGY
TRIBHUVAN UNIVERSITY
KATHMANU, NEPAL
2010**

**WATER QUALITY OF HANUMANTE RIVER WITH SPECIAL
REFERENCE TO BENTHIC MACROINVERTEBRATES
(FROM HANUMANGHAT TO NAREPHANT)**

**BY
SWORNIMA SHRESTHA**



**A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE
REQUIREMENT FOR THE DEGREE OF MASTER OF SCIENCE
CENTRAL DEPARTMENT OF ZOOLOGY
INSTITUTE OF SCIENCE AND TECHNOLOGY
TRIBHUVAN UNIVERSITY
KATHMANU, NEPAL
2010**

DECLARATION

I, hereby, declare that the work presented in this thesis entitled “**WATER QUALITY OF HANUMANTE RIVER WITH SPECIAL REFERENCE TO BENTHIC MACROINVERTEBRATES (FROM HANUMANGHAT TO NAREPHANT)**” was done by myself and has not been submitted anywhere for the award of any other degree. All sources of information have been acknowledged in the reference to the authors or institutions to whom they belong.

.....
Swornima Shrestha

Date:

RECOMMENDATION

Miss Swornima Shrestha has completed the thesis entitled, “**WATER QUALITY OF HANUMANTE RIVER WITH SPECIAL REFERENCE TO BENTHIC MACROINVERTEBRATES (FROM HANUMANGHAT TO NAREPHANT)**”, under my supervision and guidance. It is the candidate’s original work which brings out important findings on water quality and benthic macro invertebrates. To the best of my knowledge, this thesis has not been submitted for any other degree.

I recommend that the thesis be accepted for the partial fulfilment of the requirements for the degree of Master of Science in Zoology specializing in Ecology.

.....

Prof. Khadga Basnet, Ph.D.

Supervisor

Central Department of Zoology

Tribhuvan University

Kirtipur, Kathmandu

Date:

APPROVAL

On recommendation of supervisor Prof. Dr. Khadga Basnet, this thesis submitted by Swornima Shrestha entitled **“WATER QUALITY OF HANUMANTE RIVER WITH SPECIAL REFERENCE TO BENTHIC MACROINVERTEBRATES (FROM HANUMANGHAT TO NAREPHANT)”**, is approved for examination and submitted to Tribhuvan University for the partial fulfilment of the requirements for the degree of Master of Science in Zoology specializing in Ecology.

.....

Prof. Ranjana Gupta, Ph.D.

Head

Central Department of Zoology

Tribhuvan University

Kirtipur, Kathmandu

Date:

ACCEPTANCE

This thesis submitted by Miss Swornima Shrestha entitled “**WATER QUALITY OF HANUMANTE RIVER WITH SPECIAL REFERENCE TO BENTHIC MACROINVERTEBRATES (FROM HANUMANGHAT TO NAREPHANT)**”, has been accepted for the partial fulfilment of the requirements for the degree of Master of Science in Zoology specializing in Ecology.

EXPERT COMMITTEE

.....

Prof. Khadga Basnet, Ph.D.

Supervisor

Central Department of Zoology

Tribhuvan University

Kirtipur, Kathmandu

.....

Prof. Ranjana Gupta, Ph.D.

Head

Central Department of Zoology

Tribhuvan University

Kirtipur, Kathmandu

.....

External Examiner

.....

Internal Examiner

Date:

Acknowledgements

I acknowledge heartfelt gratitude to my honorable supervisor Prof. Dr. Khadga Basnet, for this noble guidance and regular supervision throughout my study. He optimistically accepted the tedious job of reading my entire manuscript without which this thesis could not be accomplished.

I am also grateful to Dr. Ranjana Gupta, Head of Central Department of Zoology and other teachers and staff of the department for providing valuable suggestions and academic support.

I am indebted to Mr. Narayan Prasad Ghimire of Central Department of Botany for providing me laboratory for analysis. My sincere thanks go to Central Bureau of Statistics, Thapathali and Central Department of Meteorology, Babarmahal for providing me necessary data.

I am grateful to municipality of Bhaktapur and Madhyapur for providing necessary information necessary for my thesis. I wish to extend my thanks to my friends who really helped me a lot during sample collection, laboratory works and my write up. I would like to express my huge gratitude to Mr. Bhim Raj Dhakal of Department of English of Tribhuvan University for editing my thesis within short period of time.

Finally, I am really thankful to my family members for their continuous support and encouragement to complete my thesis.

Swornima Shrestha

Roll Number:13

Batch:63/64

TU Reg No.:5-2-37-662-2003

Symbol Number:345

ABSTRACT

For the last few decades, the water quality of the most religious and sacred Hanumante river of Bhaktapur has been degraded due to the discharge of untreated sewage and industrial effluents. I investigated the water quality of the Hanumante river by assessing benthic macrofauna and physico-chemical conditions. Physico-chemical parameters, such as temperature, pH, total dissolved solids, conductivity, free carbon dioxide, dissolved oxygen, Biological oxygen demand, nitrate, phosphate and abundance of benthic macro invertebrates were studied by taking water samples from seven upstream to downstream sampling sites during the pre-monsoon and post-monsoon periods of the year.

The geographical and physical conditions of each site were recorded in the preliminary survey. Benthic invertebrates were collected from each sample site qualitatively. Benthic invertebrates were identified into order in the laboratory with the help of existing keys. Laboratory analysis of the collected water samples was done whereas some parameters were measured in field.

Water quality status was better in upstream than in downstream. As the river proceeded downwards the sewage, industrial effluents, solid waste dumping, agricultural effluents were found to be directly mixed into the river. Dissolved oxygen (DO) decreased, and BOD gradually increased in the downstream indicating organic pollution and a good relationship between DO and BOD, ($r=-53112$). Remarkable changes was seen in the parameters along all sites indicating the degree of pollution at each site. Diversity of benthic macro invertebrates was high in headwater than in downstream. Plecoptera, Ephemeroptera and Trichoptera were abundant in head water zone while Diptera and Oligochaeta were more abundant in downstream indicating a high pollution level. Extended Biotic Index (EBI) showed the abundance and diversity of benthic macro invertebrates comparatively better in upstream (EBI=8) than in downstream (EBI=2).

Fluctuation in water quality during the pre-monsoon and post-monsoon period indicated the degree of pollution varied with seasons. Pollution level was high during the pre-monsoon period than in the post-monsoon.

TABLE OF CONTENTS

RECOMMENDATION

I

APPROVAL

II

ABSTRACT

III

ACKNOWLEDGEMENTS

IV

TABLE OF CONTENTS

V

LIST OF TABLES

VII

LIST OF FIGURES

VIII

1. INTRODUCTION

1-3

1.1 Background

1

1.2 Objectives

3

1.3 Research Hypothesis

3

1.4 Rationale

2. LITERATURE REVIEW

4-7

2.1 Biological Indicator of Pollution of Bagmati River

4

2.2 Biological Water Quality of Bagmati River

5

2.3 Benthic Invertebrates

6

2.4 Relation Between Macro Invertebrates with Nitrogen	6
2.5 Relation Between Physical and Biological Parameters	6

3. RESEARCH METHODS

8-18

3.1 Study Site	8
3.2 Research Design and Instrumentation	9
3.3 Methods and Materials	11
3.4 Data Collection	14
3.5 Data Analysis	16

4. RESULTS

19-29

4.1 Physical Factors	19
4.2 Physico-Chemical Factors	19
4.3 Biological Factors	20
4.4 Correlation Between Physico-chemical and Biological Parameters	25
4.5 Relationship between Occurrence and Physico-Chemical Parameters	25

5. DISCUSSION

29-33

5.1 Water Quality Status	24
5.2 Physico-Chemical Quality	24
5.3 Biological Water Quality	27

5.4 Correlation Between Biological and Physico-Chemical Quality

27

6. CONCLUSIONS AND RECOMMENDATIONS

33-34

REFERENCES

ANNEXES

PHOTO PLATES

LIST OF TABLES

Table 3.1	Description of Sites with brief physical features
Table 3.2	3.3.1 Physico- Chemical Parameters of Water
Table 3.3	Lists of Benthic macro invertebrates
Table 3.4	Water quality criteria and standards proposed for Bagmati river and its tributaries
Table 4.1	Physico-Chemical Parameters of Hanumante river during Pre-monsoon
Table 4.2	Physico-Chemical Parameters of Hanumante river during Post-monsoon
Table 4.3	Comparison between parameters in different sites during Pre-monsoon
Table 4.4	Comparison between parameters in different sites during Post-monsoon
Table 4.5	Correlation between Physico-chemical parameters and Occurrence of Benthos

LIST OF FIGURES

Lists		Pages
Figure 3.1	Annual temperature of Bhaktapur	8
Figure 3.2	Annual precipitation of Bhaktapur	8
Figure 3.3	Sampling Sites along the Hanumante river	11
Figure 4.1	Seasonal Variations of pH	22
Figure 4.2	Seasonal Variations of Temperature	22
Figure 4.3	Seasonal Variations of TDS	22
Figure 4.4	Seasonal Variations of BOD	22
Figure 4.5	Seasonal Variations of Free Carbondioxide	22
Figure 4.6	Seasonal Variations of Conductivity	22
Figure 4.7	Seasonal Variations of DO	23
Figure 4.8	Seasonal Variations of Nitrate	23
Figure 4.9	Seasonal Variations of Phosphate	23
Figure 4.10	Seasonal Variations of Abundance	24
Figure 4.11	Seasonal Variations of EBI Value	24
Figure 4.12	Figure 4.12 Diversity of macro invertebrates in post monsoon	25
Figure 4.13	Figure 4.12 Diversity of macro invertebrates in pre monsoon	25