

**THE SPREADING PATTERNS AND ENVIRONMENTAL IMPLICATIONS OF  
WATER HYACINTH (*EICHHORNIA CRASSIPES*) INFESTATION IN LAKE  
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## ABSTRACT

Water hyacinth (*Eichhornia crassipes*) is an invasive aquatic macrophyte associated with major negative economic and ecological impacts in the Lake Naivasha region since the plant's introduction into the lake in 1986. This study sought to examine the extent and status of water hyacinth infestations in Lake Naivasha and its environmental implications. The study hypothesized that water hyacinth had significantly affected water quality, benthic biodiversity and the general utility of Lake Naivasha. Landsat satellite images, processed and analyzed using a hybrid unsupervised image classification approach, were used to assess water hyacinth extent and distribution in Lake Naivasha for the years 1995, 2000 and 2003. The inferred extent of water hyacinth coverage for the years considered were 74, 86 and 102 ha respectively. This indicated that water hyacinth has continued to spread in the lake despite the presence of some control measures. A sample of 60 riparian community members consisting of 45 fishermen and 15 farmers was interviewed to assess the challenges they are facing as a result of the continued presence of water hyacinth. A structured interview of 31 key informants and discussions with groups of people involved in the management of Lake Naivasha was also conducted. Data was analyzed using both descriptive and inferential statistics. The result showed that water hyacinth infestation in Lake Naivasha has affected the socioeconomic status of the communities depending on it. There was for example a decrease of total fish production from 513 to 110 tons per year (a 22% decrease). In addition there was a 30% decline in water supply to Naivasha Municipality (from 10,000 m<sup>3</sup> to 7,000 m<sup>3</sup>) in the year 2000. Field observations of the locations of water hyacinth, the control measures in place and visual estimation of water hyacinth were done. Field measurements were done to determine the impact of water hyacinth on water quality and the diversity of aquatic macroinvertebrates and zooplanktons. Two sampling sites were selected (one under water hyacinth and another at shore line without water hyacinth) to compare the results of the measurements. At each of these habitats 10 sampling areas were randomly selected. Water quality variables from the two habitats were compared by means of one-way analysis of variance (ANOVA). For species diversity, Shannon-Weiner Diversity Index (H') and Simpson Diversity Index (D) were applied to both habitats of the 10 sampling sites for the sampling dates (between October 2003 and November 2004). The sample analysis showed that free carbon dioxide was significantly higher ( $P < 0.05$ ) in water hyacinth infested areas ( $26.45 \pm 1.02 \text{ mgL}^{-1}$ ) than in open water ( $12.86 \pm 1.92 \text{ mgL}^{-1}$ ). Dissolved oxygen was significantly lower ( $P < 0.05$ ) in the infested areas ( $1.96 \pm 0.71 \text{ mgL}^{-1}$ ) when compared with open water ( $5.98 \pm 0.85 \text{ mgL}^{-1}$ ). Similarly pH was significantly lower ( $P < 0.05$ ) in water hyacinth infested area ( $6.92 \pm 0.04$ ) than in open water ( $7.71 \pm 0.05$ ). Although the temperature was higher in the infested areas ( $27.5 \pm 0.60^{\circ}\text{C}$ ) than open water ( $26.7 \pm 0.52^{\circ}\text{C}$ ) the difference was not significant ( $P > 0.05$ ). The Shannon-Weiner Diversity Index (H') of macroinvertebrates was significantly lower ( $P < 0.005$ ) under water hyacinth mats ( $H' = 0.56$ ) than in water hyacinth-free zones ( $H' = 0.34$ ). Similarly, the Simpson Diversity Index (D) of zooplankton was found to be significantly lower ( $P < 0.005$ ) under water hyacinth mats ( $D = 0.50$ ) than in water hyacinth-free zones ( $D = 0.79$ ). Fish species diversity was found to be higher at the areas with water hyacinth ( $H' = 0.94$ ) than in the open water ( $H' = 0.69$ ) at 5% level. Water hyacinth appeared to have reduced the abundance and diversity of the macroinvertebrates and zooplankton in the lake. It can therefore be concluded that the presence of water hyacinth was found to have affected the ecology of Lake Naivasha and therefore its utility. Effective control of water hyacinth in Lake Naivasha is important, in order to prevent both ecological and economic loss due to loss of biodiversity.



## TABLE OF CONTENTS

<b>DECLARATION</b> .....	i
<b>COPY RIGHT</b> .....	ii
<b>DEDICATION</b> .....	iii
<b>ACKNOWLEDGEMENT</b> .....	iv
<b>ABSTRACT</b> .....	v
<b>TABLE OF CONTENTS</b> .....	vi
<b>LIST OF TABLES</b> .....	xi
<b>LIST OF FIGURES</b> .....	xiii
<b>LIST OF PLATES</b> .....	xv
<b>APPENDICES</b> .....	xvi
<b>LIST OF ABBREVIATIONS</b> .....	xvii
<b>CHAPTER ONE: INTRODUCTION</b> .....	1
1.1 Introduction.....	1
1.2 Statement of the research problem.....	7
1.3 Significance of the study.....	8
1.4 Objectives of the study.....	9
1.5 Research questions.....	9
1.6 Justification for the study.....	10
1.7 Definition of terms.....	11
<b>CHAPTER TWO: LITERATURE REVIEW</b> .....	14
2.1 Background information.....	13
2.2 Taxonomy and biological characteristics of water hyacinth.....	15
2.3 Control of water hyacinth.....	15
2.3.1 Biological control of water hyacinth.....	16
2.3.2 Mechanical control of water hyacinth.....	20
2.4 Utilizing water hyacinth.....	20
2.4.1 Loss of water.....	22
2.4.2 Disruption of fishing activities.....	22

water transport and water uptake.....	24
2.5.4 Incidence of disease.....	25
2.5.5 Economic impacts.....	25
2.5 The impacts of water hyacinth infestations.....	22
2.6 Remote sensing and GIS applications for mapping and spatial modeling of invasive species.....	28
2.6.1 Spatial and temporal scale and accuracy.....	30
2.6.2 Geographic Information System (GIS) and the study of hydrophytes.....	30
2.7 Review of related research works on Lake Naivasha.....	32
2.7.1 Water abstraction from the lake.....	32
2.7.2 Lake pollution from industry and agriculture.....	33
2.7.3 Impact of alien invasive species on Lake Naivasha.....	34
2.7.4 Impact of human population increase.....	36
2.8 Conceptual framework.....	38
<b>CHAPTER THREE: THE STUDY AREA.....</b>	<b>41</b>
3.1 Lake Naivasha and its basin.....	41
3.2 Geology, geomorphology and soils of Lake Naivasha .....	44
3.3 Climate .....	45
3.4 Hydrology and water balance .....	46
3.5 Ecology .....	50
3.6 Socio-economic features of the conservation and development process .....	56
3.7 Population .....	57
3.8 Research and data for the Lake Basin .....	58
<b>CHAPTER FOUR: METHODOLOGY.....</b>	<b>59</b>
4.0 Introduction.....	59
4.1 Data requirements, sources and types.....	59
4.2 Data collection procedures.....	60
4.3 Collection of data on introduction of water hyacinth and its spread.....	60
4.4 Sampling frame, design and sample sizes.....	61
4.4.1 Non-probability sampling.....	61



4.4.2 Probability sampling.....	62
4.5 Questionnaire administration .....	64
4.5.1 Structured questionnaires.....	65
4.6 Group discussions.....	65
4.7 Observations.....	65
4.8 Mapping of the distribution of water hyacinth using remotely sensed data.....	66
4.8.1 Satellite image processing.....	67
4.8.2 Extraction of potential water hyacinth from water-masked imagery.....	68
4.9 Field measurements of the biological conditions of water hyacinth.....	70
4.10 Determination of the impact of water hyacinth on water quality.....	71
4.10.1 Collection of water samples.....	71
4.10.2 Determination of physicochemical parameters.....	72
4.10.3 Statistical analysis.....	73
4.11 Determination of the impact of water hyacinth on macroinvertebrates of Lake Naivasha...74	
4.11.1 Sampling and macroinvertebrates sampling processing.....	74
4.11.2 Statistical analysis.....	75
4.12 Determination of the impact of water hyacinth on the abundance and diversity of zooplanktons of Lake Naivasha.....	75
<b>CHAPTER FIVE: RESULTS .....</b>	<b>76</b>
5.1 History and spread of water hyacinth on Lake Naivasha.....	76
5.2 Water hyacinth cover, density and frequency.....	79
5.3 Relative growth rate.....	81
5.4 Water hyacinth spread in Lake Naivasha.....	82
5.5 Present status and distribution of water hyacinth in Lake Naivasha.....	90
5.6 Impact of water hyacinth in the Lake Naivasha basin and status of its control.....	92
5.6.1 Effect of water hyacinth on the physicochemical characteristics of Lake Naivasha.....	93
5.6.2 Effect of water hyacinth infestations on zooplankton populations of Lake Naivasha.....	100
5.6.3 Macrophyte diversity.....	103
5.6.4 Macro-invertebrate diversity.....	105

5.6.5 Fish diversity and habitat preferences.....	110
<b>5.7 Socio-economic impacts of water hyacinth</b>	
5.7.1 Fishing industry.....	114
5.7.2 Transport.....	118
5.7.3 Water supply.....	119
5.7.4 Health.....	119
5.7.5 Agriculture.....	120
<b>5.8 Water hyacinth control strategies in Lake Naivasha.....</b>	<b>124</b>
5.8.1 Evaluation of the impact of Neochetina weevils on water hyacinth.....	124
5.8.2 Manual removal of water hyacinth.....	127
<b>CHAPTER SIX: DISCUSSION.....</b>	<b>129</b>
6.1 Water hyacinth mapping in lake Naivasha.....	129
6.2 The spread of water hyacinth in Lake Naivasha.....	129
6.3 Proliferation of water hyacinth in Lake Naivasha.....	129
6.4 Environmental implications of water hyacinth in lake Naivasha.....	133
6.4.1 Physical impact of water hyacinth on water quality.....	135
6.4.2 The impact of water hyacinth on species diversity.....	137
6.4.3 Impact of water hyacinth on human activities in Lake Naivasha.....	140
6.5 The control of water hyacinth.....	143
<b>CHAPTER SEVEN: CONCLUSIONS AND RECOMMENDATIONS .....</b>	<b>153</b>
7.1 Introduction.....	153
7.2 Conclusions.....	153
7.3 Recommendations for the management of Lake Naivasha.....	156
7.4 Areas for further research.....	147
<b>REFERENCES.....</b>	<b>163</b>
<b>APPENDIX 1: Characterization of major arthropods for control of water hyacinth.....</b>	<b>178</b>
<b>APPENDIX 2: Field planning schedule.....</b>	<b>179</b>
<b>APPENDIX 3: Research questionnaire.....</b>	<b>180</b>
<b>APPENDIX 4: Interview schedule guide for Fisheries Department personnel.....</b>	<b>185</b>



<b>APPENDIX 5:</b> Interview guide for Kenya Agricultural Research Institute officials.....	187
<b>APPENDIX 6:</b> Interview guide for people living around the lake .....	188
<b>APPENDIX 7:</b> Interview guide for Ministry of Tourism officials .....	189
<b>APPENDIX 8:</b> Interview guide for the fishermen.....	190
<b>APPENDIX 9:</b> List of stakeholders who participated in focus group discussion.....	191
<b>APPENDIX 10:</b> Sampling point map for Lake Naivasha.....	192
<b>APPENDIX 11:</b> Lake Naivasha water quality parameters (Shoreline areas without and with water hyacinth).....	193