COMPARATIVE ANALYSIS OF ZOOPLANKTON SPECIES DIVERSITY AND VERTICAL DISTRIBUTION AT GOREANGAB AND AVIS DAM, WINDHOEK, NAMIBIA

BY:

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Declaration

I hereby declare that this work is the product of my own research efforts, undertaken under the supervision of Mr. F.P. Nashima and has not presented elsewhere for the award of the degree. All the sources have been duly and appropriately acknowledged.

Candidate Signature: ……………………………………………… Date: ………………………..

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Certification

This is to certify that this report has been examined and approved for the award of the degree of Bachelor of Science in Fisheries and Aquatic Science of the University of Namibia.

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Dedication

I dedicate this work to my mum Mrs. C. Mapwesera, my wife Grace Mapwesera, Tamandani Mapwesera, Christabel Mapwesera, all relatives and friends in Malawi for missing me during the course of my study.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Abstract

A study to compare the zooplankton species diversity and vertical distribution at Goreangab and Avis dam was conducted. Systematic sampling was used to collect samples whereby a total of three stations per site were sampled at different depths. A cruising boat and the Niskin sampler were used to collect the samples. Zooplankton species were identified and counted in the Laboratory using a Zooplankton Identification Guide, Light microscope and Haematocytometer. Shannon – Weiner Index *of diversity was used to calculate species diversity of zooplankton at each station following a vertical profile for the two dams. To determine the significance in species diversity of zooplankton between Goreangab and Avis dam, F – test from the Two- way Analysis of Variance (ANOVA) with no blocking was used using GENSTAT programme. Furthermore, the multiple linear regression was used to determine the relationship between the environmental conditions and the species diversity. The results showed no significant interaction between site and depth ($p>0.05$). No significant differences in zooplankton species diversity ($p>0.05$) between Goreangab and Avis dam, and also no significant difference ($p>0.05$) existed in the vertical distribution of the zooplanktons between the two sites. No significant relationship ($p>0.05$) was observed between environmental parameters (pH, temperature, dissolved oxygen) and zooplankton species diversity. This implies that the two sites had similar zooplankton species and that the combination of site and depth has no effect on the diversity and distribution of zooplanktons.*

Key words: Haematocytometer, hypolimnion, oxycline, Species diversity, thermocline, Zooplankton

CHAPTER ONE

INTRODUCTION AND LITERATURE REVIEW

1.1.General Introduction

Zooplanktons are myriads of diverse floating and drifting animals with limited power of locomotion. The majority of them are microscopic, unicellular or multicellular forms with size ranging from a few microns to a millimeter or more and in addition to size variations; they have morphological differences (Goswami *et al*., 2004).

Zooplankton plays an important role in understanding the faunal biodiversity of aquatic ecosystems. They include representatives of almost every taxon of the animal kingdom and occur in the pelagic environment either as adults (holoplankton) or eggs and larvae (meroplankton). By absolute abundance of both types and their presence at varying depths, the zooplanktons are utilized to assess energy transfer at secondary trophic level. They feed on phytoplankton and facilitate the conversion of plant material into animal tissue and in turn constitute the basic food for higher animals including fishes, particularly their larvae. Furthermore, zooplankton support many major fisheries and mediate fluxes of nutrients and chemical elements essential to life on earth (Machida *et al*., 2009). The fishes mostly breed in areas where the planktonic organisms are plenty so that their young ones could get sufficient food for survival and growth. Certain planktonic organisms are capable of concentrating radioisotopes and can act as indicator of certain pollutants (Goswami*et al*., 2004).

The zooplankton are more varied as compared to phytoplankton, their variability in any aquatic ecosystem is influenced mainly by patchiness, diurnal vertical migration and seasons. In addition zooplankton survival is also indirectly affected by levels of pH, nutrients like nitrogen and phosphorus which affect their prey like algae, protozoa and bacteria (Ciruna and silk, 2005). This study assessed the zooplankton diversity and vertical distribution between the two sites which can in turn be used as an indicator of the productivity or environmental stress of the two water bodies.

1.1.1. Problem Statement

Changes in zooplankton communities can be particularly useful as assessment tool due to their rapid responses to environmental stress. Water quality affects the abundance of organisms, species composition, stability, productivity and physiological conditions of most aquatic communities. Consequently, the nature of aquatic communities is an indication of the quality of water. Studies of zooplankton communities provide a valuable assessment of the overall health of aquatic systems. Zooplankton diversity and distribution as a measure of biological water quality assessment can be used to explain the mechanism of biological waste water treatment methods and to serve as an index for the effectiveness of the treatment.

According to Saksena (2006), rotifers can be used as bio indicators of water quality and he concluded that; *Brachionus angularis, Trichocerca cylindrica, Polyurthra euryptera, Pompholyx sulcata, Rotaria rotatoria, Filinia longiseta* are indicators of heavy pollution (Eutrophy). Whereas species such as; *Ascomorpha ovalis, Asplanchna herricki, Synchaeta grandis, Ploesoma hudsoni, Anuraeopsis fissa, Monostyla bulla* and *M. hamata* are indicators of fresh and clean waters (Oligotrophy) while a variety of rotifers including *Brachionus, Keratella spec*, are inhabitants of moderately clean (mesotrophy) waters. Taking these findings into consideration, this study tried to assess the zooplankton diversity and vertical distribution as an indicator of water quality and also ecological disturbance of the Goreangab and Avis dam.

1.1.2. Research Objectives

(a) Determine and compare species diversity and vertical distribution of zooplanktons in Goreangab and Avis dam

(b) To determine the interactions effects between site and depth in relation to zooplankton species diversity and vertical distribution

(c) To determine the relationship between environmental factors and zooplankton species diversity

1.1.2. The Specific Research Question

(a) Are there significant differences in species diversity and vertical distribution of zooplanktons between Goreangab and Avis dam?

(b) Are there significant interactions effects between site and depth in relation to zooplankton species diversity and vertical distribution?

(c) What relationship exists between environmental factors and zooplanktons species diversity?

1.1.3. Research Hypotheses:

- There are significant differences in species diversity and vertical distribution of zooplanktons between Goreangab and Avis dam.
- There are significant interaction effects between site and depth in relation to zooplankton species diversity and vertical distribution
- There is a significant relationship between environmental factors and zooplankton species diversity.

1.2. Literature Review

1.2.1. General description of zooplankton and the environment

The animals making the zooplankton are taxonomically and structurally diverse. They range in size from microscopic, unicellular organisms (Lalli and Parsons, 1997). Although all zooplankton are capable of movement, by definition none is capable of making their way against the current. Zooplanktons are heterotrophic organisms and they are grazers and feed on plankton, bacteria and protozoa (Sigee, 2005).

Although zooplankton grazers can be separated into three main groups of rotifers, cladocerans, crustaceans and copepod crustaceans, other invertebrates such as insect may also be important in the sense that some are predators which help regulate other zooplankton populations (Irvine, 1997). Zooplankton may be divided into two groups; the holoplanktons and the meroplankton. Holoplankton zooplanktons are those that remain in a planktonic state for their entire life cycle.

The other group is meroplanktons which is the group of zooplankton that is restricted to a limited period of the year because they are at a particular stage of development (i.e. like larvae which turns to insects). Rotifer and crustacean zooplankton are holoplanktonic while insects mainly the chironomid larvae which occur in the water column for a short summer period are meroplanktonic zooplankton. Primary productivity in lakes by aquatic plants and algae requires the light mixture of nutrients, temperature and sunlight (Silk and Ciruna, 2005).

Season, shading from surrounding terrestrial vegetation, landforms and cloudiness in the atmosphere all affect how much light reaches the surface of the water body. Furthermore, Silk and Ciruna (2005) have pointed out that once the sunlight reaches the surface of the water body, the most important variable determining how useful it will be is the clarity of the water. This can also be used to measure the water quality. The more the clarity, the more deeply the light can penetrate supporting photosynthesis to greatest possible depth. If photosynthesis can be evenly distributed in the water column, there can be an even distribution of zooplanktons which are grazers because there will be a lot of phytoplanktons which are primary producers. Converse of water clarity is turbidity, which is simply the ability of water to attenuate or block the passage of light. The more turbid the water body is, the less the light penetration. This in turn can reduce the rate of photosynthesis vertically which can also affect the distribution of grazing zooplankton (Lalli and Parsons, 1997).

The distribution and diversity of zooplankton in a given community is affected by different factors and among others predation is one of the notable factors. Irvine (1997) reported that one of the most important predators of zooplankton is the larva of the dipteran insect *Chaoborus*. This larva is present in many lentic systems, from large lakes to small ponds, and is particularly in tropical waters where it may have a major influence in zooplankton diversity in the water bodies like Lake Malawi. Pagano (2003), concurred with Irvine and observed that *Chaoborus* larvae have a particular role in shallow tropical waters where visual predation by zooplanktivorous fish may be limited by low visibility due to high turbidity in shallow conditions and low fish population. The grazing activity and biological characteristics of rotifers, cladocerans and copepods differ in a number of key respects (Sigee, 2005).

1.2.2. Species Diversity and Distribution of Zooplankton

Species diversity is the number and abundance of different species within a given area (Lawrence, 2005). It is one measure of biological diversity. According to Claridge *et al*. (1997) in recognizing species, we are attempting to provide a framework for describing and understanding the diversity of living organisms and their evolutionary relationships. However, there have been longstanding controversies about the interaction between particular species concepts and theories of speciation. Morin (1999, reported that the potentially confusing complexity of communities encourages ecologists to use various descriptors to condense and summarize information about number, identity and relative abundance of species. No single number, index, or graph can provide a complete description of a community, but some of these measures provide a useful way of comparing different communities.

May (1975), observed that one single number that goes a long way towards characterizing a biological community is simply the total number of species present. This number often called species richness is synonymous with the most basic notions of biodiversity. It is in practice a difficult number to obtain, partly because we simply do not have complete taxonomic information about many of the groups of organisms found in even the most studied communities. Although species richness provides an important basis for comparisons among communities, Maguran (1988), pointed out that it says nothing about the relative commonness and rarity of species. In view of this, various diversity indices have been proposed which account for variation in both the number of species in the community, and the way that individuals within the community are distributed. Measures of biodiversity are commonly used as a basis for making decisions about conservation action or planning more generally (Gaston and Spicer, 2004).

According to Rao *et al.*, (2006), the diversity index for zooplankton was found to be influenced by the evenness and richness of the species. On the other hand, they observed a strong correlation between individual species density and community diversity in the cladocera to be influenced by food availability. In unpolluted or transparent water bodies, active diurnal vertical migration was found to be characterized by large zooplanktons (Dobryinin, 2009). To the contrary, in polluted waters, small zooplanktons dominate because they can easily float. Easton and Gophen (2003), reported that zooplankton distribution is also influenced by several other factors; for example, food levels, temperature, oxygen saturation, the presence of fish kairomones (Lampert, 1993), and possibly invertebrate predation, may have an equal or stronger influence on distribution then direct predation by fish. Light intensity appears to be a trigger for directional changes in migration and many zooplankton species are phototaxic (Buchanan & Haney, 1980; Haney, 1993; Ringelberg, 1995).

The general evidence is that changes in light intensity is the primary factor regulating the vertical distribution of zooplankton and that, predation, temperature, food availability, dissolved oxygen and chemical cues modify the photoresponses of several zooplankton species (Biol Rev Zaret & Suffern, 1976; Stich & Lampert, 1981; Bollens & Frost, 1989; Ringelberg, 1999). Many taxa of both marine and freshwater zooplankton perform diel vertical migrations with amplitudes from a few to 100 metres (Hutchinson, 1967). The 'normal' pattern is an evening ascent and a morning descent, though several cases of 'reversed' migrations have been described (Ohman, Frost & Cohen, 1983; Bayly, 1986).

Migrating zooplanktons spend the day in deep waters but stay near the surface at night. Lampert (1989), pointed out that, the amplitude of the movements and the shape of the vertical distribution of the population may be very different between species and between ontogenetic stages of the same species and may be influenced by factors like turbidity and food abundance (Bohrer, 1980; George, 1983). Zooplankton may either migrate up and down together in a narrow band or may be sharply stratified in deep waters during the day but spread throughout the entire water column at night. Lampert (1989), further observed that, the presence of vertical migration in so many taxa suggests that it has some adaptive value. Although there is no reason to believe that the same ultimate factor drives migration in all taxa, it is interesting that all migrating filter-feeding zooplankton experience similar disadvantageous environmental conditions. This effect is principally similar in freshwater and in the sea but may be more pronounced in stratified lakes. Migrating zooplanktons spend the night in warm food-rich surface waters but they leave this advantageous environment during the day to stay in the cold hypolimnion where quantity and quality of food are low.

CHAPTER TWO

MATERIALS AND METHODS

2.1. Study Area

This study was conducted at Goreangab and Avis dam in Windhoek, Namibia. The two water bodies are lentic system, which means their water is stagnant. Goreangab is found in Windhoek, the capital city of Namibia, 9km from the city centre and lies at latitude 22^{o}31'S and 17^{o}01'E (*See figure 1*). The average annual rainfall is 360mm while its annual average evaporation is 3400mm (Petrus, 2004). The Goreangab dam, with the capacity of 3.6Mm^3 was built downstream from Windhoek and a conventional treatment plant which was constructed to treat the surface water from the reservoir to potable standards.

The treatment plant was constructed to deal with the cities and industrial effluents. The whole city including its informal settlements lies upstream from and within the catchment of Goreangab dam, and its growth has created pollution that has seriously compromised the water quality in the reservoir. The Goreangab dam catchment is about 150Km^2 and situated mainly to the south of the Auas mountains. Two main rivers, the Aresbusch and the Gammams rivers, contribute the bulk of the catchment water supply to the dam. These rivers, mainly Gammams dump medium of wastes from industries it passes through. On the other hand, Avis dam is located to the east of Windhoek city 22^{o}34'S and 17^{o}08' E (*See figure 2*). It is composed of three main landforms which are; slopes and ridges of the foothills of the Eros and Auas mountains, river beds and floodplain. The floodplains together with the dam, comprises an attractive setting of comparatively un-spoilt nature.

Figure 1: Satellite Image of Goreangab Dam (Source: Google Earth, 2010)

Figure 2: Satellite Image of Avis Dam (Source: Google Earth, 2010)

2.2. Study Design

Water Samples were collected from the two sites (i.e. Goreangab and Avis dam). Sampling followed a systematic design whereby a total of three stations were sampled per site, for a period of one month. The depths sampled were; surface (0m), 2m, 4m, and 6m and so on. A total of 16, 100ml bottles were sampled for all the sites per sampling day. Samples were taken to University of Namibia, Fisheries and Aquatic Sciences laboratory for identification whereby the experiment was laid out as a Two - factor experiment in a Completely Randomized Design (CRD) replicated five times. Each sampling day were representing a replicate.

2.3. Data collection

Data collection was conducted using the Department of Fisheries and Aquatic Sciences cruising boat. Sampling was done during the period between 31 July, 2010 and 28 August, 2010.

2.3.1. In situ Sampling Procedure:

Samples were collected as follows:

The surface samples were collected using the sampling bottles directly from the surface. Fixation: The samples were fixed immediately with 10ml 4% formalin solution to preserve the zooplanktons. Samples from the other depths (2m, 4m and 6m) were collected using a Niskin sampler. All the sampling bottles were marked with site name and depth for identification. Environmental factors (temperature, pH, and dissolved oxygen) were collected and recorded on a sheet (*See Appendix 4).*

2.3.2. Laboratory Analysis

Samples were kept in the laboratory (*See Appendix 3; plate 1*).

The samples were analyzed within a period of not more than 10 days as keeping the samples longer in the laboratory makes identification difficult. Samples from the three different stations per site were sieved using a 106µm sieve and the contents were diluted into 100ml. A drop of the sample was taken from the bottle and put on a Haematocytometer with a volume of 0.00025mm^3 where it was observed using the light microscope at different magnifications.

The numbers of individuals identified in the Haematocytometer were multiplied by 400 to account for the 100ml where the sample was taken. Guide to Identification of Freshwater Microorganisms (Maths/Science Nucleus, 2004), Field Guide to Zambian Fishes, Planktons and Aquaculture (Utsugi and Mazingaliwa, 2002) were used to identify the zooplankton up to species level. The number of species was recorded on a sheet (*See Appendix 5).* Microphotography of the species identified was taken for reference (*See Appendix 3*, *plates 2*, *3*, *4*).

2.4. Data Manipulation and Analysis

The species diversity of zooplankton at each site and depth was calculated using Shannon – Weiner Index at diversity on *Primer 5.0* for windows. To determine the significant difference in species diversity and vertical distribution of zooplankton between Goreangab and Avis dam, F – test from the Two - way Analysis of Variance (ANOVA) with no blocking was used using *GENSTAT* statistical program and were tested at $\alpha = 0.05$. Furthermore, the Multiple Linear Regression (MLR) was used to determine the relationship between the environmental factors and species diversity.

CHAPTER THREE

RESULTS

3.1. Species diversity and vertical distribution

The results showed no significant interaction (F = 0.648, d.f=3, 32; p>0.05) between site (Goreangab, Avis dam) and Depth (0m, 2m, 4m, 6m). No significant difference (F= 0.575, d.f=1, 32; p>0.05) in the mean species diversity between Goreangab and Avis dam. No significant difference (F = 0.510, d.f=3, 32; p>0.05) in the vertical distribution was observed (Table 1, 2). At both sites, cladocerans, rotifers and copepods were identified. Different species of rotifers; (*Brachionus calyciforus* and *keratella valga*) were identified at Goreangab dam, whereas, *Brachionus budapestinensis* was the only rotifer identified at Avis dam. *Cyclop species* was the only species of copepods identified at both sites. *Moina micrura* was identified in the cladocerans in both sites. Nauplius larvae were also identified at both Goreangab and Avis dam (*See Appendix 4*).

Table 1: Analysis of Variance (ANOVA)

Source of Variation	D.F	SS	MS	F-Value
Site	1	0.0527	0.0527	0.575
Depth	3	0.3886	0.1295	0.510
Interaction	3	0.2744	0.0915	0.648
Residual	32	5.2649	0.1645	
Total	39	5.9806		

3.2. The Relationship between Environmental Factors and Species Diversity

The results showed no significant relationship (F= 0.344, d.f=3, 36; p>0.05) between environmental factors (Temperature, pH and dissolved oxygen) and the species diversity in both sites (Table 2). The observed relationship yielded a model; $y = 0.842- 0.0148x_1 – 0.0257x_2+ 0.0512x_3$ which showed a negative non linear correlation of temperature (x_1) and pH(x_2) at both sites with dissolved oxygen (x_3) showing a positive correlation at both Goreangab and Avis dam (Figures: 1, 4, 5, 6, 7, 8, 9, 10). No significant linear pattern was observed for all environmental factors in relation to the diversity and distribution of zooplankton species.

Table 2: Summary for Regression Analysis of Variance

Source of Variation	D.F	SS	MS	F-Value
Depth	3	0.629	0.2095	0.344
Residual	36	0.583	0.1829	
Total	39	7.212	0.1849	

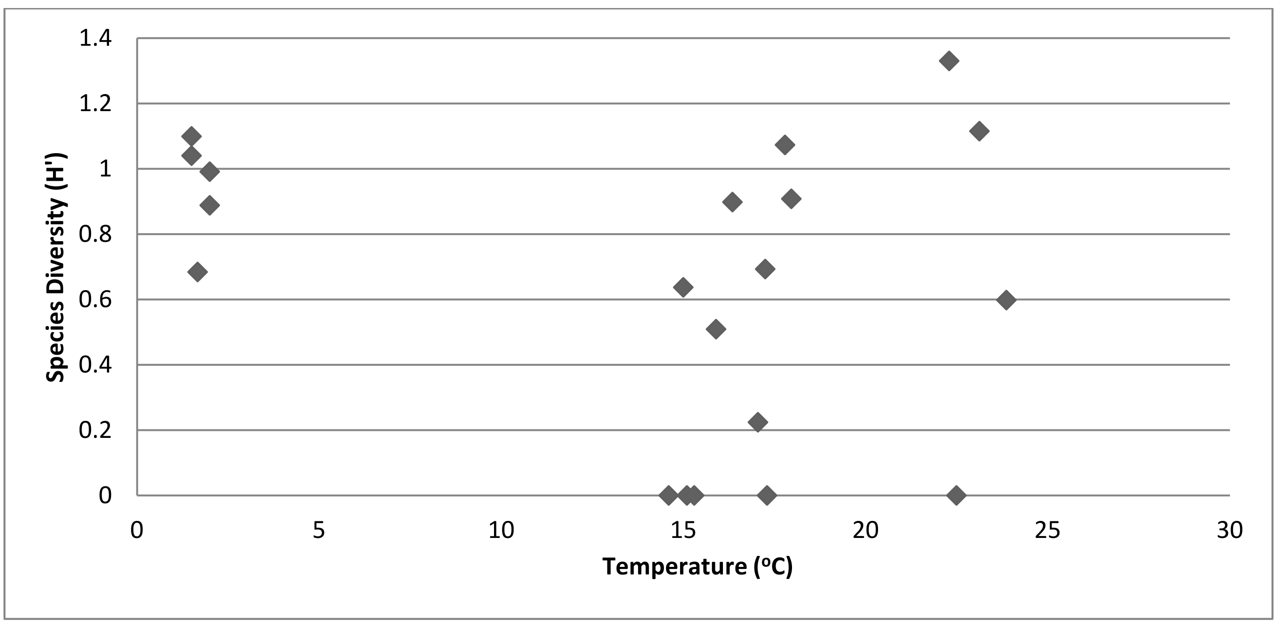

Figure 3: The Relationship between Temperature and Species Diversity at Goreangab

The figure overleaf shows how the species diversity was changing or distributed with the change in temperature at Goreangab dam. There was no linear pattern observed.

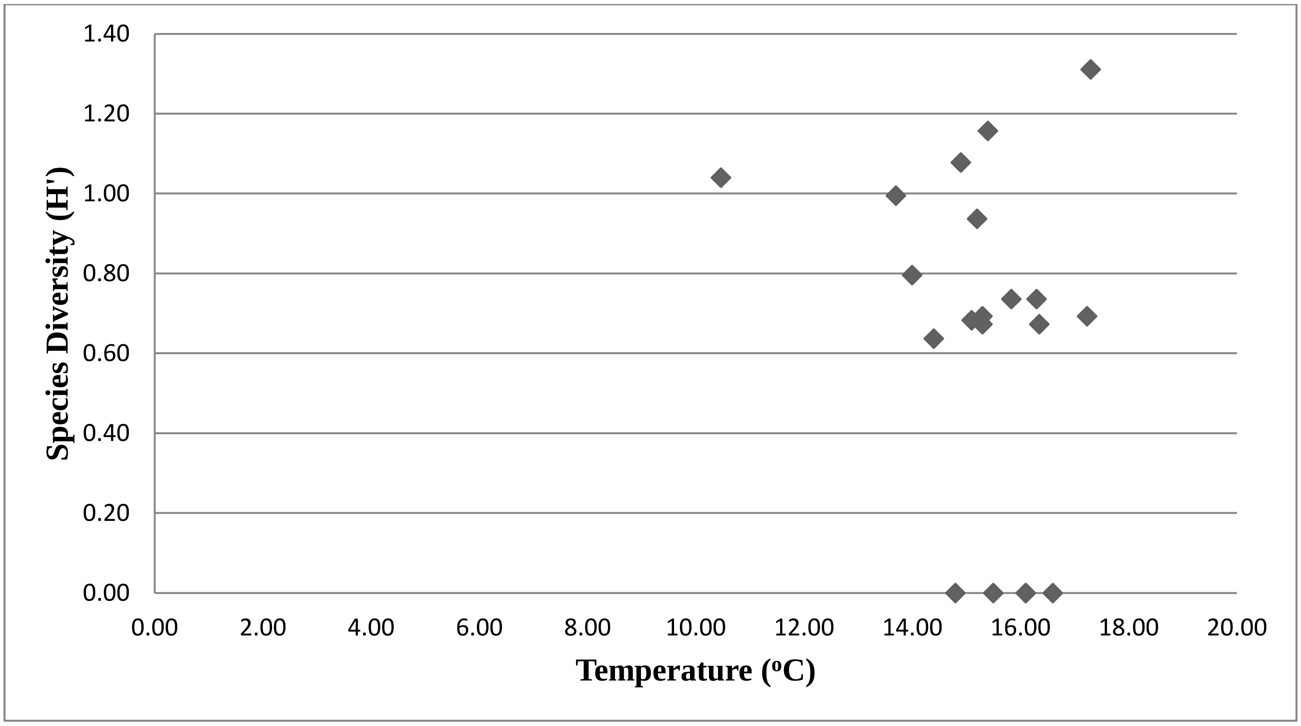

Figure 4: Relationship between Temperature and Species Diversity at Avis Dam

The figure above shows how the species diversity was changing or distributed with the change in temperature at Avis dam. The data points were not linear.

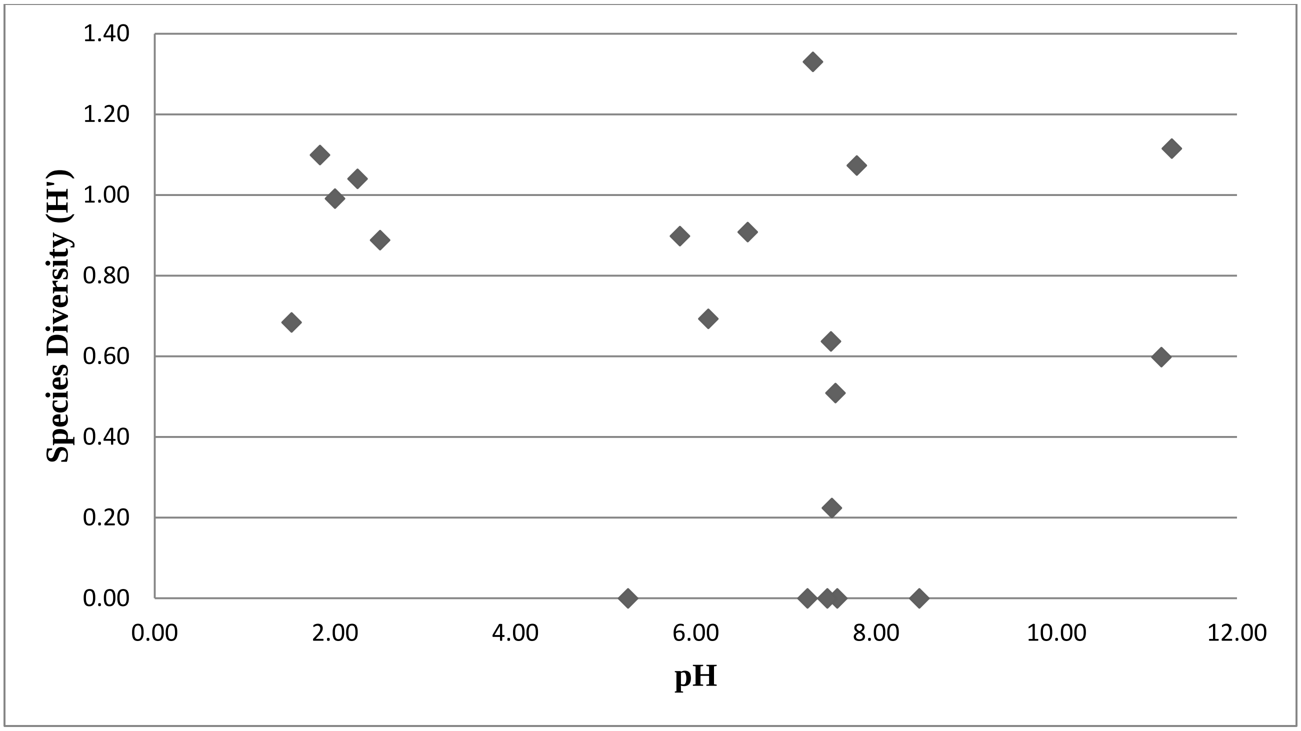

Figure 5: Relationship between pH and Species Diversity at Goreangab Dam

The figure above shows how the species diversity was changing or distributed with the change in pH at Goreangab dam. No pattern was shown.

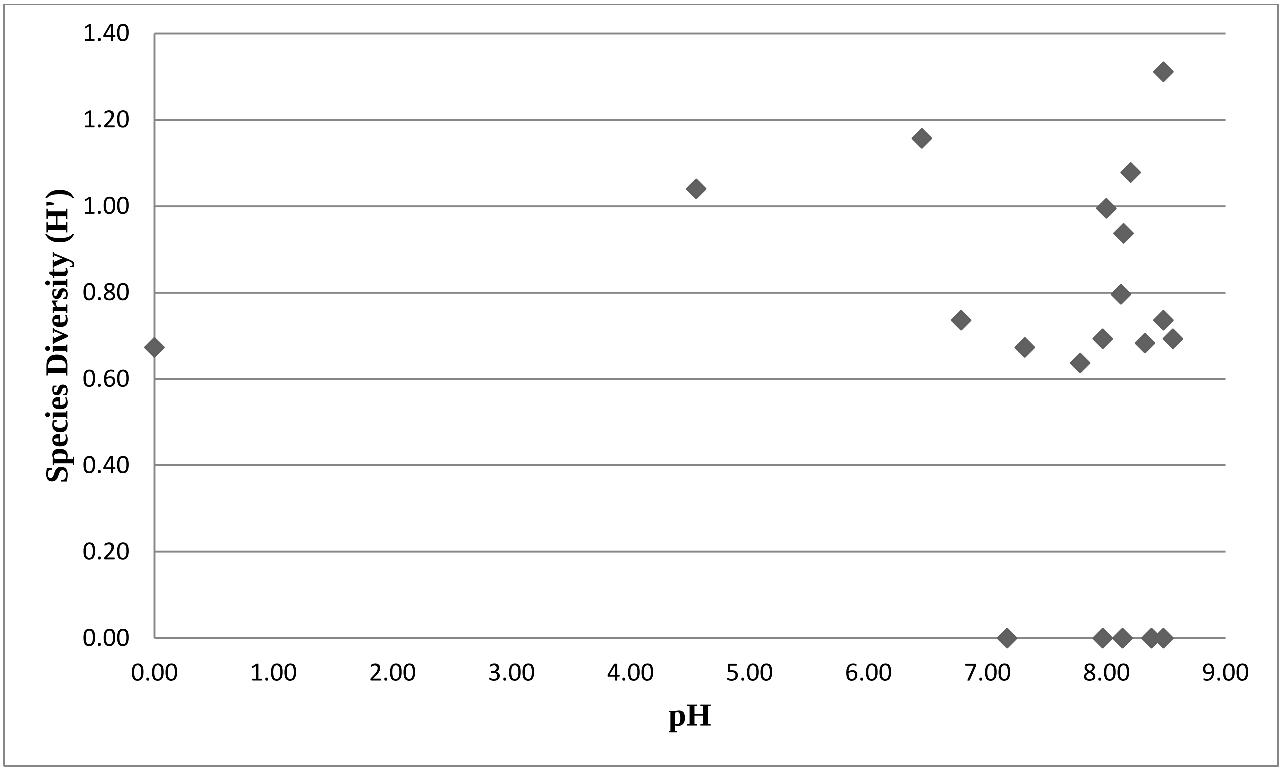

Figure 6: The relationship between pH and Species Diversity at Avis Dam

The figure above shows how the species diversity was changing or distributed with the change in pH at Avis dam. The data points were not linear

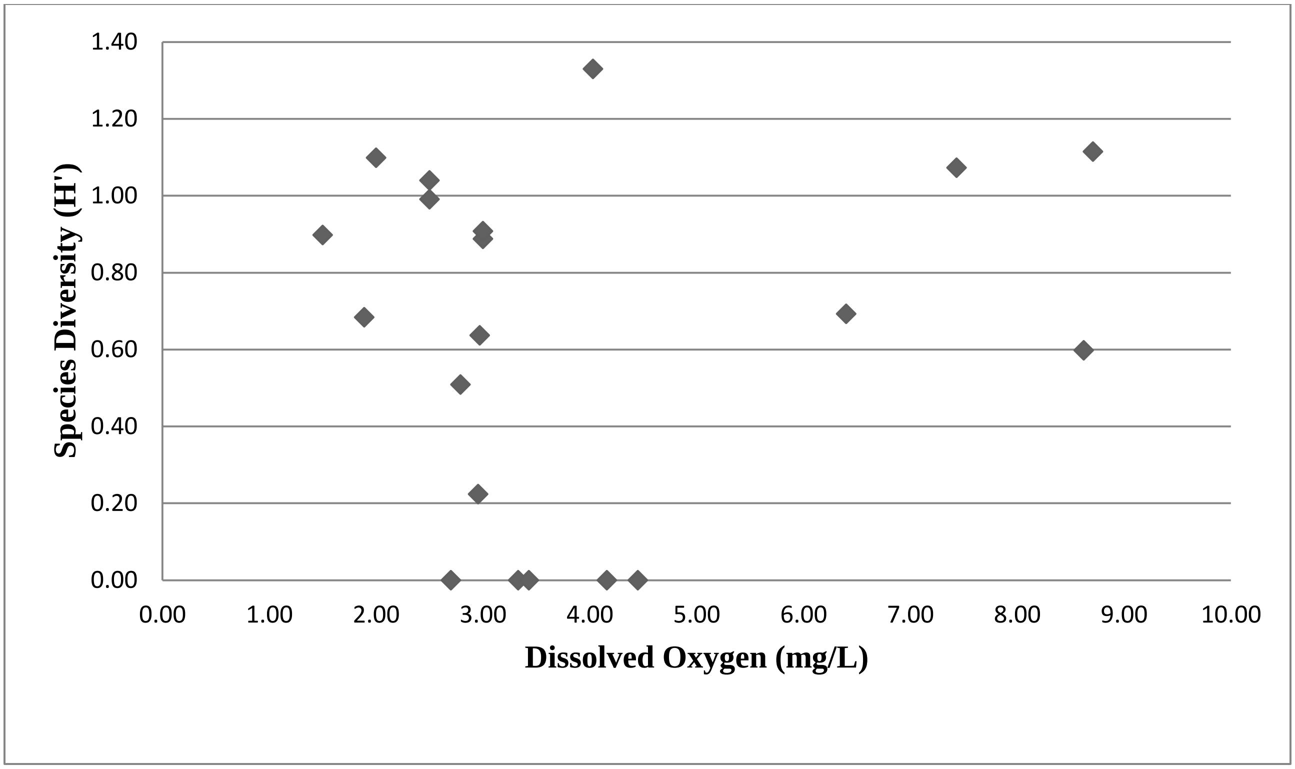

Figure 7: The Relationship between Dissolved Oxygen and Species Diversity for Goreangab

It is evident from the figure above that species diversity was changing or distributed with the change in dissolved oxygen at Goreangab dam. The data points were not linear.

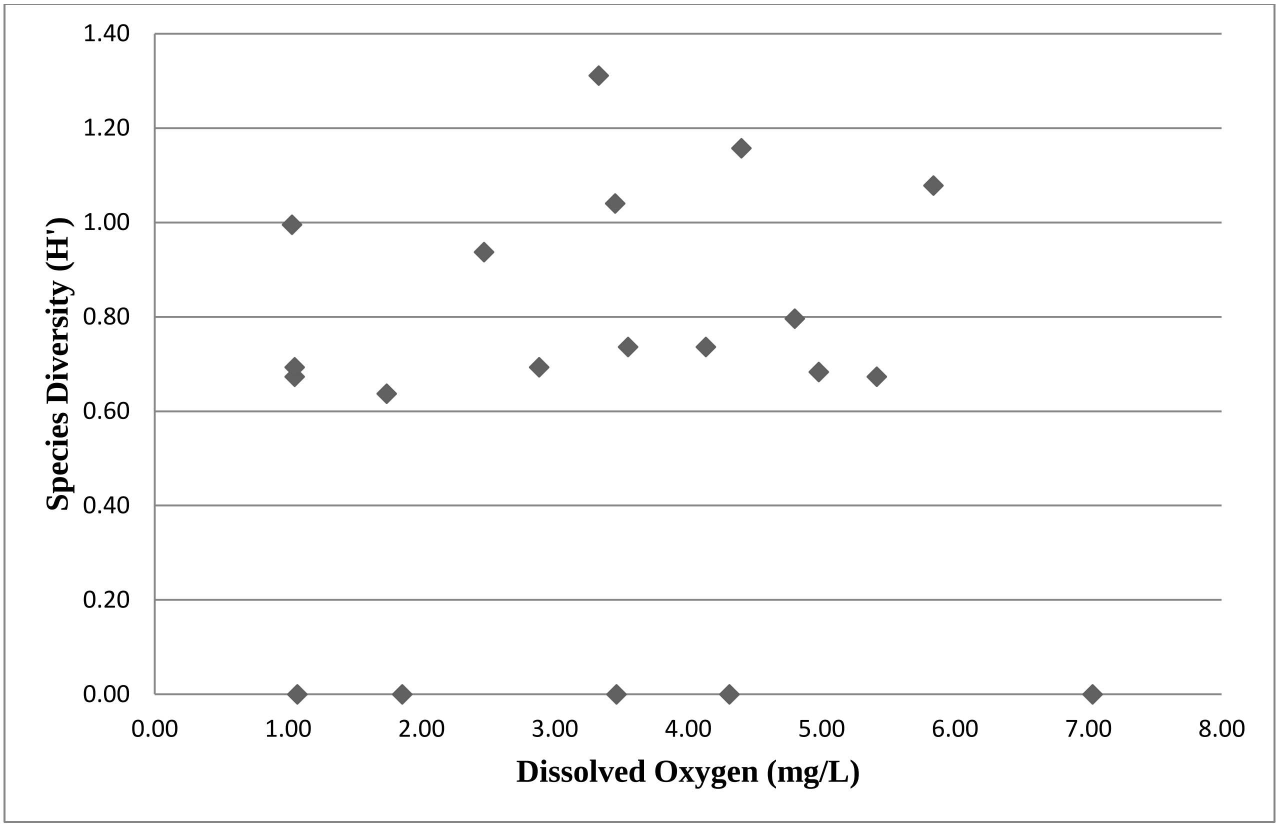

Figure 8: The Relationship between Dissolved Oxygen and Species Diversity for Avis Dam

The figure above shows how the species diversity was changing or distributed with the change in dissolved oxygen at Avis dam. The data points were not linear.

CHAPTER FOUR

DISCUSSION, CONCLUSION AND CONTRIBUTION TO KNOWLEDGE

4.1. Discussion

This study was aimed to compare species diversity and vertical distribution of zooplankton between Goreangab and Avis dam in Windhoek. At the same time, environmental parameters were also measured to establish their relationship with the species diversity of zooplankton. The results showed no significant interaction between site and depth ($F=0.648$; $d.f= 3, 32$; $p>0.05$) meaning the combination of the two factors had no effect on the species diversity and distribution. From the results, it is shown that the two dams have no significant difference in species diversity of zooplanktons ($F= 0.575$, $d.f=1, 32$; $p>0.05$).). Although literature have indicated that zooplankton occurrence can be used as a measure of ecological disturbance and water quality in different water bodies, this was however not the case, although it is evident that water quality and the disturbance to the ecosystems between Goreangab and Avis dam varies.

On the other hand, the results showed no significant different ($F=0.510$, $d,f= 3,32$; $p>0.05$) in zooplankton vertical distribution in both dams. This might be due to what Buchanan and Haney (1980), Haney (1993) and Ringelberg (1995) as cited in Lampert (2001) that light intensity seems to be a trigger for directional changes in migration and many zooplankton species are phototaxic. Since the depth of both dams is below 10m, it can be said that light penetration in the two dams can reach the bottom easily and this might lead to zooplankton not showing a distinctive pattern as you go down the vertical profile. Zaret & Suffern (1976); Stich & Lampert (1981); Bollens & Frost (1989); Ringelberg (1999) concluded that, there is a general evidence that changes in light intensity is the primary factor regulating the vertical distribution of zooplankton. They further noted that, biotic and abiotic factors like predation, temperature, food availability, dissolved oxygen and some chemical cues modify the photoresponses of several zooplankton species.

The findings further revealed no significant linear relationship ($p=0.344$, d.f=3, 36; $p>0.05$) between the environmental parameters and zooplankton species diversity at the two dams. There was a negative non-linear correlation between temperature and pH to zooplankton species diversity as compared to a positive non-linear correlation between dissolved oxygen and zooplankton species diversity for both dams (*See Figures:3,4,5,6,7,8; Appendix 2*).

The pH of water in aquatic environments is a condition that can exert a powerful influence on the distribution and abundance of aquatic organisms (Begon *et al*, 2006). It is further argued that, low or high pH may act in three ways; firstly, it affects organisms directly by upsetting osmoregulation, enzyme activity and gaseous exchange across respiratory surfaces. Secondly, it affects aquatic organisms indirectly by increasing the concentration of toxic heavy metals particularly aluminum (Al^{3+}) but also manganese (Mn^{2+}) and (Fe^{3+}). Finally, it affects organisms indirectly by reducing the quality and range of prey. If organisms like zooplanktons are to survive for a long time, in a particular community in a certain geographical region, it must be able to feed, reproduce and well adapted to the environment it encounters. Many different environmental factors affect zooplankton species and they interact and change with time. According to King (1989), the oxygen level in the environment is important to organisms because they need it for cellular respiration. He further indicated that, in a liter of air, there is 210cm^3 of oxygen.

In a liter of water saturated with oxygen, however, there is always less than $10cm^3$ of oxygen dissolved. Since the rate of diffusion of oxygen in water is slower than the rate of diffusion in air, aquatic animals need to extract oxygen from the water. Thus the reduction in the level of dissolved oxygen in water may be critical for aquatic animals like zooplankton living in rivers, streams, lakes and even ponds. These results contradicted with what Easton and Gophen (2001) found that zooplankton diel variation in distribution being affected by thermocline and oxycline in the water column. This might be due to the fact that the environmental factors were collected during one season where the changes were not much, and also due to a short profile of the two dams.

4.2. Conclusion

This is a single season study at particular sites and the results found cannot necessarily be extrapolated in the long-term biological events and processes of the two dams. The physical structures of the two dams are not uniform throughout the year, nor are temperature, pH, dissolved oxygen and nutrient composition. This study has pointed some of the physical and ecological forces which shape the processes that influences the diversity and distribution of zooplankton between the two dams.

4.3. Contribution to Knowledge

This study has impacted knowledge in the sense that the investigator has gained in depth understanding of conducting an independent research. Knowledge gained includes research design, data collection, analysis and interpretation. The skills of critic and synthesize other authors’ work cannot be left without mentioned. Let alone this research can be used as a basis for establishing an inventory for zooplankton diversity in the two dams.

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APPENDICES

Appendix 1: Summary Table for Treatments (Depth)

Depth (m)	Site		Mean
	Goreangab	Avis	
6	0.448	0.632	0.540[a]
0	0.653	0.609	0.631[a]
2	0.881	0.634	0.758[a]
4	0.876	0.692	0.784[a]
Grand Mean	0.715	0.642	0.678
F (Interaction, 3, 39d.f)			0.648
S.e.d.			0.2565
L.S.D			0.5225

C.V %	59.8

Note: Means with the same letter are not significantly different

Appendix 2: Regression Analysis between Environmental Factors showing Y- Intercept, Slope and Coefficient of Determination (R^2) in Species Diversity at Goreangab and avis dam.

Site	Goreangab			
Environmental Factor	Y-Intercept	Slope	R^2	Y-Interc
Temperature (^oC)	-0.014	0.833	0.060	-0.069
pH	-0.040	0.888	0.068	-0.028
Dissolved Oxygen(mg/L)	0.024	0.536	0.014	0.003

Appendix 3: Samples in the laboratory and organisms identified

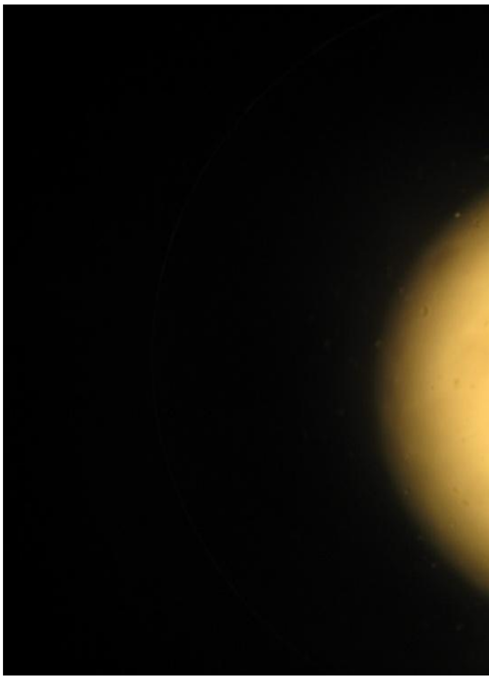
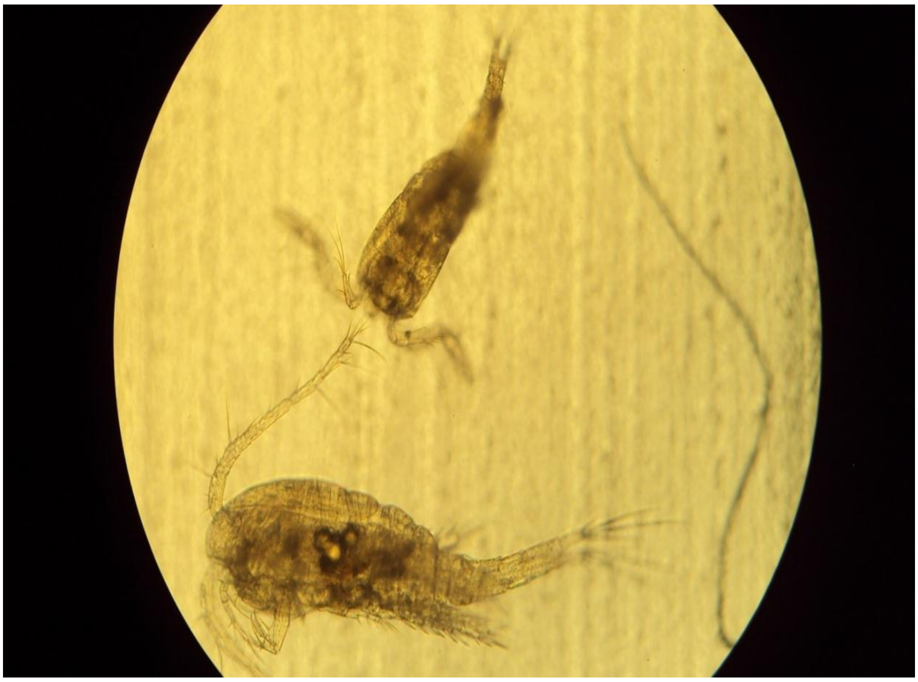


Plate 1: Samples in the Laboratory **Plate 2: *Brachionus***

***calyciforus* X10mg**



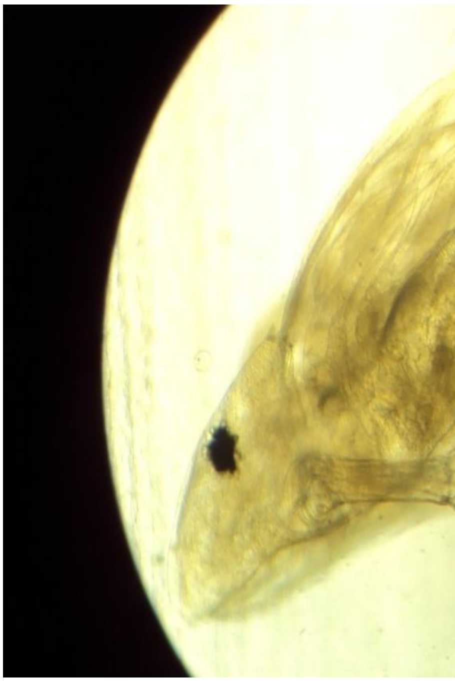


Plate 3: ***Moina micrura*** **X10Mg** **Plate 4:** ***Cyclops***

spp. **X10Mg**

Appendix 4: Environmental Data Collection Sheet

Date	**Site**	**Water Parameter**	**Replicate**	**Depth**	**Station 1**	**Station 2**	**Stat**
31/07/10	Goreangab	Temperature(^{o}C)	1	0	23.7	23.2	
31/07/10	Goreangab	Temperature(^{o}C)	1	2	22.4	22.6	
31/07/10	Goreangab	Temperature(^{o}C)	1	4	22.3	0	

31/07/10	Goreangab	Temperature(^{o}C)	1	6	22.5		
31/07/10	Goreangab	Temperature(^{o}C)	1	Bottom	24.6	23.4	
31/07/10	Goreangab	pH	1	0	7.22	7.3	
31/07/10	Goreangab	pH	1	2	7.34	7.28	
31/07/10	Goreangab	pH	1	4	7.3	0	
31/07/10	Goreangab	pH	1	6	7.24	0	
31/07/10	Goreangab	pH	1	Bottom	7.22	7.92	
31/07/10	Goreangab	Dissolved Oxygen (mg/L)	1	0	5.68	4.99	
31/07/10	Goreangab	Dissolved Oxygen (mg/L)	1	2	4.5	5	
31/07/10	Goreangab	Dissolved Oxygen (mg/L)	1	4	4.03	*********	***
31/07/10	Goreangab	Dissolved Oxygen (mg/L)	1	6	4.45	*********	***
31/07/10	Goreangab	Dissolved Oxygen (mg/L)	1	Bottom	6.04	3.9	
31/07/10	Avis	Temperature(^{o}C)	1	0	17.3		
31/07/10	Avis	Temperature(^{o}C)	1	2	16.3		
31/07/10	Avis	Temperature(^{o}C)	1	4	15.3		
31/07/10	Avis	Temperature(^{o}C)	1	Bottom	15.3		
31/07/10	Avis	pH	1	0	8.48		
31/07/10	Avis	pH	1	2	8.48		
31/07/10	Avis	pH	1	4			

31/07/10	Avis	pH	1	Bottom	7.97		
31/07/10	Avis	Dissolved Oxygen (mg/L)	1	0	3.33		
31/07/10	Avis	Dissolved Oxygen (mg/L)	1	2	3.55		
31/07/10	Avis	Dissolved Oxygen (mg/L)	1	4	1.05		
31/07/10	Avis	Dissolved Oxygen (mg/L)	1	Bottom	1.05		
7/8/2010	Goreangab	Temperature(^{o}C)	2	0	16.7	18.2	
7/8/2010	Goreangab	Temperature(^{o}C)	2	2	16.1	16.2	
7/8/2010	Goreangab	Temperature(^{o}C)	2	4	15.7	16	
7/8/2010	Goreangab	Temperature(^{o}C)	2	6	14.6	*	*
7/8/2010	Goreangab	Temperature(^{o}C)	2	Bottom	14	15.1	
7/8/2010	Goreangab	pH	2	0	7.78	7.71	
7/8/2010	Goreangab	pH	2	2	7.56	7.71	
7/8/2010	Goreangab	pH	2	4	7.55	7.49	***
7/8/2010	Goreangab	pH	2	6	7.57	*********	***
7/8/2010	Goreangab	pH	2	Bottom	7.5	7.48	
7/8/2010	Goreangab	Dissolved Oxygen (mg/L)	2	0	1.62	1.98	
7/8/2010	Goreangab	Dissolved Oxygen (mg/L)	2	2	2.75	3.04	***
7/8/2010	Goreangab	Dissolved Oxygen	2	4	2.94	3.31	***

		(mg/L)					
7/8/2010	Goreangab	Dissolved Oxygen (mg/L)	2	6	2.7	*********	***
7/8/2010	Goreangab	Dissolved Oxygen (mg/L)	2	Bottom	1.6	3.37	
7/8/2010	Avis	Temperature(^{o}C)	2	0	18.3	16	
7/8/2010	Avis	Temperature(^{o}C)	2	2	16.7	15.5	***
7/8/2010	Avis	Temperature(^{o}C)	2	4	14.8	*********	***
7/8/2010	Avis	Temperature(^{o}C)	2	Bottom	18.3	14.8	
7/8/2010	Avis	pH	2	0	8.5	8.61	
7/8/2010	Avis	pH	2	2	8.47	8.29	***
7/8/2010	Avis	pH	2	4	7.97	*********	***
7/8/2010	Avis	pH	2	Bottom	8.47	7.97	
7/8/2010	Avis	Dissolved Oxygen (mg/L)	2	0	3.29	2.55	
7/8/2010	Avis	Dissolved Oxygen (mg/L)	2	2	3.56	5.06	***
7/8/2010	Avis	Dissolved Oxygen (mg/L)	2	4	1.07	*********	***
7/8/2010	Avis	Dissolved Oxygen (mg/L)	2	Bottom	3.5	1.07	
14/08/10	Goreangab	Temperature(^{o}C)	3	0	16.7	15.3	
14/08/10	Goreangab	Temperature(^{o}C)	3	2	15.1	14.8	***
14/08/10	Goreangab	Temperature(^{o}C)	3	4	15.1	15.5	***

14/08/10	Goreangab	Temperature(^{o}C)	3	6	15	*********	***
14/08/10	Goreangab	Temperature(^{o}C)	3	Bottom	15.4	15.2	
14/08/10	Goreangab	pH	3	0	7.81	7.7	
14/08/10	Goreangab	pH	3	2	7.67	7.65	***
14/08/10	Goreangab	pH	3	4	7.53	7.63	***
14/08/10	Goreangab	pH	3	6	7.5	*********	***
14/08/10	Goreangab	pH	3	Bottom	7.48	7.64	
14/08/10	Goreangab	Dissolved Oxygen (mg/L)	3	0	1.6	2.02	
14/08/10	Goreangab	Dissolved Oxygen (mg/L)	3	2	2.18	2.29	***
14/08/10	Goreangab	Dissolved Oxygen (mg/L)	3	4	2.78	2.37	***
14/08/10	Goreangab	Dissolved Oxygen (mg/L)	3	6	2.97	*********	***
14/08/10	Goreangab	Dissolved Oxygen (mg/L)	3	Bottom	3.17	2.26	
14/08/10	Avis	Temperature(^{o}C)	3	0	14.8	16.6	
14/08/10	Avis	Temperature(^{o}C)	3	2	14.9	14.9	***
14/08/10	Avis	Temperature(^{o}C)	3	4	13.7	*********	***
14/08/10	Avis	Temperature(^{o}C)	3	Bottom	13.9	14.4	
14/08/10	Avis	pH	3	0	5.3	8.36	
14/08/10	Avis	pH	3	2	8.15	8.26	***
14/08/10	Avis	pH	3	4	8	*********	***

14/08/10	Avis	pH	3	Bottom	8.16	8.21	
14/08/10	Avis	Dissolved Oxygen (mg/L)	3	0	5.56	4.8	
14/08/10	Avis	Dissolved Oxygen (mg/L)	3	2	6.28	5.4	***
14/08/10	Avis	Dissolved Oxygen (mg/L)	3	4	1.03	*********	***
14/08/10	Avis	Dissolved Oxygen (mg/L)	3	Bottom	7.14	6.23	
21/08/10	Goreangab	Temperature(^{o}C)	4	0	17.48	17.9	
21/08/10	Goreangab	Temperature(^{o}C)	4	2	15.9	*********	***
21/08/10	Goreangab	Temperature(^{o}C)	4	4	18	16.1	***
21/08/10	Goreangab	Temperature(^{o}C)	4	6	15.1	*********	***
21/08/10	Goreangab	Temperature(^{o}C)	4	Bottom	19.7	15	***
21/08/10	Goreangab	pH	4	0	7.48	7.96	
21/08/10	Goreangab	pH	4	2	7.55	*********	***
21/08/10	Goreangab	pH	4	4	7.53	7.49	***
21/08/10	Goreangab	pH	4	6	7.46	*********	***
21/08/10	Goreangab	pH	4	Bottom	7.52	7.46	***
21/08/10	Goreangab	Dissolved Oxygen (mg/L)	4	0	3.38	1.12	
21/08/10	Goreangab	Dissolved Oxygen (mg/L)	4	2	2.79	*********	***
21/08/10	Goreangab	Dissolved Oxygen	4	4	2.74	3.17	***

		(mg/L)					
21/08/10	Goreangab	Dissolved Oxygen (mg/L)	4	6	3.43	*********	***
21/08/10	Goreangab	Dissolved Oxygen (mg/L)	4	Bottom	3.12	3.73	***
21/08/10	Avis	Temperature(°C)	4	0	16	15.2	
21/08/10	Avis	Temperature(°C)	4	2	14.7	15.5	***
21/08/10	Avis	Temperature(°C)	4	4	14.4	*********	***
21/08/10	Avis	Temperature(°C)	4	Bottom	16	14.4	***
21/08/10	Avis	pH	4	0	8.53	8.45	
21/08/10	Avis	pH	4	2	8.22	8.43	***
21/08/10	Avis	pH	4	4	7.78	*********	***
21/08/10	Avis	pH	4	Bottom	8.51	7.78	
21/08/10	Avis	Dissolved Oxygen (mg/L)	4	0	3.07	3.69	
21/08/10	Avis	Dissolved Oxygen (mg/L)	4	2	6.13	3.83	***
21/08/10	Avis	Dissolved Oxygen (mg/L)	4	4	1.74	*********	***
21/08/10	Avis	Dissolved Oxygen (mg/L)	4	Bottom	3.2	1.74	***
30/08/10	Goreangab	Temperature(oC)	4	0	17.8	17.4	
30/08/10	Goreangab	Temperature(oC)	4	2	17.3	17.2	***
30/08/10	Goreangab	Temperature(oC)	4	4	16.6	16.1	***

30/08/10	Goreangab	Temperature(oC)	4	6	15.3	***********	***
30/08/10	Goreangab	Temperature(oC)	4	Bottom	15.3	18.9	***
30/08/10	Goreangab	pH	4	0	6.39	6.59	
30/08/10	Goreangab	pH	4	2	6.12	6.16	***
30/08/10	Goreangab	pH	4	4	5.82	5.83	***
30/08/10	Goreangab	pH	4	6	5.25	**********	***
30/08/10	Goreangab	pH	4	Bottom	5.47	6.72	***
30/08/10	Goreangab	Dissolved Oxygen (mg/L)	4	0	4.44	2.76	
30/08/10	Goreangab	Dissolved Oxygen (mg/L)	4	2	6	6.8	***
30/08/10	Goreangab	Dissolved Oxygen (mg/L)	4	4	1.51	1.49	***
30/08/10	Goreangab	Dissolved Oxygen (mg/L)	4	6	4.16	**********	***
30/08/10	Goreangab	Dissolved Oxygen (mg/L)	4	Bottom	3.7	1.95	***
30/08/10	Avis	Temperature(oC)	4	0	16.7	16.5	
30/08/10	Avis	Temperature(oC)	4	2	16	16.7	***
30/08/10	Avis	Temperature(oC)	4	4	15.4	**********	***
30/08/10	Avis	Temperature(oC)	4	Bottom	16.1	16	
30/08/10	Avis	pH	4	0	7.3	7.1	
30/08/10	Avis	pH	4	2	6.83	7.8	***
30/08/10	Avis	pH	4	4	6.45	**********	***

30/08/10	Avis	pH	4	Bottom	6.75	7.14	
30/08/10	Avis	Dissolved Oxygen (mg/L)	4	0	6.1	7	
30/08/10	Avis	Dissolved Oxygen (mg/L)	4	2	1.53	9.3	***
30/08/10	Avis	Dissolved Oxygen (mg/L)	4	4	4.4	**********	***
30/08/10	Avis	Dissolved Oxygen (mg/L)	4	Bottom	2	6	

Appendix 5: Laboratory Data Collection Sheet

Date	**Site**	**Replicate**	**Depth(m)**	**Zooplankton**	**Subsamples**		
					1	**2**	**3**
31/07/2010	Goreangab	1	0	Cyclop sp.	0	0	0
31/07/2010	Goreangab	1	0	Anuraeopsis fissa	0	0	0
31/07/2010	Goreangab	1	0	Brachionus budapestinensis	0	0	0
31/07/2010	Goreangab	1	0	Brachionus calyciforus	0	0	0
31/07/2010	Goreangab	1	0	Nauplius larvae	0	0	0

31/07/2010	Goreangab	1	0	Moina micrura	800	400	800
31/07/2010	Goreangab	1	0	Keratella valga	0	0	0
31/07/2010	Goreangab	1	2	Cyclop sp.	800	0	0
31/07/2010	Goreangab	1	2	Anuraeopsis fissa	0	0	0
31/07/2010	Goreangab	1	2	Brachionus budapestinensis	0	400	0
31/07/2010	Goreangab	1	2	Brachionus calyciforus	0	0	0
31/07/2010	Goreangab	1	2	Nauplius larvae	1200	800	0
31/07/2010	Goreangab	1	2	Moina micrura	1200	800	800
31/07/2010	Goreangab	1	2	Keratella valga	0	0	0
31/07/2010	Goreangab	1	4	Cyclop sp.	0	400	400
31/07/2010	Goreangab	1	4	Anuraeopsis fissa	0	0	0
31/07/2010	Goreangab	1	4	Brachionus budapestinensis	0	0	0
31/07/2010	Goreangab	1	4	Brachionus calyciforus	0	0	800
31/07/2010	Goreangab	1	4	Nauplius larvae	0	0	0
31/07/2010	Goreangab	1	4	Moina micrura	0	0	400
31/07/2010	Goreangab	1	4	Keratella valga	0	400	0
31/07/2010	Goreangab	1	6	Cyclop sp.	0	0	0
31/07/2010	Goreangab	1	6	Anuraeopsis fissa	0	0	0
31/07/2010	Goreangab	1	6	Brachionus budapestinensis	0	0	0
31/07/2010	Goreangab	1	6	Brachionus calyciforus	0	0	0
31/07/2010	Goreangab	1	6	Nauplius larvae	0	0	0

31/07/2010	Goreangab	1	6	Moina micrura	0	0	0
31/07/2010	Goreangab	1	6	Keratella valga	0	0	0
31/07/2010	Goreangab	1	Bottom	Cyclop sp.	400	0	0
31/07/2010	Goreangab	1	Bottom	Anuraeopsis fissa	0	0	0
31/07/2010	Goreangab	1	Bottom	Brachionus budapestinensis	0	0	0
31/07/2010	Goreangab	1	Bottom	Brachionus calyciforus	0	0	0
31/07/2010	Goreangab	1	Bottom	Nauplius larvae	0	0	0
31/07/2010	Goreangab	1	Bottom	Moina micrura	0	0	0
31/07/2010	Goreangab	1	Bottom	Keratella valga	0	0	0
31/07/2010	Avis	1	0	Cyclop sp.	400	0	0
31/07/2010	Avis	1	0	Anuraeopsis fissa	800	0	400
31/07/2010	Avis	1	0	Brachionus budapestinensis	0	400	0
31/07/2010	Avis	1	0	Brachionus calyciforus	0	0	0
31/07/2010	Avis	1	0	Nauplius larvae	0	0	0
31/07/2010	Avis	1	0	Moina micrura	0	0	0
31/07/2010	Avis	1	0	Keratella valga	0	0	0
31/07/2010	Avis	1	2	Cyclop sp.	400	800	800
31/07/2010	Avis	1	2	Anuraeopsis fissa	0	0	0
31/07/2010	Avis	1	2	Brachionus budapestinensis	0	0	0
31/07/2010	Avis	1	2	Brachionus calyciforus	0	0	0
31/07/2010	Avis	1	2	Nauplius larvae	0	0	400

31/07/2010	Avis	1	2	Moina micrura	0	0	400
31/07/2010	Avis	1	2	Keratella valga	0	0	0
31/07/2010	Avis	1	4	Cyclop sp.	400	400	0
31/07/2010	Avis	1	4	Anuraeopsis fissa	0	0	0
31/07/2010	Avis	1	4	Brachionus budapestinensis	0	0	0
31/07/2010	Avis	1	4	Brachionus calyciforus	0	0	0
31/07/2010	Avis	1	4	Nauplius larvae	0	800	
31/07/2010	Avis	1	4	Moina micrura	0	0	0
31/07/2010	Avis	1	4	Keratella valga	0	0	0
31/07/2010	Avis	1	Bottom	Cyclop sp.	400		
31/07/2010	Avis	1	Bottom	Anuraeopsis fissa	0	0	0
31/07/2010	Avis	1	Bottom	Brachionus budapestinensis	0	0	0
31/07/2010	Avis	1	Bottom	Brachionus calyciforus	0	0	0
31/07/2010	Avis	1	Bottom	Nauplius larvae	0	0	0
31/07/2010	Avis	1	Bottom	Moina micrura	0	0	0
31/07/2010	Avis	1	Bottom	Keratella valga	0	0	0
7/8/2010	Goreangab	2	0	Cyclop sp.	0	0	0
7/8/2010	Goreangab	2	0	Anuraeopsis fissa	0	0	0
7/8/2010	Goreangab	2	0	Brachionus budapestinensis	0	0	0
7/8/2010	Goreangab	2	0	Brachionus calyciforus	0	0	0
7/8/2010	Goreangab	2	0	Nauplius larvae	0	0	0

7/8/2010	Goreangab	2	0	Moina micrura	0	0	0
7/8/2010	Goreangab	2	0	Keratella valga	0	0	0
7/8/2010	Goreangab	2	2	Cyclop sp.	800	0	400
7/8/2010	Goreangab	2	2	Anuraeopsis fissa	0	0	0
7/8/2010	Goreangab	2	2	Brachionus budapestinensis	0	0	0
7/8/2010	Goreangab	2	2	Brachionus calyciforus	0	0	0
7/8/2010	Goreangab	2	2	Nauplius larvae	0	400	1200
7/8/2010	Goreangab	2	2	Moina micrura	0	400	800
7/8/2010	Goreangab	2	2	Keratella valga	0	0	0
7/8/2010	Goreangab	2	4	Cyclop sp.	0	0	0
7/8/2010	Goreangab	2	4	Anuraeopsis fissa	0	0	0
7/8/2010	Goreangab	2	4	Brachionus budapestinensis	0	0	0
7/8/2010	Goreangab	2	4	Brachionus calyciforus	0	0	0
7/8/2010	Goreangab	2	4	Nauplius larvae	0	400	0
7/8/2010	Goreangab	2	4	Moina micrura	400	0	0
7/8/2010	Goreangab	2	4	Keratella valga	0	0	0
7/8/2010	Goreangab	2	6	Cyclop sp.	400	0	0
7/8/2010	Goreangab	2	6	Anuraeopsis fissa	0	0	0
7/8/2010	Goreangab	2	6	Brachionus budapestinensis	0	0	0
7/8/2010	Goreangab	2	6	Brachionus calyciforus	0	0	0
7/8/2010	Goreangab	2	6	Nauplius larvae	0	0	0

7/8/2010	Goreangab	2	6	Moina micrura	0	0	0
7/8/2010	Goreangab	2	6	Keratella valga	0	0	0
7/8/2010	Goreangab	2	Bottom	Cyclop sp.	0	1200	0
7/8/2010	Goreangab	2	Bottom	Anuraeopsis fissa	0	0	0
7/8/2010	Goreangab	2	Bottom	Brachionus budapestinensis	0	0	0
7/8/2010	Goreangab	2	Bottom	Brachionus calyciforus	0	0	0
7/8/2010	Goreangab	2	Bottom	Nauplius larvae	0	0	0
7/8/2010	Goreangab	2	Bottom	Moina micrura	0	400	400
7/8/2010	Goreangab	2	Bottom	Keratella valga	0	0	0
7/8/2010	Avis	2	0	Cyclop sp.	0	400	0
7/8/2010	Avis	2	0	Anuraeopsis fissa	0	0	0
7/8/2010	Avis	2	0	Brachionus budapestinensis	0	0	0
7/8/2010	Avis	2	0	Brachionus calyciforus	0	0	0
7/8/2010	Avis	2	0	Nauplius larvae	0	0	0
7/8/2010	Avis	2	0	Moina micrura	0	0	0
7/8/2010	Avis	2	0	Keratella valga	0	0	0
7/8/2010	Avis	2	2	Cyclop sp.	0	0	0
7/8/2010	Avis	2	2	Anuraeopsis fissa	0	0	0
7/8/2010	Avis	2	2	Brachionus budapestinensis	0	0	0
7/8/2010	Avis	2	2	Brachionus calyciforus	0	0	0
7/8/2010	Avis	2	2	Nauplius larvae	0	0	0

7/8/2010	Avis	2	2	Moina micrura	1200	1200	0
7/8/2010	Avis	2	2	Keratella valga	0	0	0
7/8/2010	Avis	2	4	Cyclop sp.	0	0	0
7/8/2010	Avis	2	4	Anuraeopsis fissa	0	0	0
7/8/2010	Avis	2	4	Brachionus budapestinensis	0	0	0
7/8/2010	Avis	2	4	Brachionus calyciforus	0	0	0
7/8/2010	Avis	2	4	Nauplius larvae	0	0	0
7/8/2010	Avis	2	4	Moina micrura	400	400	800
7/8/2010	Avis	2	4	Keratella valga	0	0	0
7/8/2010	Avis	2	Bottom	Cyclop sp.	0	0	0
7/8/2010	Avis	2	Bottom	Anuraeopsis fissa	0	0	0
7/8/2010	Avis	2	Bottom	Brachionus budapestinensis	0	0	0
7/8/2010	Avis	2	Bottom	Brachionus calyciforus	0	0	0
7/8/2010	Avis	2	Bottom	Nauplius larvae	0	0	0
7/8/2010	Avis	2	Bottom	Moina micrura	400	0	400
7/8/2010	Avis	2	Bottom	Keratella valga	0	0	0
14/08/2010	Goreangab	3	0	Cyclop sp.	1200	0	800
14/08/2010	Goreangab	3	0	Anuraeopsis fissa	0	0	0
14/08/2010	Goreangab	3	0	Brachionus budapestinensis	0	0	0
14/08/2010	Goreangab	3	0	Brachionus calyciforus	0	0	0
14/08/2010	Goreangab	3	0	Nauplius larvae	0	0	0

14/08/2010	Goreangab	3	0	Moina micrura	0	400	0
14/08/2010	Goreangab	3	0	Keratella valga	0	0	0
14/08/2010	Goreangab	3	2	Cyclop sp.	400	400	800
14/08/2010	Goreangab	3	2	Anuraeopsis fissa	0	0	0
14/08/2010	Goreangab	3	2	Brachionus budapestinensis	0	0	0
14/08/2010	Goreangab	3	2	Brachionus calyciforus	0	0	0
14/08/2010	Goreangab	3	2	Nauplius larvae	400	0	400
14/08/2010	Goreangab	3	2	Moina micrura	400	800	400
14/08/2010	Goreangab	3	2	Keratella valga	0	0	0
14/08/2010	Goreangab	3	4	Cyclop sp.	800	400	400
14/08/2010	Goreangab	3	4	Anuraeopsis fissa	0	0	0
14/08/2010	Goreangab	3	4	Brachionus budapestinensis	0	0	0
14/08/2010	Goreangab	3	4	Brachionus calyciforus	0	0	0
14/08/2010	Goreangab	3	4	Nauplius larvae	0	0	0
14/08/2010	Goreangab	3	4	Moina micrura	0	800	400
14/08/2010	Goreangab	3	4	Keratella valga	0	0	0
14/08/2010	Goreangab	3	6	Cyclop sp.	400	400	400
14/08/2010	Goreangab	3	6	Anuraeopsis fissa	0	0	0
14/08/2010	Goreangab	3	6	Brachionus budapestinensis	0	0	0
14/08/2010	Goreangab	3	6	Brachionus calyciforus	0	0	0
14/08/2010	Goreangab	3	6	Nauplius larvae	0	0	800

14/08/2010	Goreangab	3	6	Moina micrura	0	0	0
14/08/2010	Goreangab	3	6	Keratella valga	0	0	0
14/08/2010	Goreangab	3	Bottom	Cyclop sp.	800	400	800
14/08/2010	Goreangab	3	Bottom	Anuraeopsis fissa	0	0	0
14/08/2010	Goreangab	3	Bottom	Brachionus budapestinensis	0	0	0
14/08/2010	Goreangab	3	Bottom	Brachionus calyciforus	0	0	0
14/08/2010	Goreangab	3	Bottom	Nauplius larvae	0	0	0
14/08/2010	Goreangab	3	Bottom	Moina micrura	0	0	400
14/08/2010	Goreangab	3	Bottom	Keratella valga	0	0	0
14/08/2010	Avis	3	0	Cyclop sp.	0	400	400
14/08/2010	Avis	3	0	Anuraeopsis fissa	0	0	0
14/08/2010	Avis	3	0	Brachionus budapestinensis	0	0	0
14/08/2010	Avis	3	0	Brachionus calyciforus	0	0	0
14/08/2010	Avis	3	0	Nauplius larvae	0	0	0
14/08/2010	Avis	3	0	Moina micrura	0	400	0
14/08/2010	Avis	3	0	Keratella valga	0	0	0
14/08/2010	Avis	3	2	Cyclop sp.	400	400	0
14/08/2010	Avis	3	2	Anuraeopsis fissa	0	0	0
14/08/2010	Avis	3	2	Brachionus budapestinensis	400	400	400
14/08/2010	Avis	3	2	Brachionus calyciforus	0	0	0
14/08/2010	Avis	3	2	Nauplius larvae	0	0	0

14/08/2010	Avis	3	2	Moina micrura	800	800	400
14/08/2010	Avis	3	2	Keratella valga	0	0	0
14/08/2010	Avis	3	4	Cyclop sp.	0	0	0
14/08/2010	Avis	3	4	Anuraeopsis fissa	0	0	0
14/08/2010	Avis	3	4	Brachionus budapestinensis	0	0	0
14/08/2010	Avis	3	4	Brachionus calyciforus	0	0	0
14/08/2010	Avis	3	4	Nauplius larvae	0	0	0
14/08/2010	Avis	3	4	Moina micrura	400	800	400
14/08/2010	Avis	3	4	Keratella valga	0	0	0
14/08/2010	Avis	3	Bottom	Cyclop sp.	0	0	0
14/08/2010	Avis	3	Bottom	Anuraeopsis fissa	0	0	0
14/08/2010	Avis	3	Bottom	Brachionus budapestinensis	0	400	0
14/08/2010	Avis	3	Bottom	Brachionus calyciforus	0	0	0
14/08/2010	Avis	3	Bottom	Nauplius larvae	0	0	0
14/08/2010	Avis	3	Bottom	Moina micrura	400	0	800
14/08/2010	Avis	3	Bottom	Keratella valga	0	0	0
21/08/2010	Goreangab	4	0	Cyclop sp.	0	0	1200
21/08/2010	Goreangab	4	0	Anuraeopsis fissa	0	0	0
21/08/2010	Goreangab	4	0	Brachionus budapestinensis	0	0	0
21/08/2010	Goreangab	4	0	Brachionus calyciforus	0	0	0
21/08/2010	Goreangab	4	0	Nauplius larvae	400	400	0

21/08/2010	Goreangab	4	0	Moina micrura	400	800	400
21/08/2010	Goreangab	4	0	Keratella valga	0	0	0
21/08/2010	Goreangab	4	2	Cyclop sp.	800	1200	1200
21/08/2010	Goreangab	4	2	Anuraeopsis fissa	0	0	0
21/08/2010	Goreangab	4	2	Brachionus budapestinensis	0	0	0
21/08/2010	Goreangab	4	2	Brachionus calyciforus	0	0	0
21/08/2010	Goreangab	4	2	Nauplius larvae	400	0	0
21/08/2010	Goreangab	4	2	Moina micrura	0	400	0
21/08/2010	Goreangab	4	2	Keratella valga	0	0	0
21/08/2010	Goreangab	4	4	Cyclop sp.	1600	1600	1200
21/08/2010	Goreangab	4	4	Anuraeopsis fissa	0	0	0
21/08/2010	Goreangab	4	4	Brachionus budapestinensis	0	0	0
21/08/2010	Goreangab	4	4	Brachionus calyciforus	0	0	0
21/08/2010	Goreangab	4	4	Nauplius larvae	0	0	0
21/08/2010	Goreangab	4	4	Moina micrura	400	0	0
21/08/2010	Goreangab	4	4	Keratella valga	0	0	0
21/08/2010	Goreangab	4	6	Cyclop sp.	0	0	0
21/08/2010	Goreangab	4	6	Anuraeopsis fissa	0	0	0
21/08/2010	Goreangab	4	6	Brachionus budapestinensis	0	0	0
21/08/2010	Goreangab	4	6	Brachionus calyciforus	0	0	0
21/08/2010	Goreangab	4	6	Nauplius larvae	0	0	0

21/08/2010	Goreangab	4	6	Moina micrura	0	0	0
21/08/2010	Goreangab	4	6	Keratella valga	0	0	0
21/08/2010	Goreangab	4	Bottom	Cyclop sp.	800	1600	400
21/08/2010	Goreangab	4	Bottom	Anuraeopsis fissa	0	0	0
21/08/2010	Goreangab	4	Bottom	Brachionus budapestinensis	0	0	0
21/08/2010	Goreangab	4	Bottom	Brachionus calyciforus	0	0	0
21/08/2010	Goreangab	4	Bottom	Nauplius larvae	0	0	0
21/08/2010	Goreangab	4	Bottom	Moina micrura	800	1200	400
21/08/2010	Goreangab	4	Bottom	Keratella valga	0	0	0
21/08/2010	Avis	4	0	Cyclop sp.	0	0	0
21/08/2010	Avis	4	0	Anuraeopsis fissa	0	0	0
21/08/2010	Avis	4	0	Brachionus budapestinensis	0	0	0
21/08/2010	Avis	4	0	Brachionus calyciforus	0	0	0
21/08/2010	Avis	4	0	Nauplius larvae	0	0	0
21/08/2010	Avis	4	0	Moina micrura	0	0	0
21/08/2010	Avis	4	0	Keratella valga	0	0	0
21/08/2010	Avis	4	2	Cyclop sp.	0	0	0
21/08/2010	Avis	4	2	Anuraeopsis fissa	0	0	0
21/08/2010	Avis	4	2	Brachionus budapestinensis	0	0	0
21/08/2010	Avis	4	2	Brachionus calyciforus	0	0	0
21/08/2010	Avis	4	2	Nauplius larvae	1200	400	0

21/08/2010	Avis	4	2	Moina micrura	400	400	400
21/08/2010	Avis	4	2	Keratella valga	0	0	0
21/08/2010	Avis	4	4	Cyclop sp.	0	0	0
21/08/2010	Avis	4	4	Anuraeopsis fissa	0	0	0
21/08/2010	Avis	4	4	Brachionus budapestinensis	0	0	0
21/08/2010	Avis	4	4	Brachionus calyciforus	0	0	0
21/08/2010	Avis	4	4	Nauplius larvae	0	400	0
21/08/2010	Avis	4	4	Moina micrura	400	0	400
21/08/2010	Avis	4	4	Keratella valga	0	0	0
21/08/2010	Avis	4	Bottom	Cyclop sp.	0	0	0
21/08/2010	Avis	4	Bottom	Anuraeopsis fissa	0	0	0
21/08/2010	Avis	4	Bottom	Brachionus budapestinensis	800	0	400
21/08/2010	Avis	4	Bottom	Brachionus calyciforus	0	0	0
21/08/2010	Avis	4	Bottom	Nauplius larvae	0	0	0
21/08/2010	Avis	4	Bottom	Moina micrura	400	400	800
21/08/2010	Avis	4	Bottom	Keratella valga	0	0	0
21/08/2010	Avis	4	Bottom	Trichocera cylindrica	0	400	0
28/08/2010	Goreangab	5	0	Cyclop sp.	800	400	800
28/08/2010	Goreangab	5	0	Anuraeopsis fissa	0	0	0
28/08/2010	Goreangab	5	0	Brachionus budapestinensis	0	0	0
28/08/2010	Goreangab	5	0	Brachionus calyciforus	0	0	0

28/08/2010	Goreangab	5	0	Nauplius larvae	0	0	800
28/08/2010	Goreangab	5	0	Moina micrura	0	0	400
28/08/2010	Goreangab	5	0	Keratella valga	0	0	0
28/08/2010	Goreangab	5	2	Cyclop sp.	0	1200	1200
28/08/2010	Goreangab	5	2	Anuraeopsis fissa	0	0	0
28/08/2010	Goreangab	5	2	Brachionus budapestinensis	0	0	0
28/08/2010	Goreangab	5	2	Brachionus calyciforus	0	0	0
28/08/2010	Goreangab	5	2	Nauplius larvae	0	0	0
28/08/2010	Goreangab	5	2	Moina micrura	800	800	800
28/08/2010	Goreangab	5	2	Keratella valga	0	0	0
28/08/2010	Goreangab	5	4	Cyclop sp.	800	0	800
28/08/2010	Goreangab	5	4	Anuraeopsis fissa	0	0	0
28/08/2010	Goreangab	5	4	Brachionus budapestinensis	0	0	0
28/08/2010	Goreangab	5	4	Brachionus calyciforus	0	0	0
28/08/2010	Goreangab	5	4	Nauplius larvae	0	400	0
28/08/2010	Goreangab	5	4	Moina micrura	400	400	0
28/08/2010	Goreangab	5	4	Keratella valga	0	0	0
28/08/2010	Goreangab	5	6	Cyclop sp.	800	0	0
28/08/2010	Goreangab	5	6	Anuraeopsis fissa	0	0	0
28/08/2010	Goreangab	5	6	Brachionus budapestinensis	0	0	0
28/08/2010	Goreangab	5	6	Brachionus calyciforus	0	0	0

28/08/2010	Goreangab	5	6	Nauplius larvae	0	0	0
28/08/2010	Goreangab	5	6	Moina micrura	0	0	0
28/08/2010	Goreangab	5	6	Keratella valga	0	0	0
28/08/2010	Goreangab	5	Bottom	Cyclop sp.	800	1200	1600
28/08/2010	Goreangab	5	Bottom	Anuraeopsis fissa	0	0	0
28/08/2010	Goreangab	5	Bottom	Brachionus budapestinensis	0	0	0
28/08/2010	Goreangab	5	Bottom	Brachionus calyciforus	0	0	0
28/08/2010	Goreangab	5	Bottom	Nauplius larvae	0	0	0
28/08/2010	Goreangab	5	Bottom	Moina micrura	400	0	400
28/08/2010	Goreangab	5	Bottom	Keratella valga	0	0	0
28/08/2010	Avis	5	0	Cyclop sp.	0	0	0
28/08/2010	Avis	5	0	Anuraeopsis fissa	0	0	0
28/08/2010	Avis	5	0	Brachionus budapestinensis	0	0	0
28/08/2010	Avis	5	0	Brachionus calyciforus	0	0	0
28/08/2010	Avis	5	0	Nauplius larvae	0	0	0
28/08/2010	Avis	5	0	Moina micrura	0	0	0
28/08/2010	Avis	5	0	Keratella valga	0	0	0
28/08/2010	Avis	5	2	Cyclop sp.	0	400	400
28/08/2010	Avis	5	2	Anuraeopsis fissa	0	0	0
28/08/2010	Avis	5	2	Brachionus budapestinensis	0	0	0
28/08/2010	Avis	5	2	Brachionus calyciforus	0	0	0

28/08/2010	Avis	5	2	Nauplius larvae	0	0	0
28/08/2010	Avis	5	2	Moina micrura	400	800	400
28/08/2010	Avis	5	2	Keratella valga	0	0	0
28/08/2010	Avis	5	4	Cyclop sp.	800	0	400
28/08/2010	Avis	5	4	Anuraeopsis fissa	0	0	0
28/08/2010	Avis	5	4	Brachionus budapestinensis	400	400	0
28/08/2010	Avis	5	4	Brachionus calyciforus	0	0	0
28/08/2010	Avis	5	4	Nauplius larvae	400	0	0
28/08/2010	Avis	5	4	Moina micrura	1200	400	400
28/08/2010	Avis	5	4	Keratella valga	0	0	0
28/08/2010	Avis	5	Bottom	Cyclop sp.	0	400	0
28/08/2010	Avis	5	Bottom	Anuraeopsis fissa	0	0	0
28/08/2010	Avis	5	Bottom	Brachionus budapestinensis	0	0	0
28/08/2010	Avis	5	Bottom	Brachionus calyciforus	0	0	0
28/08/2010	Avis	5	Bottom	Nauplius larvae	0	400	0
28/08/2010	Avis	5	Bottom	Moina micrura	400	400	1200
28/08/2010	Avis	5	Bottom	Keratella valga	0	0	0