PERCENT MORTALITY OF WATER FLEA *Daphnia magna* TO WATER SAMPLES COLLECTED FROM JALAUD RIVER

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APPROVAL SHEET

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"Percent mortality of *Daphnia magna* to water samples collected from Jalaud River"

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ABSTRACT

Water pollution is causing the world a great damage today. Living organisms are now depleting in number due to this problem. One way to prevent their total extinction is to revive the safe and fresh environment for them to dwell on. Some organisms would be of big help to identify several conditions of the bodies of water.

Daphnia magna is commonly used a bio-toxicity indicator for water pollution. It used due its short doubling time, high sensitivity to heavy metals and simplicity. The mortality rate of Daphnia indicates that the water was polluted or not.

This study simply determined the mortality rate of Daphnia magna when exposed to water samples collected from Jalaud River, Bangga Bante, Iloilo. Water samples were collected from Jalaud River around three o'clock in the afternoon. The temperature, amount of dissolved oxygen and pH levels were measured on-site. Forty daphnia magna were added to each sample poured into a basin. Every 6 hours an observation was done, whether there is a change on the number of daphnia from the initial population. After 24-hour exposure, results showed that there is higher mortality rate obtained from the upstream than from the downstream water samples.

Using the PAST software, t-test method was used to know the significance of the data obtained. The results of the t-test showed that there was no significant difference on the upstream and downstream samples, same as well as to the temperature and amount of dissolved oxygen. Only the pH levels showed a significant difference among the parameters measured.

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CHAPTER 1

INTRODUCTION

A. Background of the Study

Water is an essential resource for living systems, industrial processes, agricultural production and domestic use. Water pollution nowadays is a very pressing problem the world is experiencing. Everywhere we look water is getting dirtier and more harmful for living organisms.

Water is our most important natural resource. Without it the world as we know it would not exist. Water nourishes all the living organisms on out planet. That is why we need to stop polluting, and try to keep water clean. There is only so much useable water in the world.

Water pollution is a large problem of the industrial life style. It is found all around the world. The majority of the world does not have safe clean drinking water. Scientist believes that the availability of fresh water is one of the largest problems in the world. Bad water is spreading disease all over Africa, Asia, and Latin America. Some examples of water born diseases are dysentery, yellow fever, cholera, and malaria. More than a million people in developing countries are affected by polluted water. Unsanitary water is the cause of 3/4 of the world's diseases.

Water pollution occurs when people put so much waste into a water system that its natural cleansing process cannot function properly. Since all creatures need clean water to live, water pollution is a serious problem and concern (World Book Multimedia Encyclopedia, 1996; Flores, et al, 1999)

Daphnia magna, commonly called as water fleas, is a freshwater crustacean, which is used to evaluate water toxicity. It is used because of its high sensitivity towards several heavy metals like copper, nickel, iron, lead and cadmium. (H Movahedian, B Bina, GH Asghari, 2005) The concentrations of these metals greatly affect the growth and population of *Daphnia magna*.

Daphnia are small Crustaceans - barely visible with the naked eye. They are usually smaller than 3mm. They look like water fleas. They are usually seen in large lagoon types of wastewater systems. They are one of the most common crustaceans to be found in lakes, ponds and quiet streams. They feed on bacteria, phytoplankton, rotifers, flagellates, ciliates, and detritus. (**Daphnia* can consume prey sizes from bacteria to rotifers and large ciliates). (Mauree, 2002)

Daphnia magna, a very effective bio-indicator, can provide valuable information about tested substances and can be used satisfactorily as an alternative method to prescreen toxicity of substances of known mechanism of action. (S Veselá, V Ondruška, K Kuča, J Patočka, 2006)

The purpose of this study is to evaluate the water quality of two selected location using *Daphnia magna* as test organism to indicate whether the water sample is polluted or not. It will also inform the residents of the current condition of the river. This

B. Statement of the Problem

What is the percent mortality of *Daphnia magna* after a 24-hour exposure to water samples collected from Jalaud River, Bangga Bante, Iloilo?

C. Objectives of the Study

This study aims to:

- Determine water temperature, pH levels and amount of Dissolved Oxygen in water samples collected from Jalaud River.
- Compare the level of toxicity on two locations of Jalaud River based on the percent mortality of *Daphnia magna.*

D. Hypothesis

There is no significant difference between the percent mortality of *Daphnia magna* when exposed to water samples collected from Jalaud River.

E. Research Paradigm

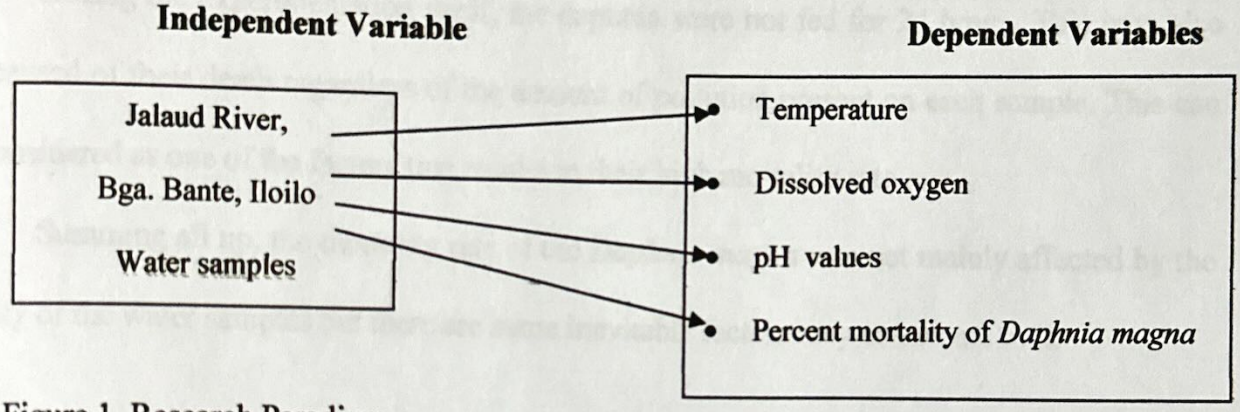

Figure 1. Research Paradigm

F. Significance of the Study

This study serves as an update on the present status of the river abovementioned. The response of the test organism towards water collected will also indicate that the river water collected is not toxic and safe for recreational activities.

Water pollution- bodies of water contain substances dangerous for living things.

- Water pollution is the major problem that will be minimized after the study is conducted.

Water quality- determined by the amount of substances found in water (potable or sea water)

- In this study, water quality will be determined using *Daphnia magna* as its bioindicator.

Water sample- representative of a larger body of water collected for research study

-In this study, the water sample will be collected from 3 sites along Iloilo River

Control group- water samples that are pure (free from any contamination or additives)

-In this study, the control samples will be the distilled water

Water sampling- a technique used to collect water from a certain site using either random sampling or assigned sampling.

- Water sampling will be a preliminary step in water testing in this study.

Testing sites- location where the samples will be collected.

- The testing site of the study is Jalaud River in Bangga Bante, Iloilo.

Water testing- a process on which a certain organism or equipment is used to test whether the water is clean or not.

- In this study, water testing is the main procedure to be used.

CHAPTER II

REVIEW OF RELATED LITERATURE

This chapter focuses on eight parts, namely: (A) *Daphnia magna* , (B) Wastewater, (C) Water Pollution, (D) Water Quality, (E) pH Level, (F) Temperature, (G) Dissolved Oxygen, (H) Water Testing.

A. Daphnia magna

Daphnia magna is a freshwater crustacean, which can be barely seen by the naked eye. They are usually smaller than three millimeters. They are closely related to crabs and shrimps. They are usually found in lakes, ponds and quiet streams or sometimes in large types of wastewater. They reproduce and carry their eggs in a brood pouch on their backs and hatch live babies. (Anonymous)

The United States Environmental Protection Agency recommends *Daphnia magna* as test organism in water toxicity testing. They are used to measure the toxicity of the water at LD50. Their mortality rate shows how toxic the water is. They are very sensitive to several heavy metals—iron, cadmium, lead, nickel, copper, etc. They are also sensitive to pesticides, bleaching agents, detergents, and many other dissolved toxins.

They are filter feeders—bacteria, rotifers, phytoplankton, flagellates, ciliates and detritus. They also minimize the growth of algae on ponds or aquariums.

Daphnia live in shallow water, usually ponds, lakes, or streams. They are usually found close to the surface of the water, near vegetation, and away from currents. Ponds with barnyard drainage, pools by dumps or swamps are an ideal place to find daphnia. In a good area thousands can be found. (http://www.selah.k12.wa.us/SOAR/SciProj2003/RachelF.html, 2003)

In a study done by Movahedian and others (2005), it was mentioned that the water flea *Daphnia magna* is the most commonly used zooplankton in toxicological tests in wastewater treatment, due to short doubling time, high sensitivity, and simplicity; therefore, it was used as an indicator in this study (APHA, AWWA, WEF, 1992; Official Gazette, 1996; USEPA, 2000).

In another study, Villegas Navaro et al. (1999) reported the use of *Daphnia magna* as a toxicity indicator for textile industrial effluents to show that the toxicity tests combined with physico-chemical analysis are essential in the evaluation of effluent quality and also in the assessment of treatment plant efficiency in Mexico. Toxicity evaluation is an important parameter in wastewater quality monitoring as it provides the complete response of test organisms to all compounds in wastewater.

Also, in a study conducted by Šárka Veselá and others, the results simply tells that *Daphnia magna* is a very effective bioindicator which can provide valuable information about tested substances and can be used satisfactorily as an alternative method to prescreen toxicity of substances of known mechanism of action. Their study aims to know the reaction of daphnia towards acetylcholinesterase reactivators. They conclude, "higher toxicity of 7-MEOTA in time if compared to tacrine and similar toxicity of berberine chloride in both tests is explained as a consequence of their metabolism in the daphnid's body." Tests with daphnids can provide valuable information and can be used to prescreen and compare the toxicity of the tested substances.

In a study done by Damian K. Higgins and John F. Miesner, they also used *Daphnia magna* as bioindicator in assessing the aquatic toxicity in Irrigation Drainwater, Newlands Project Area on the months of March to August 2005. In this study, they did several tests to

come up with the results. One of their procedures is also identifying inorganic constituents. The presence of such greatly affected the percent mortality of *Daphnia magna*.

B. Wastewater

Wastewater is any water that has been adversely affected in quality by anthropogenic influence. It comprises liquid waste discharged by domestic residences, commercial properties, industry, and/or agriculture and can encompass a wide range of potential contaminants and concentrations. In the most common usage, it refers to the municipal wastewater that contains a broad spectrum of contaminants resulting from the mixing of wastewaters from different sources.

In a study by Movahedian and others (2005), it was mentioned that "toxicity tests were also used for evaluation of domestic and industrial wastewater effluents (Tisler and Zagorc, 1999; Villegas Navaro et al., 1999; Richard et al.,2000). It is reported that although the effluent meets all physicochemical requirements but regarding its toxicity, it may cause considerable negative effects in receiving waters. Effluent quality evaluation in Iran is based on physicochemical parameters. In this study, the toxicity removal efficiency of different units of Isfahan Wastewater Treatment Plant (IWTP) was evaluated and the validity of regular physicochemical parameters as limits for discharge to receiving waters is discussed."

In the same study, they conclude "however, it should be noted that the quality and quantity of raw wastewater could be quite different due to culture, custom, nutrition, health education, etc. (Metcalf and Eddy, 2003). As the results of both studies were found to be in the same range of 95% confidence limit, therefore, the accuracy of the results is acceptable."

In the same study, as well, they finally conclude "as it is almost impossible to mention any certain substance responsible for toxicity in wastewater, it is reasonable to declare that removal of both organic and inorganic substances in wastewater resulted in toxicity reduction.

Therefore, using biotoxicity tests is an economical and technical method for direct measurement of toxicity in wastewater effluent. The Dept. of Environment of Iran (DOE) has set BOD5 and SS levels of less than 30 and 40 mg/l, respectively, as permissible limits for effluent discharge into receiving waters (DOE, 2000). Although IWTP meets this requirement, care must be taken regarding the toxicity."

The study by Movahedian and others (2005), the wastewater was obtained from a wastewater treatment plant at Isfahan, Iran.

C. Water Pollution

Water pollution is due to the growing population of the world. There is not enough space for the disposal of certain substances that can destroy the ecosystem. The factories, for example, dump their waste products on the water without thinking of the consequences that it will result. The shipping companies eliminate their waste in the middle of the sea or ocean yet the waves still brought those substances to shore. The industrial and commercial establishments direct their pipes to the bodies of waters without anything filtering the dirt.

Suspended particles are the most frequent pollutants of water. Increasing use of fertilizers and pesticides, farming operations, irrigation and drainage system practices, municipal and agricultural wastes and other factors contributes to a general increase in water pollution (Soil and Water Conservation Engineering, 1993) (Nepomuceno, et al., 1999)

Water pollution occurs when people put so much waste into a water system that its natural cleansing process cannot function properly. Since all creatures need clean water to live, water pollution is a serious problem and concern (World Book Multimedia Encyclopedia, 1996; Flores, et al, 1999)

Water pollution is a large problem of the industrial life style. It is found all around the world. The majority of the world does not have safe clean drinking water. Scientist believes that the availability of fresh water is one of the largest problems in the world. Bad water is spreading disease all over Africa, Asia, and Latin America. Some examples of water born diseases are dysentery, yellow fever, cholera, and malaria. More than a million people in developing countries are affected by polluted water. Unsanitary water is the cause of 3/4 of the world's diseases.(http://www.selah.k12.wa.us/SOAR/SciProj2003/RachelF.html, 2003)

Wastewater treatment is a relatively recent practice. Prior to the mid 1800's human and other wastes usually were just dumped or conveyed to the nearest body of water without treatment. As a result, groundwater and other sources for drinking and bathing were regularly contaminated with sewage. Epidemics of cholera, typhoid, dysentery, and other waterborne diseases killed thousands, and outbreaks were especially devastating in densely populated areas.

C.1 Water Pollutants

Pollutants in water include a wide spectrum of chemicals, pathogens, and physical chemistry or sensory changes. Many of the chemical substances are toxic. Pathogens can produce waterborne diseases in either human or animal hosts. Alteration of water's physical chemistry includes acidity, electrical conductivity, temperature, and eutrophication. Eutrophication is the fertilisation of surface water by nutrients that were previously scarce. Even many of the municipal water supplies in developed countries can present health risks. Water pollution is a major problem in the global context. It has been suggested that it is the leading worldwide cause of deaths and diseases, and that it accounts for the deaths of more than 14,000 people daily (Wikipedia 2007).

Most water pollutants are eventually carried by the rivers into the oceans. In some areas of the world the influence can be traced hundred miles from the mouth by studies using hydrology transport models. Each successive step up the food chain causes a stepwise concentration of pollutants such as heavy metals (e.g. mercury) and persistent organic pollutants such as DDT. This is known as biomagnification which is occasionally used interchangeably with bioaccumulation. (Wikipedia 2007)

Many chemicals undergo reactive decay or chemically change especially over long periods of time in groundwater reservoirs. A noteworthy class of such chemicals are the chlorinated hydrocarbons such as trichloroethylene (used in industrial metal degreasing and electronics manufacturing) and tetrachloroethylene used in the dry cleaning industry (note latest advances in liquid carbon dioxide in dry cleaning that avoids all use of chemicals). Both of these chemicals, which are carcinogens themselves, undergo partial decomposition reactions, leading to new hazardous chemicals (including dichloroethylene and vinyl chloride). (Wikipedia 2007)

D. Water Quality

Water quality is that of a simple property that tells whether water is polluted or not. In fact, water quality is a very complex subject, in part because water is a complex medium intrinsically tied to the ecology of the Earth. Industrial pollution is a major cause of water pollution, as well as runoff from agricultural areas, urban stormwater runoff and discharge of untreated sewage (especially in developing countries). (Wikipedia, 2007)

The suitability of water for aquatic and for human use depends on its quality. Water quality is determined by the concentration of biological, chemical, and physical contaminants-

the amounts and kinds of suspended and dissolved substances, the degree of acidity or alkalinity (water pH), temperature, color and transparency, taste and odor and the presence of undesirable organisms. (Grollier Encyclopedia, 1991; Nepomuceno, et al., 1999)

Because of this, standards have been made for drinking water. These standards strive to prevent health problems by defining the quality of water available for human use or consumption. (Schwab, et al, 1993; Chin, et al, 1999)

In a review of the methods for acute and chronic toxicity assessment of single substances, effluents and industrial waters conducted by Milda Zita Vosylienë: water quality determination of the inhibition of the mobility of Daphnia magna Straus (Cladocera, Crustacea). "The standard describes the method for the determination of the acute toxicity to Daphnia magna of a) chemical substances which are soluble under the conditions of the test, or can be maintained as a stable suspension or dispersion under the conditions of the test; b) industrial or sewage effluents, treated or untreated, after decantation, filtration or centrifugation if necessary; c) surface or ground waters. Principle: determination of the initial concentration, which, in 24 h, immobilizes 50% of the exposed Daphnia magna individuals, under the conditions defined in the Standard. This concentration, which is the initial effective inhibitory concentration, is designated as 24 h – EC50i. If possible and if necessary, the initial concentration, which immobilizes 50% of the exposed D. magna individuals in 48 h, can be determined. The estimation of the 24 h – EC50i is performed using appropriate statistical methods. Precision of the method was evaluated by an inter-laboratory test."

Guidelines for Surface Water Quality (Inland and Marine)

All surface waters of the country shall be free from:

1) Domestic, industrial, agricultural, or other man-induced non-thermal components of discharges, alone or in combination with other substances or in combination with other components of discharges (whether thermal or non-thermal), which:

a) Settle to form putrescent deposits or otherwise create a nuisance

b) Float as debris, scum, oil, or other matter in such amounts as to form nuisance

c) Produce color, odor, taste, turbidity, or other conditions in such degree as to create a nuisance

d) Are acutely toxic

e) Are present in concentrations which are carcinogenic, mutagenic, or teratogenic to human beings or to significant, locally occurring wildlife or aquatic species 3

f) Pose a serious danger to the public health, safety, or welfare

2) Thermal components of discharges, alone or in combination with other discharges or components of discharges (whether thermal or non-thermal),which:

a) Produce conditions so as to create nuisance

b) Increase the temperature of the receiving water body to cause substantial damage or harm to the aquatic life or vegetation therein, or interfere with the designated beneficial uses.

(*Source: Water Quality Guidelines and General Effluent Standards of 2008*)

E. pH level

The acidity or alkalinity of wastewater affects both treatment and the environment. Low pH indicates increasing acidity, while a high pH indicates increasing alkalinity (a pH of 7 is neutral). The pH of wastewater needs to remain between 6 and 9 to protect organisms. Acids and

other substances that alter pH can inactivate treatment processes when they enter wastewater from industrial or commercial sources.

(http://cobweb.ecn.purdue.edu/~epados/septics/wwater.htm)

As the pH level of the water decreases, the water becomes more acidic which is lethal to aquatic organisms.

F. Temperature

Temperature is the degree or intensity of sensible heat of a body or of the atmosphere. It is a significant qualitative factor because it influences the metabolic rate of the aquatic organisms and the rate of chemical reactions in the body of water. (Nepomuceno, et al, 1999)

The best temperatures for wastewater treatment probably range from 77 to 95 degrees Fahrenheit. In general, biological treatment activity accelerates in warm temperatures and slows in cool temperatures, but extreme hot or cold can stop treatment processes altogether. Therefore, some systems are less effective during cold weather and some may not be appropriate for very cold climates. (http://cobweb.ecn.purdue.edu/~epados/septics/wwater.htm)

Wastewater temperature also affects receiving waters. Hot water, for example, which is a byproduct of many manufacturing processes, can be a pollutant. When discharged in large quantities, it can raise the temperature of receiving streams locally and disrupt the natural balance of aquatic life. (http://cobweb.ecn.purdue.edu/~epados/septics/wwater.htm)

G. Dissolved Oxygen

The Dissolved Oxygen test measures the current oxygen levels in the water. The DO level varies with temperature. DO levels are highest in the afternoon due to photosynthesis and lowest just before dawn. DO is lowered by an increase in temperature (as from a discharge of hot

water form a power station), increases in aerobic oxidation (due to increases in organic matter from sewage or due to inorganic fertilizers such as phosphates and nitrate with overstimulate algal growth). Water with DO<1ppm is dead.

H. Water Testing

Water testing is the continuous sampling of various liquid streams and the analysis of their quality. These liquid streams include watercourses such as rivers and lakes, groundwater, recirculated cooling streams, boiler feed water or condensate, and process effluents. (http://www.coleparmer.com/techinfo/techinfo.asp?htmlfile=WaterTesting.htm&id=818)

CHAPTER III

METHODOLOGY

The experiment was conducted at Bagsit's Residence, Landheights 3, Phase 2, Buntatala, Jaro, Iloilo City.

A. Materials and Equipments Used

For culturing the *Daphnia magna*:

- Dipper
- Five hundred micrometer sieve for catching the daphnia
- Two 10- gallon containers or four 5-gallon containers
- Aerator
- Plankton net (to cover the top portion of the container)
- 0.30 grams of baker's yeast (good for 10 feeding sessions)
- 0.15 grams of spirulina powder (good for 10 feeding sessions)
- 10x Magnifying glass

Water Collection

- Eighteen amber bottles
- Dipper
- Thermometer
- DO meter
- pH meter

Water Testing

- Eighteen 12" diameter basins
- Eighteen 16"x16" plankton net
- Water Samples Collected from the rivers mentioned above

B. Research Design

Water samples were collected from upstream and downstream of the Jalaud River, Bga. Bante, Iloilo. Three trials were done on each location. On each trial, three samples was acquired. After the collection, the samples were brought to Bagsit's Residence. The samples were poured into a 12-inch diameter basin. Forty daphnia were added to the water sample. The

C. Culture of *Daphnia magna*

C. I. Collection of Water Sample Containing *Daphnia magna*

Using a dipper, collect the water sample slowly and make sure not to include other substances that can endanger the population of the Daphnia being collected. Using the magnifying glass, carefully observe whether there is presence of Daphnia in it or not. Daphnia looks like a small transparent shrimp swimming in the water.

C.II. Preparing the Actual Culture Set-up

The culture was placed in a 5-gallon (19-liter) container. An aerator was placed to sustain enough oxygen for the Daphnia. The container must be cleaned with soap and distilled water. The container was filled with fresh rainwater. Once the container is filled, put the aerator to start eliminating the unnecessary minerals needed for the culture of *Daphnia magna*.

D. Water Sampling

D.I. Location of Water Sampling

The river that was evaluated was Jalaud River in Bangga Bante, Iloilo. The samples were collected at around three thirty in the afternoon. The first location was near the shore and the other was 100 meters from the first location. In each location, three trials were conducted. In a trial, three samples were collected.

D. II. Container Specifications

The container used in collecting the samples will be a 500-mL amber bottle. This will be used so that exposure to sunlight may not greatly affect the composition of the sample. Before collecting the samples, the bottles was washed using the water on the sampling site. The bottles was also labeled.

D. III. Measuring of pH level

To determine pH level of the water sample, the pH meter was dipped into the water sample from each sampling area. The pH meter displayed a pH value. Each pH level measured will be recorded. The determination of the pH level was done three times for accuracy.

D. IV. Determination of Water Temperature

The laboratory thermometer was used to measure the water temperature of each water sample. The thermometer was washed using distilled water. Make sure that the liquid mercury is in place before it is dipped into the water sample of each sampling area. To assure accuracy, the temperature was taken three times and then be recorded.

D. V. Determination of Dissolved Oxygen

A digital DO meter was used to determine the dissolved oxygen of the water samples. The probe of the meter was washed with distilled water to be neutralized. The probe was immersed in the water samples of each sampling area three times. The readings was recorded. (Flores, et al. 1999)

E. Water Testing

E.I. Preparation of the Test Organisms

Using a dropper, forty *Daphnia magna* was placed on each basin. Five hundred milliliters of water sample was poured into a basin with *Daphnia magna* on it.

E.II. Preparation of the Water Samples

The basins were labelled with the sample number and location collected from (e.g. sample 1, upstream). Pour the water sample into the basin with forty *Daphnia magna.*

E.III. The Set-up

The set-up was isolated and will not be placed to direct sunlight. The results was recorded right after the water sample is poured on the basin with *Daphnia magna*. The changes such as-- mobility and percent mortality of the organism will be recorded every 6 hours in 24 hours upon addition of *Daphnia magna* on the water sample. The remaining *Daphnia magna* alive on each sample was counted using a dropper. Compare the original number of Daphnia to the remaining ones on each sample. The immobility of the Daphnia magna will indicate that they are already weakening and eventually they will die.

CHAPTER IV

RESULTS AND DISCUSSION

A. Results

This study was conducted to have an update on the current status of Jalaud River in Bga. Bante, Iloilo. It also informed the residents that the river is still safe for conducting recreational activities like swimming and fishing.

The main objective of the study was to compare the percent mortality of *Daphnia magna* when exposed to river water collected from the said river. The percent mortality of the test organism was also affected by the parameters measured--- pH values, amount of Dissolved Oxygen and temperature.

There were eighteen samples tested in the study. It was then divided into two locations: upstream and down stream. On each sample, the pH level, temperature and amount of Dissolved Oxygen were measured on-site. Upon collection, the samples were brought to Bagsit's Residence and were set aside. Forty *Daphnia magna* were added to the water sample that was poured into a basin.

Table 1. Mean values of Upstream and Downstream components

	Upstream	Downstream
pH	7.0944	7.2033
Temperature	31.289°C	31.144°C
Dissolved Oxygen	1.3044 ppm	1.3578 ppm
Percent mortality of *Daphnia magna*	32.5%	31.67%

Table 2. The table of significance of the data obtained

	t-value	Significance	Interpretation
pH value	-6.434	8.2607×10^{-6}	significant
Temperature	0.45579	0.65467	Not significant
Dissolved Oxygen	-1.8541	0.082259	Not significant
Percent mortality of *Daphnia magna*	0.39223	0.70006	Not significant

B. Discussion

Our bodies of water nowadays are becoming more toxic than the usual. Garbage can be seen everywhere near the bodies of water. This problem is due to lack of enough space

Daphnia magna, known for its simplicity in handling, short doubling time and high sensitivity to heavy metals, is widely used as a bio-toxicity indicator. It was used as the test organism simply because of its features abovementioned.

The mean pH of the downstream is higher than the upstream. There is also a greater variance among the samples collected from the downstream than the upstream. This simply indicates that the pH of samples collected from the upstream are more consistent and stable compared to that of the downstream.

The mean temperature of the two locations showed that the upstream is more humid than the downstream. Yet, the table of significance showed that the data obtained is not significant.

The mean amount of Dissolved Oxygen in the upstream is lower than the downstream. This simply indicates that the downstream location gives a more favorable

environment for living things. This simply shows that organisms can adjust faster on higher amounts of Dissolved Oxygen.

Summing all up, the percent mortality of the *Daphnia magna* more likely depends on the parameters measured. It can tolerate pH levels more or less than 7 but not more than 8.5. It can adapt to an environment with more oxygen present. And can survive at temperature closer to those of human temperature.

CHAPTER V

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This study mainly aimed to compare the percent mortality of *Daphnia magna* when exposed to water samples collected from upstream and downstream locations of Jalaud River, Bga. Bante.

Specifically, it aimed to:

- Determine water temperature, pH levels and amount of Dissolved Oxygen in water samples collected from Jalaud River.
- Compare the level of toxicity on two locations of Jalaud River based on the percent mortality of *Daphnia magna.*

A. Summary

As a whole, the percent mortality of *Daphnia magna* indicates the water quality of the river. The river is still safe for recreational activities. The parameters measured gave an apparent evidence that the river water is still conducive for usual past-time activities done by the residents dwelling there. Also that the river still have the capability to sustain life process used by living things.

B. Conclusion

The objectives of the study were achieved. The percent mortality of the *Daphnia magna* showed that the water quality of the river water collected is still safe for human activities.

C. Recommendations

It is recommended to have more bodies of water to be evaluated. In this way, more comparison could be done. Other parameters (total suspended solids; nitrate, phosphate content, etc.) may be included to make more precise measurements and analysis of water quality.

Moreover, determining the amount of heavy metals present in the water samples will also make a more concrete assessment of the body of the water to be evaluated. This will make a clearer view of how polluted the body of water is.

As for the test organism, *Daphnia magna*, it is ideal that the number of organisms will be increased so that there will be greater percent mortality from the initial population to the final population.

It is also recommended that the test organism will be bred for a longer period of time so that it will be immune to the environment it dwell in.

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APPENDICES

Appendix A

RAW DATA

Table 3. Parameters measured that may have caused the mortality of *Daphnia magna* from upstream and downstream

UPSTREAM			
	pH values	**DO content (ppm)**	**temperature (°C)**
sample 1	7.09	1.31	30.9
sample 2	7.08	1.29	31.8
sample 3	7.06	1.28	32.5
sample 4	7.06	1.36	30.5
sample 5	7.07	1.35	31.4
sample 6	7.09	1.32	30.9
sample 7	7.11	1.28	31.5
sample 8	7.17	1.30	30.7
sample 9	7.12	1.25	31.4
mean	7.094444444	1.304444444	31.28888889
S.D	0.03503966	0.03503966	0.619363473

DOWNSTREAM			
	pH values	**DO content (ppm)**	**temperature (°C)**
sample 10	7.19	1.31	31.9
sample 11	7.16	1.22	31.6
sample 12	7.14	1.26	30.3
sample 13	7.26	1.37	31.8
sample 14	7.23	1.42	31.7
sample 15	7.21	1.45	31.6
sample 16	7.23	1.43	30.0
sample 17	7.21	1.39	30.8
sample 18	7.20	1.37	30.6
mean	7.203333333	1.357777778	31.14444444
S.D	0.036742346	0.078863454	0.658027355

Number of *Daphnia magna* left alive after 6, 12, 18 and 24 hours

	0 hours	6 hours	12 hours	18 hours	24 hours	% mortality
upstream	40	35	32	31	28	30.00%
	40	36	34	32	29	27.50%
	40	34	32	30	27	32.50%
	40	35	30	28	26	35.00%
	40	34	29	27	23	42.50%
	40	36	34	32	30	25.00%
	40	37	34	32	29	27.50%
	40	34	32	29	26	35.00%
	40	35	31	28	25	37.50%
mean						**32.50%**
downstream	40	37	34	32	29	27.50%
	40	38	35	31	28	30.00%
	40	37	33	30	28	30.00%
	40	37	31	29	26	35.00%
	40	36	32	30	27	32.50%
	40	35	31	28	25	37.50%
	40	36	34	31	28	30.00%
	40	37	33	30	27	32.50%
	40	38	35	32	28	30.00%
mean						**31.67%**

APPENDIX B

PLATES

Plate 1. Location where *Daphnia magna* was collected

Plate 2. Culture set-up for *Daphnia magna*

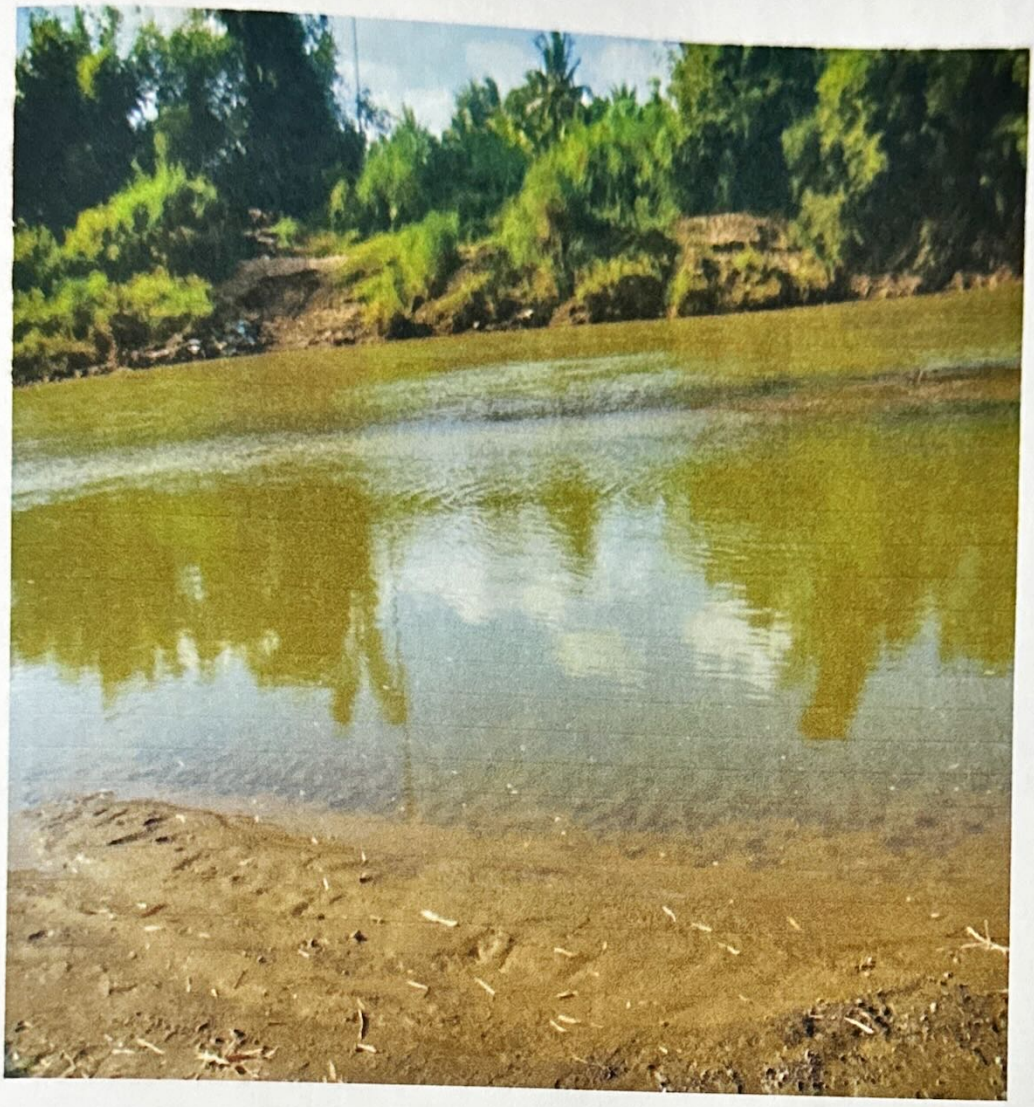

Plate 3. Sampling site (Jalaud River in Bangga Bante, Iloilo)

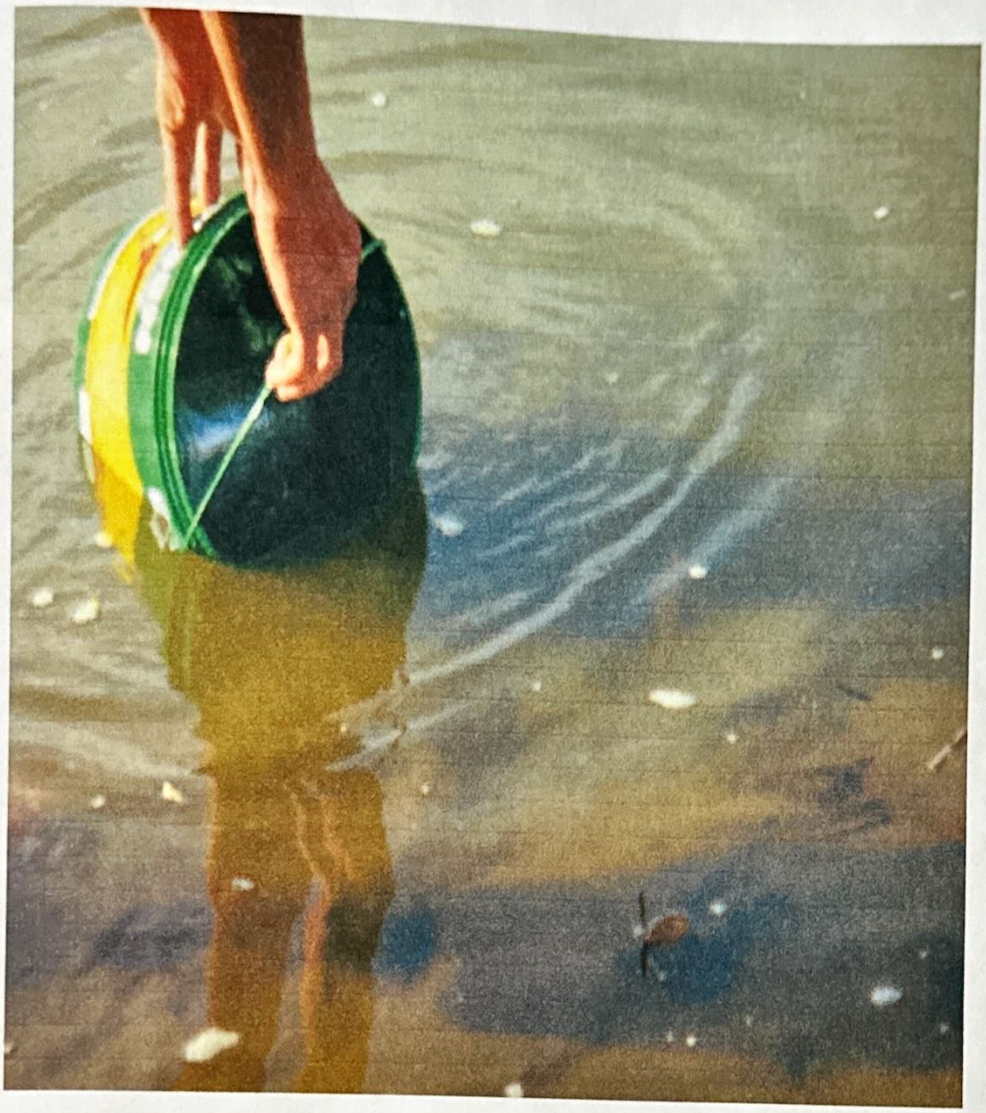

Plate 4. Water collection

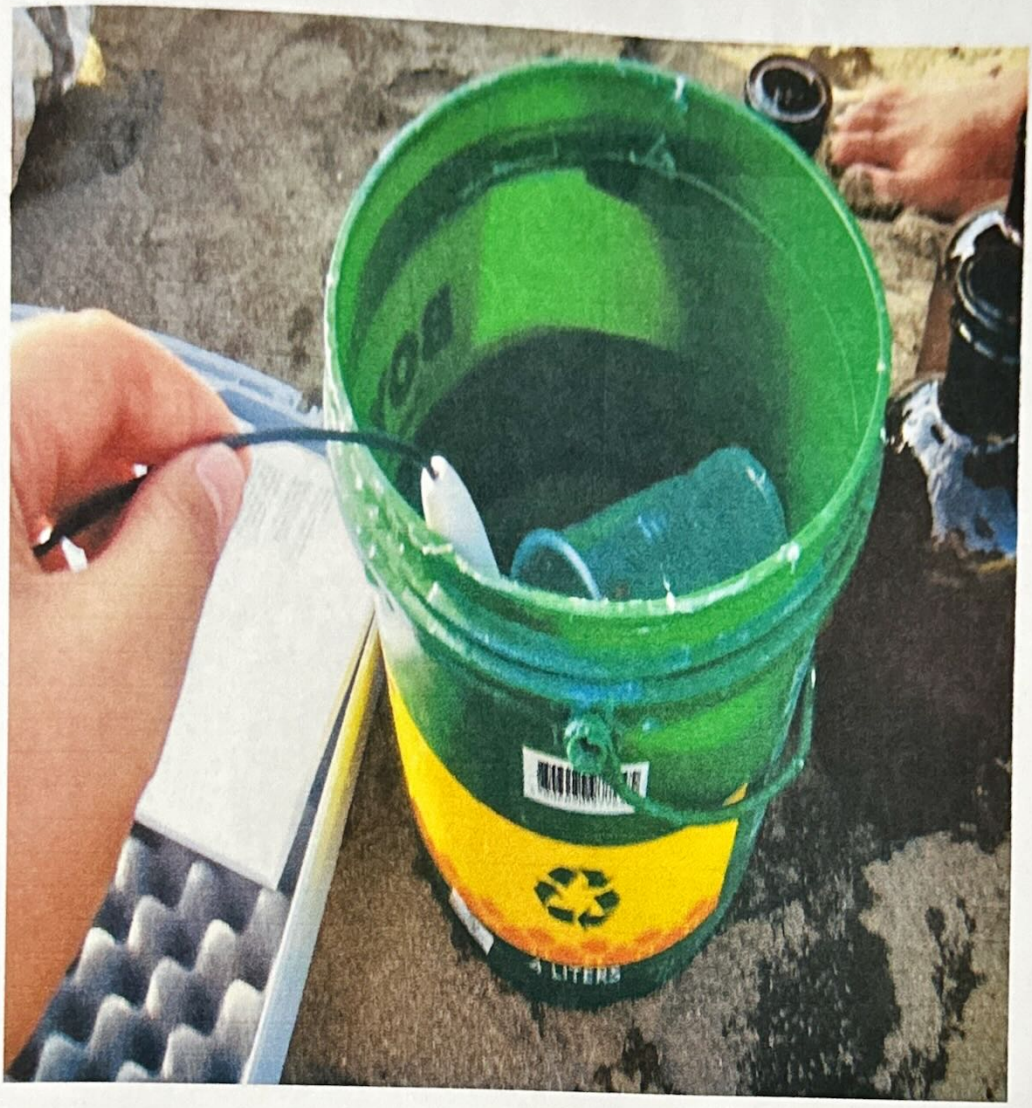

Plate 5. Measuring the pH level of water samples

Plate 6. Measuring the dissolved Oxygen and Temperature of water samples

Plate 7. Upstream water samples

Plate 8. Downstream water samples

Plate 9. Daphnia magna in a basin (the red spots)