1 TABLE OF CONTENTS

DECLARATION

I Nyran Tahija, declare that research paper titled "Evaluation of water and soil suitability of farming freshwater prawns (*Macrobrachium rosenbergii*) in the Inland Baining of East New Britain, of Papua New Guinea" is my own work, conducted under the **Mr. Wallain Ulaiwi**. I affirm that the content of this paper is original and that the information written in this report is true and accurate based on my research study.

Student signature_____ Date _____

Supervisor signature_____Date_____

ACKNOWLEDGEMENT

I would like express my deepest gratitude to my supervisor **Mr. Wallain Ulaiwi**, whose guidance and support were invaluable in helping me complete my research study. Your expertise, encouragement, and feedback have played a crucial role in shaping this project and contribution to its success. Thank you for your dedication and commitment to helping me achieve my goals.

Contributors of the project:

Mr. Wallain Ulaiwi- Lecture for fisheries management (supervisor)

Essau Palum – Data Collector

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Oscar Suaoto- Data Collector

1 INTRODUCTION

1.1 OVERVIEW OF FRESHWATER PRAWNS

The giant freshwater prawns, (*Macrobrachium rosenbergii*) is distributing from North-west India to Vietnam, Philippines, Papua New Guinea and Northern Australia. It is the biggest freshwater prawns in the world, the male growing size of 320 mm and weighing over 200g Ling SW, (1969). The expert of the food and Agriculture Organization (FAO) as Shao Wenling who discovered that the survival of the giant freshwater prawns (Macrobrachium rosenbergii) larvae was possible in brackish environment. Since the 1980s, freshwater prawn (*Macrobrachium rosenbergii*) farming has been tried in several Pacific Island countries. *Macrobrachium rosenbergii* is the main freshwater prawn species used for commercial aquaculture because of its fast growth, attractive size, meat quality and omnivorous (eating both plants and animals) feeding habits Nandal, S and Pickering, T, (2006).

1.2 BACKGROUND OF THE RESEARCH PROBLEM

Water and soil qualities play significant roles in the farming of giant freshwater prawn. The study evaluated water and soil qualities for giant freshwater prawn farming site suitability by using Dissolved oxygen meter to measure the physical parameters (Temperature, pH, and dissolved oxygen) and two simplest methods to check the clay content using soil ball test and water retention test. Site suitability analysis can assist to identify the best location for prawn production. Farming of freshwater prawn is a great deal of interest in prawn farming, intending producers must carefully investigate the requirements for achieving success. Apart from that, suitable level of water and soil quality parameters are still under investigations as these are the crucial factors for prawn production Hossain MS, Das NG (2010).

Pacific Island countries and territories have a suitable climate for cultures of the giant river prawn (Macrobrachium rosenbergii). Despite this, there is currently only limited production of prawns within the region. Now, increasing demand and record prices for seafood are raising the profile of freshwater prawns as an important aquaculture commodity Timothy P, (2014). Although earlier attempts to farm Macrobrachium rosenbergii in Hawaii, Fresh Polynesia and New Caledonia failed, some farmers are successful farm operating in Fiji Island. Other countries such as the Vanuatu and Papua New Guinea are moving in the same direction. Freshwater prawns (Macrobrachium rosenbergii) is formally classified as M. rosenbergii "eastern strain" and is indigenous to Papua New Guinea. Fresh water prawns have never been commercially farmed in Papua New Guinea Timothy P, (2014).

An existing study conducted by Timothy P, (2014) did research and found out that there are barriers contribute to why freshwater prawns was not farmed in Papua New Guinea. This may be due to (1) lack of scientific knowledge about the breeding and growth characteristics of this prawns, (2) lack of capacity to culture prawns through technically demand of hatchery phase. Nevertheless, we can be able to farm freshwater prawns if we understand the scientific knowledge about breeding and growth characteristics in terms biology, ecology and the physical and chemical parameters that will determine the survival rate of the freshwater prawns. Farming of freshwater prawn is a great deal of interest in prawn farming, intending producers must carefully investigate the requirements for achieving success. Freshwater prawn farming is not for everyone and is certainly not for the "weekend farmer". Like other live animals, prawns require daily attention and a patient approach Nandal, S and Pickering, T, (2006).

1.3 RESEARCH GAP

The research topic mainly focuses on assessment of the environment in terms of assessing the water, and soil whether it is suitable or unsuitable for freshwater prawns farming. In the context of Papua New Guinea, farming of freshwater prawns was established in the many other provinces such as Madang, East New Britain, New Ireland, Daru, and Alotau and more. From articles and journals, I have read, I came to realize the importance of the three processes involved in farming prawns or other inland aquatic fish species. It is very important to have background knowledge of the environment that is suitable for the freshwater prawns you want to farm. The other important thing is to have a clear understanding on how to manage to culture prawns. Finally, the market analysis of the freshwater prawns. Most people tend to think that wherever a place that has water supply available, it is good to construct ponds, without realizing that site selection requires certain criteria to assess the environment in terms of topography, soil, water quality, fertilization, and drainage system.

These criteria combined together to assess the environment in an effective way with precise estimation. Therefore, the research study aims to provide information on the water parameters and soil suitability to the people who are interested to tap into farming of freshwater prawns. The water and soil parameters are the initials stage and very important in determining the site selection of farming. To support this statement on water parameters and soil suitability, according to Zafar M et al (2015) water and soil quality parameters perform vital roles in the site suitability analysis for sustainable prawn production. This is not a new idea; it has already conducted by other countries. Measuring of water parameters specifically using Do meter and soil test method to check the clay content. The approach applied methodology using pacific island context to assess the Inland Bainning whether the site is suitable or unsuitable to farm freshwater prawns. I would acknowledge Nandal, S and Pickering, T, (2006) for the methodology extracted and used in carrying out this project.

1.4 RESEARCH QUESTION

An interview carried out recently showed that most freshwater prawns are used for food consumption, and not for marketing nor farming. This opportunity captured my interest in asking these questions in relation to farming of freshwater prawns.

1) Is the inland Bainning has the potential to farm freshwater prawns?
2) What are the water and land suitability requirement of site selection?

1.5 AIM

The aim of the research topic is to find out whether the Inland Baining site is suitable or unsuitable to farm freshwater prawns (Macrobrachium rosenbergii).

1.6 OBJECTIVE

The main objectives of the study are to answer the research question:

1) To assess the water parameters in terms of measuring water quality for temperature, dissolved oxygen and water pH level.
2) To assess the soil clay content by using two methods
    - Water retention test
    - Soil ball test

1.7 CONTRIBUTION

The study is more like a research development study to investigate and assess the water and soil parameters for prawns farming in the Inland Baining. The contribution of this study will benefit the people of Inland Baining by utilizing the prawns in terms constructing ponds to farming. There are many benefits of farming freshwater prawns in terms marketing thus, it creates employment, earning money to help support them. From my observation, the local Baining people mostly tap into agriculture production such as marketing of vegetables, fruits and etc. A recently surveyed that was carried out few people harvest freshwater prawns for food consumption purposes. In overall, the results of my project were successfully achieved and the scope area of Tavaluai River meets the eligibility criteria ranges unlike Milo and Keravat River. Hopefully pond construction can be established from the areas from Tavaluai and towards Pomio site. This is a bonus information can be well distributed to the farmers and interested people who are into aquaculture, I would suggest using traditional way of farming freshwater prawns. I would not encourage technology farming since many research discourage using sophisticated technology thus it has negative impact on the environment.

1.8 OUTLINE AND LIMITATION

During the data collection there are limitation of tools in terms measuring instrument for the minerals and ions present in water. Therefore, only few water parameters such dissolved oxygen, temperatures, and pH level was taken using portable dissolved oxygen meter. Addition, due to time frame of the research, cost, and tools, the scope of the study area is within small area. To expand the study scope and collect much information required to produce accurate and effective results, the limitation of tools to measure chemical, minerals, GIS mapping, and r- programming software for data analysis. These are very important factors that will contribute to the achievement of the desire outcome of the research in a bigger scope. The reason why all these matters to this research because this topic chosen is only done by the aqua-culturist expert. For my case, the study is within a small scope area. Therefore, portable dissolved oxygen meter is appropriate and method is used in assessing soil is best suit the scope.

2 LITERATURE REVIEW

There are good number of studies done on my research topic based on water and soil parameters of *(Macrobrachium rosenbergii)*. They provided insightful information on site selection and different approach developed to assess the site suitability in relation to my research topic. The information is given on the literature review, I only selected few papers that will be a guide through my research. The information will be extracted from Nandal, S and Pickering, T, (2006), FAO, (1994), and Hossain MS, Das NG. (2010) as a guide to my research. There are similarities of methods used in assessing the water and soil will be under-review and why it is selected as my research guide. The outline of the literature review will be focusing on the two objectives with the given details of what have been done by other researchers. Respectively with the water and soil (site suitability) requirement.

2.1 Site suitability requirement

2.1.1 Soil suitability

Site suitability analysis can assist to identify the best location for prawn production, also soil qualities investigated were land use, slope, pH, texture, organic carbon and organic matter. The major challenges in identifying a suitable site for prawns farming are the absence of baseline knowledge on the physicochemical and the nature of the relief requirements besides current land use pattern. Inappropriate land use for prawn farming without considering the several important factors can lead to environmental pollution, ecological imbalance, increase salinity, land degradation, destruction of the forest, sedimentation and outbreaks of diseases, breeding poverty as well as any other social conflicts Zafar M et al. (2015) and Hossain et al (2010).

Soils for pond construction should be composed of clay, silt and some fine sand. The physical strength, permeability, plasticity and physico-chemical interactions of the soil need to be considered in making decisions on overall site suitability and the most appropriate method of pond construction. It is recommended that soils contain at least 20–50% clay to prevent excessive seepage of water from the pond. If the soil is too sandy, the pond banks will erode easily and water will seep through the pond sides and bottom Nandal, S and Pickering, T, (2006). Site suitability in terms of water level, and soil quality parameters are still are investigation according Zafar M et al. (2015).

A similar study conducted by FAO (1994) The quality of soil influences both productivity and water quality in a pond. However, it must also be suitable for dike construction. To determine soil suitability the two most important properties to examine are *soil texture* (particle size composition) and porosity or permeability (ability to let water pass through). The pond bottom must be able to hold water (have a low porosity like clay) and the soil should also contribute to the fertility of the water by providing nutrients (soil texture consists of a lot of clay particles) so the best soil for pond construction contains a lot of clay. There three ways can be used to predict whether they will be suitable for pond construction, and they are squeeze method, ground water test, and water permeability test. Addition to that, a study conducted by Nandal, S and Pickering, T, (2006) also mention the similar methods used in assessing the soil suitability using three methods. And they are water retention test, soil ball test, and soil ribbon test. In overall the two reviews, have same method used in assessing soil site suitability using simplest, and affordable cost involved.

However, in bigger perspective involving large area or scope to cover, than multiple criteria in terms of advance method and tools are utilize in investigating the soil and water parameters. A study conducted by Rosazlin A (2017). The study was to assess the water and soil quality requirements for prawn production, the technique used to assess the land suitability by using GIS combined with the Analytic Heracrcy Process (AHIP) and Weighted Linear Combination (WLC) to improve the results of the site suitability analysis. The incorporation of GIS techniques with multi criteria decision analysis (MCDA) is an effective procedure for analyzing land suitability and Weighted Linear Combination (WLC) to improve the results of the site suitability analysis. The incorporation of GIS techniques with multi criteria decision analysis (MCDA) is an effective procedure for analyzing land suitability Turgut B et al (2013) and Malczewski J, Rinner C (2015).

Additionally, other researchers have applied land suitability analysis in different field such as identification of appropriate site of prawns farming Hossain et al (2010), allocation of land for agriculture Turgut B et al (2013). For my case study since I don't have equipment, small area to cover, and time frame therefore, I will assess the site by looking at appropriate site of prawn in terms of type of soil present, allocation of land for agriculture and selecting appropriate sites for the land use planning using FAO (1994) and Nandal, S and Pickering, T, (2006) methods.

2.1.2 Water suitability

The water quality parameters measure was bio-chemical oxygen demand, chemical oxygen demand, ammonia nitrogen, pH, dissolved oxygen, water temperature, total suspended solids, nitrite concentration and phosphate concentration. These are the physical parameters that is necessarily essential when measure the water quality. However, with the resources and equipment I have. I can only measure, water temperature, dissolved oxygen, pH, salinity, and turbidity of the water to determine its quality.

2.1.2.1 Temperature

Water temperature is one of the important parameters in the hatchery and the grow out phase of the Macrobrachium rosenbergii (W. rosenbergii). It determines, to a large degree, the amount of dissolved oxygen in water and life processes such as feeding, reproduction and locomotion are influenced by temperature. Lower and upper temperature tolerance level in M. Rosenbergii is l6 and 36 degrees respectively and optimum growth occurs at 30 degrees in grow out operation. Additionally, according to a study conducted by Dugan et al (1976)

he has been observing prawns spawning and maintained a constant temperature photoperiod of 27 .50C and I4 hours light respectively. They also found the optimal temperature for larval rearing is 28-300C. Optimal temperature for survival to reduces the growth and increases the susceptibility to the diseases Keda Nath M, (2020).

2.1.2.2 Dissolved oxygen

Dissolved oxygen is one of the most critical water parameters for the hatchery and grow out operation in the freshwater prawn. Heavy organic load, water scarcity and water blooms often deplete dissolved oxygen in the pond particularly observed before sunrise, according to Keda Nath M, (2020). Dissolved oxygen helps both in respiration of prawn as well to maintain favorable chemical and hygienic environment. As freshwater prawns continued to exposed to low dissolve oxygen, as a result will cause negative impacts in terms respiratory system, liver, and kidney.

2.1.2.3 pH

pH of water body influences the acid base condition of the body fluid of the organism. In most natural waters have pH values 6.5 to 9.0 and the acid and alkaline death points for fish and prawn are about pH 4.0 and I 1.0 respectively. However, if water is more acidic than pH 6.5 or more alkaline than 9.0 to 9.5 for long periods, reproduction and growth will diminish. *M. rosenbergii* larvae require saline water for development and they are usually reared at salinity in the range of 8.0 to 17%, Although salinity as low as 6.O% have been used for some stages. The optimum salinity for the growth of adult is 0.0 to 5.0%.

3 METHODOLOGY

3.1 STUDY SITE

Papua New Guinea has hot, humid tropical climate which is experienced all, year around. The country experience two distinctive seasons wet and dry. Due to climate change the weather patterns are unpredictable in most times, but according to *World bank* the wettest month tend to be from (December – March) and dry (June and September) of the year. The study was conducted in the Gazelle district, along the Bainning areas situated in the Nort part of East New Britain province. The Gazelle district is divided into various local level government (LLG) and inland Bainning is the Centre location of the study site. The Inland Bainning is rich with forest, and wildlife biodiversity. Due to the varieties of forest diversity, agriculture activities, human disturbance, logging companies is now operating and cutting down trees and natural factors. It is likely that the human impact has on the environment in terms of soil and water quality will be degraded as times goes on. Therefore, the target scope of the study is along the three main rivers within the Inland Bainning. The first site to the third site respectively from Tavaluai river, Milo River, and Keravat river. The samples were taken for three (3) weeks from the end of July to first week of September 2023 including the dry and wet season.

Figure 1. *Map of Gazelle district, Inland Baining Rural (LLG) showing the location site of the research study using GIS mapping software. The scope areas of the study will be based around the red circle indicated on the google map. The three study sites are located within the Inland Baining and they are Tavaluai river, Milo River (Vudal river), and Keravat river.*

3.2 DATA COLLECTION

The (5) samples were located in each of the three main river system that has freshwater prawns are found. Each sampling site must be closest to the access road and the river system. From the previous studies student have found out that the allocated rivers do have prawns from Tavaluai River, Milo River, and Keravat River. From each sampling site was determine by assessing the water quality from a distance of 1 km using a Dissolved oxygen meter within an interval of 250m, can be referred to figure 1. The soil test was conducted perpendicular to the river of 5m. The sampling site were chosen accordingly to the availability of prawns in the river system to test the water quality whether is it suitable or unsuitable for the prawns to survive. The soil test is to prove whether it is suitable or unsuitable by conducting two methods express by Nandal, S and Pickering, T, (2006). The first and second method respectively used is water retention test and soil ball test. The standard criteria of site suitability were extracted from the literature review as a guide to my project. I specifically selected one literature review which is on Nandal, S and Pickering, T, (2006) as my guide because the methodology is appropriate to my study environment and the availability of tools. According to New and Valenti (2000) did a summary of the ideal range of values for various water quality factors that are used as my reference and guide against my data.

3.2.1 Water quality test procedure and analysis

The procedure of assessing the water quality based on 4 parameters, includes the temperature, dissolved oxygen, pH, and water transparency. Based on the water requirement several water quality parameters that are directly involved with giant freshwater prawn (Macrobrachium rosenbergii) metabolism were also introduced such as temperature, nitrite and phosphate concentration. A Dissolved oxygen meter was used to measure the water parameters. The electrode was directly placed into the water to take the measurement at the depth approximately 5 cm on the water surface. As I was taking the reading of the physical parameters, the boys were recording the data onto a note book. The reading was taken on temperature (°C) and dissolved oxygen (mg/L). With the pH, samples of five (5) clear containers were filled with water and tested out in the science laboratory. The water transparency or water turbidity is a simpler method of making this measurement is to put your arm down to the elbow in the water. If you can see the tips of your fingers, the water is too clear. If you cannot see your palm, then the phytoplankton density is too high. Moreover, the data was collected within the interval of 250 m of a total length of 1000m of the river system. Water samples were collected using a horizontal water sampler from three location. When I was collecting data from the river system in comparison to people living along the side of the river bank and areas where no one lives along the river bank. The data taken indicate water quality drops with high DO recorded and the water is too murky or green with phytoplankton, referred to the river's banks were is over populated with people living due to access of water in terms of disturbance, land usages, unlike rivers no one is living besides. This is a difference I have noticed when collecting the data. Therefore, the data was collected on the areas were not disturbed by human activities to see if water quality can still be maintained.

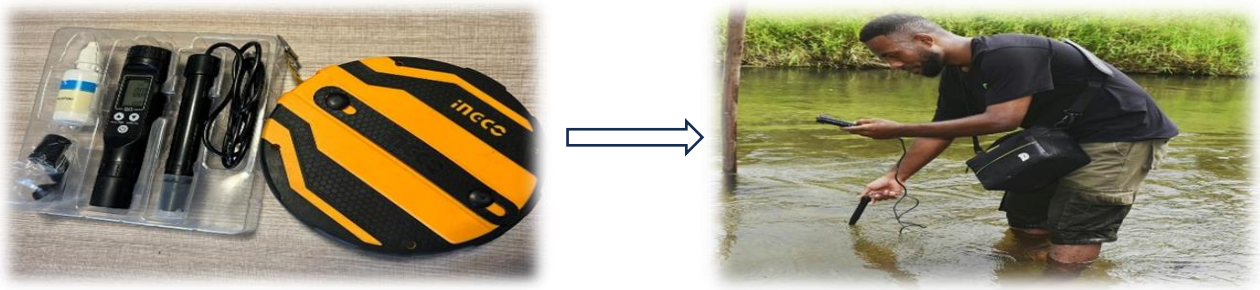

Figure 2, *Shows the instrument (Dissolved oxygen meter and tape measure) DO was used to measure the water parameters. Also, the tape measure was used to measure the distance of the river and the intervals of 250 m for each data collection. From previous studies, the rivers were exposed to human activities and disturbed so therefore, the data collected purposely to know the status of water quality of survival of the freshwater prawns.*

3.2.2 Soil test procedure and analysis

Soils for pond construction should be composed of clay, silt and some fine sand. The physical strength, permeability, plasticity and physico-chemical interactions of the soil need to be considered in making decisions on overall site suitability and the most appropriate method of pond construction. It is recommended that soils contain at least 20–50% clay to prevent excessive seepage of water from the pond. If the soil is too sandy, the pond banks will erode easily and water will seep through the pond sides and bottom Nandal, S and Pickering, T, (2006). Therefore, there are two simple tests, can be used to check whether the soil has enough clay content is by using (1) water retention test and (2) soil ball test.

My two friends from the villages of Inland Baining assist me for my special project, they helped me dug three pits with the measurement of 1 m depth and 30 cm diameter of the pit (holes). The three pits were categorized into three sections, the control, the second pit is covered with plastic, and the last pit was compacted with clay without plastic. After we dug the hole, I poured bucket of waters into the pit about 30 cm. We waited for 10 minutes for the soil surrounding soil to get thoroughly wet, then I put a ruler into the pit as same water level. After an hour, I went and check the new level mark. And how much the water level has dropped in millimeters. From there with the information, I can be able to worked out the water retention test calculation.

The second test is soil ball test, this test is simple. The soil that has been dug earlier from the pit, I took the soil with my bare hands and form it into a round ball. Slightly bigger than the size of my fist by wetting it slightly. When the ball is carefully shaped into a roundball, I dropped the ball from my head height onto flat ground. If the ball retains its shape, or goes only slightly out of shape, it contains enough clay for pond construction. A ball made from soil that is too sandy will flatten out, crack open, or even shatter on hitting the ground. Alternatively, if the ball remains intact and does not crumble after considerable handling, there is enough clay in the soil. This is the two simple test I did used to check whether the soil has enough clay content.

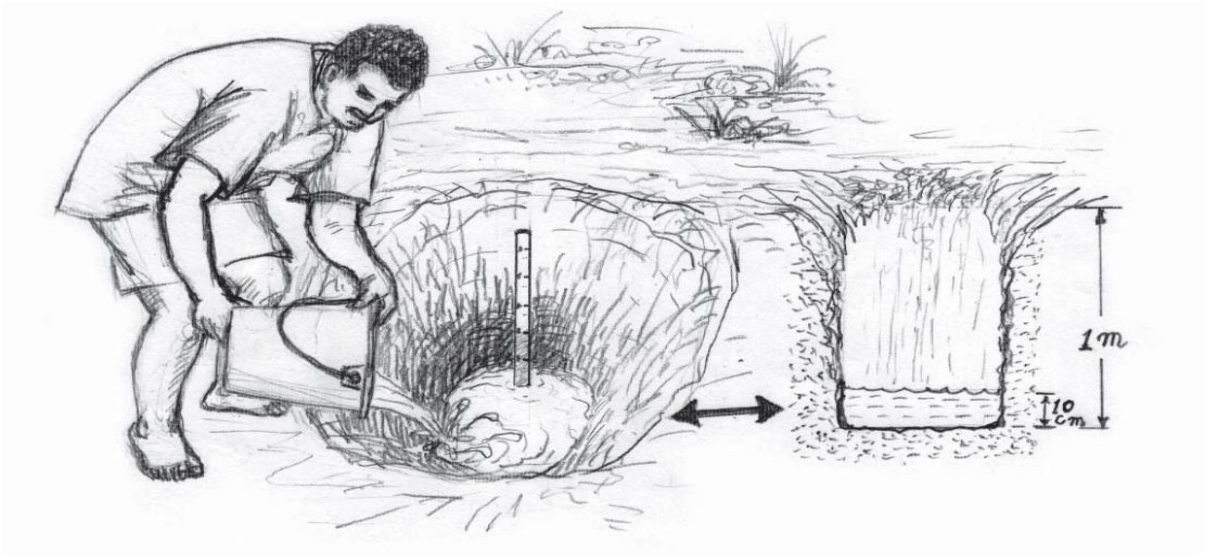

Figure 1, *A simple sketch of the procedure of water retention tests can be used to check whether the soil has enough clay content: the water retention test; source of the information Nandal, S and Pickering, T, (2006)*

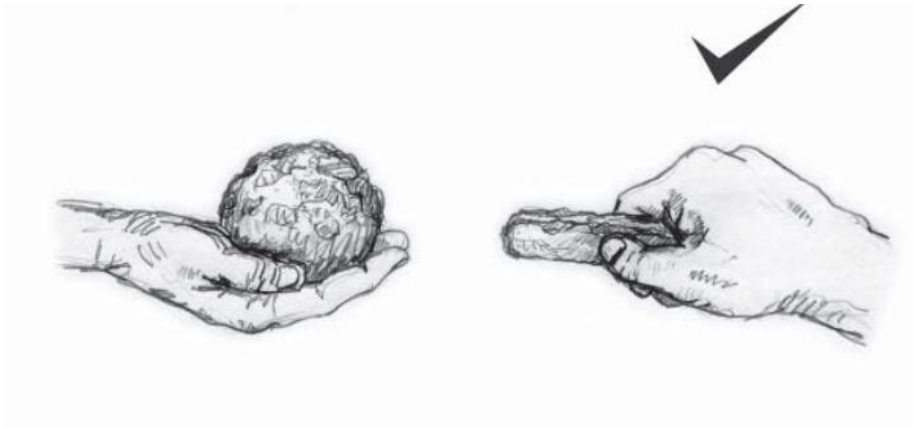

Figure 2, *A simple sketch of the procedure of soil ball tests can be used to check whether the soil has enough clay content: the water retention test; source of the information and pictures Nandal, S and Pickering, T, (2006)*

3.3 DATA ANALYSIS

The data collected for the water parameters measurement of each of the rivers are coded and entered into a database system using Microsoft Excel software to produce descriptive statistics by observing the trend. Furthermore, details are shown on the appendix's sections. The data was analyzed by calculating average rate of each water parameters compared to literature review standard criteria that could help me make an accurate prediction of the inland Bainning whether the water is unsuitable or suitable to farm freshwater prawns or not. For the soil test, the data recorded were sorted out into a table and were analyzed in comparison with my data calculation vs literature review criteria standard range.

4 RESULTS

4.1.1.1 Water and soil quality test.

Table 1*. The table shows the average water quality parameters (my data) vs literatures reviews criteria requirements Source: New and Valenti (2000)*

Parameters	Ranges	Average	Literature Ranges	Literature Average
Dissolved oxygen	4.5-11.34mg/L	**7.04mg/L**	3-7mg/L	**5mg/L**
Temperature	26-33.6°C	**29.64°C**	26-31°C	**28.5°C**
pH	7-8.4	**7.62**	7.2-8.5	**7.85**

***Table 2**, The table indicate the soil test data recorded using two methods vs the literature reviews standard criteria ranges. To be biased on data interpretation will considering other articles ranges by considering climate in the region.*

Soil test method	**My data**	**Literature range** Timothy, P and Satya N, (2006)	**Comment**
1.) Water retention test	1.) Tavaluai (4.94mm/hour) =B 2.) Milo (8.230 mm/hour) =C 3.) Keravat (9 mm/hour) = C	• > 5mm/hour unsuitable • < 5mm/hour suitable	In general, the types of soil present are loamy and clay However, due to rate of seepage is very high, there is not enough clay to hold the water.
2.) Soil ball test	If the ball retains its shape, or goes only slightly out of shape, it contains enough clay for pond construction. 1.) Tavaluai = Moderate 2.) Milo = Not good 3.) Keravat = Not good	A ball made from soil that is too sandy will flatten out, crack open. Which mean there is not enough clay	In general, Tavaluai has good soil (Clay 60%) compared to other two rivers

Key A= Good, B= Moderate, C= Bad

***Table 3**, The table below shows the details calculation of water retention test on each respectively study area and using practical and observation to assess the soil using soil ball test.*

Tavaluai River	***Milo River***	***Keravat River***
Calculation of water retention test The hole is filled with water at 1.30 pm to 2.55 pm (85 minutes later) the level has drop 7 mm. Rate of seepage = 7 minutes/85 min = 0.823mm/min×60 min = **4.9411 mm/hour** (This is less than 5mm/hour, indicating the soil is satisfactory) Soil ball test. **Good (**Refer to the methodology)	**Calculation of water retention test** The hole is filled with water at 10.50 am to 12.00 pm (70 minutes later) the level has drop 10 mm. Rate of seepage = 10 minutes/ 70 min = 0.14285mm/min×60 min = **8.230 mm/hour** (This is more than 5mm/hour, indicating the soil is unsuitable to construct pond to culture freshwater prawns. Soil ball test. **Bad** (Refer to the methodology)	**Calculation of water retention test** The hole is filled with water at 1.00 pm to 2.40 pm (100 minutes later) the level has drop 15 mm. Rate of seepage = 15 minutes/100 min = 0.15mm/min×60 min = 9 mm/hour (this is more than 5mm/hours indicating the soil is unsuitable. Soil ball test: **bad** (Refer to the methodology

4.1.1.2 Table 4. Water quality requirement standard criteria

Water quality requirements for freshwater prawn farming	
Temperature	(°C) 26–31<18 and > 35 22–28
pH (units)	7.0–8.5 >9.5 5.5–8.3
Dissolved oxygen (ppm)	3–7 >2
Salinity (ppt)	<7
Transparency (Secchi reading in cm)	25–40
Source: New and Valenti (2000).	

5 DISCUSSION

5.1.1 The water parameters suitability

When constructing a prawn's farm, it is essential to consider the water and soil parameters. Water and soil quality parameters perform vital roles in the site suitability analysis for sustainable prawn production. In reference to table 1, the data were collected for the water parameters for the three rivers Tavaluai, Milo, and Keravat River respectively. The data collected were calculated in each of the water parameters to find the average, and ranges. The average, and ranges compared with the literature review to know the status of the water quality of the three rivers in the Inland Baining.

The result was supported by the finding conducted by New and Valenti (2000). Water temperature is the most important environmental variables for prawn production because it affects prawn growth, feeding, reproduction, and behavior. As shown on table 1, there are slightly differences of my data ranges and average compared to the literature review with 26-33.6°C to 26-31°C respectively for temperature. According to a journal by (Dr. KN. Mohantha,2020) freshwater prawns are sensitive to fluctuation of the water parameters. A small change in temperature can stress out or kill freshwater prawns. From the data collected, the temperature is out of the range meaning, it's not healthy for the prawns to tolerate the within the range level of temperature. The possible outcome expected to see dead prawns found along the river. I have seen few freshwater prawns were dead and found along the river bank. It simply gives an indication that temperature is the main cause that put stress, as a result of death.

For the ranges assessed for dissolved oxygen recorded was a bit higher than the literature review. The mean of dissolved oxygen for this present study were within the range of 4.5 mg/l to 11.34 mg/l were obtained due to the amount of DO in water is mainly dependent upon the water temperature whereby colder water can carry more dissolved oxygen than warmer water according to Boyd CE (2017). According to Che Osmi et al., (2015). DO is among the most important water quality parameter in assessing the river water quality status and the higher DO values indicates the good aeration condition of a place. Thus, adequate DO is necessary for good water quality in intensive aquaculture systems, Osmi SAC, Ishak WFW, Azman MA, et al. (2018). In overall the dissolved oxygen is in its suitable range. The reason why dissolved oxygen measured was higher because of several reason, from my observation the main reason is the flow of water, the more turbulent the water flow is, the more oxygen the water will contain. Because of this reason there is high concentration of dissolved oxygen in the water. This can be seen as a positive sign, as good level of dissolved oxygen is generally associated with healthier aquatic ecosystem and better water quality. The mean water pH obtained for this present study were within the range of 7 to 8.4. As compared with the results obtained from previous studies, water pH of 7.2 to 8.4 was regarded to be the most suitable for prawn production. Thus, water pH is an

important factor to be measured and monitored for prawn pond because water reactions are based on the pH level Ezekiel BB, Firuza B, Mohammad L, et al. (2018).

The ranges and average are within the suitable range. So therefore, in overall my data collected indicated that temperature is out of ranges compared to dissolved oxygen and pH level which are in a suitable range. This doesn't mean water quality in overall is dropped, they are in good condition however, the water parameters cannot be controlled. They can be influence by climatic factors of the area. Therefore, the climate of the area to help decide whether prawns can be cultured year-round or only during certain times of the year. The interaction between climate and farm site determines the suitability of the site for pond production of *(M. rosenbergii)*. Important climatic factors include that should be taken into consideration are, rainfall, temperature, sunlight, and wind exposure. To be concerned with changes in water parameters can be associate with human disturbance and nature. In order to control the water parameters and chemical. There has to be pond construction develop to be able to control water parameters within a confined areas rather than expose to direct sunlight. All the parameters are somehow inter-related to each other.

5.1.2 Factors contribute in degrading of water quality

From the observation of the three rivers identified within the Inland Baining, there are several factors that contribute to degrade the quality of the water. The factors that contribute to the degradation of water quality are human activities such as chopping down of trees, chemicals enter the freshwater, usages of water as dumping area of waste and climatic factor. All these factors degrade the water quality and adding stress to prawn's species. Studies have proven that polluted water and damage environment will take years to recovers to its normal state.

5.1.3 Biological- indicator of water quality

The bio-indicators that tell you the present status of water in terms of macro-invertebrate or fish diversity, benthic, algae growth and benthic oxygen demand. For this case, freshwater prawns were seen in Tavaluai and Milo River except for Keravat was no prawns seen as I was recording the data. More interestingly prawns that was identified was dead and some spotted was live. It is clear indication that the present status of the water of the two site Tavaluai and Milo is moderate for the survival for prawns. However, through observation of Keravat River algae was found, it is a biological-indicator of water quality. According to studies, algae are small Thallus-like photosynthetic organism. It is freshwater, marine and brackish water living. Excess growth of algae in water indicates polluted water. In relevance to the statement above can be proof to raw data collected shown in the section of appendices.

5.1.4 The soil parameters suitability

In reference to table 2, the table shows the soil test data using the two method (1) water retention test, and (2) soil ball test that was carried out by Nandal, S and Pickering, T, (2006). The soil test was done separately for the three rivers to check the clay content of the soil whether there is enough clay soil to hold water form draining. The table indicate the test results of the data compared to the literature review standard criteria range. The literature review ranges for water retention test, rate of seepage is >5mm/hour is in the suitable range and is less than 5mm/hour which is not within suitable range. The rate of seepage calculated for Tavaluai is 4.94mm/hour which is equal to 5mm/hour. In this case, the soil is satisfactory meaning it contain approximately 55% of the clay to prevent excessive seepage of water from the pond. The second test was soil ball test, the ball retains its shape when dropped from the height. This indicate that the soil contains enough clay. In overall from the two results, soil suitability for Tavaluai is within good condition to construct prawns compared to other two sites.

In further explanation, the water retention test for Milo and Keravat River have the same results for rate of seepage is 8.23mm/hour and 9mm/hour respectively. The rate seepage is more than 5mm/hour, according to the literature range both soils identified within the two rivers are not within the soil suitable range. This is an indication there is less clay available of 30% with loamy soil 40% within the river, to prove that, soil ball test was carried and happen to be, the ball was crack when landed on the grown. According to the to Nandal, S and Pickering, T, (2006). Ball made from soil that is too sandy will flatten out, crack open. As shown in figure 3 on the methodology sections is a pictures of soil ball test. By looking at the ball, mainly the soil is composed of mixture of sand, silt, and smaller amount of clay. In overall, the data collected compared to the literature review, indicate that Milo and Keravat River soil present is not suitable to construct pond.

6 CONCLUSION AND IMPLICATION

The evaluation of water and soil parameters for farming freshwater Macrobrachium rosenbergii in the Inland Baining of East New Britain province provides valuable insights for aquaculture farming. The finding highlights the importance soil test and water quality of maintaining optimal water quality conditions, such as pH, temperature, and oxygen level to support growth and health of freshwater prawns. Additionally, understanding soil characteristics and nutrients levels can aid in enhancing productivity and minimizing environmental impacts.

Based on the evaluation of soil and water parameters in Inland Baining, it is evident water parameters in terms of dissolved oxygen, pH, and temperature are in the site suitable for freshwater prawns. However, the water parameters have the possibility to fluctuate and can put stress on the prawns. Therefore, to be concerned with changes in water parameters can be associate with human disturbance and nature. In order to control the water parameters and chemical. There has to be pond construction develop to be able to control water parameters within a confined area rather than expose to direct sunlight, rainfall, wind, and temperature.

For the soil test, it is evident that the favorable condition site is Tavaluai River unlike two site, Milo and Keravat River. In overall, the results indicate that the area has the potential to support a successful prawn cultivation project. Areas where soil is not suitable, there are alternatives such as using river system as water supply to continue maintain the level of water level when constructing a pond for culture freshwater prawns.

Further studies can carefully plan will be necessary to fully capitalize on the site's suitability and to expand the study scope. I would recommend, in order for the study research to be more effective. There has to be all appropriate tools available to measure all the water parameters including physical, and chemical. For the land suitability (Analytical hierarchy process) AHP method, GIS, and r-programming, and phyton software for data analysis.

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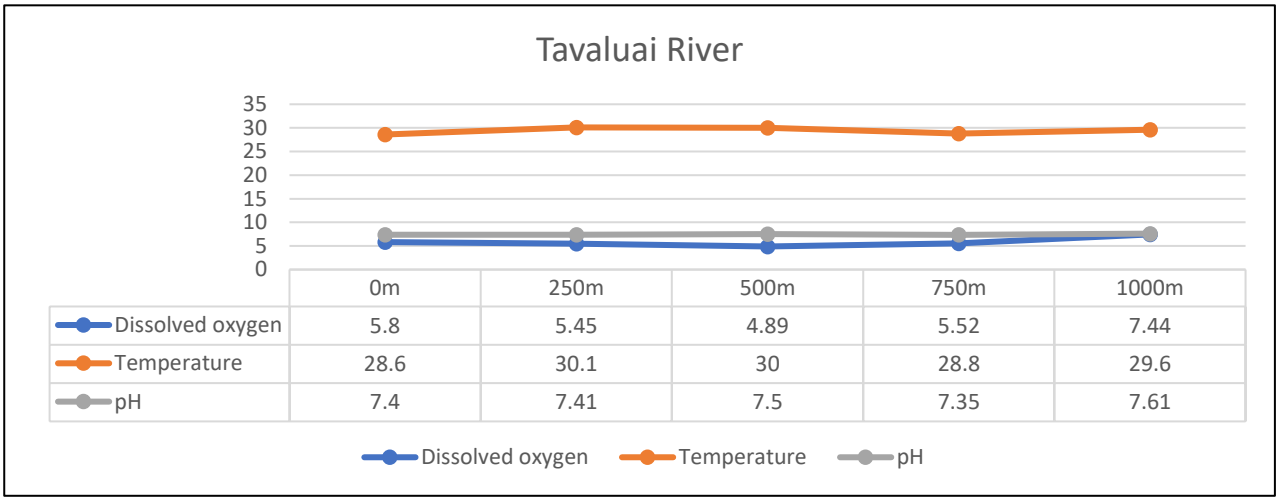
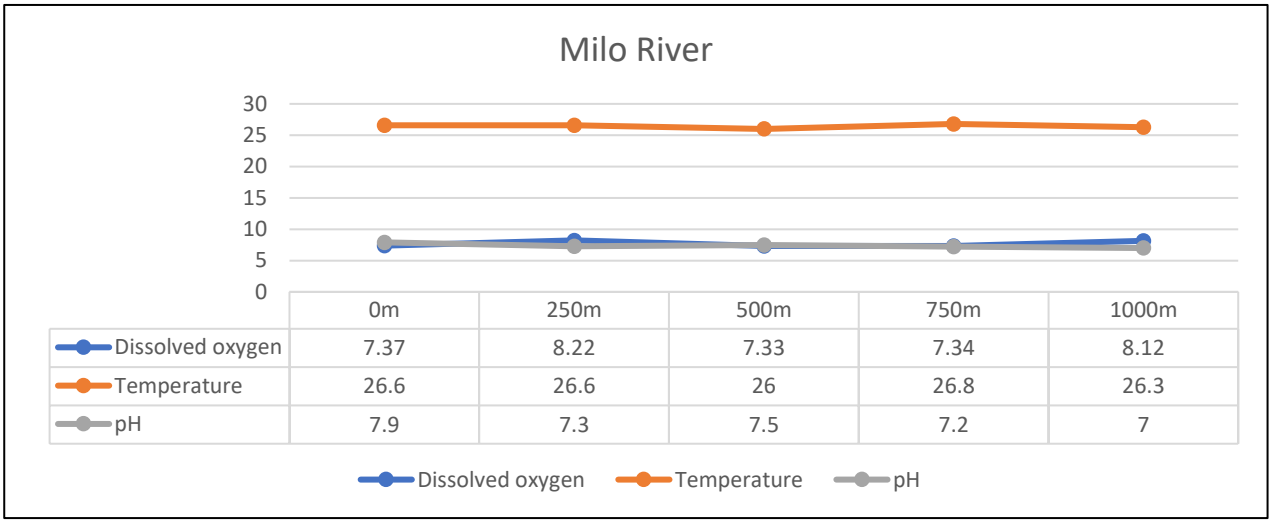
8 APPENDICES

1.) Tables of raw data for the water parameters were sorted out into scatter plot



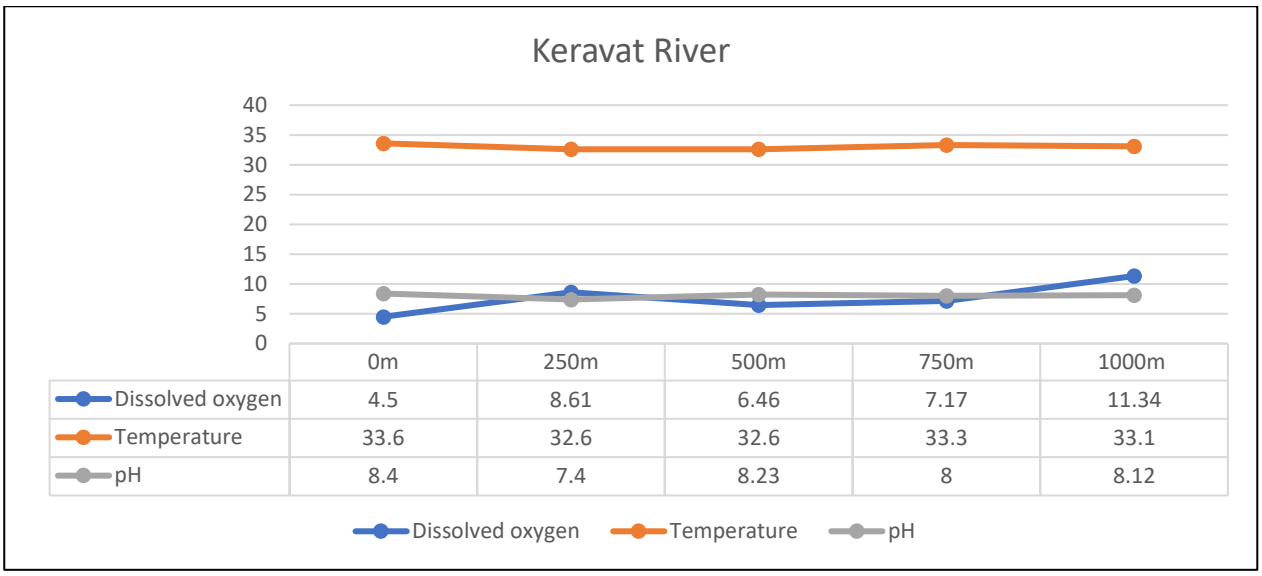
	0m	250m	500m	750m	1000m
Dissolved oxygen	5.8	5.45	4.89	5.52	7.44
Temperature	28.6	30.1	30	28.8	29.6
pH	7.4	7.41	7.5	7.35	7.61

8.1.1 Figure 1. Show the raw data collected and was analyzed for the water parameters at Tavaluai river, in the Inland Baining (28 August 2023 during sunny day)



	0m	250m	500m	750m	1000m
Dissolved oxygen	7.37	8.22	7.33	7.34	8.12
Temperature	26.6	26.6	26	26.8	26.3
pH	7.9	7.3	7.5	7.2	7

8.1.2 Figure 2. Show the raw data collected and was analyzed for the water parameters at Milo River, in the Inland Baining (4 September 2023 during dull day)



	0m	250m	500m	750m	1000m
Dissolved oxygen	4.5	8.61	6.46	7.17	11.34
Temperature	33.6	32.6	32.6	33.3	33.1
pH	8.4	7.4	8.23	8	8.12

8.1.3 Figure 3. Show the raw data collected and was analyzed for the water parameters at Keravat river, in the Inland Baining (11 September, 2023 during sunny day)

8.1.4 Calculation for water retention

i. Dig three pits (control, cover with plastic, the other pit compacts with soil).

ii. Fill the pit with water until it reaches certain level marked.

iii. Take the measurement of the level of water drop after 1 hour using ruler, convert the cm to ml.

iv. Record the reading on the data sheet, also stop watch is required for time keeping.

v. According to the literature review rate of seepage less than 5mm/hour indicating soil is good contain enough clay. More than 5mm/hour, indicating that the soil is not good for pond construction.

vi. Blow is an example of how to calculate water retention test.

Worked example of water retention test

The hole is filled with water at 3.17 p.m. At 4.53 p.m. (96 minutes later) the level has dropped by 7 mm.

Rate of seepage = 7 mm/96 min
= 7/96 mm/min
= 0.0729 mm/min x 60 min
= 4.375 mm/hour

This is less than 5 mm/hour, indicating that the soil is satisfactory.