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POPULATION OF MACROZOOBENTOS IN MARIAH BANDAR SPRING WATERS, PEMATANG BANDAR DISTRICT, SIMALUNGUN REGENCY, NORTH SUMATRA

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ABSTRACT

Research on macrozoobenthic populations in Mariah Bandar Springs, Pematang Bandar District, Simalungun Regency, North Sumatra Province was carried out from May 2022 to June 2022. The purpose of this study was to gather information about macrozoobenthos populations in Mariah Bandar Springs and to find out about the diversity of macrozoobenthos populations in Mariah Bandar Spring Waters. This research was conducted in three locations, namely upstream, middle and downstream of Mariah Bandar Springs. There are each sub-location from each of these locations, in one location consisting of the upper, middle and lower ends. Each of the locations uses three points in macrozoobenthos sampling. Macrozoobenthos sampling using surber net. The results showed that there were 9 species of macrozoobenthos including Lumbricus sp, Thiara winteri, Enallagma nymph, Thiara scraba, Corbicula fluminea, Chironomus sp, Orthetrum glaucum larvae, Hagenius brevistylus and Euplanaria sp. Based on the Shannon-Wienner diversity index, locations I, II, III have low diversity (H' = 0.147).

Introduction

Population is a collection of individuals who are in a certain area and interact with each other to meet the needs of life. Ecosystems that are on earth have different types and will form a single unit called the biosphere. One type of ecosystem is the spring water ecosystem. Springs are a natural phenomenon where water flows from the ground which is a source of clean water and is very useful for fulfilling human needs. The water that comes out is clean and suitable for consumption because it has undergone natural purification or self-purification.

The Mariah Bandar spring bath is approximately 20 meters wide and 40 meters long. Based on the environmental baseline, the Mariah Bandar springs are divided into

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three, namely upstream, middle and downstream.
As for some community activities in the spring, of course it affects the quality of the water and can affect the biota that live in the spring, one of which is macrozoobenthos.

The Mariah Bandar spring bath, which is located in Pematang Bandar sub-district, Simalungun Regency, North Sumatra Province, is one of the waters used as a recreation area for the community around the Mariah Bandar area. Mariah Bandar Springs has very clear water and there are rocks inside that can be seen directly. Not only are they in the springs, these rocks are also located around the springs which are commonly used by local people to wash their clothes and other activities.

The Mariah Bandar spring bath is approximately 20 meters wide and 40 meters long. Based on the environmental baseline, the Mariah Bandar springs are divided into three, namely Upstream, Middle and Downstream. As for some community activities in the spring, of course it affects the quality of the water and can affect the biota that live in the spring, one of which is macrozoobenthos. Macrozoobenthos are organisms that live in waters for the most part, and also have a relatively large body size, making it easier to carry out the identification process. The movement of macrozoobenthos is very limited/sesile and is usually at the bottom of the waters. The existence of macrozoobenthos is strongly influenced and depends on the sensitivity level of the aquatic environment and each macrozoobenthos has a different sensitivity range (Pelealu *et al*., 2019). Macrozoobenthos as aquatic organisms have many advantages as biological benchmarks, namely they can show ecological instability and repair various forms of pollution (Fastawa *et al*., 2018). Organisms that include macrozoobenthos include crustaceans, isopoda, oligoseta, molluscs, nematodes and annelids (Cummins, 1975). This macrozoobenthos group is very important in aquatic ecosystems because it is very influential in the food chain. Macrozoobenthos is often used to predict imbalances in the physical, chemical, and biological environment of a water body. Contaminated waters will affect the survival of macrozoobenthos because macrozoobenthos are aquatic organisms that are easily exposed to the presence of contaminants, both physical and chemical pollutants. A healthy or unpolluted waters will show a balanced number of individuals from almost all existing species. On the other hand, the distribution of the number of individuals is not evenly distributed and there tend to be species that dominate in polluted waters. Based on the nature of life, benthos is divided into phytobenthos, namely plant benthos and zoobenthos, namely animal benthos (Sumanto, 2019).

Research on macrozoobenthos populations in Spring Waters is still very minimally carried out. Based on this, it is necessary to conduct research on macrozoobenthos populations in Mariah Bandar Springs in order to determine the various types of macrozoobenthos populations in these springs.

Materials and Methods

This research was conducted at the Mariah Bandar spring, Pematang Bandar District, Simalungun Regency. This research was conducted from March to May 2022. The materials used in this study were 40% formalin and 70% alcohol. While the tools used in this study were suber nets, buckets, 5 ml volumetric pipettes, plastic bags, tweezers, secchi disks, labels, stationery, collection bottles and magnifying glasses.

The sampling process in this study uses a source net and is filtered using a multilevel filter. Macrozoobenthos sampling was carried out with five repetitions, every four days a repetition of macrozoobenthos sampling was carried out. Macrozoobenthos sampling was carried out at several sub-locations per location taken, namely there were upper, middle and lower sub-locations. First, the surfer net is placed in certain predetermined locations to obtain macrozoobenthos. Furthermore, the substrate that is on the inside

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of the surber net is inserted into the net. After carrying out this process, lift the net from the bottom of the water and pour the substrate that has been obtained into the multilevel filter. After that, pour the water little by little to get the macrozoobenthos covered by the substrate. Substrate that is poured with water will slowly drop through the multilevel filter, leaving macrozoobenthos.

The research data were analyzed quantitatively (index) with several components analyzed, namely the Shannon-Winner diversity index, the Bray Curtis similarity index, the dominance index and physico-chemical parameter analysis. The research data were analyzed quantitatively (index) with several components analyzed, namely the ShannonWinner diversity index, the Bray Curtis similarity index, the dominance index and physico-chemical parameter analysis. The research data were analyzed quantitatively (index) with several components analyzed, namely the ShannonWinner diversity index, the Bray Curtis similarity index, the dominance index and physico-chemical parameter analysis.

Results and Discussion

Research data regarding the number of macrozoobenthos species spread across 3 location points can be seen in table 1.
Macrozoobenthos data

Table 1. Data on the number of macrozoobenthos at 3 location points

No	Genus	Parameter		
		Location I	Location II	Location III
1.	*Lumbricus* sp	17	10	16
2.	*Thiara winteri*	1	-	-
3.	*Enallagma nymph*	1	-	-
4.	*Thiara scraba*	1	-	-
5.	*Corbicula fluminea*	-	1	-
6.	*Chironomus* sp	-	6	-
7.	Larva *Orthetrum glaucum*	-	6	-
8.	*Hagenius brevistylus*	-	-	1
9.	*Euplanaria* sp	-	-	1

Based on the data obtained, at location I there were 20 macrozoobenthic individuals, at location II there were 17 macrozoobenthic individuals and at location III there were 18 macrozoobenthic individuals. The total number of macrozoobenthos individuals that were successfully obtained was 55 individuals belonging to 5 classes and 9 species. *Lumbricus sp*. has a small body, relatively varied body length, but the body length of this species can reach 5-15 cm with a slightly reddish and transparent body color. *Thiara winteri* has a very small body shape measuring 1 cm, but can still be seen without using a microscope. The top of the species looks spiky and terraced. The lower shell pattern is segmented and there are also several pointed shells around the body of this species. *Corcicula fluminea* has a small body size with a size of about 1-2 cm. The surface of the shell has semicircular segments that surround the body of the species and the surface of the body is also smooth without any hair growing. *Euplanaria sp* has a flat and soft body shape and a relatively varied body length, about 530 mm in length. Body color is not too flashy and brownish-white in color. *Thiara -scraba* has a unique shell shape and a small size of about 1 cm, has a dark shell color and a shell head shape that resembles a temple. The next macrozoobenthos species is *Chironomus sp* where this species has a bright red body with a black head and has fangs on both sides of its mouth. It has a small body with a body length of about 1 mm. *Hagenius brevistylus* has a small body size with a size of 5-15 mm, has a pair of round antennae and a brown body. *Enallagma nymph* has an oval body with a pair of antennae on its head, has 3 tails on its body and has a green body. *Orthetrum glaucum larvae* have a size of approximately 1025 mm. The body is green and has 6 legs, there is a pair of antennae on the head. This species is the larva of a dragonfly named *Orthetrum glaucum.*

According to Krisnafi et al, 2021, The results showed that 12 species of macrozoobenthos consist of 9 genus, 6 families, 4 classes and 2 phylum.

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Diversity Value (H'), Similarity Index (E), Dominance Index (C) at Each Location.

Table 2. Data for Calculation of Diversity Values (H'), Similarity Index (E), Dominance Index (C) at Each Location.

Index	Location	Average	Category
Diversity	I, II,III	0,591	Low
Similarity	I, II, III	0,634	Moderate
Dominance	I, II, III	0,618	High

Diversity index, similarity index and dominance index are indexes that are often used to determine the condition of an aquatic environment. The diversity index (H') of macrozoobenthos which has been found in 3 locations of Mariah Bandar spring waters, Pematang Bandar sub-district, Simalungun Regency obtained values ranging from 0.426 to 1.200 with an average result obtained of 0.591. The lowest diversity index values were found in locations I and III, namely obtaining values of 0.588 and 0.426. The area of location I is the origin of springs appearing, while location III is the location of disposal of water flowing from upstream. At location I, 4 species of macrozoobenthos *Lumbricus sp*, *Thiara winteri*, *Enallagma nymph* and *Thiara scraba* were found. Location III contains species of *Lumbricus sp*, *Hagenius brevistylus*, *Euplanaria sp*.

Macrozoobenthos diversity index value indicates the category of moderate to mild contamination (H value 1.40-1.97) (Darojat *et al*., 2020). The cause of the low diversity in the two locations is due to pollution by the surrounding community in the form of garbage, detergent waste and pesticide waste originating from paddy field water that flows into springs. Springs with a small average discharge are generally used by the surrounding community, but when the water discharge is large it is usually used by companies to make drinking water or other water needs (Sudarmadji *et al*., 2012).

The existence of decomposition activities can also be one of the unfavorable causes for aquatic organisms. The presence of infectious microorganisms or what are often called pathogenic microorganisms such as protozoa and viruses. This type of microorganism can attack and infect any organisms that have just reproduced and make it a disease that attacks and can result in death for these organisms, one of which is macrozoobenthos.

The highest diversity index value was found at location II, which was 1,200. At location II, 4 types of macrozoobenthos species were found including *Orthetrum glaucum larvae*, *Corbicula fluminea*, *Lumbricus sp* and *Chironomus sp*. The diversity index at location II according to the research conducted reached the moderate category, but when compared to locations I and III, location II was the location with the highest diversity index. The high diversity index is due to the presence of a fairly even number of various types of macrozoobenthos species. This of course can be used as a determinant of the quality of the water.

According to the Shannon-Wienner diversity index, locations I, II, III are included in the low diversity, if synchronized with the level of pollution, it can be said that locations I, II and III are included in the high pollution group. However, if you look at the condition of the waters at a glance, it does not appear that these waters are polluted because the water in these waters is always flowing so it is always replaced with new water and if you look at the color of the waters, the water in the Mariah Bandar Springs is clear like clean mineral water.

The macrozoobenthos similarity index in the waters of Mata Air Mariah Bandar, Pematang Bandar District, has obtained figures ranging from 0.95 to 0.330 with an average calculation result of 0.173. There are 3 requirements for calculating the similarity index with numbers 0 to 1. If the similarity index shows the number 0, then the species similarity at that location is relatively low and one species can be said to dominate. However, if the similarity index is towards 1, then the macrozoobenthos similarity is high and indicates that there is no single dominant species so that the macrozoobenthic distribution is evenly distributed. Therefore,

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the similarity index at Mata Air Mariah Bandar is classified as moderate because the average similarity index does not reach 1.

The macrozoobenthos dominance index in Mariah Bandar Springs which was obtained at location I was 0.730, at location II was 0.327 and at location III was 0.796. The average dominance index value of the three locations is 0.618. Dominance index values at the three locations belong to the high dominance index ($0.60 < C \leq 1.00$: High Dominance) or it can be said that there are species that dominate (Melati & Fachrul, 2007).

The status of the high or low dominance of a species is related to the value of similarity. The higher the similarity index value, the dominance index value will decrease and vice versa. Dominance index values that are close to 0 are generally followed by diversity values that tend to be high, but if the dominance is high or close to 1, it can be said that the diversity in these waters is low (Munandar *et al*., 2016).

Physical and Chemical Parameters of Mariah Bandar Springs

The results of measuring the physico-chemical parameters of water at the Mariah Bandar Springs at 3 locations can be seen in tables 3 and 4.

Table 3. Physical Parameters at Mariah Bandar Springs

Parameter	Lokation			Average
	I	II	III	
Temperature (ºC)	25	27	25	25,6
Substrate	Sandy	Sandy	Sandy	Sandy
Dept (cm)	72	35	63,3	56,76
Brightness (cm)	72	35	63,3	56,76

Based on tables 3 and 4 it can be seen that the temperature values at each study location are in numbers that range between 25-27oC. The temperature at location I is 25ºC. This temperature is the lowest temperature at the three locations. Then at location III the calculated temperature is 27ºC. This temperature is the highest temperature at the location of this study.

The type of substrate found in the Mariah Bandar Springs is sand. After conducting research on macrozoobenthos and water samples, it can be concluded that the substrate in the Mariah Bandar Springs is sandy which tends to contain lots of vegetation.

The depth of Mariah Bandar Springs varies quite a bit in each location. For location I after measuring the depth was 72 cm, for location II the depth was only 35 cm, and for location III the depth reached 63.3 cm. The average depth of the Mariah Bandar Springs is 56.76 cm.

The waters of Mariah Bandar springs choose undoubted water quality, because at first glance these waters are very clear. Location I has a brightness that reaches the baseline of 72 cm, for location II after getting the results it is 35 cm and for location III the brightness level is 63.3 cm, so that the total average brightness level of the 3 locations is 56.76 cm.

An aquatic environment has several parameters that are very influential in the survival of organisms in it. Some physical parameters that can usually affect this are temperature, current speed, substrate, depth and brightness. One of the parameters that can affect activity and can stimulate and inhibit the process of breeding aquatic organisms is temperature. In general, changes in temperature or an increase in water temperature to a certain scale can speed up the process of breeding organisms in a body of water (Ridwan et al., 2016). The results of temperature measurements that have been carried out in three research locations are 25ºC-27ºC. The highest temperatures were at location II which was exposed to direct sunlight, while the lowest temperatures were at locations I and II which were covered by shady trees. The low temperature at location I is not only due to shady trees, namely because at that location there is a spring from Mariah Bandar Waters and people rarely carry out activities at that location. The increase in temperature at location II is due to the fact that there are no shady trees in that location or the waters are exposed to direct sunlight. The process of transferring heat from sunlight will be faster if the water conditions are open compared to waters that are covered by shade

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(Pranoto, 2017). Calculation of the temperature in the waters of Mariah Bandar Springs, Pematang Bandar Simalungun District, shows that the temperature in the water can support the micro and macro organisms in it.

Table 4. Chemical Parameters in Mariah Bandar Springs

Parameter	upstream	downstream
BOD_5 (mg/L)	1,1	1,4
pH	5,58	5,62
Disolved Oxygen (mg/L)	3,3	4,1

The pH value of the water at the three locations ranged from 5.58 to 5.60. Calculation of the pH of the water is carried out in 2 places, namely at the downstream and upstream locations. The lowest pH is at the upstream while the highest pH is at the downstream location. The BOD value for each location was between 1.1-1.4 mg/L. Dissolved oxygen (DO) at the location of this study ranged from 3.3 to 4.1 mg/L. The highest dissolved oxygen value is in the downstream, which is 4.1 mg/L, while the lowest dissolved oxygen value is in the upstream of the spring, which is 3.3 mg/L.

An environment is no less important to determine whether or not an ecosystem in the area is good. There are two parameters that greatly affect the condition of an environment, namely biotic and abiotic parameters. Biotic parameters are parameters that describe living organisms or creatures, while abiotic parameters are parameters that describe non-living organisms. These abiotic parameters include pH, DO, BOD, namely as elements that are used as a determinant of the existence of a population of organisms in maintaining life in a waters.

Living things that live in waters can live in pH conditions ranging from weak acids to weak bases. The condition of a water which has strong acid to strong base properties can endanger the survival of micro and macroorganisms. This is because strong bases and strong acids can interfere with the process of respiration and metabolism of marine life.

Dissolved oxygen is one of the important parameters in a chemical parameter which also has an important role and is also a limiting parameter for the survival of aquatic biota organisms. What is unique is that several types of aquatic organisms can even live in waters with minimal dissolved oxygen content (Sinambela & Sipayung, 2015).

Biological Oxygen Demand (BOD) is the amount of oxygen needed by organisms in aquatic ecosystems to chop or degrade organic waste materials contained in water and process them into carbon dioxide and water. In general, the oxidation process in water takes quite a long time (Warlina, 2004).

The process of measuring BOD is an important chemical parameter to be able to determine a quality in these waters. This BOD value is used as an indication of how much oxygen the aquatic organisms that live in it should need. The existence of BOD testing activities in a waters aims to minimize the amount of toxic when the amount is known and further processing can be carried out biologically (Daroni & Arisandi, 2020). A good BOD standard for recreational waters and aquaculture is if the waters are less than 3 mg/L, whereas if the waters are for sea water it is 10 mg/L (Hariyadih, 2004).

Conclusions

The population of macrozoobenthos that was found in the Mariah Bandar Springs, Pematang Bandar District consisted of 9 species, namely *Lumbricus* sp, *Thiara winteri*, *Enallagma nymph*, *Thiara scraba*, *Corbicula fluminea*, *Chironomus* sp, *Larva Orthetrum glaucum*, *Hagenius brevistylus* dan *Euplanaria* sp. The Shannon-Wienner diversity index at all study sites is included in the low diversity index. The similarity index of the Mariah Bandar Springs in Pematang Bandar sub-district, Simalungun Regency ranges from 0.95-0.330 with an average calculation result of 0.634 belonging to the medium similarity index group. The dominance index at the three study locations ranged from 0.327 to 0.796 with an average dominance index of 0.618, categorized into a high dominance index. Physical and chemical

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parameters of the waters as a whole are relatively normal and can still support the survival of macrozoobenthos.

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