Prolife
Jurnal Pendidikan Biologi, Biologi, dan Ilmu Serumpun
https://ejournal.uki.ac.id/index.php/prolife

Monitoring of Macroinvertebrate Species In Sibolga Waters

Arman Harahap*
Universitas Labuhan Batu, Sumatera Utara, Indonesia
* *Corresponding author*: armanhrahap82@gmail.com

Article History

Received : 25 October 2022
Approved : 15 November 2022
Published : 30 November 2022

Keywords
Macroinvertebrate, Sibolga, bioindicator

ABSTRACT

The waters of sibolga is the waters are very widespread in , this area is densely populated, so there are many community activities that take place such as Transportation, Fisheries, Bathing, sand Mining and other.The purpose of this study is to determine the role of Macroinvertebrate as a bioindicator of water quality in the waters of Sibolga Tapanuli Tengah, as well as determine the quality of water in the flow of the waters Sibolga physical properties, chemical has. The research was conducted from November 2021 to February 2022, the samples taken from the three research stations. From the results obtained Macroinvertebrate in the identification in this study consisted of 3 Phyla of invertebrates namely : Annelids, which consists of 2 classes, Arthropods consisting of 1 class and Molusca, which consists of 1 class. Based on the data of Macroinvertebrate obtained at each research station, then the obtained value of population density, relative density and frequency of presence of that at station I the value of its highest density is Tubifex sp. with the value of the density of the population of 18,519 individual/m2, the density is relatively 25,862% and the frequency of the presence of 55,555%. off at 3. at station 2 the highest density is Tubifex sp. with the value of the density of the population of 18,519 individuals/m2, relative density 25,862% and a frequency of 55,555%. also note that the total score obtained by the method storet, namely -30, this shows that if connected with the raw water quality of class I is then classified in the waters of class III, which means that light polluted. The high total score method storet on the entire research station due to the presence of a variety of activities at each of the stations, settlements, sand mining and other activities. Where these activities produce waste, which in the end increases the content of Phosfat, COD, TSS and BOD5, thus causing the waters of the Waters of Sibolga is light polluted.

INTRODUCTION

The waters of the tapering has the current speed is slow and the accumulated mass of water that goes with the fast Waters Sibolga including Lotic Water (Barus, 1996). The waters are the waters very widespread in North Sumatra in the area is also densely populated, so there are many

community activities that take place such as Transportation, Fisheries, Bathing, sand Mining and other. The presence of various human activities around these Waters which resulted in the Waters Sibolga the thought is already tainted. One of the biota that can be used as parameters of the biology in determining the condition of a waterfront is the Macroinvertebrate .

The composition of the Spread and species of Macroinvertebrate may be monitored to assess the quality of Waters (Badea *et al*., 2010). Macroinvertebrate sensitive to water quality and therefore, used as the most often bioindikasi natural and polluted rivers (Morse *et al*., 2007). Macroinvertebrata is the organism kesesil with hostility limited, the Waters are of good quality usually have the high species diversity and vice versa on the waters of the bad or polluted (Fachrul, 2007).

MATERIAL AND METHODS

This research was conducted in the Waters Sibolga Kabupaten Tapanuli Tengah North Sumatra Province. This research was conducted in the month of November 2021 to February 2022. Based on the zone of the existing environment established 3 stations in the different observations. sampling of Macroinvertebrate was done by using the Method of Purposive Random Sampling. Sampling of Macroinvertebrate conducted a total of 9 replications at each station.

Tools and Materials

The tools used in this study include pH meter, thermometer, puck sechii, Lamnot, Mesh surber, pasteur pipette, erlenmeyer 125 ml, split, a 5-liter bucket, bottle film, cool box, plastic rope, plastic 5 kg, duct tape, paper labels, pencils, markers, bottles of alcohol and the Global Positioning System. While the materials used were $MnSO_4$, KOHKI, $H2SO_4$, Na_2S2O_3, alcohol and starch.

The Sampling Method

Samples of Macroinvertebrate were taken using a mesh surber then Mesh surber put in the bottom of the River, and then the substrate is dredged so that the Macroinvertebrate netted in a mesh surber such. Samples obtained sorted using the hands to sample large-sized and floatation method to sample small-sized (which can't be sorted). The sample is cleaned with water and soaked with formalin 4% for 1 day, then washed and dried, the sample is put in a sample bottle that has been filled with 70% alcohol as a preservative, and then given a label. Samples brought to the laboratory to be identified with the use of books of reference Edmonson (Edmonson & Pennak, 1978). The measurement Factors of Physics and Chemistry of the Waters, namely: Water Temperature, BOD5, Light Intensity, DO,

Nitrate, phosphate. The test solution was transferred each into a 50 ml volumetric flask and distilled water was added until it was exactly marked, then the test solution was transferred to a test bottle for analysis of seawater samples that had been labeled. The test seawater samples are ready to be analyzed using an Atomic Absorption Spectrophotometer (AAS). To find out the correlation between heavy metal content in water and sediment, a linear regression test was performed (Sudjana, 1992). Statistical analysis Anova was carried out with the help of Microsoft Software and Statistical Package For Social Science (SPSS) version 16.0 to determine differences in concentrations of heavy metals Cu, Pb and Zn in seawater and sediments from each station. The environmental parameters measured included temperature, pH, salinity, brightness, and current velocity during sampling.

RESULT AND DISCUSSION

Classification Of Macroinvertebrate

Macroinvertebrate were identified in this study consisted of 3 Phyla of invertebrates namely : Annelids, which consists of 2 classes, Arthropods consisting of 1 class and Molusca, which consists of 1 class.

The density of Benthos (K), Relative Density (KR) and Frequency Presence (FK) at each research station

Based on the data obtained it is known that the composition and number of Macroinvertebrate at the station 1 has the number of individuals the highest being in station 2 has a number of individual low. This is due on Station 1 there are community activities that take place, so that the number of Macroinvertebrate there is much more when compared with the other Stations. and at station 2 the activities of the community there are found that such as sand mining, household waste. Class insect which is found is *Argia* sp., found at the station of 2.3. *Boveria* sp., found at the station. *Chironomus* sp., found at stations 1,2 and 3. *Ghompus* sp., in stations 1,2, and 3. *Miathyria* sp., in station 1,2. *Naucorinae* sp. was found at station 2,3. *Paraleptophlebia* sp. found in station 2. *Pelocoris* sp. found in station 1,2 and 5. *Pleurocera* sp. was found at station 1. Insect found every station is different and the amount of the genus that found as many as 9 genus and Insect that has a habitat on the surface of the stone and gravel (Handayani *et al*,. 2000), insect found in the waters that are experiencing an increase in fertility (Rini, 2007).

Gastropods were found to consist of *Goniobasis* sp., *Neanthes* sp., *Tubifex* sp. Class Gastropods found at each research station with an abundance of the highest in station 1 that has a base substrate muddy sand. Gastropod is an organism that has spread widely on the substrate rocky, sandy or muddy, but these organisms tend to like a substrate base of sand and a little muddy (Hutchinson, 1974).

Based on the data of Macroinvertebrate obtained at each research station, then the obtained value of population density, relative density and frequency of presence of that at station I the value of its highest density is *Tubifex* sp. with the value of the density of the population of 18,519 individual/m2, the density is relatively 25,862% and the frequency of the presence of 55,555%. off at 3. at station 2 the highest density is Tubifex sp. with the value of the density of the population of 18,519 individuals/m2, relative density 25,862% and a frequency of 55,555%.

Tubifex sp. is a Gastropod that has the highest density in station 1 and found at each research station. This is caused by the katahanannya against pollutants, so that the ability to live very high. *Goniobasis* sp. live in the flow of the rivers and lakes in the rocks and substrate that hard, but it can also be found on the substrate is smooth and on vegetation as periphyton. Gastropods abundant in waters with a substrate of sandy bottom (Setiadi, 2005). *Goniobasis* sp. is a Gastropod that has the highest density at station 5 and found at each research station. This is caused by the state of the Waters Sibolga The rocks, the substrate was smooth and sandy. *Goniobasis* sp. live in the flow of the rivers and lakes in the rocks and substrate that hard, but it can also be found on the substrate is smooth and on vegetation as periphyton. Gastropods abundant in waters with a substrate of sandy bottom. *Argia* sp. only found at stations 2,3 this occurs because the substrate conditions are suitable and factor of chemical physics for his life. So also *Boyeria* sp. found at station 3 because this area is tolerant for his life because the base substrate that is sandy and a little muddy.

Nilai Indeks Similaritas

Based on the data analysis obtained value of the Index of Similarity (IS) of Macroinvertebrate at each station as shown in Table 1. The value of the Index of Similarity (IS) was obtained at 5 research stations ranged from 62.5 percent -84,21%.

Table 1. The Value Of The Index Of Similarity

Stasiun	1	2	3
1		77.78 %	66.67%
2			82.35%
3			

The value of the Index of Similarity (IS) was highest at station 3 based on the Index of Similarity of the Macroinvertebrate in each study site were observed, can be made the classification of the study site as follows:

IS= 75-100 : very similar

50-75 : similar

25-50 : not similar

18<25 : very similar.

From the table 1. above can be seen that the index of similarity between stations 1 and 2 by 77,78%, station 1 and 3 in the amount of 66.67%, station 1 and 3 by 70.59%, atasiun 1 by 70.59%. It can be concluded that the index of similarity between stations 1 and 3 are relatively similar. Then stations 2 and 3 of 82,35%, 2 relatively similar. This is due to several factors physical chemical waters between the stations is quite similar. Station 3. This is due to several factors physical chemical waters between stations is also similar.

Conditions mikrositus relatively homogeneous will be occupied by individuals of the same type because the species naturally has developed mechanisms of adaptation and tolerance to habitat (Suin, 2002). The highest similarity can be achieved between the 2 habitats to be compared are 100% if on both the habitat of living types of the same animal (Krebs, 1989). The greater the similiritas then the same type at different locations more and more (Suwondo *et al*., 2004).

Nilai Distribusi Morisita (Id)

Data about how the spread or distribution of all types of Macroinvertebrate found in the waters of the Sibolga indicated by the value of the distribution of Morisita (Id).

Table 2. The Value Of The Distribution Index Of Morista

No.	Genus	Indeks Morista	Keterangan
1	*Argia* sp	0	Random
2	*Boyeria* sp	3,24	Clustered
3	*Chironomus* sp	0,64	Normal
4	*Gomphus* sp	0,98	Normal
5	*Miathyria* sp	0,66	Normal
6	*Naucorinae* sp	0	Random
7	*Paraleptophlebia* sp	0	Random
8	*Pelocoris* sp	0	Random

9	*Pleurocera* sp	0	Random
10	*Goniobassis* sp	0,89	Normal
11	*Neanthes* sp	1,28	Clustered
12	*Tubifex* sp	0,33	Normal

With the following criteria:

Id = 0 of random distribution or random

Id > 1 distribution of clustered

Id < 1 a normal distribution

From the above table it can be seen that the distribution of Macroinvertebrate found in the waters of the Sibolga so varied that there are five species whose life randomly, then there are two species that are spreading clustered, and there are four more species that its distribution is normal. This is caused by the Macroinvertebrate of these choose to live in suitable habitat on waters both in terms of physical factors-chemical waters and availability of Nutrients (Harahap *et al*., 2020). Mengelompoknya type of Gastropod allegedly because of its life clustered, uniform and stick to one place all the time (Suwondo *et al*., 2004). Factors of physics and chemistry are almost evenly distributed in a habitat and the availability of food for organisms that live in it largely determines the organisms that live in groups or random or normal (Suin, 2002).

The nature of Physics, Chemistry and Biology of the Waters of the Sibolga Based on the Method of Storet Physical-chemical properties of the water contained in the Waters of the Sibolga connected with criteria stated by Storet, which is known by the method Storet are listed on Table 3.

Table 3. The score of Each Value of Physical, Chemical and Biological based on the Method of Storet

No	Parameter	Baku Mutu	Hasil Pengukuran			Score			
		Air Gol.1	Min	Max	Rata^2	Min	Max	Rata^2	Total
1.	Suhu (^{0}C)	Deviasi 3	23	24,5	23,75	0	0	0	0
2.	pH	6-9	7,8	8,1	7,95	0	0	0	0
3.	DO (mg/l)	6	6,9	7,2	7,05	0	0	0	0
4.	BOD_5 (mg/l)	3	2,9	5	2,95	0	0	0	0
5.	NO_3^- (mg/l)	10	0,386	2,248	1,317	0	0	0	0
6.	PO_4^{3-} (mg/l)	0,2	0,258	0,614	0,436	-2	-2	-6	-10
7.	COD (mg/l)	25	49,92	72,12	61,02	-2	-2	-6	-10
8.	TDS (mg/l)	1000	36	46	41	0	0	0	0
9.	TSS (mg/l)	50	112	164	138	-2	-2	-6	-10
									Total Score - 30

From the above data, it is known that the content of phosfat, COD, and TSS has exceeded the limits of raw water quality, while the parameters still meet the quality of the raw water i.e. Temperature, pH, BOD5, DO, Nitrate and TDS. From the above table

it is known also that the total score obtained by the method storet, namely -30, this shows that if connected with the raw water quality of class I is then classified in the waters of class III, which means that light polluted.

The high total score method storet on the entire research station due to the presence of a variety of activities at each of the stations, settlements, sand mining and agriculture. Where these activities produce waste, which in the end increases the content of Phosfat, COD, TSS and BOD5, thus causing the waters of the Waters of the Sibolga is light polluted.

CONCLUSIONS

From the research that has been conducted to see the diversity of Macroinvertebrate in the Waters of Sibolga, it can be concluded: Based on the parameters of physics, chemistry and biology by using the method of storet according to Raw Water Quality in Stations 1, 2, and 3, So that it belongs to the class of light polluted. From the results obtained Macroinvertebrate in the identification in this study consisted of 3 Phyla of invertebrates namely : Annelids, which consists of 2 classes, Arthropods consisting of 1 class and Molusca, which consists of 1 class. The value of the Index of Similarity (IS) obtained on the five research stations ranged from 62.5 percent -84,21%, and included in the conditions are similar. Based on the value of the distribution Morista that the distribution of Macroinvertebrate found in the waters of the Sibolga so varied that there are five species whose life randomly, then there are two species that are spreading clustered, and there are four more species that its distribution is normal. this is caused by the Macroinvertebrate of these choose to live in suitable habitat on waters both in terms of physical factors and chemical waters and availability of nutrients.

REERENCE

Barus, T.A, 1996, *Metode Ekologi untuk Menilai Kualitas Suatu Perairan Lotik*. Program Studi Biologi USU FMIPA – USU, Medan.

Badea, B.A., Gagyi-Palffy, A., Stoian, L.C., Stan, G. 2010. *Preliminary studies of quality assessment of aquatic environments from Cluj suburban areas,based on some invertebrates bioindicators and chemical indicators*. AACL Bioflux, 3(1), pp. 35-41.

Kubosova, K., Brabec, K., Jarkovsky, J., Syrovatka, V. 2010. *Selection of indicative taxa for river habitats: a case study on benthic macroinvertebrates using indicator species analysis and the random forest methods*. Hydrobiologia, 651, pp. 101-114.

Morse, J.C., Bae, Y.J., Munkhjargal, G., Sangpradub, N., Tanida, K., Vshivkova, T.S., Wang, B., Yang, L., Yule, C.M. 2007. *Freshwater biomonitoring with macroinvertebrates in East Asia*.

Frontiers in Ecology and the Environment 5(1), pp. 33-42.

Fachrul, M.F. 2007. *Metode Sampling Bioekologi.* Bumi Aksara. Jakarta.

Edmonson, W.T. 1959, *Fresh Water Biology,* John Willey and Sons. New York.

Pennak, R. W. 1978. *Fresh Water Invertebrates of United States*. Second Edition. A. Willey Interscience Publ. John Willey and Sons, New York

Handayani, S.T., Suharto, B., Marsoed. 2000. Penentuan status kualitas perairan Sungai Brantas Hulu dengan Biomonitoring makrozoobentos. BIOSAIN. 1 (1) : 30-38

Rini, D. A. 2007. *Mengenal Makroinvertebrata Bentos*. Warta Konservasi Lahan Basah. Hlm. 3.

Hutchinson, G. E. 1974. *A. Treatise on Limnology,* Volume IV The Zoobentos, Edited by Yvette Hl. Edmonson. John Willey & Sons, Inc. New York.

Setiadi, D. 2005. Keanekaragaman Spesies Tingkat Pohon di Taman Wisata Alam Ruteng Nusa Tenggara Timur, *Jurnal Biodiversitas* 6 : 118-122.

Suin, N.M. 2002. *Metoda Ekologi Edisi 2.* Universitas Andalas, Padang.

Krebs, C. J. 1989. *Experimental Analysis of Distribution and Abundanc*. Third Edition, Harper & Prow Publisher, New.York.

Suwondo, Febrita, E. Sumanti. F. 2004. *Struktur Komunitas Gastropoda pada Hutan Mangrove* di Pulau Sipora Kabupaten Kepulauan Mentawai Sumatera Barat. *Jurnal Biogenesis* 2 (1) 2005. Hlm. 25-29.

Harahap, A., Khairul, Kusno, Sriono, Fitria, E., Panjaitan, B., Jannah, M., Ilham, K.I. 2020. Species Composition & Ecology Index Of The Family Gobiidae At The Mangrove Belawan Of Sicanang Island. International Journal of Advanced Science and Technology 29(5), pp. 4877 – 4882.