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BIOASSESMENT OF BATANG AIR DINGIN WATER QUALITY BY USING MACROZOOBENTHOS IN KOTO TANGAH DISTRICT, PADANG CITY

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ABSTRACT

This study aims to determine the composition and structure of the macrozoobenthos community in Batang Air Dingin and water quality based on BMWP ASPT. This study used a survey method in determining the station by purposive sampling, based on typhical environmental condition along the river. Macrozoobenthos samples was collected by using *surber net* 30x30 cm^2. The result showed the community in the form of Gastropods 6 genera, Insecta 26 genera, Oligochaeta 1 genus, and Hirudinea 1 genus. Total density of macrozoobenthos in the Batang Air Dingin river was 1182,22ind/m^2 ranging from 180,00 ind/m^2 to 402,22 ind/m^2 with the highest density was found in the first station and the lowest at station four. The predominant type found at each station is different, station I is *Elophyla, Neopherla, Hydropsyche;* station II *Eukifferiella, Polypedilum, Elophyla, Hydropsyche;* station III *Clithon, Eukifferiella, Polypedilum*, *Orthocladius;* station IV *Clithon*and *Thiara.* The diversity of macrozoobenthos in Batang Air Dingin river range between 1,95-2,51 is classified as moderate with even distribution (E=0,84) range between 0,81-0,89. Batang Air Dingin water quality using BMWP ASPT from upstream to downstream range between 6,12 – 3,5. Classified unpolluted to heavily polluted.

Keyword : Batang Air Dingin, BMWP ASPT, Community, macrozoobenthos, Water quality.

INTRODUCTION

The city of Padang has several main rivers, namely Batang Arau, Batang Kuranji, Batang Kandis, and Batang Air Dingin. Batang Air Dingin is located in Koto Tangah District, Padang City. Batang Air Dingin has a watershed area of 12919.7 ha with the length of the main river which is 26089.7 m or 26.1 km. The Batang Air Cold River Basin in the north is bordered by the Singkarak Lake Watershed; in the east by the Sumani River Basin; in the west with the Batang Kandis River Basin and the Indonesian Ocean; and in the south with the Batang Kuranji River Basin (Yanti et al., 2017).

The river as an open ecosystem waters is greatly influenced by the surrounding environment.

Changes in river water quality conditions are the impact of waste from existing land uses. Changes in the pattern of agricultural land use, settlements, recreation areas as well as increased human activity both in rivers and along rivers will have an impact on hydrological conditions in a watershed. Various human activities in fulfilling their daily needs that produce waste will contribute to pollution and reduce the quality of river water (Purwati, 2015).

The development of aquatic biological condition assessment techniques using biological parameters (bioassessment) to determine the health status of rivers has been started since the 19th century. The use of biological parameters is very important to use to assess the health of a river in addition to measuring physical and chemical parameters, because the environmental damage of rivers has a negative impact on organisms. Biological components such as: fish, periphyton, and macrozoobenthos, which are used as biological indicators, can be used to assess the quality of rivers caused by physical and chemical changes in waters. Biological attributes such as the index of BMWP ASPT (Biomonitoring Working Party Average Score Per Taxon) indicate the tolerance range of the macroavertebrate benthic community to pollution (Sudarso et al., 2008).

The increasing number of population causes an increase in human activities such as agricultural activities, household waste disposal, the use of rivers as a recreation area, sand and stone excavation, the construction of dams in Batang Air Dingin. All of these activities can affect the condition of river water quality and ultimately affect the presence of river biota such as macrozoobenthos which are sensitive to environmental changes. The presence or absence of macrozoobenthos and their community structures in rivers may reflect river water quality. In the last 14 years, there has been no recent information regarding the assessment of water quality in the Batang Air Dingin river biologically, in this case using the macrozoobenthic community.

The purpose of this study is to determine the composition and structure of the macrozoobenthic community and to determine the quality of Batang Air Dingin based on the BMWP-ASPT index.

MATERIALS AND METHODS

Research Sites

Sampling was carried out along the Batang Air Dingin stream in Koto Tangah District, Padang City. Sample identification was carried out at the Animal Ecology Research Laboratory, Department of Biology, Faculty of Mathematics and Natural Sciences, Andalas University. This study used a survey method in determining the station by purposive sampling, based on environmental baseline along the river. Each station in the collection of 5 benthic samples as a replication at different microhabitats. Macrozoobenthic samples were taken using a surber net 30x30 cm^2. Station I is at Balai Gadang, where the water condition is still maintained and not yet polluted. Station II is located after the Letung River Dam after the confluence of the Letung River with Batang Air Dingin where there is a bath. Station III is located in Koto Pulai where there are dams and excavation activities C as well as densely populated settlements. Station IV is located

before it empties into Batang Kabuang where many areas of agricultural land and residential areas are located (Fig.1).

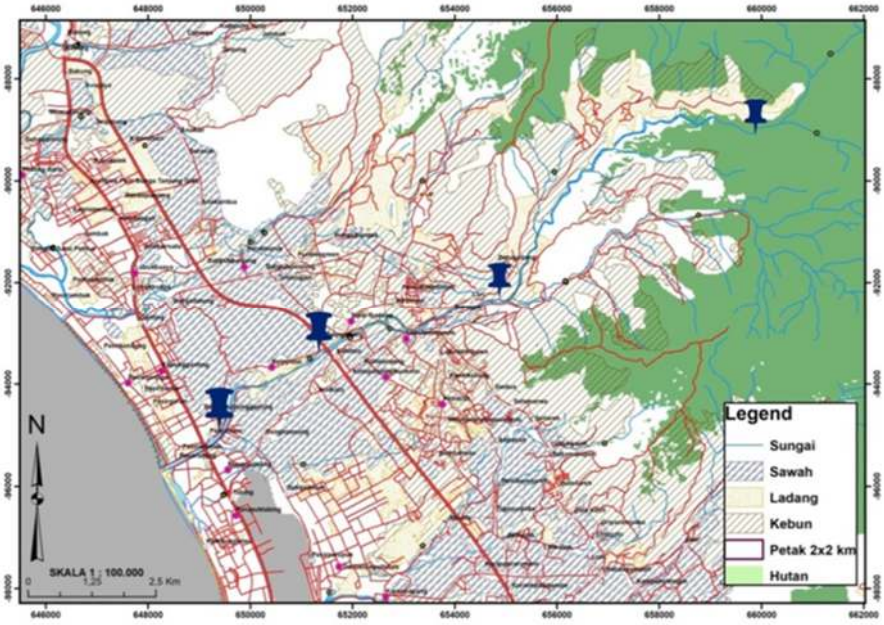

Fig. 1. Map of the Batang Air Dingin Research Location

Tools and Materials

The tools and materials used in this study were the Surber Net size 30 cm x 30 cm, a multilevel filter (Tyler Screen Scale) with a filter eye size of 250 microns and 4.47 mm, Current meter, wire brush, rake, small shovel, dark bottle. , bright bottle, Erlenmeyer 250 ml, volumetric pipette, dropper pipette, volume 5 ml, 2.5 ml and 1 ml syringe, thermometer, plastic tray, label paper, plastic bucket, tweezers, collection bottle, 1 l volume water sample bottle, plastic with a volume of 2 kg, 5 kg and 15 kg, rubber bands, microscope, electric balance, desiccator, petridish, digital camera, GPS, meter, whatman paper, tool box, ice box, gloves, scale stick, mask and tools write. The materials used were 40% formalin, 70% alcohol, MnSO4, KOH / KI, concentrated H2SO4, 1% starch, 0.02 N NaOH, 0.025 N Na2S2O3, 1% phenolphthalein, aquadest and pH paper.

DATA ANALYSIS

Bioassessment of water quality based on macrozoobenthos using the BMWP-ASPT index

Determination of water quality using biological indicators refers to the Biological Monitoring methode Party Average Score Per Taxon (BMWP-ASPT) (Le-Thu-Ha et al., 2002). The identified macrozoobenthos were grouped into families then, each family was determined by a score referring to the score of the previous researchers and then the total at each station. The total value of the BMWP is used as the basis for calculating the ASPT. The results of the ASPT index calculation value are used to determine the quality of water in the Batang Air Dingin.

$$ASPT = \frac{The\ total\ BMWP\ index\ score}{Number\ of\ families\ found}$$

Table 1. Modification of the BMWP (Biological Monitoring Working Party)

Family	BMWP1	BMWP2	BMWP3	BMWP4	BMWP5	BMWP6
Heptageniidae	10	10	10	10	10	10
Baetidae	4	4	4	4	4	4
Hydropsychidae	5	5	5	5	5	5
Perlidae	10	10	10	10	10	10
Elmidae	-	5	5	5	5	5
Calopterygidae	-	6	-	6	6	6
Atyidae	3	-	-	3	3	3
Potamidae	8	-	-	8	8	8
Pyralidae	-	8	-	8	8	8
Simuliidae	-	5	-	5	5	5
Chironomidae	2	2	2	2	2	2
Tipulidae	5	5	5	5	5	5
Hydrobiidae	-	-	3	3	3	3
Lymnaeidae	-	3	3	3	3	3
Erpobdellidae	-	3	3	3	3	3

References: BMWP1: Le-Thu-Ha *et al* (2002); BMWP2: Demool et al (2017); BMWP3: Hawkes (1997); BMWP4: Lestari (2011); BMWP5: Anestiana (2017); BMWP6 : Ardenta (2018).

The results of the calculation of the ASPT (Average Score Per Taxon) are then categorized into 4 groups which can be seen in Table 2.

Table 2. Value Category ASPT (Average Score Per Taxon)

ASPT Value	Water quality
>6.0	Not polluted
5-6	Lightly polluted
4-5	Moderately polluted
<4.0	Heavily polluted

Reference: Mandaville, 2002

RESULTS AND DISCUSSION

Composition of the macrozoobenthic community

Based on research that has been conducted in Batang Air Dingin waters, there were 34 genera and 532 individuals. These genera are classified into 4 classes (Gastropod, Insect, Oligochaeta, and Hirudinea). Gastropod class (1 order, 2 families, 6 genera), Insect class (8 orders, 16 families, 26 genera), Oligochaeta class (1 order, 1 family, 1 genus), and Hirudinea class (1 order, 1 family, 1 genus) (Table 3).

Table 3. Composition of macrozoobenthos on Batang Air Dingin

No.	Classes	Order Amount	Number of Family	Number of Genera	Number of Individuals
1	Gastropoda	1	2	6	88
2	Insecta	8	16	26	440
3	Oligochaeta	1	1	1	2
4	Hirudinea	1	1	1	2

Total	**11**	**20**	**34**	**532**

From the research above, the Insecta class had the highest number of genera and the number of individuals, namely 26 genera with 440 individuals. The large number of genera and the number of individuals found in Batang Air Dingin is because the Insecta class can live in various substrates on the river bed consisting of spleen and larvae, especially in. Insecta is able to live in various basic substrates such as rocky, sandy, gravel, and mud, can live in fast and slow flowing waters. Macrozoobenthos can live in these conditions because they have a special ability to adapt. This adaptation can be in the form of a body that is stream line, has claws, has a sucker on the feet (sucker) (Odum, 1993).

The Gastropod class has 6 genera with 88 individuals. The Gastropod class is only found in areas that have a slightly rocky substrate, sand, gravel and mud which is a suitable place to live. This is also confirmed by Suartini (2010) that the Mollusca group of the Gastropoda class is an organism. Which has a fairly wide distribution range, namely on rocky, sandy and muddy substrates and waters indicated to be contaminated with organic matter.

Macrozoobenthos from the Oligochaeta and Hirudinea classes were the least found. Oligochaeta and Hirudinea classes were only found in 1 genus each with 2 individuals. Oligochaeta class was found in slightly muddy microhabitates, while Hirudinea class was found in downstream areas with sand and mud substrate. According to Pennak (1978), Hirudinea is mostly a group that lives in fresh water, although there are many species in marine and terrestrial. Can be found in ponds, swamps, lakes, and slow water flows and muddy substrates. The cause of the low number of individuals in the Oligochaeta and Hirudinea Classes is due to the fact that these rivers are generally fast flowing and rocky substrates.

Batang Air Dingin Water Quality based on BMWP-ASPT

The presence of macrozoobenthos can reflect the conditions of a waters. The one of the method that can be used to determine the quality of waters with benthic communities is the BMWP ASPT (Biological Monitoring Working Party - Average Score Per Taxon). According to Mandaville (2002), the criteria for water quality are based on the BMWP ASPT value, namely a value of <4 is classified as heavily polluted, a value of 4-5 is classified as moderate, a value of 5-6 is classified as lightly polluted, and a value of> 6 is classified as not polluted. The results of the macrozoobenthic score for each family on the index at the four stations in Batang Air Dingin can presented on the Table 4.

The BMWP ASPT score tends to decrease from station I to station IV. The highest ASPT value was obtained at station I,> 6 which was classified as not polluted, then followed by stations II and III with ASPT values of 6.0 and 5.42 which were classified as lightly polluted. The lowest ASPT value at station IV, which is 3.5, is classified as heavily polluted. The high ASPT value at station I is because station I is an upstream river area with secondary forest conditions that are still protected from human activities. At stations II and III there are residential settlements on the riverbanks. At station III there is excavation C, densely populated settlements, and dam construction but has not shown any effect on water quality at both stations. The low value of ASPT at station IV is due to the high organic content with a TOM of 12.9 mg /

ℓ. The high level of organic matter at station IV is due to the input of agricultural waste and household waste around the river. The flow of water at station IV is fairly slow, so solid wastes such as litter, agricultural waste, resident waste originating from the previous station are carried away and will settle at this station so that the organic matter content at station IV is higher than other stations. Water discoloration also occurs at station IV, where the river water is cloudy black but odorless.

Table 4. Results of the analysis of macrozoobenthic scores with the BMWP-ASPT index

No.	Family	BMWP Score				BMWP modification*
		I	II	III	IV	
1	Neritidae	-	-	6	6	6
2	Thiaridae	-	-	3	3	3
3	Elmidae	5	5	5	-	5
4	Gyrinidae	5	5	-	-	5
5	Psephenidae	5	5	5	-	5
6	Chironomidae	2	2	2	2	2
7	Staphylinidae	-	-	-	2	2
8	Tipulidae	5	5	-	5	5
9	Baetidae	4	4	-	-	4
10	Caenidae	7	7	7	-	7
11	Heptageniidae	10	10	-	-	10
12	Siphlonuridae	10	-	-	-	10
13	Naucoridae	5	-	-	-	5
14	Pyralidae	8	8	-	-	8
15	Gomphidae	8	-	-	-	8
16	Lestidae	8	-	-	-	8
17	Perlidae	10	10	10	-	10
18	Hydropsychidae	5	5	-	-	5
19	Tubificidae	1	-	-	-	1
20	Hirudinidae	-	-	-	3	3
	TOTAL	98	66	38	21	
	ASPT	**6,12**	**6,0**	**5,42**	**3,5**	

Note: * Modification based on Le-Thu-Ha et al (2002); Demool et al (2017); Hawkes (1997); Lestari (2011); Anestiana (2017); Ardenta (2018).

CONCLUSIONS

Macrozoobenthic communities in the waters of Batang Air Dingin were obtained as many as 4 classes (Gastropoda, Insecta, Oligochaeta, and Hirudinea). Gastropod class (2 orders, 2 families, 6 genera), Insecta class (8 orders, 16 families, 26 genera), Oligochaeta class (1 order, 1 family, 1 genus), and Hirudinea class (1 order, 1 family, 1 genus). The status of water quality in Batang Air Cold is classified as uncontaminated to heavily polluted with BMWP values ranging from 21-98, ASPT ranging from 3.5-6.12. The highest BMWP ASPT value is at station I, while the lowest BMWP ASPT value is at station IV.

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