

Diversity of Shrimps at Asam-Asam River in Tanah Laut as A Teaching Material:

Preliminary Study of Teaching Material Development On Environmental Toxicology Subject

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Abstract— Shrimps play several important roles as resource of animal protein and a part of an ecosystem balance. However, diversity of shrimps depends highly on the condition of their habitats. The aim of this research was to analyze the diversity of shrimps which lives in Asam-Asam River as a teaching material in the form of a leaflet. The method of this research was the descriptive method. This research used three stations of observation. The first station was situated at Asam-Asam River near the natural vegetation. The second station was situated at Asam-Asam River near the outlet of Coal-fired Power Plant (hence PLTU as Indonesian acronym), and the third station was situated at Asam-Asam River near the settlement of residents. Each station was divided into two zones that were the left and the right sides of the river. Shrimps found were identified by using the shrimp-identification books and then were analyzed by using formula. The results of this research showed that there were four species of the shrimps which were found in all stations, namely : *Palaemon concinnus*, *Metapenaeus monoceros*, *Macrobrachium rosenbergi*, and *Macrobrachium acanthurus*. The value of diversity indexes of Station I, II, and III respectively were 0,271, 0,693, and 0,271 or diversity indexes of the shrimps were low ($H' = <1$). The results of this research will be developed become teaching material in form of a leaflet which were valid and reliable according to the validators.

Keywords— *diversity; shrimp; Asam-Asam River*

I. INTRODUCTION

Diversity of shrimps is part of river diversity of freshwater ecosystems. Shrimps are found at freshwater ecosystems which have an important role in keeping the balance of ecosystems because of its role as one of the food chains. Freshwater shrimps often are found in Asam-Asam River.

Asam-Asam River have several functions. Beside its function as the facility for water transportation for society, Asam-Asam River is a livelihood of the society. In addition, Asam-Asam River has a function of the resource of drinking water, especially several decades ago [1]. People who live around Asam-Asam River often catch shrimps and fish in the river. Shrimps can be the resource of prominent food which contains high protein. According to early survey from

researcher, the shrimp-population tends to decrease. This was estimated to be caused by several activities which have been operated in the area. One of these activities is the Coal-fired Power Plant (PLTU) which products liquid waste. Row material of the Coal-fired Power Plant is coals. The liquid-waste of the PLTU contains several heavy metals which are harmful if they enter the river. The other activity is throwing the waste into the river by the resident. Those activities can disturb the balance of the river ecosystem. When the river ecosystem is disturbed, habitats of the shrimps could be disturbed, too. As the results, the diversity of the shrimps could decrease.

The condition of Asam-Asam River had been polluted chemically because the parameter contains Zink (Zn), hydrogen of sulfide (H_2S), and iron (Fe) were above the threshold of quality standards based on the regulation of the Governor of South Kalimantan Number 05 of 2007 [2]. The values of each parameter were $Zn = 0,087$ mg/l, $H_2S = 0,003$ mg/l and $Fe = 1,66$ mg/l. Whereas the value of standards respectively were $Zn = 0,05$ mg/l, $H_2S = 0,002$ mg/l, and $Fe = (-)$ or very small.

II. METHOD

The tools which were used to take the shrimp samples were a dragnet (*lunta* in Banjarese language) and several tools which were used to take the water samples were bottles of samples. The method used this research was descriptive method. The data were collected directly by doing observation to the field. This research was located at Asam-Asam River in Tanah Laut Regency. The procedures of this research were to observe the location of research, and then prepare the tools and materials. The next steps were to determine the area of the sampling points. The sampling points consisted of three stations. The first station was situated at Asam-Asam River near natural vegetation. The second station was situated Asam-Asam River near the Coal-fired Power Plant (PLTU) and the third station was situated at Asam-Asam River near settlement of resident. Each station was divided into two zones that were the left and the right sides of the river. Each the side

consisted of the ten sampling points. The dragnet (*lunta*) was used to catch shrimps and then the shrimps were put into plastic samples and were given a label of each zone as well as recorded. The shrimps which found in the field were collected for counting the shrimps. Some of the environmental parameters were measured and the shrimps were identified by using the shrimp-identification books. Then, they were analyzed by using the following formula:

$$H' = - \sum_{i=1}^s (p_i \ln p_i). \quad (1)$$

III. RESULTS

A. Diversity of the Shrimps

According to the results of the research which was done at Asam-Asam River of Tanah Laut, there were two families of shrimps (Palaemonidae and Penaeidae) which consisted of four species, that were *Palaemon concinnus*, *Metapenaeus monoceros*, *Macrobrachium rosenbergii*, dan *Macrobrachium acanthurus*.

TABLE I LIST OF THE AMOUNT (NP) OF THE SHRIMPS AT THE RESEARCH AREA

| Species' name | Station I Amount (NP) | Station II Amount (NP) | Station III Amount (NP) |
|----------------------------------|-----------------------------|------------------------------|-------------------------------|
| <i>Palaemon concinnus</i> | 170 | 116.667 | - |
| <i>Metapenaeus monoceros</i> | 30 | - | - |
| <i>Macrobrachium rosenbergii</i> | - | 83.333 | 167.307 |
| <i>Macrobrachium acanthurus</i> | - | - | 32.692 |
| Total | 200 | 200 | 200 |

Notation :

- Station I : Area of the Asam-Asam River near the natural vegetation
 Station II : Area of the Asm-asam River near Electr Generator of Stem Power (PL
 Station III : Area of the Asam-Asam River near the settlement of Residents

TABLE II LISTS OF THE DIVERSITY INDEKS OF THE SHRIMPS AT THE RESEARCH AREA

| Species' name | Station I Diversity Index (H') | Station II Diversity Index (H') | Station III Diversity Index (H') |
|----------------------------------|--------------------------------------|---------------------------------------|--|
| <i>Palaemon concinnus</i> | 0.178 | 0.346 | - |
| <i>Metapenaeus monoceros</i> | 0.321 | - | - |
| <i>Macrobrachium rosenbergii</i> | - | 0.346 | 0.073 |
| <i>Macrobrachium acanthurus</i> | - | - | 0.197 |
| Total | 0.500 | 0.693 | 0.271 |

Notation :

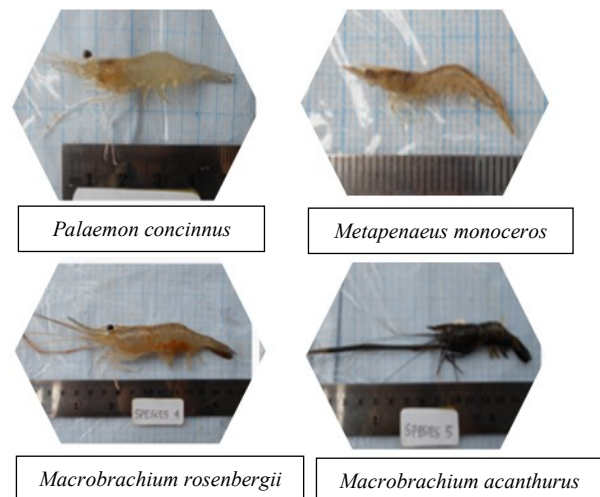
- Station I : Area of the Asam-Asam River near the natural vegetation
 Station II : Area of the Asm-asam River near the outlet of Electric Generator of Stem Power (PLTU)
 Station III : Area of the Asam-Asam River near the Settlement of Residents

TABLE III. THE VALUE OF THE ENVIRONMENTAL PARAMETERS AT ASAM-ASAM RIVER IN TANAH LAUT

| Environmental, physical and chemical Factors | Station | | |
|--|-------------------|-------------------|-------------------|
| | I | II | III |
| Temperature | 29-30°C | 26-27°C | 26-27°C |
| Acidity of degrees | 7.5 – 8.0 | 6.6 – 6.9 | 7.2 – 7.4 |
| Current speed | 0.0313-0.0323 m/s | 0.04 – 0.0476 m/s | 0.0455-0.0556 m/s |
| Brightness | 48 – 50 cm | 28 – 30 cm | 19 – 23 cm |
| Suspended solids | 0.2186 mg/l | 0.2959 mg/l | 0.3092 mg/l |
| Water Depth | 124-168 cm | 78—105 cm | 106-121 cm |
| Basic Subtract | Sandy mud | Pebble mud | Clay mud |
| Sulfide | 0.041 mg/l | 0.118 mg/l | 0.108 mg/l |
| Phosphate | 0.069 mg/l | 0.006 mg/l | 0.006 mg/l |

B. Teaching Material Development

The result of the research about the diversity of the shrimps at the Asam-Asam River in Tanah Laut were poured out into a teaching material in form of a *leaflet*. The species which were found in this study area were only four species, that were:



IV. DISCUSSION

A. The shrimps found at Asam-Asam River in Tanah Laut

According to description of the shrimps at Asam-Asam River in Tanah Laut, there were four species of the shrimps that consisted of the two families, namely Palaemonidae and Penaeidae. According to Table I, at the station I (near natural vegetation) and II (near the outlet of the PLTU) there were only *Palaemon concinnus* species was found. This was

because there were many water plants as the shrimps' food in station I. This was supported by [3] statement that the species of the *Palaemon concinnus* could be reproductive well since its habitats were planted by water plants. Besides, the water of the river in the station I still contains brackish water and this statement is in line with the statement of [4] that habitats which are liked by *Palaemon concinnus* is estuary which includes brackish water. Ref [5] said that in general, coastal area and sea have more stable pH and there were range of limited value, namely 7,6 – 8,3 of pH. This is an alkalinity.

No species of shrimp was not found at the station III. This was estimated that *Palaemon concinnus* could not adapted by the habitat condition in the station III where the condition in station III was very far from the estuary area. The salinity of the station III was estimated low. The other reasons were that the water plants as a shrimp's food in the station III were few in number and the brightness of station III was low, namely only 19 to 23 cm. Then, the basic subtract of station III was the mud clay.

Metapenaeus monoceros was only found at the station I (near natural vegetation area), whereas it was not found at the station II (near the outlet of PLTU area) and station III (near the of the settlement-residents). This was estimated that station I had the habitats which contain the sandy mud. Ref [6] said that *Metapenaeus monoceros* like sediment area which contain a mud sandy as its habitat better than the other habitats.

Macrobrachium rosenbergii was found at the station II (area near the PLTU) and station III (area of the residents' settlement) although it was not found at the station I (near the natural vegetation area). This was caused by the characteristic of *Macrobrachium rosenbergii* which was not active during the day. This was supported by [7] that *Macrobrachium rosenbergii* was one of a nocturnal shrimps. It was the animal which is active in the night. During the daylight, it is more likely to hide under the plants, rocks, or other things in the water because *Macrobrachium rosenbergii* does not like the sunlight [8]. Ref [9], the members of *Macrobrachium* were shrimps which prefer freshwater, such as river, pond, and lake as their habitats.

Macrobrachium acanthurus was only found at the station III (area of the settlement-residents). This was due to many detritus estimated at the station III detritus as a source of main food for *Macrobrachium acanthurus*. This detritus comes from disposal of organic wastes from settlement of residents. Some of the disposal of organic wastes were food- residue and feces thrown to the river.

The suspended solids which were at the station III was higher (SS= 0,309 mg/L) than the station I and station II. This suspended solids could trigger other microorganism to survive in this area. Ref [10] said that *Macrobrachium acanthurus* shows the characteristic of omnivore, and their main food is detritus, while the others were oögonium, macroalgae, and a part of benthos.

B. The amount and the Diversity of Shrimps at Asam-asam River in Tanah Laut

According to the results of this research, the shrimp with the most important value and the highest amount was *Palaemon concinnus* species compared to the other species. This was estimated since the food which was needed from this shrimp was enough because of many plants in this area. Ref [11] state that plants are the main food of shrimps, whereas mollusca and insect are the supplement food. This was supported by [3] that the *Palaemon concinnus* could be reproductive well because its habitats have many plants as the source of food. *Metapenaeus monoceros* had the lowest amount. It was considered that *Metapenaeus monoceros* could not adapt at the area of natural vegetation.

According to the results of this research (Table I), the diversity index of the all stations were low ($H' < 1$). The low-diversity indexes were caused by pollution of sulfide which disturbed the survival of shrimps. The results of measurement showed the water quality at Asam-Asam River in this research area had the concentrations of the sulfides of 0,04 mg/l to 1,118 mg/l, whereas the threshold of quality standard of sulfide was 0,002 mg/l. The sulfides were estimated to come from disposal waste of cola-fired power plant (PLTU) and disposal waste of residents' settlement. Ref [12] said that this molecule could be from the organic material which appeared during the rain, from industrial waste, domestic waste, and agriculture waste. Sulfides were toxic for water biota, including shrimps, although their concentrations were 0,1 mg/l [13]. This was supported by the condition of hydrogen sulfide which tends to become a problem in the society who is near certain industry. Hydrogen sulfide was found at the deposit of coal and oil which were mobilized by people [14]. Ref [15] said that shrimps can lose of balance at the concentration of sulfide of 0,1 to 0,2 ppm and they cannot survive at the concentration of sulfide of 1 ppm.

In addition, the low diversity index is might be caused by the concentrations of suspended solids in this location of the research (Table III) which were high above 20 mg/l. This statement was supported by [16] that suspended solids in the streams could reduce the number of species in the ecosystem.

The other possibility of the low-diversity index of the shrimps in this location of the research area was that the shrimps are usually caught by the communities around the river for self-consumption and trade to the other communities. According to the community near the river, the shrimps are caught by the community almost every week by fishing or using dragnet.

C. Teaching material according to results of the research

The results of this research were very important to become the teaching material in Biology especially in Environment Toxicology subject because the results explain about the livings diversity. The livings diversities are in the curriculum of the Senior High Schools or in the Universities. We can explain one of the living diversities with the results of this research, that were the diversity of the shrimps which be lives in the river. We can mention of the shrimps which were be

lives at the Asam-Asam River. Also, we can explain why the diversity of the shrimps were low in the area of study.

In addition, students can describe the shrimps and show the picture of the shrimp species which was life at the Asam-Asam River. Then, students can finally more understand about the living diversities in the rivers, especially in the Asam-Asam River around the PLTU.

V. CONCLUSION

Based on results and data analysis which had been done at the Asam-Asam River in Tanah Laut, we were found that :

1. There were four species of shrimps which consisted of three species from the Palaemonidae families and one species from the Panaeidae family. The species of the Palaemonidae were *Palaemon concinnus*, *Macrobrachium rosenbergii* and the species of the Panaeidae was *Metapenaeus monoceros*.
2. The count results of the diversity index according to Shanon-Winner $\{H' = - \sum_{i=1}^s (pi \ln pi)\}$ at the all of the stations of observation, we were found that the diversity index were low ($H' < 1$.)
3. The results of the research in form of the *leaflet* was very useful and can be used for teaching material.

VI. SUGGESTION

We need further research at other different-characteristic-habitats about the kind of shrimps with using an different apparatus on

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