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# *Zooplankton Diversity at Pearl Shell Cultivation Locations on Bintangor Island, Teluk Kabung, Padang City*

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***Abstract*— Given the very important role of zooplankton in aquatic ecosystems, a study was conducted with the aim of analyzing the diversity of zooplankton which includes species, abundance and ecological index as well as water quality on Bintangor Island, Teluk Kabung. Zooplankton is one of the biota that has an important role because it acts as a linking link between primary producers and biota at a higher trophic level. Zooplankton is also one component in the food chain which is measured in relation to the production value of an ecosystem. This is because zooplankton has a dual role as both the first level consumer and the second level consumer, which is the link between plankton and nekton. Zooplankton can only live and thrive in suitable water conditions. If the environmental conditions are suitable, the zooplankton will grow and develop properly. Data was collected by survey at 3 observation stations determined by a simple random technique. The results showed that the type and abundance of zooplankton found on Bintangor Island, Teluk Kabung, Padang City was quite varied with the number of species as many as 15 which were divided into 7 classes. Based on the calculation of the ecological index shows that the abundance of zooplankton in the category of waters that are less stable.**

***Keywords*— diversity, zooplankton, pearl shell, bintangor island**

## I. INTRODUCTION

Plankton are aquatic organisms that float by passive movement and cannot fight the current. Plankton consists of phytoplankton and zooplankton. Phytoplankton are autotrophs and become primary producers of waters, while zooplankton are the first level consumers that directly prey on phytoplankton. Zooplankton is one of the biota that has an important role because it acts as a linking link between primary producers and biota at a higher trophic level (Clark et al., 2001). Zooplankton is also one component in the food chain which is measured in relation to the production value of an ecosystem. This is because zooplankton has a dual role as both the first level consumer and the second level consumer, which is the link between plankton and nekton (Pratono et al., 2005). The primary production of phytoplankton in a waters is controlled by the presence of zooplankton in these waters (Yuliana and Ahmad, 2017) and is directly proportional to the presence of phytoplankton (Ningrum and Wijiyono, 2015). According to Arinardi (1997) the abundance of zooplankton is highly dependent on the abundance of phytoplankton, because phytoplankton is food for zooplankton, thus the abundance of zooplankton will be high in waters with a high content of phytoplankton. Besides being influenced by the availability of food (phytoplakton), the abundance of zooplankton is closely related to changes in the aquatic environment, both physical, chemical and biological (Wibowo et al., 2004; Aji et al., 2014; Agusta, 2014; Raza'i, 2017).

Zooplankton can only live and thrive in suitable water conditions. If the environmental conditions are suitable, the zooplankton will grow and develop properly. Vice versa, if the environmental conditions and the availability of phytoplankton do not match the needs of the zooplankton, the zooplankton cannot survive and will seek suitable environmental conditions. Environmental

conditions suitable for zooplankton can be found in waters that are not under ecological pressure from land or from the waters themselves. Such water conditions are strongly influenced by various activities carried out by the community, both activities carried out on land and activities in the waters concerned. Likewise, the existence of zooplankton is strongly influenced by various activities carried out by the community around the waters of Bintangor Island, Teluk Kabung. Bintangor Island Regency, Teluk Kabung is an island that has a large potential of marine resources. There is a coral reef ecosystem, a diversity of fish species and is used as a marine aquaculture and capture fisheries area. The highly developed marine aquaculture activity on Bintangor Island, Teluk Kabung is pearl oyster cultivation which produces export quality pearl seeds from Pinctada maxima shellfish.

In the context of sustainable use and management of coastal and marine resources, especially in supporting economic activities and the sustainability of their ecosystems, these waters must be maintained so that they continue to support the diversity of organisms and produce added value in terms of aesthetics and fish availability. The presence of fish and water fertility is one indicator of the presence of zooplankton, considering the role of zooplankton in the ecosystem as the first consumer to eat phytoplankton, then zooplankton is eaten by the children of the fish. Based on the function of zooplankton in these waters, it is very important to conduct research with the aim of analyzing the structure of the zooplankton community which includes species, abundance, ecological index and water quality on Bintangor Island, Teluk Kabung

## II. Research Methodology

This research was conducted in January 2021 on Bintangor Island, Teluk Kabung, Padang City, North Sumatera (Figure 1). The main data collected in this study are biological parameters (zooplankton), while the supporting data are physical and chemical parameters of the waters. Data collection is done by survey method. Observation stations were determined by simple random sampling (Clark and Hosking, 1986; Morain, 1999). A total of 3 observation stations are distributed proportionally to the research location, so that they can represent the characteristics of the area being surveyed. Each observation and sampling station is determined by its coordinate position by means of a GPS (Global Positioning System). Zooplankton samples were taken by filtering 100 liters of surface water using a 10 liter volume bucket. The sample was filtered using plankton net no. 25, filtered sample water was put in a 20 ml sample bottle and preserved by using Lugol's preservative as much as 2-4 drops. During analysis, 1 ml was taken using a pipette and observed using a microscope. Each sample was repeated observations 3 times. Identification of zooplankton was carried out to the genus level with the help of Yamaji (1996) and Nontji (2008) books. Measurements of water parameters including temperature, salinity, pH, brightness and dissolved oxygen were carried out directly in the field. In addition to direct measurements in the field, water samples were also taken to analyze the physical and chemical parameters of the waters. Biological parameters (zooplankton), physical and chemical were analyzed at the Laboratory of Animal Ecology, Biology Department, Andalas University. In addition to the abundance of zooplankton, several ecological index were calculated. The calculation of the ecological index includes diversity index (Shannon-Wiener Index, H') and uniformity index (Evenness Index, E). The index calculation refers to Michael (1984) with the following formula:

$$H' = -\sum_{i=1}^{s} pi \ln pi$$

Information :

H' : Shannon Wiener diversity index

ln : natural logarithm

S : total number of species

Pi : number of individuals of one species per number of individuals all species.

Diversity index criteria:

H' < 1 : low diversity index

1 ≤ H' ≤ 3 : medium diversity index

H' > 3 : high diversity index

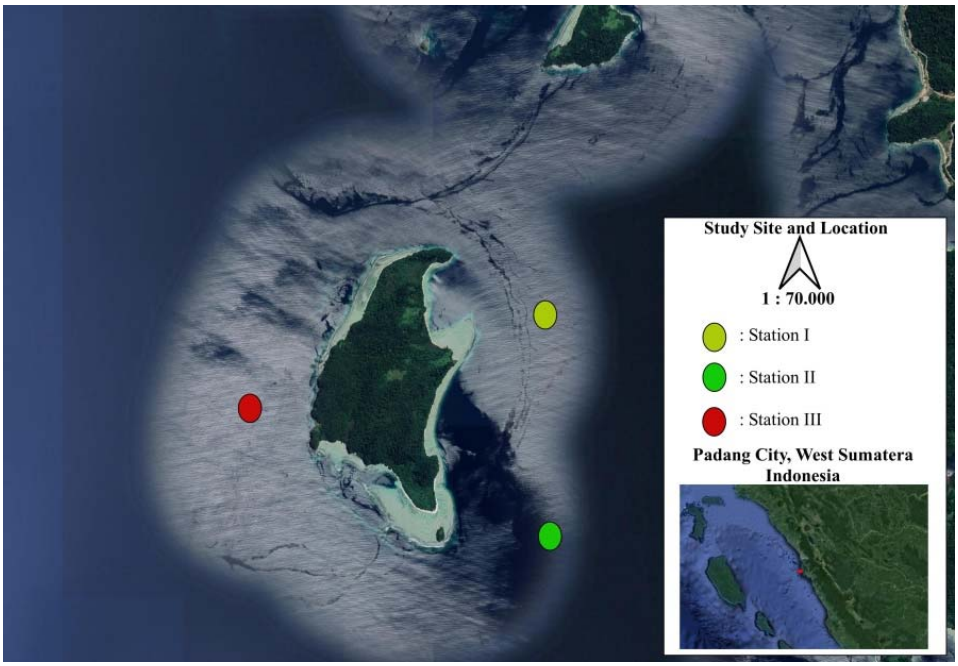


Figure 1. Map of Research Location in Bintangor Island, Teluk Kabung, Padang City

## III. Result And Discussion

Species Composition and Abundance Based on the results of identification and enumeration of zooplankton found at the study site as many as 15 species, consisting of 9 orders Cyclopoida (2 species), Harpactidae (2 species), Calanoidae (1 species), Copelata (3 species), Anysomyaria (1 species), Atlantidae (1 species), Euopisthobrancia (2 species) Scalpellomorpha (1 species) and Canalipalpata (1 species). The abundance of zooplankton found was quite varied, where there was one dominant genus found at the research site, Nauplius with an abundance of 7.73 ind $L^{-1}$ (Table 1) and a relative abundance of 63.38% (Table 1).

Table 1. Abundance of Zooplankton on Bintangor Island, Teluk Kabung, Padang City

| Class | Ordo | Species | Abundance(ind $L^{-1}$) | Relatif Abundance (%) |
|---|---|---|---|---|
| Crustaceae | Cyclopoida | *Nauplius* | 7.73 | 63.38 |
| | | *Cyclops* sp | 0.33 | 0.33 |
| | Harpacticoida | *Microstella rosea* | 0.33 | 6.52 |
| | | *Microstella norvegica* | 0.27 | 2.33 |
| | Calanoida | *Calanus finmarchicus* | 0.27 | 4.39 |
| Appendicularia | Copelata | *Appendicularia sicula* | 0.13 | 0.13 |
| | | *Oikopleura dioca* | 0.87 | 7.05 |
| | | *Megalocercus huxleyi* | 0.27 | 0.27 |
| Sticholonchea | | *Sticholonche zanclea* | 0.40 | 4.52 |

| | | | | |
|---|---|---|---|---|
| Bivalvia | Anysomyaria | *Pinctada maxima* | 0.07 | 2.13 |
| Gastropoda | Atlantidae<br>Euopisthobrancia | *Atlanta peroni*<br>*Limacina inflata*<br>*Limacina* sp | 0.20<br>0.20<br>0.07 | 4.32<br>6.38<br>0.07 |
| Hexanauplia | Scalpellomorpha | *Lepas anatifera* | 0.27 | 6.45 |
| Polychaeta | Canalipalpata | *Sabellaria cementarium* | 0.07 | 0.07 |

The genus most often found at the research site is the genus of the class Crustacea. Overall zooplankton in the sea is dominated by crustaceans, both in the number of individuals and the number of species (Odum, 1971) and the dominance of crustaceans in the waters is related to the omnivorous nature or eaters of everything (phytoplankton, zooplankton, detritus), making it easy to get food (Arinardi et al., 1997). Meanwhile, according to Pranoto et al. (2005), the crustacean class has a higher composition because they are generally euryhaline or better able to withstand large changes in salinity or migrate further to the river mouth. Then according to Mulyadi and Radjab (2015) stated that the dynamics or variations in the composition of zooplankton are generally influenced by the availability of food, suitable environmental conditions, competition and predation factors and the effect of vertical migration of zooplankton. Zooplankton with a high abundance was found at station I near the pearl clam floating cage, because the area had sufficient nutrients from land near the coast. Different conditions were obtained at station III close to the high seas, where zooplankton were of low density. Zooplankton that have high mobility tend to migrate to areas with lots of phytoplankton, in order to get space to move freely. The abundance of zooplankton is influenced by the abundance of phytoplankton which is a result of the high content of nutrients, especially nitrate and phosphate which is supported by the conditions of the aquatic environment (Arinardietal, 1997; Patmawati et al., 2018).

To see the level of stability of the aquatic environment, several zooplankton ecological indices have been calculated including the diversity index (Shannon-Wiener Index, H') and the uniformity index (Evenness Index, E) (Table 2). The diversity index describes the richness of plankton species found in a waters. The uniformity index describes the level of balance in species composition, and the dominance index is a description of the presence or absence of a dominating plankton species or group (Odum, 1971). The higher the diversity value of an area, the waters have a stable diversity. The diversity index at the study site ranged from 0.10 to 0.92 with an average value of 0.53. Based on Odum (1971) this value is included in the category of low diversity and has low community stability. The spatial distribution of the diversity index is shown in Figure 3b. The diversity index at the location is relatively very low (<1) spread over all observation stations. The uniformity index shows a fairly high value with an average of 0.25. The average value is included in the category of low uniformity (Odum, 1971). Thus, based on the ecological index, a low diversity index is obtained, and high uniformity means that the zooplankton community on Bintangor Island, Teluk Kabung, Padang City, if there are environmental factors that decrease or increase, the community structure will quickly change, but there is a tendency for dominance by species to occur. Type certain.

Table 2. Zooplankton Abundance and Ecological Index on Bintangor Island, Teluk Kabung, Padang City

| Variable | Average | Range |
|---|---|---|
| Abundances | 11.47 | 0.07-7.73 |
| Diversity Index | 0.53 | 0.10-0.92 |
| Equitability Index | 0.25 | 0.04-0.47 |

The results of observations of water quality conditions at the study site are shown in Table 3. Water quality parameters are generally still in good condition to support marine biota according to quality standards (Minister of Environment, 2014). The results

of temperature observations show a range of 27-28 °C with an average value of 27.6 °C, this temperature condition is still classified in the good category for marine biota. According to Tambaru et al. (2014) the temperature range for zooplankton development is 27°C-32°C. The brightness of the waters at the study site shows a value that strongly supports the growth of marine biota according to quality standards (Minister of Environment, 2004) with an average value of 17.3 m (Table 3). The level of light penetration is strongly influenced by suspended and dissolved particles in the water, thereby reducing the rate of photosynthesis. The measured brightness level is very relative to the water depth. Meanwhile, turbidity can cause negative effects on water quality, especially levels of DO, BOD, temperature and have an impact on the diversity of fish species, due to a decrease in photosynthesis, populations of plankton, algae and microphytes (Makmur et al., 2012).

The results of the turbidity measurement showed a range of 0.07-0.10 with an average value of 0.086 (Table 3). This range still meets the threshold value of the quality standard for marine biota, which is 5 NTU (Minister of Environment, 2004). The condition of the degree of acidity (pH) as a result of field measurements illustrates that the pH conditions at the study site are waters that tend to be alkaline with an average pH range of 8. This indicates that the waters are quite ideal for zooplankton growth. The results of salinity measurements showed a range of 33-34 ppm with an average value of 33.6 ppt (Table 3). Dissolved oxygen was recorded in a fairly high range, namely in the range of 10.9–12.4 mg $L^{-1}$ and an average value of 11.2 mg $L^{-1}$.. The oxygen value is still categorized as suitable for the development of marine biota (Minister of Environment, 2004). Dissolved oxygen conditions in the waters are influenced, among others, by temperature, salinity, water mass movement, atmospheric pressure, abundance of phytoplankton and oxygen saturation levels around it and the stirring of water masses by the wind (Simanjuntak, 2009).

Table 3. Physico-chemical conditions in the waters of Bintangor Island, Teluk Kabung

| Variabel | Unit | Range | Average | Quality Standard |
|---|---|---|---|---|
| Temperature | ºC | 27- 28 | 27.6 | Natural |
| Light Intensity | M | 16-18 | 17.3 | >3 |
| Total Supended Solid | Mg $L^{-1}$ | 0.07-0.10 | 0.08 | <5 |
| pH | | 8 | 8 | 7-8.5 |
| Salinity | Ppm | 33-34 | 33.6 | Natural |
| Dissolved Oxygen | Mg $L^{-1}$ | 10.9-12.4 | 11.2 | >5 |

## IV. CONCLUSION

The results of this study indicate that the type and abundance of zooplankton found on Bintangor Island, Teluk Kabung, Padang City is quite varied with the number of species as many as 15 which are divided into 9 orders and 7 classes, of which 5 species are found in the Crustacea class. Based on the calculation of the ecological index which includes the diversity index and uniformity index, it shows that the zooplankton community is in the category of less stable waters.

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