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MACROZOOBENTOS COMMUNITY STRUCTURE AT ECOSHRIMP RESERVOIR POND, WAETUOE VILLAGE, LANRISANG DISTRICT, PINRANG REGENCY

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ABSTRACT

Mollusc has great commercial benefits in capture fisheries and aquaculture. However, it can also cause economic losses and human suffering. Some macrozoobenthos of the mollusc species are intermediate hosts for parasites and pests in aquaculture pond systems. The reservoir in the pond is a sedimentation area and a biofilter to optimise water quality before flowing into the pond. This study aims to analyze the macrozoobenthos community structure at the eco shrimp reservoir pond located in Waetuoe Village, Lanrisang District, Pinrang. Macrozoobenthos sampling was carried out using a 1x1 m quadrant transect. The results showed that the identified molluscs comprised eight species grouped into four families and two classes, including Gastropods and Bivalves. The abundance of macrozoobenthos at the pond's edge was smaller than those in the middle part (994 individuals vs. 1095 individuals). *Sermyla requtii* was the species with the highest density of 350 ind/m^2 at the edge and 670 ind/m^2 in the middle of the reservoir. The frequency of occurrence of macrozoobenthos at both observation sites has a value of > 25%. The diversity index at the edge of the reservoir (1.7015) and in the middle of the reservoir (1.2533) is relatively moderate. The uniformity index value at the edge of the reservoir (1.8620) and in the middle of the reservoir (1.3715) is relatively high. The dominance index value at the edge of the reservoir (0.2192) and in the middle of the reservoir (0.4124) is relatively low. The particle size analysis shows that the sediment type in the reservoir is medium sand with an average median value (d50) of 0.29 mm.

Keywords: Abundance, Ecoshrimp, Macrozoobenthos, Reservoir, *Sermyla requtii*

INTRODUCTION

Fish farming is one form of global industry with relatively rapid growth. The potential for brackish water farming in Pinrang Regency includes shrimp farming, milkfish, and seaweed (Agustinii *et al.,* 2019). Several pond fish farmers in Pinrang Regency manage their ponds traditionally with a polyculture system (mixed) of tiger prawns, milkfish, tilapia, and seabass by utilizing the food chain as an energy source (Irmawati *et al.,* 2021). Some fish farmers also manage their ponds organically and environmentally friendly (ecoshrimp) without using fertilizers, artificial feeds, and drugs that contain chemicals harmful to health and the environment (Atjo, 2016). In polyculture farming,

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the things that also need to be considered are the issues of water quality and pests. Optimum water quality and managing the problems in fish farming activities are expected to overcome disease outbreaks, thereby reducing the risk of cultivation failure. Various efforts can be made to keep pond water quality on the shrimp farm good, including implementing a reservoir system in ponds, especially shrimp ponds.

The reservoir in the pond is a sedimentation plot and a biofilter to optimize water quality before flowing into the pond. The introduction and presence of molluscs, milkfish, tilapia, and other types of finfish in the reservoir are expected to function as a natural biofilter (Imai, 1971; Khalil *et al.*, 2016). In 2018, KKP, through the Directorate General of Cultivation, introduced Asia seabass (*Lates calcalifer* Bloch, 1790) or known locally as *bale kanja*, as a new type of finfish that can be polyculture with tiger prawns. They are expected to reduce the risk of disease outbreaks caused by bacteria and viruses (Irmawati *et al.*, 2021). However, the presence of molluscs in ponds is also considered a pest because they are the main consumers/direct predators that eat fish and food for cultured fish and can also cause competition for oxygen and space, which so called competition for biological requirements (Antoni & Febri, 2017; Setiyo, 2019).

Moreover, the presence of molluscs can provide a clear picture of the quality of ponds because these animals are relatively sedentary and sensitive to changes in the quality of the environment in which they live, which affect their composition and distribution. This group of animals can better reflect changes in the environment over the time because they are continuously submerged by water that varies in quality (Sijaya, 2016). The high diversity of macrozoobenthos can be used to indicate the quality of water. However, until now, there is no information about the structure of the macrozoobenthos community in the ecoshrimp pond reservoir, Waetuoe Village, Lanrisang District, Pinrang. Therefore, this study aims to determine the structure of the macrozoobenthos community in the ecoshrimp pond reservoir in Waetuoe Village, Lanrisang District, Pinrang Regency.

MATERIAL AND METHOD

This research was conducted from November 2020 - February 2021, at an ecoshrimp pond, Waetuoe Village, Lanrisang District, Pinrang Regency (Figure 1). Macrozoobenthos analysis was carried out at the Fisheries Biology Laboratory of the Department of Fisheries. The sediment texture analysis was carried out at the Coastal Oceanography and Geomorphology Laboratory, Department of Marine Sciences, Faculty of Marine Sciences and Fisheries, Universitas Hasanuddin, Makassar.

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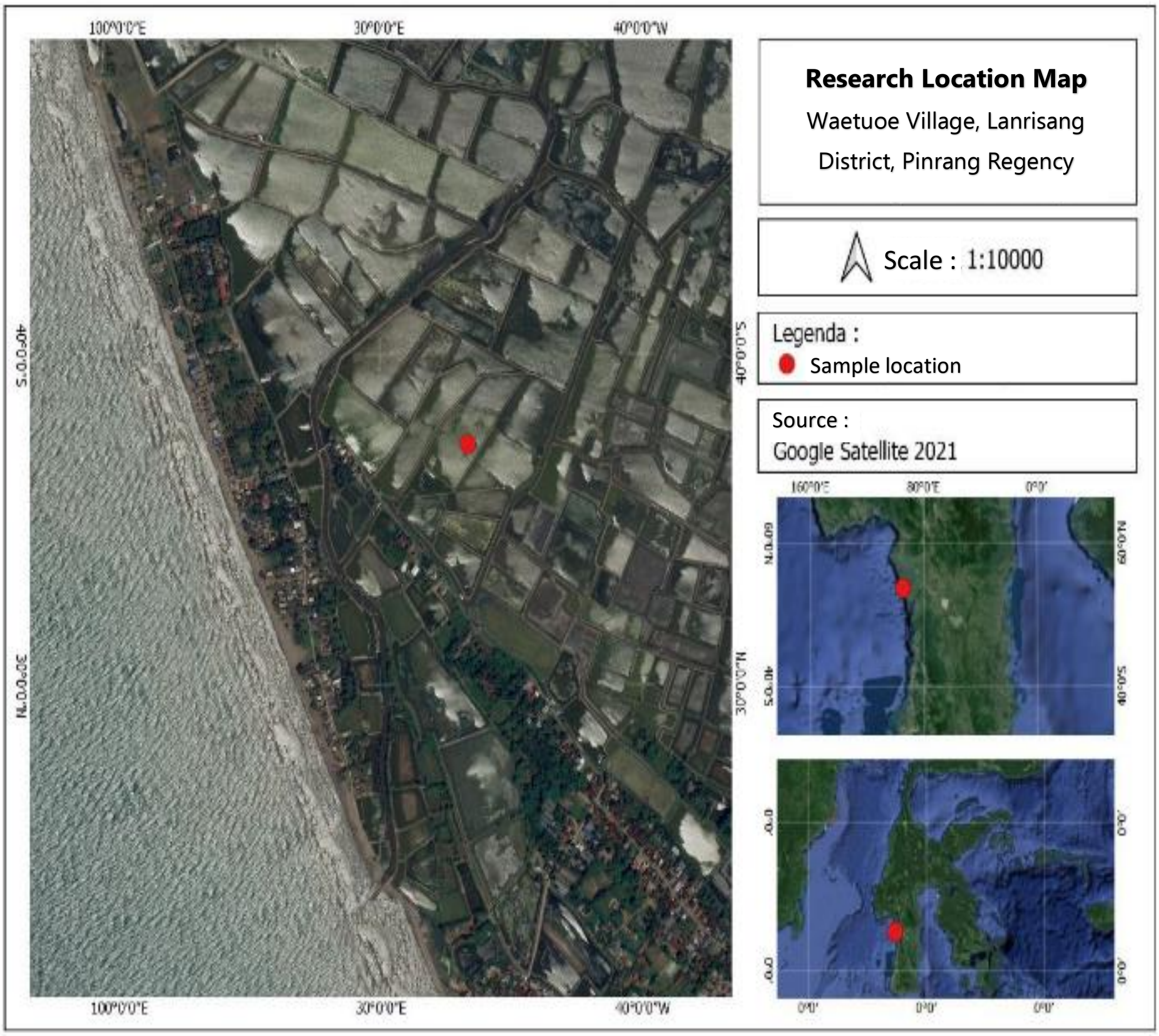

Figure 1. Research Location Map

Observation stations and sampling points are determined conceptually based on the representation of several water depth conditions. Macrozoobenthos were sampled at the edge (station I) and the middle of the reservoir (station II). The sampling point at station I, which is a ditch along the edge of the reservoir (water depth 60-70 cm deeper than that of the courtyard) (Irmawati *et al.*, 2021), consists of points around the inlet (P1), points around outlet (P2), and points representing locations outside the inlet and outlet (P3). The sampling point at station II, which is a station that represents a location with a water depth of 30-40 cm (Irmawati *et al.*, 2021) consists of two points near the ditch, including T1 and T3, and one point in the middle of the reservoir (T2). Illustrations of research sampling stations and points can be seen in Figure 2.

P-ISSN: 2355-729X
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Figure 2. Research sampling points.

Sampling was taken using a 1m x 1m quadrant-transect to assist macrozoobenthos sampling process. Sediment samples containing Macrozoobenthos were taken at nine sub-points per quadrant (Figure 3) using a shovel with a depth of approximately 5 cm. The sample taken was then put into a sample bag labeled and provided with information.

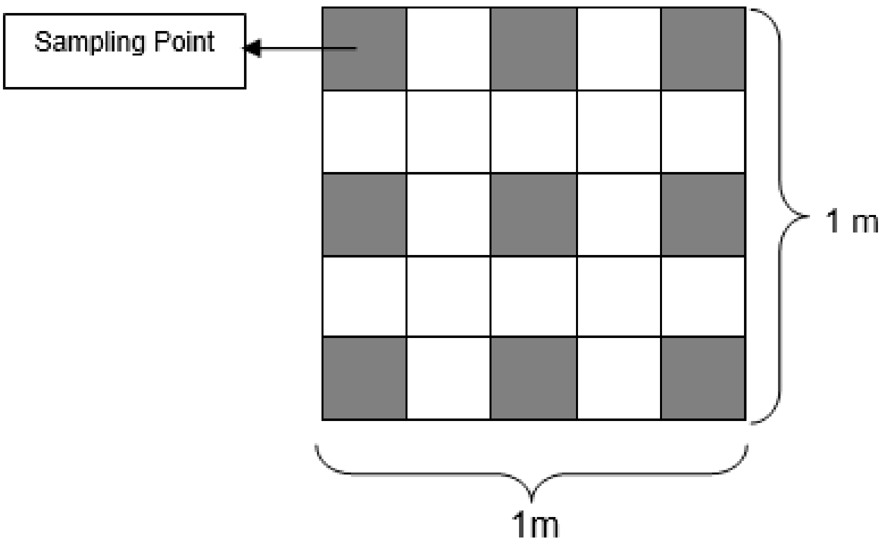

Figure 3. Illustration of sampling in a 1 x 1 m quadratic transect.

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E-ISSN: 2614-5014

Sediment and macrozoobenthos samples were preserved using ice cubes during the transport process to the laboratory. The sediment samples obtained were sieved to separate Macrozoobenthos from the sediments. Macrozoobenthos were put into a sample bottle that had been given a 70% alcohol solution and then identified using the identification guides; Dharma (1988, 1992), Carpenter & Niem (1998) and WoRMS (2021). Analysis of the substrate (sediment) based on grain size was carried out using the sieve shaker method which aims to determine the composition of the grain size of the sediment.

The macrozoobenthos data obtained were then measured for their density by dividing the number of individuals by an area (ind/m^2). Then, the frequency of presence was calculated based on the percentage of species found in the entire observation plot by referring to the formula used (Brower & Zar, 1998):

$$\text{Frequency of occurrence} = \frac{\text{the plot occupied by a certain type}}{\text{total number of plots}}$$

Shannon diversity index (H'), uniformity index (E) and dominance index (D) were calculated by following the formula used (Krebs, 1985):

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

$$E = \frac{H'}{ln\, S} \quad (2)$$

$$C = \sum (pi)^2 \quad (3)$$

Information: H' = diversity index, pi = probability of interest for each species (ni/N), ni = number of species I, N = total number of all species, E = index of species uniformity, S = number of species of organisms, C = Dominance index

RESULTS AND DISCUSSION

General Condition

Macrozoobenthos Community Structure

The macrozoobenthos community structure is characterized by biological indices. These include the number of individuals and species, diversity index, uniformity, and dominance of macrozoobenthos in reservoirs at the ecoshrimp pond cultivation area, Waetuoe Village, Lanrisang District, Pinrang. In general, during the study, 2,089 individuals were found consisting of eight species belonging to four families, three classes, and one phylum (Table 1). The phylum is Mollusc which is divided into two classes; gastropods and bivalves. In the gastropod class there are seven species, which are *Clithon dispar, Faunus ater, Telescopium telescopium, Sermyla requtii, Sermyla kupaensis, Cerithidea sp1, Cerithidea sp2*. As for the bivalves class, one species was found, namely *Crassostrea sp*.

Tabel 1. The abundance of macrozoobenthos found at the edge and middle of the reservoir

Class /Family	Genus/Species	Abundance (ind)	
		Station I	**Station 2**
Gastropods			
- Nerotidae	*Clithon dispar*	12	8
- Pachychilidae	*Faunus ater*	102	5
- Potamididae	*T. telescopium*	7	6
	S. kupaensis	228	153
	S. requtii	350	670
	Cerithidea sp1	138	106
	Cerithidea sp2	86	73
Sub Total		**923**	**1021**
Bivalves			
- Ostreoida	*Crassostrea* sp	71	74
Total		**994**	**1095**

Sermyla requtii, Sermyla kupaensis from the family of Thiaridae is a macrozoobenthos species found with the highest abundance respectively. *Sermyla request is the Thiaridae with the highest abundance found dominantly in the middle of the reservoir than the edge of the reservoir with a density level of 350 and/m2 on edge and 670 in*/m2 in the middle of the reservoir. The density of *Faunus ater, Sermyla kupaensis*, *Cerithidea sp1, Cerithidea sp2* was more dominantly abundant at the edge of the reservoir than in the middle of the reservoir. In comparison, the abundance of *Clithon dispar (Nerotidae), Crassostrea sp. (Ostreoida),* and *T. telescopium a*t the edge and in the middle of the reservoir were the same or equal (Figure 4).

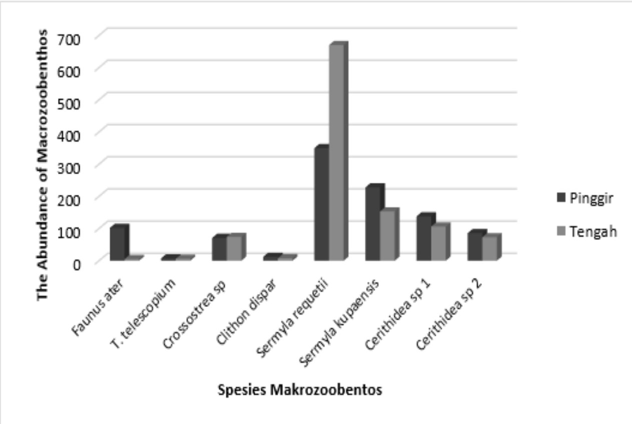

Figure 4. The abundance of macrozoobenthos

Frequency of Appearance of Macrozoobenthos at the Edge and Middle of the Reservoir

The frequency of occurrence of all macrozoobenthos species in the middle of the reservoir was 100% except for *Faunus* ater and *T. telescopium*. At the edge of the reservoir, the frequency of occurrence of all species was 100% except for *T. telescopim* and *Clithon dispar*. The frequency of occurrence of *T. telescopium* at the edge was 67% and in the middle was 33%. The frequency of appearance of *C. dispar* at the edge was 67% and the frequency of appearance of *Faunus ater* in the middle was 67% (Figure 5).

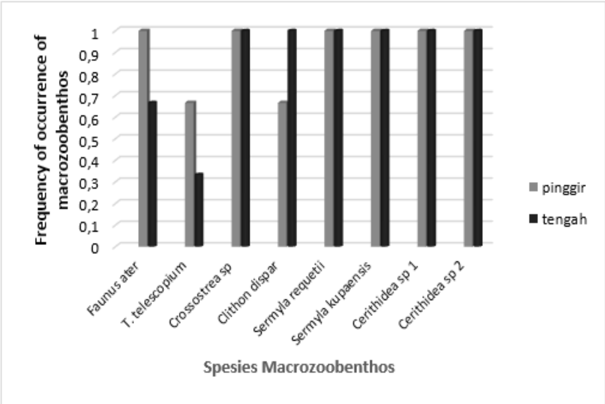

Figure 5. Frequency of occurrence of macrozoobenthos

Macrozoobenthos Ecological Index in Reservoir

Ecological diversity index values (H'), uniformity (E), and dominance (C) in general are applicable for all observation stations (Table 2). The diversity index value on the edge of the reservoir is 1.7015, and in the middle of the reservoir is 1.2533, which is less than three and is relatively moderate. The uniformity index value at the reservoir's edge and in the middle of the reservoir is close to 1, which is relatively high. On the other hand, the dominance index value at the reservoir's edge is 0.2192, while the middle of the reservoir has a dominance index value of 0.4124 which is relatively low (0<C 0.5).

Tabel 2. Value of diversity index, uniformity, and dominance

Ecological Index	The Edge of the Reservoir	The Middle of the Reservoir
Diversity	1.7015	1.2533
Uniformity	1.8620	1.3715
Dominance	0.2192	0.4124

Substrate Analysis

The substrate (sediment) analysis based on grain size was conducted to know the type of sediment as a habitat for macrozoobenthos. From the results of the analysis of particle size and sediment texture based on the Wentworth scale. It is in line with the results of Software Gradistat, which indicates that the type of sediment in the observation area tends to be dominated by medium sand with an average median value (d50) of 0.29 mm (Table 3).

Tabel 3. Sediment particle size and sediment type at the edge of the reservoir and the middle of the reservoir

Observation Area	Plot	Median d50 (mm)	Type of Sediment
The Edge of the Reservoir	P 1	0.30	Medium Sand
	P 2	0.29	Medium Sand
	P 3	0.30	Medium Sand
The Middle of the Reservoir	T 1	0.31	Medium Sand
	T 2	0.31	Medium Sand
	T 3	0.31	Medium Sand

Discussion

Molluscs are invertebrates that are part of benthos in coastal and estuarine waters. The phylum molluscs consist of six taxonomic classes, including Cephalopoda (e.g. squid, cuttlefish, octopus etc.), Monoplacophora (e.g. neopilina), Amphineura (e.g. chiton), Scaphopoda (e.g. denalium), Bivalves (e.g. ostrea, mytillus etc.) and Gastropods (e.g. snails, slugs, conch shell, cypraea). The gastropod class includes about 8% of species of the mollusk phylum (Zala et al., 2018).

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Several species of molluscs from the class of bivalvia and gastropods have great commercial benefits in capture fisheries and aquaculture. However, they can also cause economic losses and human suffering. Molluscs also play a role in biomedical research and biotechnology. Bivalves are used as animal models to study environmental and genetic interactions in tumor research. Mollusc extract is widely used as an antibacterial and is useful in medical and health sciences. Moreover, they are also important model organisms for environmental health studies. For instance, molluscs from the class of bivalves are often used in toxicological studies and environmental monitoring of heavy metals and other pollutants. Currently, one of the main targets of commercial fisheries is focused on bivalves, gastropods, and cephalopods, in this case, oysters, abalones, scallops, clams, cephalopods, and mussels as food ingredients as well as pearl button and pearl fishing (Linberg, 2001).

However, several types of molluscs are the first intermediate hosts for parasites and pests in pond cultivation system. The prosobranch gastropods act as intermediate hosts for digenean parasites, the final hosts for fish or fish-eating birds (Russel-Pinto *et al.,* 2006; Pina *et al*., 2011). Several types of coral (Coelenterata) are hosts for prosobranch and nudibranch gastropods. Several types of marine gastropods from the family of Cerithiopsidae have carnivorous grazing or mucus-feeding behavior and are grouped as parasites (Nützel, 2021).

Macrozoobenthos Community Structure

Generally, the types of macrozoobenthos at the reservoir's edge and in the middle of the reservoir are dominated by species from the gastropod class. The high abundance of gastropods compared to bivalves was also reported by Karepesina (2018). The great abundance of species from the gastropod class in the research location is due to the gastropods to their environment. Gastropods can live in various substrates ranging from coarse sand to fine sand, rocky substrates, and corals (Karepesina, 2018; Barrientos-Luján *et al*., 2021). This type of sandy substrate is very suitable for mollusks, especially for the gastropod and bivalves class. This is because the type of sandy substrate makes it easier for gastropods and bivalves to get a supply of nutrients and water needed for their survival and makes it easier to filter food. In the gastropod class, impermeable skin functions as a barrier, many breathe through the air and eat plankton or organic matter (Sijaya, 2016).

The highest density of eight species of macrozoobenthos found at the edge of the reservoir and in the middle of the reservoir was the spesies of *Sermyla riquetii* from the Thiaridae family. The abundance of this species at the research site is partly due to the species

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having a tolerance range of habitats ranging from freshwater to brackish water. In Thailand, *Sermyla riquetii* tends to be found in calmer river areas than in inflowing rivers, as its habitat is on silty and sandy substrates (Lentge-maaß *et al*., 2021).

The lowest density of eight species of macrozoobenthos found at the edge of the reservoir and in the middle of the reservoir was *T. telescopium* species from the Potamididae family. The density and distribution of *T. telescopium* species are influenced by their habitat condition, food availability, predation, and competition. *T. telescopium* is a group of native biota from mangrove ecosystems with habitat criteria of having open land, fine mud, large enough puddles, and high availability of organic matter. *T. telescopium* can live in the type of sedimentary sandy mud, muddy sand and sand as long as mangrove trees overgrow it (Kurniawati *et al.,* 2014; Hasibuan *et al.,* 2018).

Occurrence Frequency of Macrozoobenthos at the Edge and Middle of the Reservoir

In general, the frequency of appearance of eight species at the edge of the reservoir and the middle of the reservoir is categorized as the habitat still in line with its development because it has an occurrence frequency value (FK) > 25%. This is in line with the statement by Brower & Zar (1998) that a habitat can be said to be suitable for the development of an organism if the FK value is > 25%. Furthermore, Kariono *et al.* (2013) stated that species with a high frequency of occurrence are due to the sampling location, indicating that the environment is still in line with the habitat of macrozoobenthos. This shows that the species obtained can adapt to the environment and have a reasonably high tolerance range to environmental factors, and the species can reproduce well.

Groups of molluscs (bivalves and gastropods) have a fairly strong adaptation to environmental changes because they have hard shells that are more likely to survive than other groups. In addition, gastropods and bivalves have a relatively large pattern of adaptation to changes in environmental factors, causing this group to have a wide distribution, which can be found on all types of substrates with extended food niches (Alwi *et al*., 2020; Wishnu *et al*., 2020).

Macrozoobenthos Ecological Index in Tandon

The calculation results indicate that the diversity index value (H´) at the edge of the reservoir and the middle of the reservoir is less than 3. Based on the Shannon-Wiener index (Krebs, 1985), the diversity at the two observation sites was included in the moderate category ($1 \leq H' \leq 3$), which showed the distribution of the number of individuals for each species was not the same. This is in line with Pong-Masak & Pirzan (2006) statement,

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who stated that the diversity in the cultivated area is in the moderate category. The species diversity index is strongly influenced by the number of species, the number of individuals, and each species' distribution pattern. The smaller the number of species and the variation in the number of individuals for each species, the uneven distribution will decrease the diversity index (Karepesina, 2018). Furthermore, according to Odum (1996), diversity is related to the stability of an ecosystem. If the diversity index of an ecosystem is relatively high, the condition of the ecosystem tends to be stable. In contrast, if the diversity of an ecosystem is relatively low, the environmental conditions of the ecosystem tend to be polluted.

Based on the calculation of the uniformity index value, the value at the edge of the reservoir and the middle of the reservoir is close to 1, which is classified as stable and has high population uniformity (e> 0.6) (Insafitri, 2010). If the index value is close to 0, it means that the uniformity between species in the community is low, which reflects the very different individual richness of each species. The uniformity index is close to 0, meaning that there may be a species that dominates. On the other hand, if the index value is close to 1, it means that the uniformity between species is relatively the same, and there are no significant differences (Choirudin *et al.*, 2014).

The dominance index value at the edge of the reservoir and in the middle of the reservoir shows the dominance index value is relatively low (0 < C 0.5), indicating that no species dominates the community. It means that each individual at the observation station has the same opportunity and maximally utilizes the resources in these waters (Alwi *et al.*, 2020). The high or low dominance value is related to the uniformity index value. The dominance index value has a value that is opposite to the uniformity index value. If the dominance index value (C) is high, the uniformity index value (E) tends to be low, and vice versa. A relatively high uniformity value usually follows a dominance index close to 0. In contrast, if a dominance index value close to 1 means that there are species that dominate in water characterised by a low diversity index value (Munandar *et al.,* 2016).

The high and low values of the diversity index, uniformity, and dominance at each observation station are caused by habitat conditions and the behaviour of an organism that can adjust to these environmental conditions. Changing habitat conditions can affect the species distribution in that habitat. (Yulianto, 2006).

CONCLUSION

The macrozoobenthos in the ecoshrimp reservoir pond were found to be from the

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phylum of Mollusca, classified into four families and two classes; gastropods and bivalves. The species found were *Clithon dispar, Faunus ater, Telescopium telescopium, Sermyla requtii, Sermyla kupaensis, Cerithidea* sp1*, Cerithidea* sp2*, Crossostrea* sp. The highest abundance of macrozoobenthos found at the reservoir's edge and the middle was the species Sermyla require from the family of Potamididae. The frequency of occurrence of each macrozoobenthos species was >25% which indicated that the habitat was still suitable for its growth. Based on the results of the analysis at the research site, the diversity index is in the medium category. The uniformity index is in the high category. At the same time, the dominance index is classified as a low category (no species dominates).

SUGGESTION

It is necessary to carry out further research related to water quality parameters, especially those that can affect the distribution of macrozoobenthos in reservoirs in the eco shrimp pond area, Waetuoe Village, Lanrisang District, Pinrang.

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