Ecobios Journal of Environmental Science
Volume 2 Issue 2 (December 2025): 87-98
ISSN (Online): 3064-1470 | DOI: 10.71024/ecobios.2025.v2i2.72

Macrozoobentos Diversity as Bioindicators in the Gili Meno Saltwater Lake, Indonesia

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Received: July 21 2025, Revised: December 5 2025, Accepted: December 31 2025

Abstract. This study aims to determine the macrozoobenthos as a bioindicator in Gili Meno Saltwater Lake. The type of research is descriptive with a quantitative approach and using random sampling method. Data collection techniques using preliminary tests, macrozoobenthos sampling, macrozoobenthos identification, and measurement of environmental parameters. Data analysis techniques used are Shanon-Wiener diversity index, evenness index, Simpson's dominance index, and important value index. The results showed that the water quality in the Gili Meno Saltwater Lake tends to be low with the value of environmental parameters in the first repetition of the average salinity was 34.60±0.55. The average temperature is 32.33±1.23. The average pH is 7.64±0.09. While in the second repetition, the average salinity was 41.5±0.58. The average temperature is 33.6±1.18. The average pH is 7.7±0.15. The average DO is 4.00±3.27. The average BOD was 4.00±3.40. Macrozoobenthos obtained as many as 114 individuals consisting of 3 families and 5 species. The highest importance value index (IVI) value is 152%. The H' value is 0.38, the E value is 0.24, and the C value is 0.85, indicating that the diversity and evenness of macrozoobenthos are low with high dominance or dominant species.

Keywords: Macrozoobenthos, bioindicators, diversity, saltwater lakes, Gili Meno

INTRODUCTION

A lake is a form of ecosystem that is located in a small area of the earth's surface (Kumurur, 2002). A lake is one of the common waters that has a concave shape and contains water (Melinda et al., 2021). Lakes have an ecological function, namely being a breeding ground for aquatic organisms; the function of cultivation is a place to catch fish with floating nets around the lake; and socio-economic functions that directly affect society (Abimanyu, 2016).

Lakes have several types, one of which is differentiated based on the type of water. Among them is saltwater lakes. Saltwater lake is a water that has a salty taste and does not release water (Yanti, 2023), due to high evaporation and will only leave salt deposits at the bottom of the lake (Rokhimaturrizki, 2022). One of the saltwater lakes in Indonesia is located in Lombok, West Nusa Tenggara, precisely on Gili Meno. Gili Meno is famous along with two other Gili, namely Gili Trawangan and Gili Air (Wijaya & Muliadi, 2018).

Gili Meno is located in Gili Indah Village, Menang District, North Lombok Regency, West Nusa Tenggara Province. Gili Meno is geographically located between Gili Trawangan and Gili Air (Rahman & Hadi, 2021). The saltwater lake located on Gili Meno has a unique characteristic, namely its salinity is higher than the salinity of waters in Indonesia in general. The salinity of the Gili Meno saltwater lake is 54.00±0.82 ppt while the salinity in the waters is usually around 33 – 43 ppt (Rahman, 2022). This high salinity will affect the biota that inhabits these waters, one of which is macrozoobentos.

Macrozoobentos are macro invertebrates of 1 mm or more in size that live on the bottom of the water (Akbar, 2021). Macrozoobentos have a long lifespan and slow moving, so the existence of macrozoobentos is able to indicate conditions in a body of water (Siagian et al., 2023). As a bioindicator, macrozoobentos provide an advantage with their habit of living on substrates. Water quality can be judged by the amount of composition and abundance of macrozoobentos in a body of water (Putri et al., 2023).

Water quality is the nature of water and the content of water biota, substances, energy, or other components in the water. Water quality is measured and expressed through several parameters, namely physical, chemical, and biological parameters (Effendi, 2024). Physical parameters such as temperature, salinity, and *Total Dissolved Suspended* (TDS). Chemical parameters such as pH, dissolved oxygen, and *Biochemical Oxygen Demand* (BOD). The biological parameter is macrozoobentos.

Previous research conducted by (Asra, 2009) finding out the water quality of rivers and lakes based on macrozoobentos as indicators. The conclusion of the study is that the presence of macrozoobentos indicates that both waters are polluted. The study focuses on oligotropic lake waters, and research on saltwater lakes to measure water quality with macrozoobentos as bioindicators has not been widely done. Therefore, the purpose of this study is to determine the relationship between water quality and macrozoobentos diversity in the saltwater lake of Gili Meno.

RESEARCH METHODS

Time and Place of the Research

The research was conducted in April-May 2025 at the Gili Meno Salt Water Lake located in Gili Indah, Menang District, North Lombok Regency, West Nusa Tenggara. This type of research is quantitative descriptive using the *purposive sampling* method to take research samples. The tools used in this study are TDS meter, pH meter, DO meter, BOD meter, HTC-1, salinometer, *water sampler*, and *water stirrer* to measure water quality. Transect 1 x 1 m, macrozoobentos identification manual, sieve, sample bottle, scissors, stationery, camera, ruler, and millimeter block for sampling macrozoobentos. The materials used in this study were macrozoobentos samples, lake water samples, and 4% formalin.

Data Collection Techniques

Sampling was carried out using the *Random sampling* based on the topography of the environment. Location determination of sampling is measured by GPS (*Global Positioning System*). Macrozoobentos sampling using the transect method with an area of 1 x 1 m (Marcelino et al., 2023). Samples were taken at 3 points with two repetitions in the Gili Meno mangrove area with a distance of 10 m per point. Macrozoobentos samples were taken using a sieve with a depth of 15 – 20 cm, then filtered using a sieve (Widhiandari et al., 2021). The filtered sample was put into a sample bottle and given a 4% formalin solution, then labeled to be identified at the Integrated Laboratory of the State Islamic University of Mataram. Macrozoobentos are identified using an identification book *The Living Marine Resources of the Western Central Pacific: Volume 1. Seaweeds, corals, bivalves, and gastropods* by Carpenter, K. E. and Niem, V. H. (1998); *Benthic Macroinvertebrates* by Smith, B., Storey, R., and Valois, A. (2020); and molluscabase.org website. Environmental parameters measured to measure the physico-chemical factors of water, namely temperature, salinity, *Total Dissolved Suspended* (TDS), pH, *Dissolved Oxygen* (DO), and *Biochemical Oxygen Demand* (BOD).

Data Analysis Techniques

Samples of macrozoobentos that have been identified were analyzed using the calculation of the important value index, the Shanon-Wiener diversity index, the equality index, the Simpson dominance index, and the Margalef type wealth index.

a. Important Value Index

   The important value index is calculated by the Mueller-Dombois and Ellenberg (1974) formula.

b. Shanon – Wiener Diversity Index

$$H' = -\Sigma pi \, Ln \, Pi$$

Description:
H’ = Shanon-Wiener Diversity Index
Pi = Comparison between the number of individuals of a type and the number of individuals of the entire type
Ln = Natural logarithm

Environmental community criteria based on diversity index:
H' < 1 = Low diversity
1 ≤ H' ≤ 3 = Moderate diversity
H' > 3 = High diversity

c. Equality Index

$$E = H'/Ln\ (S)$$

Description:
0 < E < 0.4 = Low evenness
0.4 ≤ E ≤ 0.6 = Moderate evenness
E > 0.6 = High evenness

d. Simpson's Dominance Index

$$C = \Sigma(ni/N)^2$$

Description:
C = Simpson's dominance index
Ni = Number of individuals per species
N = Number of individuals of the entire species

The dominance index ranges from 0 to 1, which indicates that the smaller the value of the dominance index, the no dominant species. On the other hand, if the value of the dominance index is getting larger, then it indicates that there is a certain species (Sirait et al., 2018).

e. Margalef Type Wealth Index

$$Dmg = (S-1)/ (Ln\ N)$$

Description :
D = Margalef wealth index
S = Number of species in habitat
N = Total number of individuals of all species in habitat

Criteria for neighborhood communities based on type wealth index:
D < 2.5 = Low type wealth
2.5 ≤ D ≤ 4 = Medium type wealth
D > 4 = High type wealth

RESULTS AND DISCUSSION

Macrozoobentos Inventaritation

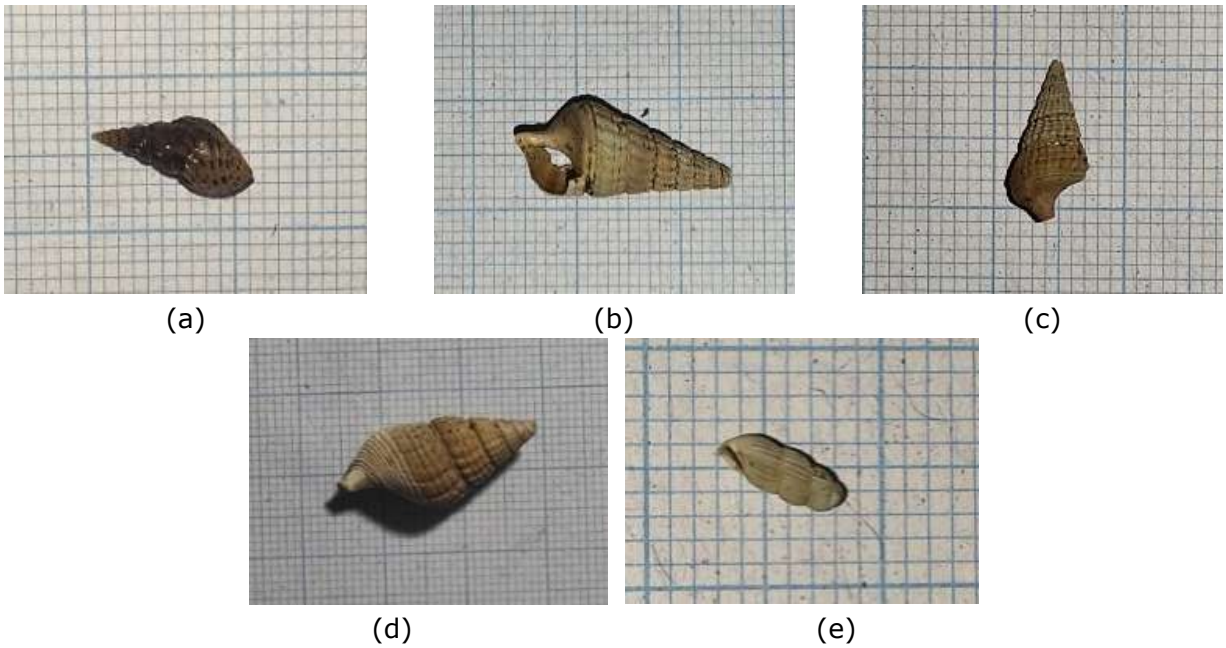
Obtained the results of macrozoobentos consisting of 3 families and 5 species, namely *Melanoides tuberculata, Cerithidea decollata, Cerithidea cingulata, Terebralia palustris, Truncatella guerinii.* The results of the calculation of the important value index (IVI) based on the identification results are *Melanoides tuberculata* with the highest IVI value of 152% and *Cerithidea cingulata* with the lowest IVI value of 7.53%. The identification results have an overall diversity index value of 0.38 which shows that the level of macrozoobentos diversity is relatively low with a total of 114 individuals and *Melanoides tuberculata* as the most species found at 105 individuals. The overall evenness index value was 0.24 and indicated that the evenness of

macrozoobentos was relatively low. The overall dominance index value is 0.85 which shows that the dominance of macrozoobentos is relatively high and there are dominant species, namely *the species Melanoides tuberculata.*

Table 1. Results of Identification of Macrozoobentos in the Gili Meno Saltwater Lake

No.	Order	Family	*Genus*	*Species*	Total
1	Caenogastropoda incertae sedis	Thiaridae	Melanoids	*Melanoid tuberculata*	105
		Potamididae	Cerithidea	*Cerithidea decollata*	3
				Cerithidea cingulata	1
			Terebralia	*Terebralia palustris*	2
2	Littorinimorpha	Truncatellidae	Truncatella	*Truncatella guerinii*	3
Totals					**114**

Based on the identification results in Table 1, the results of macrozoobentos were obtained from 114 individuals with 3 families and 5 species, including *Melanoides tuberculata, Cerithidea decollata, Cerithidea cingulata, Terebralia palustris,* and *Truncatella guerinii*. The highest number of species is found in the species *Melanoides tuberculata*, which is 105 individuals, while the species with the least is *the species Cerithidea cingulata*, which is only 1 individual. With the total number of individuals on the first iteration being 47 individuals and the second iteration being 58 individuals.



(a) (b) (c) (d) (e)

Figure 1. Makrozoobentos in the Gili Meno Saltwater Lake: a) *Melanoid tuberculata*, b) *Cerithidea decollata*, (c) *Cerithidea cingulata*, d) *Terebralia palustris*, and e) *Truncatella guerinii*

Oliveira (2019) argues that *Melanoid tuberculata* including invasive species and have a high growth rate, as well as the ability for migration and territorial expansion (Oliveira & Oliveira, 2019). This explains why this species is found most abundantly in the saltwater lake of Gili Meno. This species is often found in a variety of natural, either permanent or temporary, freshwater and brackish habitats, such as rivers, springs, rice fields, swamps, and coastal lakes (Raw et al., 2016). Meanwhile, the species that are least found in the saltwater lake of Gili Meno are *Cerithidea cingulata*, which is as many as 1 species. Farahisah states that this species is usually more widespread in sandy environments than muddy environments (Farahisah et al., 2023).

a. *Melanoid tuberculata*

Melanoid tuberculata is one of the species of aquatic mollusks of the Thiaridae family that has an average shell length of 20 – 27 mm (Shuhaimi-Othman et al., 2012). *Melanoid tuberculata* found in the Gili Meno Saltwater Lake has an average length of 1.1 cm. This species is a cosmopolitan species that is light brown in color with a tall elongated shell. Its operculum can help keep this species from drying out. This species feeds on microalgae. *Melanoid tuberculata* becomes a place for the trematode to enter (Jawed et al., 2022). *Melanoid tuberculata* is spread across almost all tropical and subtropical environments in the world. It has a spermatophore bursa and is textured in the middle of the intestine, the nonglandular oviduct is tubular in shape (Lydeard & Cummings, 2019). Its shell is very hard and only a few predators are able to destroy it.

b. *Cerithidea decollata*

Cerithidea decollata has a taper shell with an average length of 15 – 25 mm (Vannini et al., 2008). *Cerithidea decollata* The size of the study was 2.1 cm. The shell is conical in shape like a slightly rounded circle, the cavity is widened; It has 18 – 41 axial ribs on the second circle from the back, 4 – 12 ribs on the ventrolateral varix, 13 – 18 spirals that protrude in the last 1 – 4 circles. This species has a brown shell with a pinkish-gray head, has beige spots around it (Reid, 2014).

c. *Cerithidea cingulata*

Cerithidea cingulata has a shell that extends up to 4 – 6 cm, with a grooved surface and is blackish in color. It is slightly pointed in shape and has a rather wide chiffon curve (Slamet et al., 2021). *Cerithidea cingulata* found in the Gili Meno Salt Water Lake has a size of 1.2 cm. This species is dark brown in color and the inside and outside have a yellowish-brown color. The tip of the shell is pointed, the shell hole is oval in shape with the edges of the hole narrow forming an angle (Farahisah et al., 2023).

d. *Terebralia palustris*

Terebralia palustris has a brown to blackish shell with a fairly large conical shape. It is circular in shape on a clockwise shell and is often referred to as a dextral (Merly et al., 2022). Generally, this species is about 12 – 19 cm long and lives around mangrove roots (Samsi et al., 2020). *Terebralia palustris* found in the Gili Meno Saltwater Lake has a length of 2.5 cm.

e. *Truncatella guerinii*

Truncatella guerinii has a small, dense shell that is somewhat cylindrical, with many axial ribs. The height of the shell of this species can be up to 10 mm, with high tips and strong axial rib sculptures. The opening in the shell is shaped like an egg, a complete peristome, and a rather thick apertural edge. The color of the shell of this species is light beige to light reddish brown (Tan & Low, 2014). *Truncatella guerinii* found in the Gili Meno Salt Water Lake has a length of 0.5 cm.

Environmental Parameters

The salinity measurement result of the first iteration was 34.60±0.55 with values ranging from 34 – 35 ppt, and the salinity measurement results of the second iteration were 41.5±0.58 with values ranging from 41 – 42 ppt. According to Purwanti (2006) in (Khoiriyah & Purnomo, 2024), freshwater has a salinity value of less than 0.5‰; brackish water has a salinity value between 0.5 and 30‰; salt water has a salinity value between 30 and 40‰; and very salty seawater has a salinity value of more than 40‰. The salinity in this study ranged from 34 – 35 ppt in the first iteration and 41 – 42 ppt in the second iteration, which shows that the waters in the Gili Meno saltwater lake are included in the saline waters. The difference in salinity in both iterations was due to high rainfall. When the first repetition was performed, the rainfall was high and resulted in a decrease in salinity. This is in accordance with the statement (Hadiprayitno et al., 2018), which states that the salinity of a body of water will be normal during high rainfall, and salinity will increase when rainfall is low. According to the Decree of the Minister of State for

the Environment Number 51 of 2004, it is stated that the standard for the quality of optimal and good water salinity for marine life is between 33 – 34 ppt. So it is concluded that the salinity in the Gili Meno saltwater lake is relatively high.

Table 2. Environmental Parameters on the Gili Meno Saltwater Lake First Repeat

No.	Salinity (ppt)	Temperature (°C)	pH
1	35	32.8	7.55
2	35	30.8	7.65
3	34	32.0	7.60
4	34	33.7	7.63
5	35	32.4	7.78
Average	**34.60**	**32.33**	**7.64**
STDEV	**0.55**	**1.23**	**0.09**

Table 3. Environmental Parameters on the Gili Meno Saltwater Lake Second Repeat

No.	Salinity (ppt)	Temperature (°C)	pH	DO (mg/L)	BOD (mg/L)
6	41	32.0	7.94	2.29	2.22
7	42	34.0	7.66	2.39	2.43
8	41	34.8	7.69	2.30	2.22
9	42	33.7	7.60	8.87	9.09
Average	**41.5**	**33.6**	**7.7**	**4.00**	**4.00**
STDEV	**0.58**	**1.18**	**0.15**	**3.27**	**3.40**

The result of the first repeat temperature measurement was 32.33±1.23 with a temperature value between 30.8 – 33.7°C, and the result of the second repeat temperature measurement was 33.6±1.18 with a temperature value between 32 – 34.8°C. According to the Decree of the Minister of State for the Environment Number 51 of 2004, marine biota can live at an optimum temperature of 28°C – 32°C. So it was concluded that the temperature in the waters of the Gili Meno saltwater lake was relatively bad. The high temperature in a body of water does not allow macrozoobentos to live for a long time, one of which is *Melanoid tuberculata*. This species can survive in temperatures between 18°C and 25°C, with the highest temperature reaching 32.6°C (Mackie & Claudi, 2009). Other species, namely *Cerithidea cingulata*, in research (Farahisah et al., 2023) It is also only found in waters that have a temperature of 30°C – 30.5°C. Farahisah also stated that the optimal temperature for a gastropod species to live is 25-31°C.

The pH measurement result in the first iteration was 7.64±0.09 with a number ranging from 7.55 – 7.78 and the pH measurement result in the second iteration was 7.7±0.15 with a number ranging from 7.6 – 7.94 which indicates that the pH of the Gili Meno saltwater lake has alkaline properties. Aquatic organisms typically live with a pH that is close to neutral (7) because they can control the decomposition process of the waters (Daroini, 2020). According to the Decree of the Minister of the State for the Environment Number 51 of 2004, the pH value range for marine life to live is 7 – 8.5. So it is concluded that the pH value in the waters of the Gili Meno saltwater lake is normal.

The *measurement of Dissolved Oxygen* (DO) has an average of 4.00±3.27 with values ranging from 2.29 – 8.87 mg/L. The result of *the Biochemical Oxygen Demand* (BOD) measurement is 4.00±3.40 with values ranging from 2.22 – 9.09 mg/L. The highest DO and BOD values are at point 9, which is 8.87 for DO and 9.09 for BOD. The optimal DO value for marine life according to the Decree of the Minister of the State for the Environment Number 51

of 2004 is more than 5 mg/L. Based on the data obtained, only point 9 has a good dissolved oxygen value, while the other point is very low.

Daroini (2020) in his research argues that a good dissolved oxygen value is influenced by a good brightness value as well, while it is classified as very low due to the lack of sunlight supply that penetrates the waters. In line with that, sampling at point 9 was taken during the day when the sun was hot enough to illuminate the waters, while sampling at other points was done when the sun was not so hot and the sunlight was covered by the mangrove canopy. The BOD value obtained at point 9 is classified as low pollution because it has a dissolved oxygen value of more than 5 mg/L. While the BOD value at points 6, 7, and 8 is classified as moderate pollution because the dissolved oxygen value is less than 5 mg/L. So it is concluded that the BOD value of these four points is classified as polluted. The measurement results *of Total Dissolved Oxygen* (TDS) are infinite at all points. According to the 2010 Permenkes Regulation, the maximum allowable TDS level is 500 mg/L. So that the water in the Gili Meno saltwater lake is classified as unfit for drinking.

Table 4. Index of important values of macrozoobentos in the Gili Meno Saltwater Lake

No.	Species	KJ	KR (%)	FJ	FR (%)	IVI (%)
1	*Melanoid tuberculata*	11.67	92.08	1	59.88	152
2	*Cerithidea decollata*	0.33	2.63	0.22	13.31	15.94
3	*Cerithidea cingulata*	0.11	0.88	0.11	6.65	7.53
4	*Terebralia palustris*	0.22	1.75	0.22	13.31	15.06
5	*Truncatella guerinii*	0.33	2.63	0.11	6.65	9.28
	Quantity (Σ)	**12.67**	**100**	**1.67**	**100**	**200**

Description: KJ = Density Type; KR = Relative Density; FJ = Frequency Type; FR = Relative Frequency; IVI = Important Value Index.

The Important Value Index (IVI) is one way to determine the role of a species in a community, which consists of total density, frequency, and relative dominance. A species that has a greater role in its community indicates a higher IVI value, and vice versa. The higher the IVI value of a species, the greater the species will dominate its community, and vice versa. Species dominance in habitat suggests that species can utilize most of the resources in the surrounding environment (Rawana et al., 2023). Based on the data in Table 4, it is known that the highest important value index of macrozoobentos is 152%, namely species *Melanoid tuberculata*, and the lowest was 7.53% in species *Cerithidea cingulata*. The index of important values is obtained from the accumulation of relative density and relative frequency. The relative density is obtained by dividing the number of individuals by the number of points, so that the total KR is 100%.

This data shows that the species that dominate the Gili Meno saltwater lake at the 9 points are *Melanoid tuberculata*. Based on known frequency data, the total of the relative frequency of each type is 100%. The highest index of important values (IVI) is found in the species *Melanoid tuberculata* which is 152% with a total of 105 individuals, and the lowest IVI is found in the species *Cerithidea cingulata* namely 7.53% with the number of individuals as many as 1 indicating that from all the points studied, the species *Melanoid tuberculata* dominate the saltwater lake waters of Gili Meno. (Lelewa et al., 2023) mentioning that the species with the highest dominance will have a high IVI.

Based on Table 5, it is known that the total number of individuals obtained is 114. From these numbers, the numbers for pi and Ln pi were obtained with a total of 1.00 and -16.14 respectively, then pi and Ln pi were multiplied so that a diversity index (H') was obtained worth 0.38. This figure shows that the level of macrozoobentos diversity in the Gili Meno saltwater lake is relatively low. The number that belongs to the low category according to Shanon-Wiener is

when (H' < 1). Research conducted (Prasetia et al., 2022) also got a low H' value, which is 0.77. Prasetia said that the low value of H' is caused by the pattern of the spread of a species that is grouped in one place. The largest number of species are *Melanoid tuberculata* 105 individuals. This species is the only species found in all research points. This species is found in mangrove areas, precisely in its muddy waters and scattered around it.

Table 5. Macrozoobentos diversity index in Gili Meno Saltwater Lake

No.	Species	Quantity	bee	Ln pi	H'	Categories
1	*Melanoid tuberculata*	105	0.92	-0.08	0.08	
2	*Cerithidea decollata*	3	0.03	-3.64	0.10	
3	*Cerithidea cingulata*	1	0.01	-4.74	0.04	Low
4	*Terebralia palustris*	2	0.02	-4.04	0.07	
5	*Truncatella guerinii*	3	0.03	-3.64	0.10	
	Quantity (Σ)	**114**	**1.00**	**-16.14**	**0.38**	

Table 6. Macrozoobentos evenness index in Gili Meno Saltwater Lake

No.	Species	Quantity	H'	E	Categories
1	*Melanoid tuberculata*	105	0.08	0.05	
2	*Cerithidea decollata*	3	0.10	0.06	
3	*Cerithidea cingulata*	1	0.04	0.03	Low
4	*Terebralia palustris*	2	0.07	0.04	
5	*Truncatella guerinii*	3	0.10	0.06	
	Quantity (Σ)	**114**	**0.38**	**0.24**	

Based on Table 6, it is known that the total number of individuals obtained is 114. From this figure, the diversity index (H') is calculated and an H' value of 0.38 is obtained which is then divided by Ln from the number of species found, namely 5 species. The results of the evenness index (E) were obtained with a total value of 0.24 which shows that there are species that dominate these waters. In this study, it was seen that the species *Melanoid tuberculata* dominating with a total of 105 individuals. The value of the evenness index (E) was 0.24, which indicates that the evenness of macrozoobentos is relatively low (0 < E < 0.4). Research (Rizka et al., 2016) also got a low equality index value, which is 0.19, and Rizka argued that the low equality of macrozoobentos in an area shows that the total of all species is uneven.

The purpose of knowing the value of the species equality index is to determine the balance of the distribution of a species to the total species in a community. The value of the evenness index will be high when there are abundant species in an area, and vice versa (Anjani et al., 2022). If the equality index is close to 1, it indicates a high level of uniformity and no type dominates so that the individual distribution of each type is uniform or even. On the other hand, if the value of the equivalency index is close to 0, it indicates low uniformity and there is a dominating type (Ernawati et al., 2023). Highest equality index value in species *Cerithidea decollata* and *Truncatella guerinii*, with a value of 0.06 which indicates that the distribution of these two species is almost balanced.

Based on Table 7, it is known that the total number of individuals obtained is 114. From these numbers, the numbers for pi and Ln pi are obtained with a total of 1.00 and -16.14, respectively. Each pi value is squared to obtain a dominance index value, which is 0.85 which indicates that the dominance of macrozoobentos in the Gili Meno saltwater lake is relatively high or there are dominant species (0.61 < C < 1) according to Simpson's calculations.

The dominance value in this study ranges from 0 – 0.85 which if averaged gets a result of 0.85 and belongs to the high category. The high category indicates that there are certain species that dominate the area. Contrast with research (Prasetia et al., 2022) which obtained a low

dominance index result because of the three stations studied, no species dominated. The highest dominance index is found in species *Melanoid tuberculata* A total of 105 individuals. In accordance with the statement (Oliveira & Oliveira, 2019) that says that the species *Melanoid tuberculata* It has a high growth rate, the ability for migration and territorial expansion, and can also be found in different types of substrates.

Table 7. Index of macrozoobentos dominance in Gili Meno Saltwater Lake

No.	Species	Quantity	Pi	Ln Pi	C	Categories
1	*Melanoid tuberculata*	105	0.92	-0.08	0.85	Height
2	*Cerithidea decollata*	3	0.03	-3.64	0	
3	*Cerithidea cingulata*	1	0.01	-4.74	0	
4	*Terebralia palustris*	2	0.02	-4.04	0	
5	*Truncatella guerinii*	3	0.03	-3.64	0	
Quantity (Σ)		**114**	**1.00**	**-16.14**	**0.85**	

Table 8. Macrozoobentos Species Richness Index in Gili Meno Saltwater Lake

No.	Species	Quantity	Dmg	Categories
1	*Melanoid tuberculata*	105	21.96	Height
2	*Cerithidea decollata*	3	0.42	Low
3	*Cerithidea cingulata*	1	0.00	Low
4	*Terebralia palustris*	2	0.21	Low
5	*Truncatella guerinii*	3	0.42	Low
Totals (Σ)		**114**	**23.01**	

Based on Table 8, it is known that the total number of individuals obtained is 114. From this figure, the Margalef type wealth index was calculated and the highest Dmg result was obtained at 21.96 and the lowest at 0 which shows that the value of 21.96 is relatively high (Dmg > 4) and 0 is relatively low (Dmg < 2.5). The highest values are found in the species *Melanoid tuberculata* and the lowest values are found in the species *Cerithidea cingulata*.

Table 9. Bioindicator Status of Macrozoobentos in Gili Meno Saltwater Lake

No.	***Genus***	***Species***	**Bioindicator**	**Source**
1	*Melanoids*	*Melanoid tuberculata*	Contaminated	Maulana and Kuntjoro (2023)
2	*Cerithidea*	*Cerithidea decollata*	Uncontaminated	Ashuri et al., (2022)
3		*Cerithidea cingulata*		
4	*Terebralia*	*Terebralia palustris*	Uncontaminated	Saleky et al., (2023)
5	*Truncatella*	*Truncatella guerinii*	Uncontaminated	Wu et al., (2007)

According to Rau et al. (2013) in Maturbongs & Elviana, (2016), if a community has many types and the type can be replaced by one individual, then the value of the type wealth will be high. Conversely, if a community has few types and each type has a large number, then the value of the type wealth will be low. According to him, the low value of species wealth is due to the presence of fresh water which reduces the salinity level of the water. In this study, the salinity level in the Gili Meno Salt Water Lake is high, so the value of the type wealth index is relatively high.

Macrozoobentos can be used as bioindicators of an environment to measure water quality because they are able to adapt to environmental pollution (Ernawati et al., 2023). Based on the results of macrozoobentos obtained in the Gili Meno Saltwater Lake, the bioindicator status of each species can be known as shown in Table 9. Based on the table, it is known that only the

Melanoid tuberculata which can indicate that a body of water is polluted if the species is found in large numbers. Maulana et al. (2023) said in his research that the genus *Melanoids* It is often found abundant in a mangrove area and has the ability to attach to solid substrates, mud, and to plants that are flooded in rivers. Maulana also said that this species is an organism that is able to survive in polluted waters or environmental conditions (Maulana & Kuntjoro, 2023). In this study, of the five species obtained, the *Melanoid tuberculata* has the highest number of 105 individuals. It indicates that the waters in the saltwater lake of Gili Meno are included in the category of polluted waters.

CONCLUSION

Based on the research that has been conducted, 114 macrozoobentos were obtained, with the most species being *Melanoides tuberculata.* This species dominates the saltwater lake of Gili Meno and indicates that the habitat is polluted. So it can be concluded that the saltwater lake of Gili Meno is indicated to be extreme for biota habitat, judging from its higher water salinity than waters in general.

REFERENCES

Abimanyu, K. (2016). Analisis pemanfaatan sumber daya alam danau Rawa Pening kabupaten Semarang. *Geo-Image Journal*, *5*(1). https://journal.unnes.ac.id/sju/geoimage/article/view/11315

Akbar, S. S. (2021). Keanekaragaman Makrozoobentos Sebagai Bioindikator Kualitas Air di Kanal Mangetan, Anak Sungai Brantas, Kabupaten Sidoarjo. *Environmental Pollution Journal*, *1*(3). https://www.ecotonjournal.id/index.php/epj/article/view/64

Anjani, W., Habibal Umam, A., & Anhar, A. (2022). Keanekaragaman, Kemerataan, dan Kekayaan Vegetasi Hutan Pada Taman Hutan Raya Lae Kombih Kecamatan Penanggalan, Kota Subulussalam. *Jurnal Ilmiah Mahasiswa Pertanian*, *7*(2), 770–778.

Asra, R. (2009). Makrozoobentos Sebagai Indikator Biologi Dari Kualitas Air Di Sungai Kumpeh Dan Danau Arang-Arang Kabupaten Muaro Jambi, Jambi. *Biospecies*, *2*(1). https://online-journal.unja.ac.id/biospecies/article/view/262

Daroini, t. A. (2020). *Analisis Bod (Biological Oxygen Demand) Di Perairan Desa Prancak Kecamatan Sepulu, Bangkalan*.

Effendi, H. (2024). *Telaah Kualitas Air: Bagi Pengelolaan Sumber Daya dan Perairan*. PT Kanisius. https://books.google.co.id/books?id=GE8SEQAAQBAJ

Ernawati, E., Rohyani, I. S., Ardi, R. H., Wahyuningsih, A. F., Muflihah, B. H. T., & Zubair, R. A. (2023). Macrozoobenthos Diversity as A Bioindicator of Water Quality in River Sesaot Village Narmada West Lombok. *Jurnal Biologi Tropis*, *23*(2), 543–550. https://doi.org/10.29303/jbt.v23i2.4860

Farahisah, H., Azizah, N., Dewiyanti, I., & Yulvizar, C. (2023). Relationship of mangrove snail's abundance (Cerithidea sp.) with mangrove density at mangrove ecosystem in Banda Aceh and Aceh Besar. *IOP Conference Series: Earth and Environmental Science*, *1221*(1), 012057. https://doi.org/10.1088/1755-1315/1221/1/012057

Hadiprayitno, G., Ilhamdi, M. L., & Wahyudi, W. (2018). Penggunaan Teknologi Plasma Untuk Merehabilitasi Habitat Burung Secara Partisipatif Di Gili Meno Lombok. *Jurnal Pendidikan dan Pengabdian Masyarakat*, *1*(2). https://doi.org/10.29303/jppm.v1i2.845

Jawed, S. T., Al-Taher, Q. M., & Shihab, A. F. (2022). Melanoides tuberculate as Bioindicator of the Heavy Metal Contamination in Water and Sediment Pollution of Euphrates River at Thi-Qar province, Iraq. *Health Education and Health Promotion*, *10*(2), 247–253.

Khoiriyah, Q., & Purnomo, Y. S. (2024). *Kemampuan Zeolit dan Batu Apung Sebagai Media Filter dan Adsorpsi untuk Menyisihkan Salinitas, TDS, Konduktivitas dan TSS Pada Air Payau Menjadi Air Bersih*.

Kumurur, V. A. (2002). Aspek Strategis Pengelolaan Danau Tondano Secara Terpadu. *Ekoton*, *2*(1), 73–80.

Lelewa, B. R., Rumengan, A. P., Sondak, C. F. A., Paulus, J. J. H., Paruntu, C. P., & Sumilat, D. A. (2023). *Indeks Nilai Penting Komunitas Mangrove Di Daerah Pesisir Desa Minanga Dua, Kecamatan Pusomaen, Kabupaten Minahasa Tenggara, Sulawesi Utara*. *11*(3).

Lydeard, C., & Cummings, K. S. (2019). *Freshwater Mollusks of the World: A Distribution Atlas*. Johns Hopkins University Press. https://books.google.co.id/books?id=YO2ODwAAQBAJ

Mackie, G. L., & Claudi, R. (2009). *Monitoring and Control of Macrofouling Mollusks in Fresh Water Systems*. CRC Press. https://books.google.co.id/books?id=L_zRBQAAQBAJ

Marcelino, N., Apriadi, T., & Melani, W. R. (2023). Makrozoobentos Sebagai Bioindikator Kualitas Perairan di Perairan Kelam Pagi Kelurahan Dompak, Kepulauan Riau. *Jurnal Akuatiklestari*, *6*, 124–132. https://doi.org/10.31629/akuatiklestari.v6i.5171

Maturbongs, M. R., & Elviana, S. (2016). Komposisi, kepadatan, dan keanekaragaman jenis gastropoda di kawasan mangrove pesisir pantai Kambapi pada musim peralihan I. *Agrikan: Jurnal Agribisnis Perikanan*, *9*(2), 19–23. https://doi.org/10.29239/j.agrikan.9.2.19-23

Maulana, M. A., & Kuntjoro, S. (2023). Hubungan Indeks Keanekaragaman Makrozoobentos dengan Kualitas Air Kali Surabaya, Wringinanom, Gresik. *LenteraBio : Berkala Ilmiah Biologi*, *12*(2), 219–228. https://doi.org/10.26740/lenterabio.v12n2.p219-228

Melinda, T., Sholehah, H., & Abdullah, T. (2021). *Penentuan Status Mutu Air Danau Air Asin Gili Meno Menggunakan Metode Indeks Pencemaran*.

Merly, S. L., Mote, N., & Basik, B. B. (2022). Identifikasi Jenis Dan Kelimpahan Moluska Yang Dimanfaatkan Sebagai Bahan Pangan Pada Ekosistem Hutan Mangrove, Merauke. *Triton: Jurnal Manajemen Sumberdaya Perairan*, *18*(1), 55–65. https://doi.org/10.30598/TRITONvol18issue1page55-65

Oliveira, C. D. L., & Oliveira, C. Y. B. D. (2019). Growth parameters of the invasive gastropod *Melanoides tuberculata* (Müller, 1774) (Gastropoda, Thiaridae) in a semi-arid region, Northeastern Brazil. *Acta Scientiarum. Biological Sciences*, *41*(1), 45720. https://doi.org/10.4025/actascibiolsci.v41i1.45720

Prasetia, A. A., Sukma, R. N., Suwarsih, S., Joesidawati, M. I., & Spanton M, P. I. (2022). Keanekaragaman Dan Keterkaitan Moluska Pada Ekosistem Mangrove Di Kecamatan Palang Kabupaten Tuban. *Manfish Journal*, *3*(1), 92–103. https://doi.org/10.31573/manfish.v2i2.381

Putri, Y., Kurniawan, A., & Kurniawan, A. (2023). Macrozoobenthos Community As Bioindicator Of Water Quality For Fish Cultivation In The Air Duren River, Bangka Regency. *Journal of Aquatropica Asia*, *8*(2), 77–85.

Rahman, F. A. (2022). *Ekologi Mangrove Pulau Lombok*. UIN Mataram Press.

Rahman, F. A., & Hadi, A. P. (2021). Kandungan C-Organik Substrat Ekosistem Mangrove di Danau Air Asin Gili Meno Kabupaten Lombok Utara. *Bioscientist: Jurnal Ilmiah Biologi*, *9*(2), 516–526.

Raw, J. L., Perissinotto, R., Miranda, N. A. F., & Peer, N. (2016). Feeding dynamics of *Melanoides tuberculata* (Müller, 1774). *Journal of Molluscan Studies*, *82*(2), 328–335. https://doi.org/10.1093/mollus/eyv070

Rawana, Wijayani, S., & Masrur, M. A. (2023). Indeks Nilai Penting dan Keanekaragaman Komunitas Vegetasi Penyusun Hutan di Alas Burno SUBKPH Lumajang. *Jurnal Wana Tropika*, *12*(02), 80–89. https://doi.org/10.55180/jwt.v12i02.215

Reid, D. G. (2014). The genus Cerithidea Swainson, 1840 (Gastropoda: Potamididae) in the Indo-West Pacific region. *Zootaxa*, *3775*(1). https://doi.org/10.11646/zootaxa.3775.1.1

Rizka, S., Muchlisin, Z. A., Akyun, Q., Fadli, N., Dewiyati, I., & Halim, A. (2016). *Komunitas Makrozoobentos Di Perairan Estuaria Rawa Gambut Tripa Provinsi Aceh*. *1*.

Rokhimaturrizki, O. (2022). *Pengetahuan Tentang Sungai*. CV Media Edukasi Creative. https://books.google.co.id/books?id=aoJqEAAAQBAJ

Samsi, A. N., Andy Omar, S. B., Niartiningsih, A., & Soekendarsi, E. (2020). The association of fecundity and morphometrics of mangrove snail Terebralia palustris Linnaeus 1967 in the mangrove ecosystem. *IOP Conference Series: Earth and Environmental Science*, *486*(1), 012005. https://doi.org/10.1088/1755-1315/486/1/012005

Shuhaimi-Othman, M., Nur-Amalina, R., & Nadzifah, Y. (2012). Toxicity of Metals to a Freshwater Snail, *Melanoides tuberculata*. *The Scientific World Journal*, *2012*, 1–10. https://doi.org/10.1100/2012/125785

Siagian, E. T., Manik, R. R. D. S., & Sinaga, M. P. (2023). Studi Keanekaragaman Makrozoobentos Di Sungai Tanjung Pinggir Kecamatan Siantar Martoba Kota Pematang Siantar Provinsi Sumatera Utara. *Jurnal Wilayah, Kota Dan Lingkungan Berkelanjutan*, *2*(2), 10–27.

Sirait, M., Rahmatia, F., & Pattulloh, P. (2018). Komparasi Indeks Keanekaragaman Dan Indeks Dominansi Fitoplankton Di Sungai Ciliwung Jakarta (Comparison Of Diversity Index And Dominant Index of Phytoplankton At Ciliwung River Jakarta). *Jurnal Kelautan: Indonesian Journal of Marine Science and Technology*, *11*(1), 75. https://doi.org/10.21107/jk.v11i1.3338

Slamet, R., Purnama, D., & Negara, B. F. S. (2021). Identifikasi Jenis Dan Kelimpahan Gastropoda Di Pantai Teluk Sepang Kota Bengkulu. *Jurnal Perikanan Unram*, *11*(1), 26–34. https://doi.org/10.29303/jp.v11i1.216

Tan, S. K., & Low, M. E. Y. (2014). *Singapore Mollusca: 6. The family Truncatellidae (gastropoda: Caenogastropoda: Truncatelloidea)*.

Vannini, M., Lori, E., Coffa, C., & Fratini, S. (2008). Cerithidea decollata: A snail that can foresee the future? *Animal Behaviour*, *76*(3), 983–992. https://doi.org/10.1016/j.anbehav.2008.05.016

Widhiandari, P. F. A., Watiniasih, N. L., & Pebriani, D. A. A. (2021). *Bioindikator Makrozoobenthos Dalam Penentuan Kualitas Perairan Di Tukad Mati Badung, Bali*.

Wijaya, L. S. M., & Muliadi, A. (2018). Membangun Community Of Active English Communication Di Daerah Wisata Gili Meno Lombok. *Lumbung Inovasi: Jurnal Pengabdian Kepada Masyarakat*, *3*(2), 69–76.

Yanti, E. V. (2023). *Dinamika Musiman Kualitas Air di Daerah Aliran Sungai Kahayan Kalimantan Tengah*. Penerbit NEM. https://books.google.co.id/books?id=uoS3EAAAQBAJ