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Microalgae Biodiversity in the Gili Meno Saltwater Lake Area

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Abstract. This study aims to determine the biodiversity of microalgae in the Gili Meno Saltwater Lake. The type of exploratory descriptive research was conducted in April-June 2025. The sampling method uses *a random sampling method* taken at 9 different points. The results showed that as many as 21 species of microalgae were successfully identified from 9 sample points, consisting of 5 phyla and 5 dominant classes. The results of the analysis showed the value of the Shannon-Wiener diversity index (H') of 1.981, the uniformity index (E) of 0.63, and the dominance index (C) of 0.209. The highest INP value is owned by *Chrococcus turgidus* (49.41). The microalgae communities in Salt Water Lake are dominated by pollution-tolerant groups. This confirms that the condition of the aquatic ecosystem at the research site is in the moderately polluted category.

Keywords: Biodiversity, Gili Meno, water quality, microalgae

INTRODUCTION

Gili Meno is part of the Gili Matra area along with Gili Air and Gili Trawangan. It is located in the waters of Lombok Island, West Nusa Tenggara. Gili Meno is one of the three small islands that are popular tourist destinations. The island has an area of about 150 hectares and is known for its rich biodiversity. The existence of the Saltwater lake in the middle of the island also supports the abundance of biodiversity. Gili Meno Saltwater Lake is a unique ecosystem in the Gili Islands region with physical and chemical conditions that are different from the surrounding marine ecosystems (Hilyana & Rahman, 2022; Yanti, 2023). Meanwhile, the salinity level of the sea waters around Gili Meno is in the range of 32 – 35 ppt (Littaqwa et al., 2020). These extreme water conditions can have an impact on the diversity of organisms, including various types of microorganisms that live in the lake.

Microalgae are microscopic-scale single-celled organisms that are diverse in size, shape, and type; contains photosynthetic pigments, is autotrophic, and lives in aquatic habitats (Dayana et al., 2022). In general, microalgae function as a source of feed and nutrition for mollusks, bivalves, zooplankton, and some types of shrimp, as well as fish and is also used as a dietary supplement, cosmetic raw material and energy source (Setiarto, 2020). Microalgae also have a function that can be used as a bioindicator of water quality (Rawe et al., 2024). This is because microalgae play a role as the main food chain in the ecosystem (Harmoko & Krisnawati, 2018). In addition, microalgae have certain tolerance limits to the physical and chemical factors of a body of water (Kumaji et al., 2019; Setyani et al., 2024). Physical and chemical factors of water influence each other, forming different types of microalgae that dominate in various aquatic ecosystems. Research on microalgae can provide information about the condition of aquatic ecosystems because the diversity of microalgae species can reflect the conditions of the aquatic environment.

Based on research Melinda et al. (2021), the results of the analysis using the Pollution Index (*Pollution Index*) shows that the water quality in Gili Meno Saltwater Lake has a PI value of 7.35 which is categorized as Moderately Polluted. Meanwhile, some studies suggest that changes in water quality can affect the composition of microalgae communities (Dayana et al., 2022; Fadilah et al., 2022; Ramadhaniaty & Widiyastuti, 2025). Until now, there have not been many studies that specifically study the biodiversity of microalgae in the Gili Meno Saltwater Lake which has different physical-chemical characteristics from freshwater or marine lakes.

Microalgae have an important role in maintaining the balance of the ecosystem, and their existence is influenced by habitat characteristics and water quality, so it is interesting to study more deeply about their diversity in the Gili Meno Saltwater Lake. Therefore, this study aims to collect and analyze data so that the information can be comprehensively compiled and provide a better understanding of the biodiversity of microalgae in the Gili Meno Salt Water Lake.

RESEARCH METHODS

This research will be carried out in April 2025. Microalgae data sampling was done using random sampling methods at 9 different points. Sampling was carried out during the day around 12.00 to 14.00 WITA. The next microalgae identification was carried out at the Universitas Islam Negeri Mataram Laboratory.

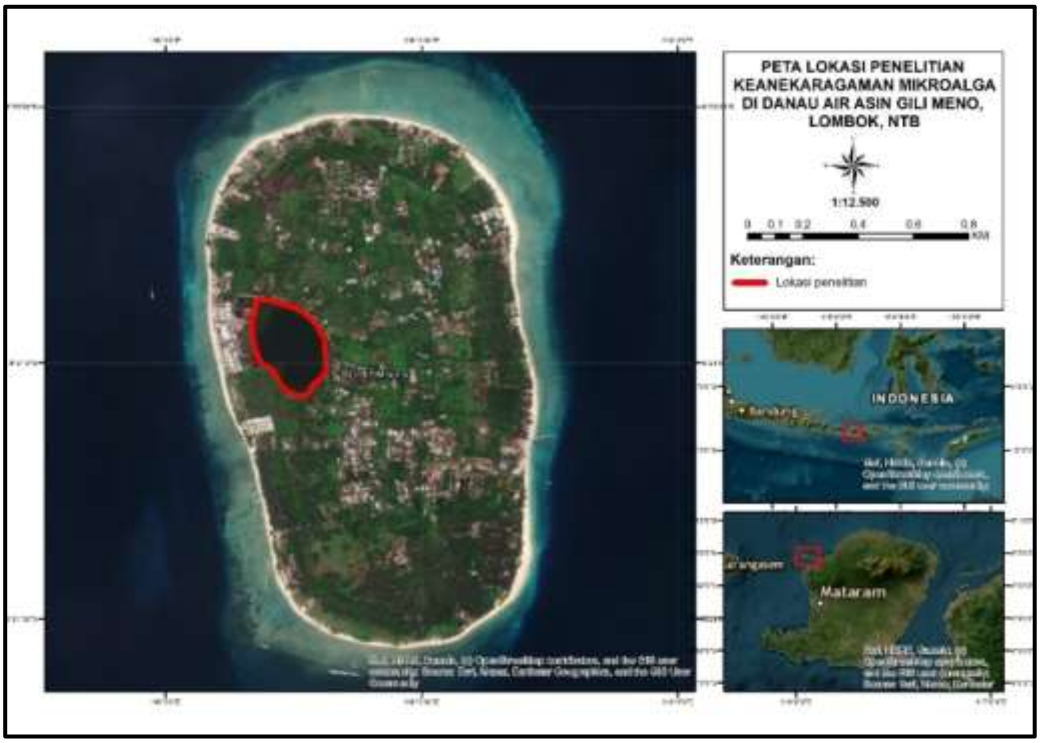

Figure 1. Microalgae research location in Gili Meno Saltwater Lake

The screening method was used to take microalgae samples from water which was carried out using a plankton net of 20 µm size. Water samples were taken as much as 100 ml which was obtained through filtration using plankton nets, then stored in sample bottles. After that, 3 drops of 4% formalin were given. Microalgae identification is carried out by making a sample of the preparation first. The sample to be observed is taken as much as one drop using a pipette and dripped on an *object glass* and closed using *a cover glass*. Observations were made using a light microscope with a magnification of 40 × 10.

Each microalgae found in the photo was then morphologically identified to the species level using the microalgae identification book, namely "*Freshwater Algae: Identification, Enumeration And Use As Bioindicators*" by Edward G. Billinger and David C. Sigee (2015), "*Freshwater Algae Of North America: Ecology And Classification*" by John D. Wehr and Robert G. Sheath (2015), "*The Algae World*" by Dinabandhu Sahoo and Joseph Seckbach (2015), and other relevant reference books and supported by *websites* such as *AlgaeBase, National Center for Biotechnology Information* (NCBI) and *Encyclopedia of Life* (EoL).

The indices calculated on the observation data are the important value index, the diversity index, the uniformity index, and the dominance index. The Index of Important Values (INP) is obtained by calculating Relative Density and Relative Frequency (Jasmine, 2007). The microalgae diversity index was calculated from each sampling point using the Shannon diversity index formula (Krebs, 2014). The level of type uniformity of the sampling location was carried out using the Sorensen type uniformity index formula (Brower et al., 1990). Microalgae dominance index using the Simpson dominance index formula (Simpson, 1949).

The value of the index of important values of microalgae is calculated by the formula:

$$IVI = RD + RF$$

IZI : Important Value Index
RD : Relative Density
RF : Relative Frequency

The value of the diversity index (H') of microalgae at each location is calculated by the formula:

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

H' : Shannon-Wiener Diversity Index
Pi : ni/N
n : Number of Individuals of each type
N : The total number of individuals of all types

The uniformity of the microalgae community at each location can be seen by calculating the uniformity index (Equability = E) with the formula:

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

E : Type Uniformity Index
H' : Species Diversity Index
S : Number of Types of Organisms

The value of the Simpson Dominance index (C) of microalgae at each location is calculated by the formula:

$$\boldsymbol{C} = \sum \left(\frac{\boldsymbol{ni}}{\boldsymbol{N}}\right)^2$$

C : Simpson's Dominance Index
That is why : Number of individuals of each type
N : Total number of individuals

RESULTS AND DISCUSSION

Microalgal biodiversity is an essential component of aquatic ecosystems because microalgae serve as primary producers that sustain aquatic food webs and contribute to biogeochemical cycles. The composition and abundance of microalgal communities are influenced by various environmental factors, including salinity, temperature, light intensity, pH, and nutrient availability. The Gili Meno Saltwater Lake is a unique aquatic ecosystem located on Gili Meno Island, West Nusa Tenggara, Indonesia, with environmental characteristics shaped by the interaction between the surrounding marine environment and adjacent terrestrial conditions. This habitat has the potential to support a diverse assemblage of microalgal species adapted to high-salinity environments. Based on the results of the study, data from microalgae observations in the Gili Meno Saltwater Lake was found, as shown in the following table.

Table 1. Results of Microalgae Observations in Salt Water Lake, Gili Meno

No.	Classes	Family	Genus	Species
1.	Cyanophyceae	Spirulinaceae	*Spirulina*	*Spirulina major*
2.	Cyanophyceae	Spirulinaceae	*Spirulina*	*Spirulina subsalsa*
3.	Cyanophyceae	Chroococcaceae	*Chloe O'Neill*	*Chroococcus turgidus*
4.	Cyanophyceae	Nodulariacea	*Nodularia*	*Nodularia sphaerocarpa*
5.	Cyanophyceae	Oscillatoriaceae	*Planktothrix*	*Planktothrix agardhii*
6.	Chlorophyceae	Chlorellaceae	*Chromochloris*	*Chromochloris zofingiensis*
7.	Chlorophyceae	Chlorodendraceae	*Tetraselmis*	*Tetraselmis chuii*
8.	Chlorophyceae	Volvocaceae	*Eudorina*	*Eudorina elegans*
9.	Trebouxiophyceae	Chlorellaceae	*Chlorella*	*Chlorella vulgaris*
10.	Bacillariophyceae	Naviculaceae	*Navicula*	*Navicula tripunctata*
11.	Bacillariophyceae	Cymbellaceae	*Cymbella*	*Cymbella aspera*
12.	Bacillariophyceae	Cymbellaceae	*Cymbella*	*Cymbella subtruncata*
13.	Bacillariophyceae	Melosiraceae	*Melissa*	*Melosira moniliformis*
14.	Bacillariophyceae	Fragilariaceae	*Synedra*	*Synedra gracilis*
15.	Bacillariophyceae	Thalassiosiraceae	*Thalassiosira*	*Thalassiosira weissflogii*
16.	Bacillariophyceae	Pleurosigmataceae	*Pleurosigma*	*Pleurosigma elongatum*
17.	Bacillariophyceae	Amphipleuraceae	*Amphipleura*	*Amphipleura pellucida*
18.	Bacillariophyceae	Pinnulariaceae	*Pinnularia*	*Pinnularia viridis*
19.	Bacillariophyceae	Naviculaceae	*Trachyneis*	*Trachyneis aspera*
20.	Bacillariophyceae	Amphipleuraceae	*Frustulia*	*Frustulia vulgaris*
21.	Chrysophyceae	Mallomonadaceae	*Synura*	*Synura glabra*

Table 2 shows microalgae species data from nine sample points. There are five classes of microalgae found. Based on the table data, it is known that the class *Bacillariophyceae* dominates and the most species found in this observation are *Chroococcus turgidus* (284 individuals), *Navicula tripunctata* (129), and *Pinnularia viridis* (75). Based on the results of research that has been carried out in the Gili Meno Saltwater Lake, microalgae consisting of 5 classes and 21 species of microorganisms were found at 9 different sample points. The names of the species are *Spirulina major, Spirulina subsalsa, Chroococcus turgidus, Nodularia sphaerocarpa, Planktothrix agardhii, Chromochloris zofingiensis, Tetraselmis chuii, Eudorina elegans, Chlorella vulgaris, Navicula tripunctata, Cymbella aspera, Cymbella subtruncata, Melosira moniliformis, Synedra gracilis, Thalassiosira weissflogii, Pleurosigma elongatum, Amphipleura pellucida, Pinnularia viridis, Trachyneis aspera, Frustulia vulgaris,* and *Synura glabra*.

On the other hand, many species show very low abundance or are not even found at all at most sample points. Species such as *Tetraselmis chuii, Cymbella aspera, Cymbella subtruncata, Melosira moniliformis, Synedra gracilis, Amphipleura peliucida*, and *Trachyneis aspera* were found in very small numbers (1-7 individuals) or were not found at many sample points. Some species such as *Spirulina major, Nodularia sphaerocarpa, Planktothrix agaradhii, Chlorella vulgaris*, and *Symura glabra* also show very minimal abundance.

This distribution pattern suggests that the ecosystems in the study area are dominated by a few specific species of microalgae, namely *Chroococcus turgidus, Navicula tripunctata, Thalassiosira weissflogii,* and *Pinnularia viridis*, while other species only appear in specific locations and conditions. High concentrations of abundance in certain species can indicate environmental conditions that strongly favor the growth of microalgae, or the presence of environmental pressures that limit the growth of other species.

Algae are considered an excellent bioindicator of water quality due to their rapid response to pollutants (Khalil et al., 2021). Algae communities can provide water quality benchmarks to describe the biological status of many disturbed ecosystems (Dobrescu et al., 2023). The growth of microalgae depends on its environment (Yong et al., 2016). The predominance of green algae and diatoms indicates oligotrophic conditions, while the abundance of blue-green algae indicates eutrophic conditions of the waters (Musharaf et al., 2011; Samudra et al., 2013). Oligotrophic means that water bodies do not receive enough nutrients to sustain aquatic life, while eutrophic means that water bodies receive too many nutrients (Dyczko et al., 2022; Fath & Jorgensen, 2020; Hoyer & Canfield Jr., 2022; Jayawardena, 2021).

Table 2. Results of Observation of the Number of Microalgae in Salt Water Lake, Gili Meno

No.	Class and Species	Sample Point									Σ
		1	2	3	4	5	6	7	8	9	
Cyanophyceae											
1.	*Spirulina major*	0	0	0	0	0	1	8	0	3	12
2.	*Spirulina subsalsa*	0	0	0	0	0	2	4	0	7	13
3.	*Chroococcus turgidus*	8	4	9	13	27	39	73	6	105	284
4.	*Nodularia sphaerocarpa*	0	0	0	0	0	0	0	0	3	3
5.	*Planktothrix agardhii*	3	0	0	0	0	0	0	0	4	7
Chrysophyceae											
6.	*Chromochloris zofingiensis*	0	0	6	0	9	0	0	3	14	32
7.	*Tetraselmis chuii*	0	0	0	0	1	0	0	0	0	1
8.	*Eudorina elegans*	0	0	1	0	2	1	0	0	11	15
Trebouxiophyceae											
9.	*Chlorella vulgaris*	0	0	0	0	0	0	4	0	0	4
Bacillariophyceae											
10.	*Navicula tripunctata*	32	12	0	4	7	19	37	0	18	129
11.	*Cymbella aspera*	1	0	0	0	0	3	2	0	0	6
12.	*Cymbella subtruncata*	0	0	0	0	0	3	2	0	1	6
13.	*Melosira moniliformis*	3	0	0	0	0	0	0	0	2	5
14.	*Synedra gracilis*	0	0	0	0	0	0	1	0	0	1
15.	*Thalassiosira weissflogii*	8	11	4	3	9	17	5	6	42	105
16.	*Pleurosigma elongatum*	0	0	0	0	1	0	8	0	1	10
17.	*Amphipleura pellucida*	0	0	0	0	0	1	0	0	0	1
18.	*Pinnularia viridis*	17	4	3	1	2	32	6	2	8	75
19.	*Trachyneis aspera*	0	0	0	0	0	0	1	0	0	1
20.	*Frustulia vulgaris*	4	1	0	2	1	8	9	0	11	36
Chrysophyceae											
21.	*Synura glabra*	0	0	0	0	0	0	0	0	1	1
Total		76	32	23	23	59	126	160	17	231	747

In the measurement of the environmental parameters of the waters of Gili Meno Saltwater Lake, the pH value at most sample points ranged from 7.55 to 7.94. This pH range indicates that the water is in a neutral condition that tends to be alkaline. pH is closely related to the diversity of biota of a water. A high pH indicates a low organic matter content (Purba et al., 2025). pH can affect many groups of microalgae that are more tolerant of certain pH shifts, while others are sensitive to changes in only small units (Kholssi et al., 2023). However, based on the results of the study, the pH level is still classified as the standard standard, which is in the range of pH levels 7-8 (Faisal et al., 2022; Meier et al., 2022). This pH range supports the process of photosynthesis, growth, and reproduction of microalgae optimally (Sakarika & Kornaros, 2016).

Temperature is considered one of the most important factors that affect the development of microalgae with regard to growth rate, cell size, biochemical composition, and nutrient requirements (Khaw et al., 2022). The temperature range of algae growth is ecologically important because it determines the range in which algae can be metabolically active and determines the distribution of algae (Teoh et al., 2010). The water temperature showed considerable variation between sample points, ranging from 30.8°C to 34.8°C. Water temperature is a parameter that affects the metabolic rate of aquatic organisms, the solubility of gases in water (including oxygen), and the rate of chemical reactions (Rubalcaba et al., 2020). Increased temperatures can reduce the solubility of dissolved oxygen and increase stress on aquatic organisms. According to Muria et al., (2023) and Gonçalves et al. (2016) In general, microalgae are able to survive at temperatures of 10°C - 35°C. At temperatures below 16°C microalgae can still grow slowly, and at temperatures above 35°C some microalgae can die or lyse (Pandey et al., 2024). The temperature obtained in the study is still included in the optimal temperature for microalgae life.

Table 3. Data of the Measurement Results of the First Repeating Environment Parameters

No.	Environmental Parameters		
	Salinity (ppt)	**Temperature (°C)**	**pH**
1	35	32,8	7,55
2	35	30,8	7,65
3	34	32	7,6
4	34	33,7	7,63
5	35	32,4	7,78
$\bar{x}$	**34,6**	**32,33**	**7,64**
STDEV	**0,55**	**1,23**	**0,09**

Table 4. Data of Measurement Results of Second Repeating Environmental Parameters

No.	Environmental Parameters				
	Salinity (ppt)	**Temperature (°C)**	**pH**	**DO (mg/L)**	**BOD (mg/L)**
1	41	32	7.94	2.29	2.22
2	42	34	7.66	2.39	2.43
3	41	34.8	7.69	2.3	2.22
4	42	33.7	7.6	8.87	9.09
$\bar{x}$	**41.5**	**33.63**	**7.72**	**3.96**	**3.99**
STDEV	**0.58**	**1.18**	**0.15**	**3.27**	**3.4**

According to Khaw et al., (2022), salinity is one of the vital factors that can regulate the growth rate and biochemical composition of microalgae, especially marine and brackish microalgae. The adaptability of microalgae depends on the type of their native habitat and changes in salinity (Haris et al., 2022). This is because the greater the difference in salinity compared to the natural habitat, the more difficult it is for microalgae to adapt, and vice versa (Ningsih et al., 2017). Salinity indicates the level of dissolved salts in water. In this study, the salinity had an average value of 34.6 ppt and 41.5 ppt. This is in accordance with the salinity value of Indonesia's marine areas with a range of 33-37 ppt (In Patty et al., 2020).

There is an increase in salinity from the first repeat to the second repeat. This happened because in the first iteration the rainfall was quite high so that it reduced the salt concentration in the saltwater lake. Meanwhile, in the second iteration, the rainfall was not so high that the salinity of the lake was still high. This is in accordance with research Handayani & Rakhmadevi (2020) and Pasaribu et al., (2023) which states that the greater or more rainfall in a marine area, the lower the salinity and vice versa, the less or less rainfall that falls, the salinity will increase.

Dissolved Oxygen (DO) and *Biochemical Oxygen Demand* (BOD) showed a pattern that varied across nine sample points. The level of dissolved oxygen in the water serves as an indicator of water quality and plays an important role in its purification process (Kulkarni, 2016). The concentration of dissolved oxygen reflects the ability of the environment to regulate itself; High oxygen levels support the process of decomposition of various pollutants more quickly, indicating that the water has good purification potential. On the other hand, low oxygen levels inhibit the process of decomposition of pollutants so that water purification takes place more slowly (Wei et al., 2019). Patty et al., (2020) stated that generally the DO level can fluctuate, namely in the range between 6 - 14 ppm. The DO value at sea level is included in the lightly polluted level when the level is 5 mg/L and falls into the heavily polluted category when the level is < 20 mg/L (Mamesah et al., 2023). The DO of sample points 6 to 8 is in the range of 2.29 – 2.39 mg/L. This value is very low for the survival of aquatic organisms. A significant increase occurred at point 9 with a DO of 8.87 mg/L, an ideal value for the development of microalgae.

Biochemical Oxygen Demand (BOD) is the amount of oxygen required by microorganisms to decompose organic matter that can be oxidized over a period of time (Vigiak et al., 2019). The BOD content in water must reach 30 mg/L in accordance with the quality standards stipulated in the Regulation of the Minister of Environment and Forestry number 68 of 2016 (Kurniajati et al., 2023). Meanwhile, based on the results of the study for BOD, points 6 to 8, the BOD value was around 2.22 to 2.43 mg/L, indicating the presence of a small amount of degradable organic matter. A more pronounced increase was seen at point 9 with a BOD of 9.09 mg/L, indicating a higher organic load at the site, although offset by an abundant supply of oxygen and mean BOD of the entire sample was 3.99 mg/L.

Table 5. Index of Important Values of Microalgae

No.	Species	DS	RD (%)	FJ	RF (%)	IVI (%)
1.	*Spirulina major*	1.33	1.61	0.33	3.80	5.40
2.	*Spirulina subsalsa*	1.44	1.74	0.33	3.80	5.54
3.	*Chroococcus turgidus*	31.56	38.02	1.00	11.39	49.41
4.	*Nodularia sphaerocarpa*	0.33	0.40	0.11	1.27	1.67
5.	*Planktothrix agardhii*	0.78	0.94	0.22	2.53	3.47
6.	*Chromochloris zofingiensis*	3.56	4.28	0.44	5.06	9.35
7.	*Tetraselmis chuii*	0.11	0.13	0.11	1.27	1.40
8.	*Eudorina elegans*	1.67	2.01	0.33	3.80	5.81
9.	*Chlorella vulgaris*	0.44	0.54	0.11	1.27	1.80
10.	*Navicula tripunctata*	14.33	17.27	0.67	7.59	24.86
11.	*Cymbella aspera*	0.67	0.80	0.78	8.86	9.66
12.	*Cymbella subtruncata*	0.67	0.80	0.78	8.86	9.66
13.	*Melosira moniliformis*	0.56	0.67	0.33	3.80	4.47
14.	*Synedra gracilis*	0.11	0.13	0.33	3.80	3.93
15.	*Thalassiosira weissflogii*	11.67	14.06	0.22	2.53	16.59
16.	*Pleurosigma elongatum*	1.11	1.34	0.11	1.27	2.60
17.	*Amphipleura pellucida*	0.11	0.13	1.00	11.39	11.53
18.	*Pinnularia viridis*	8.33	10.04	0.33	3.80	13.84
19.	*Trachyneis aspera*	0.11	0.13	0.11	1.27	1.40
20.	*Frustulia vulgaris*	4.00	4.82	1.00	11.39	16.21
21.	*Synura glabra*	0.11	0.13	0.11	1.27	1.40
	Totals	**83.00**	**100.00**	**8.78**	**100.00**	**200.00**

The Index of Important Values is a quantitative parameter used to describe the level of species dominance in a community. High Important Value Index indicates that the species can adapt to the surrounding environment compared to other species (Parwati et al., 2019). The greater the Important Value Index value of a species, the greater its role in the ecosystem in the region (Nikmah et al., 2016). Based on Table 5 of the Important Value Index of microalgae, it can be interpreted that no single species is very dominant in the community, although some species have higher important values than others. The highest Important Value Index value is owned by *Chroococcus turgidus* (49.41), followed by *Navicula tripunctata* (24.86), and *Thalassiosira weissflogii* (16.59). These species can be considered as the relatively dominant species in such microalgae ecosystems.

Chroococcus turgidus has the highest Relative Density value, which is 38.02%, and the Relative Frequency is also high (11.39%). This shows that this species has the largest number of individuals compared to other species and is quite widely distributed at the study site. *Navicula tripunctata* and *Thalassiosira weissflogii* also showed significant Important Value Index values, mainly supported by the high Relative Density of microalgae, which was 17.27% and 14.06% respectively. This suggests that both species also have sizable populations. Based on the data of the Diversity (H'), Dominance (C), and Uniformity (E) Index from nine observation points, it is known that there are variations in the community structure in each location.

Table 6. Microalgae Diversity Index (H')

No.	Species	Diversity Index (H')	Value	Categories
1.	*Spirulina major*	0.066	H'≤2.0	Low
2.	*Spirulina subsalsa*	0.071	H'≤2.0	Low
3.	*Chroococcus turgidus*	0.368	H'≤2.0	Low
4.	*Nodularia sphaerocarpa*	0.022	H'≤2.0	Low
5.	*Planktothrix agardhii*	0.044	H'≤2.0	Low
6.	*Chromochloris zofingiensis*	0.135	H'≤2.0	Low
7.	*Tetraselmis chuii*	0.009	H'≤2.0	Low
8.	*Eudorina elegans*	0.078	H'≤2.0	Low
9.	*Chlorella vulgaris*	0.028	H'≤2.0	Low
10.	*Navicula tripunctata*	0.303	H'≤2.0	Low
11.	*Cymbella aspera*	0.039	H'≤2.0	Low
12.	*Cymbella subtruncata*	0.039	H'≤2.0	Low
13.	*Melosira moniliformis*	0.034	H'≤2.0	Low
14.	*Synedra gracilis*	0.009	H'≤2.0	Low
15.	*Thalassiosira weissflogii*	0.276	H'≤2.0	Low
16.	*Pleurosigma elongatum*	0.058	H'≤2.0	Low
17.	*Amphipleura pellucida*	0.009	H'≤2.0	Low
18.	*Pinnularia viridis*	0.231	H'≤2.0	Low
19.	*Trachyneis aspera*	0.009	H'≤2.0	Low
20.	*Frustulia vulgaris*	0.146	H'≤2.0	Low
21.	*Synura glabra*	0.009	H'≤2.0	Low
Total		**1.981**	**1.0≤H'≤2.0**	**Medium**

The diversity index (H') is in the low category for all species. Some species, such as *Chroococcus turgidus, Navicula subdilussima, Navicula tripunctata*, and *Thalassiosira weissflogii*, tend to have higher H' values and are distributed at many sample points. This indicates that these species are the most abundant species that appear at the study site. Individually, each species of microalgae (with a total of 21 species) showed a very low diversity index value (H'), which was below or equal to 2.0 (H' ≤ 2.0), a total diversity index value of 1,981 and was in the medium category with a range of 1.0 ≤ H' < 2.0. This indicates that the populations of each species are not very varied. The combination of all the species is enough to place the microalgae ecosystem at a moderate level of diversity.

Table 7. Microalgae Uniformity Index (E)

No.	Species	Uniformity Index (E)	Value	Categories*
1.	*Spirulina major*	0.021	E<0.4	Low
2.	*Spirulina subsalsa*	0.022	E<0.4	Low
3.	*Chroococcus turgidus*	0.117	E<0.4	Low
4.	*Nodularia sphaerocarpa*	0.007	E<0.4	Low
5.	*Planktothrix agardhii*	0.014	E<0.4	Low
6.	*Chromochloris zofingiensis*	0.043	E<0.4	Low
7.	*Tetraselmis chuii*	0.003	E<0.4	Low
8.	*Eudorina elegans*	0.025	E<0.4	Low
9.	*Chlorella vulgaris*	0.009	E<0.4	Low
10.	*Navicula tripunctata*	0.097	E<0.4	Low
11.	*Cymbella aspera*	0.012	E<0.4	Low
12.	*Cymbella subtruncata*	0.012	E<0.4	Low
13.	*Melosira moniliformis*	0.011	E<0.4	Low
14.	*Synedra gracilis*	0.003	E<0.4	Low
15.	*Thalassiosira weissflogii*	0.088	E<0.4	Low
16.	*Pleurosigma elongatum*	0.018	E<0.4	Low
17.	*Amphipleura pellucida*	0.003	E<0.4	Low
18.	*Pinnularia viridis*	0.074	E<0.4	Low
19.	*Trachyneis aspera*	0.003	E<0.4	Low
20.	*Frustulia vulgaris*	0.047	E<0.4	Low
21.	*Synura glabra*	0.003	E<0.4	Low
	Total	**0.632**	**E>0.6**	**Height**

*** :**(E. Odum, 1993)

Table 8. Microalgae Dominance Index (C)

No.	Species	Dominance Index (C)	Value	Categories*
1.	*Spirulina major*	0.000258	0.00<C<0.5	Low
2.	*Spirulina subsalsa*	0.000303	0.00<C<0.5	Low
3.	*Chroococcus turgidus*	0.144542	0.00<C<0.5	Low
4.	*Nodularia sphaerocarpa*	0.000016	0.00<C<0.5	Low
5.	*Planktothrix agardhii*	0.000088	0.00<C<0.5	Low
6.	*Chromochloris zofingiensis*	0.001835	0.00<C<0.5	Low
7.	*Tetraselmis chuii*	0.000002	0.00<C<0.5	Low
8.	*Eudorina elegans*	0.000403	0.00<C<0.5	Low
9.	*Chlorella vulgaris*	0.000029	0.00<C<0.5	Low
10.	*Navicula tripunctata*	0.029822	0.00<C<0.5	Low
11.	*Cymbella aspera*	0.000065	0.00<C<0.5	Low
12.	*Cymbella subtruncata*	0.000065	0.00<C<0.5	Low
13.	*Melosira moniliformis*	0.000045	0.00<C<0.5	Low
14.	*Synedra gracilis*	0.000002	0.00<C<0.5	Low
15.	*Thalassiosira weissflogii*	0.019758	0.00<C<0.5	Low
16.	*Pleurosigma elongatum*	0.000179	0.00<C<0.5	Low
17.	*Amphipleura pellucida*	0.000002	0.00<C<0.5	Low
18.	*Pinnularia viridis*	0.010080	0.00<C<0.5	Low
19.	*Trachyneis aspera*	0.000002	0.00<C<0.5	Low
20.	*Frustulia vulgaris*	0.002323	0.00<C<0.5	Low
21.	*Synura glabra*	0.000002	0.00<C<0.5	Low
	Total	**0.209819**	**0.00 <C<0.5**	**Low**

*** :**(E. Odum, 1993)

According to Ludwig (1988), the uniformity index describes the size of the number of individuals between species in a community. The more uniform the distribution of individuals between species, the more the balance of the ecosystem will increase. Based on table 3, it shows that the level of uniformity of the microalgae community as a whole is in the high category, which is 0.632 which is in the range of E > 0.6. Although the uniformity index values for each individual species indicate a low category (E < 0.4), the total value indicates the opposite. This value indicates that the individual abundance of the 21 microalgae species listed in the table has a very uniform or even distribution.

According to Odum (1971), if the dominance index value is close to 1, then the community is dominated by a certain species, and if it is close to 0, then there is no dominant species in that community. The overall dominance rate of microalgae at the study site was in the low category. This is shown by the total dominance index of 0.209819 which is in the range of 0.00 < C < 0.5. Specifically, no microalgae species dominated significantly among the 21 species, all of which were in the low category (0.00 < C < 0.5). Dominance analysis (C) reveals that *Chroococcus turgidus* has the highest level of dominance with a dominance index of 0.144542 which indicates that the species is dominant.

Microalgae are known to be organisms that have a high sensitivity to environmental dynamics, so they play an important role as bioindicators in the assessment of water quality (Hairunnadawiah et al., 2022). Some species are only able to adapt to good quality waters, while others show optimal growth in environments with high concentrations of nutrients or polluted conditions. Based on the results of the study, the bioindicator status for each species of microalgae is known as follows.

Table 9. Status of Microalgae Bioindicators

No.	Species	Bioindicator	Source
1.	*Spirulina major*	Contaminated	Khalil et al., (2021)
2.	*Spirulina subsalsa*	Contaminated	Khalil et al., (2021)
3.	*Chroococcus turgidus*	Contaminated	M Radwan et al., (2018)
4.	*Nodularia sphaerocarpa*	Contaminated	Comedy (2013)
5.	*Planktothrix agardhii*	Contaminated	Lenard & Poniewozik (2022)
6.	*Chromochloris zofingiensis*	Contaminated	Palmer (1969)
7.	*Tetraselmis chuii*	Contaminated	Kutlu & Dorucu (2021)
8.	*Eudorina elegans*	Contaminated	Palmer (1969)
9.	*Chlorella vulgaris*	Contaminated	Palmer (1969)
10.	*Navicula tripunctata*	Contaminated	Shevchenko et al. (2023)
11.	*Cymbella aspera*	Contaminated	Bhakta & Adhikary (2012)
12.	*Cymbella subtruncata*	Contaminated	Palmer (1969)
13.	*Melosira moniliformis*	Contaminated	Shaaban (2001)
14.	*Synedra gracilis*	Contaminated	Palmer (1969)
15.	*Thalassiosira weissflogii*	Contaminated	Stoermer & Julius (2003)
16.	*Pleurosigma elongatum*	Contaminated	Mukherjee et al., (2016)
17.	*Amphipleura pellucida*	Uncontaminated	Cunfang et al., (2017)
18.	*Pinnularia viridis*	Uncontaminated	Kociolek & Spaulding (2003)
19.	*Trachyneis aspera*	Uncontaminated	Luthfi et al., (2024)
20.	*Frustulia vulgaris*	Contaminated	Juttner et al., (2023)
21.	*Synura glabra*	Contaminated	Munch (1985)

Based on the observations, the microalgae community in Air Asin Lake, Gili Meno, shows a very clear dominance in certain species that acts as a bioindicator of pollution. Of the total 747 individuals found, the species with the highest number is *Chroococcus turgidus* (284 individuals) of the class *Cyanophyceae*. This species is known as a strong indicator of polluted waters so its high abundance is a major marker that the lake is in a condition with an excess nutrient load. Other species that are also quite dominant are *Navicula tripunctata* (129 individuals) and *Pinnularia viridis* (75 individuals) from the class *Bacillariophyceae*. *Navicula tripunctata* is a polluted bioindicator, so its presence in large quantities further strengthens the indication of water quality degradation.

On the other hand, *Pinnularia viridis* is classified as an unpolluted bioindicator, but although the population is quite high, the number is still far below the dominance of *Chroococcus turgidus*. Thus, the existence of these clean water indicator species has not been strong enough to match the community's tendency to be more inclined towards polluting species. In addition, the species *Thalassiosira weissflogii* (105 individuals) and *Frustulia vulgaris* (36 individuals) were also found in relatively large numbers. Both species are bioindicators of pollution, so their existence adds to the evidence that aquatic conditions are closer to eutrophic status

Overall, the dominance of polluting species such as *Chroococcus turgidus*, *Navicula tripunctata*, and *Thalassiosira weissflogii* suggests that the microalgae communities in the Gili Meno Saltwater Lake are dominated by pollution-tolerant groups. This confirms that the condition of the aquatic ecosystem at the research site is in the moderately polluted category because clean water indicator species only appear in small numbers and do not dominate the community structure.

CONCLUSION

A total of 21 microalgal species belonging to five phyla and five classes were identified from nine sampling sites. Community structure analysis revealed that *Chroococcus turgidus* exhibited the highest abundance, frequency of occurrence, and Importance Value Index (IVI), indicating its prominent ecological role within the microalgal assemblage. However, the Dominance Index (C = 0.209) suggests that no single species overwhelmingly dominated the community, reflecting a relatively balanced species composition. This finding is further supported by the Shannon–Wiener Diversity Index (H' = 1.981), which indicates a moderate level of species diversity, and the Evenness Index (E = 0.632), demonstrating a fairly uniform distribution of individuals among species. Ecologically, the predominance of pollution-tolerant microalgal taxa indicates that the Salt Water Lake ecosystem is experiencing environmental stress associated with moderate levels of pollution. Therefore, the observed microalgal community structure supports the use of these organisms as reliable bioindicators of water quality and highlights the need for continuous environmental monitoring and appropriate management strategies to prevent further ecosystem degradation.

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