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Investigating Species Composition and Abundance of Marine Microalgae from Temajo Island Waters, West Kalimantan, Indonesia

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Abstract. *Temajo Island is renowned for its marine tourism activities and is home to a range of organisms, including algae. Microalgae serve as indicator species, offering insights into the aquatic environment through their species composition and abundance. This study aims to provide preliminary data on the abundance and some ecological indices (diversity, evenness, and dominance) of microalgae on Temajo Island, which will be the basis for assessing water conditions and supporting conservation efforts and sustainable management of natural resources. The research was carried out at four stations with different characteristics. At each station, surface water samples were collected using a plankton net. The microalgae in these samples were subsequently examined under a microscope, and their quantities were measured. The microalgae abundance ranged from 2.84 to 7,697.14 ind/L, with an average of 193.34 ind/L. Chaetoceros was the most abundant genus, followed by Rhizosolenia, Guinardia, Thalassiosira, Pseudo-nitzschia, and Bacteriastrum. The diversity index (H') ranged from 2.67 to 3.08, indicating moderate to high species richness, while the evenness index (E) ranged from 0.64 to 0.74, reflecting a high level of uniformity among microalgae populations. The dominance index (C) varied between 0.11 and 0.20, suggesting low dominance by any single genus. These indices collectively indicate a balanced and diverse microalgae community, underscoring the ecological health and stability of the Temajo Island waters. Preliminary information about the species composition and abundance of marine microalgae in this study provides valuable insights into the dynamics of microalgae populations and their ecological implications in the marine ecosystems of Indonesia.*

Keywords: *bacillariophyceae, biodiversity, diatom, marine microalgae*

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INTRODUCTION

Microalgae are a diverse and abundant group of single-celled organisms, encompassing both eukaryotic and prokaryotic forms. They range in size from 2 to 50 µm (Singh and Saxena, 2015; Elisabeth et al., 2021), and can thrive in various water environments, including freshwater, brackish, and marine. They may be free-floating, bottom-dwelling, or attached to surfaces (Arsad et al., 2021; Mahmudi et al., 2023; Arsad et al., 2024). From an ecological perspective, marine microalgae are critical components of marine ecosystems, playing pivotal roles in aquatic ecosystems. Algae form the base of the food web, contributing significantly to the primary production and influencing the biogeochemical cycles of carbon, nitrogen, and other essential elements (Naselli-Flores and Padisák, 2023; Lobus and Kulikovskiy, 2023). Their species composition and abundance are crucial factors that influence the ecological balance, primary productivity, and overall health of the environment. This diversity is shaped by a multitude of environmental factors, including light availability, nutrient concentrations, temperature, and salinity (Kholssi et al., 2023; DeNardis et al., 2024). Different species of microalgae thrive under varying conditions, leading to distinct community structures in different aquatic environments.

West Kalimantan with its potential coastal areas and small islands, could be one of the centers for marine biodiversity. Temajo Island, one of the small islands in West Kalimantan covering an area of 556 Ha, is uninhabited but is a popular marine tourism destination, known for its beautiful beaches and stunning underwater scenery. Temajo Island hosts a rich array of marine biodiversity, including benthic and planktonic organisms, mangroves, coral reefs, and algae. Although several previous works describe marine algal diversity and it’s potential uses, most of them have focused on macroalgae (Safitri et al., 2023; Susrini et al., 2023), with only a few discussing on microalgae (Apriansyah et al., 2021; Zainal et al., 2023). Hence, the diversity and role of marine microalgae from West Kalimantan have yet to be fully explored. Apriansyah et al. (2021) investigated the community structure of microalgae in the Peniti estuary, where the water conditions were significantly impacted by the level of human activities, including residential development, forestry resource extraction, tourism, and fishing. The microalgae community comprised 68 genera, with Euglenophyceae representing the component with the highest abundance percentage (60.93%) with an abundance value varied between 0.5 - 2141.5 ind/L. Zainal et al. (2023) conducted similar research in the waters surrounding Lemukutan Island. *Bacillariophyceae* accounted for the highest percentage (90.44%) of the microalgae community, with predominant genera including *Cocconeis*, *Nitzschia*, *Synedra*, and *Chaetoceros*. Comprehensive knowledge of the species composition and abundance of marine microalgae is critical for evaluating the vitality and productivity of marine ecosystems, and for effectively monitoring environmental fluctuations and human impacts.

This study aims to provide preliminary data on the abundance of microalgae on Temajo Island, which will serve as the basis for assessing water conditions and supporting conservation efforts and the sustainable management of natural resources. This information aids in monitoring the impacts of environmental changes and human activities on marine ecosystems in the area. Given the anticipated environmental changes driven by human activity and climate change in the future, we expect that this study will offer valuable insights into the dynamics of this phytoplankton group, which is also known for its potential to cause harmful global blooms. This study not only contributes scientifically but also has practical implications for improved environmental management and planning of coastal regions.

MATERIALS AND METHODS

Time and Sampling Area

The study took place around Temajo Island in Mempawah Regency, West Kalimantan, Indonesia (Figure 1), in August 2022. Water samples were collected from four stations across the study area, with each exhibiting distinct characteristics; Station I was situated near fisheries activities, station II was close to a tourism area, while stations III and IV represented areas with minimal human activities.

Samples Collection

Microalgae were collected by filtering 100 L of surface seawater at each sampling site using a 100 cm long plankton net with a diameter of 30 cm and a mesh size of 30 microns, repeated three times. The filtered samples were transferred into 20 mL falcon tubes as the final volume sample and preserved by adding four drops of 4% formalin solution (Edler and Elbrachter, 2010). After collection, the samples were stored in an insulated box to prevent exposure to sunlight and transported to the Laboratory of Marine Science, Universitas Tanjungpura for subsequent analysis.

Taxonomical Identification and Calculation

Samples were examined under a Smartcare binocular LED microscope (model XSZ 107BN) at x100 and x400 magnification. Microalgae were identified to the genus level following taxonomic guidelines by Davis (1995), using identification references from Yamaji (1984), van Vuuren et al. (2006), and consulting databases available at https://www.algaebase.org/.

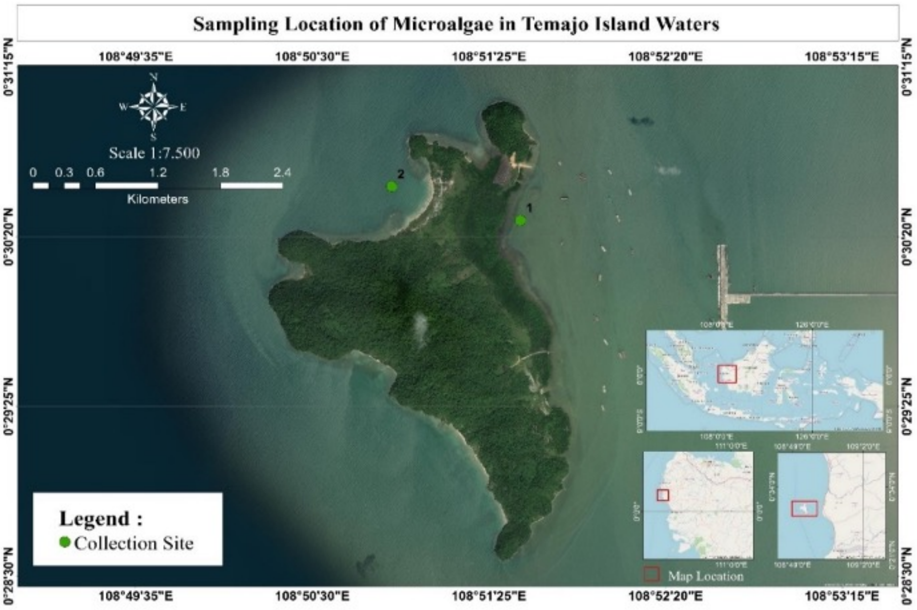

Figure 1. Sampling Location of Microalgae in Temajo Island Waters, West Kalimantan, Indonesia

Data Analysis

Species and Relative Abundance

Microalgae abundance denotes the aggregate count of species within an ecosystem, pertains to the number of individuals or the biomass of microalgae present in a specific area. Species abundance was quantitatively calculated by following this formula:

$$K_i = \frac{Q_1}{Q_2} x \frac{Vr}{Vo} x \frac{1}{P} x \frac{1}{V} x\, n_i$$

where : K is species abundance (ind/L), Q1 is the area of cover glass (mm), Q2 is the field of view area (mm), Vr is the filtered sample volume (20 mL), V0 is the drop sample volume (1 mL), P is the number of visual fields, V is the filtered water volume (100 L), and n_i is the individual amounts of enumerated microalgae (ind). Relative abundance refers to the proportion of each species in a community.

$$KR_i = \frac{K_i}{K\ total} x100\%$$

Diversity index is usually calculated to assess species diversity in a microalgal community. This index was determined using the Shannon-Wiener formula (1969):

$$H' = -\sum_{k=0}^{n} p_i \ln p_i$$

According to Odum (1993), diversity index values are categorized into three levels; H' < 1 indicates low diversity, 1 < H' < 3 represents moderate diversity, and H' > 3 signifies high diversity. The evenness index (E) is a measurement used in ecology to describe how evenly individuals of microalgae are distributed among different species in a community. This index was determined using Pielou's Evenness Index (Odum, 1993) formula:

$$E = \frac{H'}{lnS}$$

The evenness index ranges from 0 to 1, where a lower E value indicates less uniformity in population distribution among genera, suggesting unequal numbers of individuals per genus and a tendency for one genus to dominate. A higher E value, closer to 1, indicates greater uniformity, with similar numbers of individuals across genera and no single genus predominating (Krebs, 1985). The dominance index is a metric in ecological studies to assess the dominance of different species or genera within a community. It helps to understand which species are most prevalent or influential within an ecosystem. The calculation of this index followed the formula (Odum, 1993):

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

A value of C < 0.50 signifies a low level of dominance within the community, suggesting a relatively even distribution among species or genera. When 0.50 < C < 0.75, moderate dominance is indicated, suggesting that certain genera are more prevalent but not overwhelmingly so. When C > 0.75, it indicates high dominance, where a few species or genera exert significant influence over the community structure, potentially reflecting a less diverse or more specialized ecosystem (Krebs, 1989).

RESULTS AND DISCUSSION

Microalgae Composition in Temajo Island Waters

In this study, a total of 75 marine microalgae genera were found, which could be classified into 10 classes, including *Bacillariophyceae* (54 genera), *Dinophyceae* (7 genera), *Cyanophyceae* (5 genera), *Chlorophyceae* (3 genera), *Trebouxiophyceae* (1 genus), *Zygnematophyceae* (1 genus), *Dictyochophyceae* (1 genus), *Raphidophyceae* (1 genus), *Xanthophyceae* (1 genus), *Euglenophyceae* (1 genus). This study uncovered distinct variations in the types of microalgae (Figure 2) present at each sampling station, suggesting that *Bacillariophyceae* (diatom) were more prevalent compared to other classes. Diatoms are one of the most varied and ecologically significant groups of phytoplankton (Karlusich et al., 2024). They are widespread (Rimet et al., 2023), well-known cosmopolitan groups (Maltsev et al., 2021), and commonly encountered in a wide range of aquatic habitats, such as freshwater, estuaries, and marine environments worldwide (B-Béres et al., 2023; Chang et al., 2023). The domination of diatoms is supported by their high adaptability to changing of environmental parameters (Hadi et al., 2022). Previous studies reported that some species showed rapid thermal adaptation to extreme warming ocean and high tolerance to other environmental condition (Kootuparambil et al., 2019). Some previous works also demonstrated that diatoms have quick growth rates (Inomura et al., 2023) powered by the presence of sufficient nutrients (Giri et al., 2022), both macro (N and P) and micronutrients (Fe, Mn, Co, etc.) (Grossman, 2016). In addition, cell walls (i.e., frustules) containing SiO2 particles serve as mechanical protection for diatoms against copepod grazing, thereby maintaining their high abundance in the euphotic layer (Gronning and Kiorboe, 2020). Pančić et al. (2019) showed that siliceous cell walls provide protection to diatom cells ingested by adult copepods and nauplii, with some living cells still found in the fecal pellets. The thickening of siliceous walls is thus an effective strategy in defending against grazing.

Dinophyceae (dinoflagellates) contributed 9.34% to the total phytoplankton assemblage. In aquatic environment, *Dinophyceae* can be found in the surface and water column as planktonic species or attached to the substrate. Compared to diatoms, dinoflagellates tend to exhibit lower growth rates (Tang, 2008) and do not compete as effectively for nutrient absorption. Nevertheless, numerous studies have reported some species are known to generate harmful algal blooms (HABs) (Romero et al., 2023), which refer to high cell densities frequently resulting in water discoloration phenomena. Several factors influence algal blooms, such as anthropogenic actions, eutrophication, hydrodynamic variables, and climate change (Igwaran et al., 2024). The presence of some species in Temajo Island waters, like *Alexandrium*, *Ceratium*, *Dinophysis*, *Prorocentrum* has been widely reported as an algal blooming agent (Klemm et al., 2022; Samudra et al., 2023). HABs species may secrete certain toxins causing detrimental effects to the surrounding environment, including mortality of aquatic organisms and human health risks (Igwaran et al., 2024).

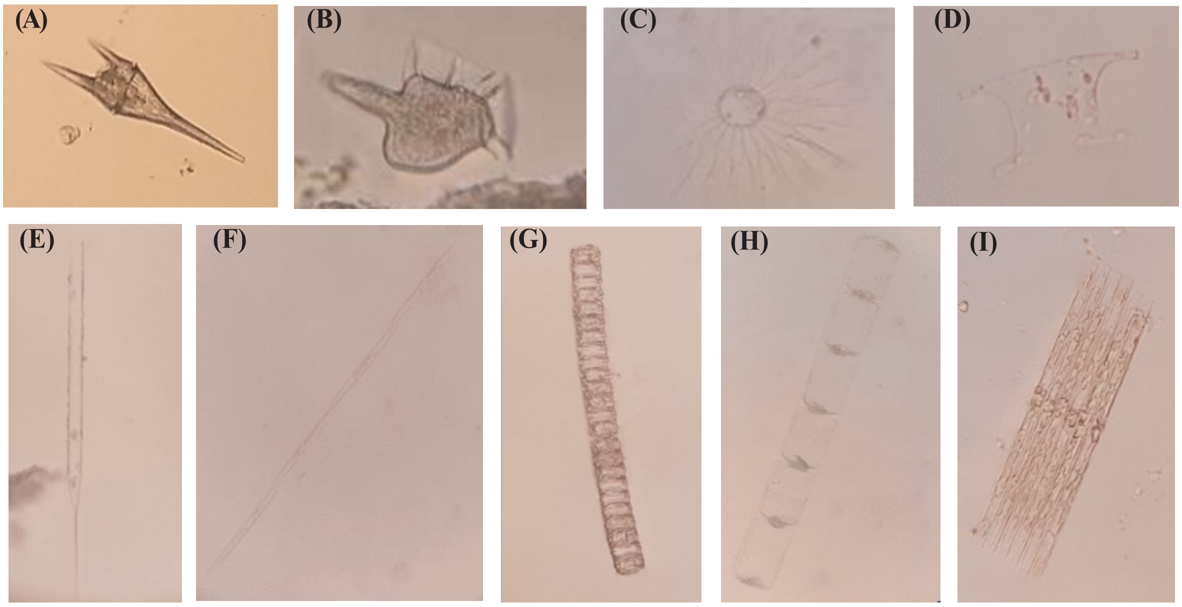

Figure 2. Microalgae found in Temajo Island Waters, (A) *Ceratium* (B) *Dinophysis* (C) *Bacteriastrum* (D) *Hemiaulus* (E) *Rhizosolenia* (F) *Pseudo-nitzschia* (G) *Oscillatoria* (H) *Lauderia* (I) *Bacillaria*

Cyanophyceae are found in almost every aquatic ecosystem, including Temajo Island. They can rapidly multiply, able to bloom in surface water under favorable conditions of light and nutrients (Ibelings et al., 2021), producing cyanotoxins (CNs) during their growth (Ballesteros et al., 2022), which can be harmful to the environment, aquatic organisms, and human health (Gobler, 2020). Our study found several types of Cyanophyceae, namely *Anabaena*, *Microcystis*, *Oscillatoria*, and *Trichodesmium* that have been widely reported as agent and toxin producers (Bakr et al., 2022). Several studies demonstrated that blooming conditions of *Cyanophyceae* occur from spring to summer (Wang et al., 2021), driven by multiple factors such as changes in temperature and nutrients. In a few species, their dominance is supported by the ability to fix nitrogen from the atmosphere and buoyancy regulation (Ibelings et al., 2021). For example, *Anabaena*, which has gas-filled cavities, can float to the water surface or slightly to the bottom depending on light and nutrient availability. Considered one of the most diverse groups, with around 563 genera and 3,797 species (Guiry & Guiry 2023), *Chlorophyceae* have been reported to have a cosmopolitan distribution and widespread occurrence in marine habitat (Mardiana et al., 2024). The optimal growth of *Chlorophyceae* is promoted by favorable water conditions, while several species tend to possess great adaptation to diverse environmental conditions (Soeprapto et al., 2023). In this sense, the composition of this class can be an important indicator for diagnosing water quality (Zikriah et al., 2020) as these species are commonly associated with organic pollution (Amaral et al., 2023) and the potential of eutrophication events (Wijeyaratne and Nanayakkara, 2020).

Species Abundance

In Temajo Island, the microalgae ranged from 2.84 – 7,697.14 ind/L, with an average of 193.34 ind/L (Table 1). *Chaetoceros*.

was the most abundant genus, followed by *Rhizosolenia* (3,693.94 ind/L), *Guinardia* (2,238.50 ind/L), *Thalassiosira* (1,886.69 ind/L), *Pseudo-nitzschia* (1,492.33 ind/L), and *Bacteriastrum* (1,472.47 ind/L). *Chaetoceros* is among the most diverse genera of marine planktonic diatoms, with numerous abundant and widely distributed species in various aquatic environments. This genus has been frequently observed in the coastal waters, including West Kalimantan (Apriansyah et al., 2021; Zainal et al., 2023). Numerous studies have also reported the abundance and dominance of *Chaetoceros* (Riouchi et al., 2021; Redzuan and Milow, 2021) in the marine environment. These conditions can be influenced by physico-chemical factors of the water. Razali et al. (2015) and Bosak et al. (2016) demonstrated that temperature, salinity, pH, and phosphate concentrations in the water column promote the succession of dominant species within the *Chaetocerotaceae* family. Thus, summer seasons often also lead to occurrences of bloom events dominated by a single species. Due to its rapid growth rate, this genus is known to tolerate high temperatures around 33-35°C and salinity levels above 20 ppt (Minggat et al., 2021). The widespread growth of *Chaetoceros* can be attributed to its capability to thrive and reproduce under hypersaline conditions (Aryawati et al., 2017). Additionally, Tanković et al. (2018) reported that a scarcity of dissolved inorganic phosphate (DIP) was identified as the primary ecological factor influencing the domination of *Chaetoceros*. In response to phosphorus depletion, C. peruvianus exhibited changes such as increased cell height, length, thickness of setae, and overall cellular volume. Moreover, Yang et al. (2016) documented the *Chaetoceros* survival strategy under conditions of dissolved inorganic nitrogen (DIN) deficiency. Under DIN-limited conditions, *Chaeotceros* debilis used dissolved organic nitrogen (DON) such as urea and amino acids available in the water, to support their growth rate.

The genus *Rhizosolenia* was frequently encountered in high density across various aquatic communities (Ramili et al., 2023), both in the water column and attached to the substrate. This genus is known to be cosmopolitan in its distribution and can thrive across a wide spectrum of environmental conditions, including variations in temperature, salinity, and pH (Lim et al., 2017). *Thalassiosira* is the diatom with the greatest diversity, globally distributed as a ubiquist species, and frequently observed in planktonic waters ranging from temperate brackish to marine environments (Hoppenrath et al., 2007). Its dominance has been documented in previous study (Shevchenko et al., 2022), and under certain conditions, it plays a significant role in the spring bloom of diatoms (Radchenko et al., 2018). *Thalassiosira* demonstrates tolerance to high water temperatures and salinity levels in coastal and estuarine ecosystems (Clavero et al., 2008).

In this study, *Pseudo-nitzschia* was also noted to have a high species abundance, a common occurrence in both coastal and oceanic waters worldwide. Pseudo-nitzschia demonstrates adaptability to various conditions (Bates et al., 2018). The dominance and blooming of this harmful microalgae have been documented by several researchers (Palenzuela et al., 2019; Hoffmeyer et al., 2020). *Pseudo-nitzschia* blooms can reach high densities, up to 107 cells/L (Trainer et al., 2012), under specific conditions of temperature, salinity, light intensity and photoperiod, primarily influenced by multiple sources of macronutrients, upwelling-mixing processes, riverine inputs, and coastal eutrophication (Pednekar et al., 2018). *Bacteriastrum* are cosmopolitan species, commonly found in temperate and tropical oceans, where they play a significant role in phytoplankton communities. *Bacteriastrum* are typically not dominant, although several studies have documented their abundance (Zainal et al., 2023; Mahmudi et al., 2023). They bloom in various marine environments, particularly in nutrient-rich coastal waters and upwelling zones. These blooms can contribute substantially to local phytoplankton biomass and are influenced by factors such as nutrient availability, light intensity, and water temperature (Pawhestri et al., 2020).

Table 1. Abundance of Microalgae in Temajo Island Waters

No	Microalgae type	Abundance (ind/L)			
		Station I	Station II	Station III	Station IV
1	***Bacillariophyceae***				
	Diatom pennate				
	Achnanthes	17.02	51.07	51.07	68.09
	Amphiprora	42.56	8.51	65.25	150.37
	Amphora	25.53	36.88	73.77	141.86
	Asterionella	22.70	79.44	0.00	0.00
	Bacillaria	5.67	5.67	19.86	19.86
	Campylodiscus	0.00	8.51	0.00	0.00
	Centronella	0.00	0.00	2.84	0.00
	Cocconeis	195.76	90.79	212.78	161.72
	Cylindrotheca	11.35	5.67	19.86	79.44
	Cymbella	0.00	0.00	22.70	5.67
	Diploneis	17.02	36.88	25.53	39.72
	Ephemera	56.74	48.23	150.37	232.64
	Gomphonema	25.53	31.21	2.84	5.67
	Grammatophora	0.00	5.67	0.00	0.00
	Gyrosigma	36.88	42.56	99.30	190.09
	Halamphora	0.00	8.51	0.00	0.00
	Isthmia	5.67	14.19	0.00	5.67
	Licmophora	5.67	14.19	5.67	0.00
	Navicula	102.14	144.69	181.58	346.13
	Nitzschia	249.67	161.72	90.79	133.35
	Pinnularia	19.86	8.51	2.84	14.19
	Plagiodiscus	0.00	5.67	0.00	0.00
	Plagiotropis	0.00	0.00	2.84	19.86
	Pleurosigma	68.09	53.91	59.58	238.32
	Psammodictyon	17.02	5.67	8.51	2.84
	Pseudo-nitzschia	59.58	107,.81	439.76	885.18
	Rhopalodia	0.00	0.00	0.00	8.51
	Seminavis	19.86	8.51	11.35	53.91

	Surirella	85.11	59.58	107.81	201.44
	Synedra	187.25	292.22	385.85	243.99
	Thalassionema	65.25	113.49	263.85	655.38
	Thalassiothrix	11.35	11.35	34.05	56.74
	Diatom Sentris				
	Asteromphalus	2.84	5.67	11.35	62.42
	Bacteriastrum	113.49	252.50	263.85	842.63
	Biddulphia	19.86	14.19	2.84	17.02
	Chaetoceros	1424.24	4111.00	4550.76	7697.14
	Corethron	2.84	11.35	11.35	8.51
	Coscinodiscus	96.46	73.77	39.72	360.32
	Cyclotella	2.84	5.67	76.60	5.67
	Cymatosira	22.70	22.70	0.00	2.84
	Ditylum	90.79	141.86	215.62	343.29
	Ethmodiscus	73.77	116.32	295.06	553.24
	Eucampia	11.35	153.21	102.14	209.95
	Guinardia	150.37	470.96	456.78	1160.39
	Hemiaulus	31.21	178.74	204.27	476.64
	Lauderia	141.86	266.69	266.69	496.50
	Leptocylindrus	70.93	136.18	357.48	360.32
	Mastogloia	34.05	19.86	11.35	70.93
	Melosira	19.86	19.86	0.00	19.86
	Odontella	96.46	283.71	226.97	556.08
	Planktoniella	25.53	17.02	65.25	127.67
	Rhizosolenia	263.85	371.66	1032.72	2025.71
	Thalassiosira	388.69	530.54	417.06	550.40
	Triceratium	31.21	45.39	70.93	130.51
2	***Dinophyceae***				
	Alexandrium	0.00	5.67	0.00	0.00
	Ceratium	19.86	229.81	104.97	139.02
	Dinophysis	8.51	25.53	0.00	2.84
	Gonyaulax	0.00	2.84	0.00	0.00
	Heterocapsa	31.21	85.11	53.91	34.05
	Podolampas	14.19	68.09	11.35	19.86
	Prorocentrum	28.37	153.21	306.41	209.95
3	***Cyanophyceae***				
	Anabaena	14.19	0.00	11.35	39.72
	Microcystis	107.81	215.62	351.80	96.46
	Oscillatoria	17.02	22.70	59.58	99.30
	Pseudanabaena	11.35	17.02	0.00	0.00
	Trichodesmium	102.14	14.19	201.44	53.91

4	***Chlorophyceae***				
	Chlamydomonas	8.51	5.67	0.00	93.63
	Monoraphidium	5.67	8.51	28.37	5.67
	Schroederia	8.51	36.88	5.67	0.00
5	***Trebouxiophyceae***				
	Rosenvingiella	0.00	0.00	2.84	0.00
6	***Zygnematophyceae***				
	Cosmarium	2.84	0.00	11.35	0.00
7	***Dictyochophyceae***				
	Dictyocha	5.67	0.00	11.35	34.05
8	***Raphidophyceae***				
	Heterosigma	2.84	0.00	0.00	0.00
9	***Xanthophyceae***				
	Tribonema	8.51	2.84	0.00	0.00
10	***Euglenophyceae***				
	Euglena	0.00	0.00	45.39	0.00
TOTAL		4865,68	9603,69	12225,20	20867,10

Ecological Indices of Microalgae

The stability of a microalgae community in aquatic environments can be evaluated using diversity metrics like the diversity index (H'), evenness index (E), and dominance index (C) (Table 2). In this study, the diversity index values ranging from 2.67 to 3.08, indicated a considerable range of species richness among microalgae populations in the marine waters. According to Odum's (1993) criteria, H' values within this range signified a moderate to high level of microalgae diversity. Therefore, these values indicated a healthy and dynamic aquatic environment, suggesting that Temajo waters support a diverse array of microalgae genera, with relatively balanced population sizes across these genera.

Table 2. Ecological Indices of Microalgae in Temajo Island Waters

Index	Station I	Station II	Station III	Station IV
Diversity index (H')	3.08	2.67	2.78	2.74
Evenness index (E)	0.74	0.64	0.68	0.67
Dominance index (C)	0.11	0.20	0.16	0.16

The evenness index (E) of microalgae in Temajo waters spanned from 0.64 to 0.74, indicating a high level of uniformity among the microalgae populations overall. This index reveals that the distribution of individuals within each genus is relatively equal, without any particular genus dominating the population. Such balanced distribution is indicative of a stable and well-regulated ecosystem, where various microalgae species coexist without one species exerting undue influence over others. This equilibrium suggested that environmental conditions in the Temajo waters support a diverse community of microalgae, contributing to the overall health and resilience of the aquatic environment. The high evenness index values observed underscore the health and natural dynamics of the microalgae community in Temajo waters. The dominance index (C) of microalgae in Temajo waters varied between 0.11 and 0.20, placing them in the low dominance category. This range suggests that no single type of microalgae exerts significant dominance over others within the population. This observation aligns with the high evenness index values, indicating a balanced distribution of individuals across different genera. The low dominance index reflects a diverse and evenly distributed community of microalgae in Temajo waters. A low dominance index, combined with a moderate diversity index and a high evenness index, indicates a diverse community of microalgae.

CONCLUSION

In the waters of Temajo Island, a total of 75 genera of microalgae were identified, with *Bacillariophyceae* being the dominant class, comprising 72% of the total microalgae community. Commonly found genera were *Chaetoceros*, *Rhizosolenia*, *Guinardia*, *Thalassiosira*, *Pseudo-nitzschia*, and *Bacteriastrum*. Microalgae abundance ranged widely from 2.84 to 7,697.14 ind/L, with an average of 193.34 ind/L. The diversity index (H') indicated a medium to high level of diversity. The evenness index (E) was high, suggesting a balanced distribution of individuals among genera. The dominance index (C) fell into the low category, indicating no significant dominance of any particular genus within the community. Thus, the environmental conditions in the Temajo waters support a diverse community of microalgae, contributing to the overall health and resilience of the aquatic environment.

AUTHOR CONTRIBUTION

I.S. conceptualization, methodology, sampling, formal analysis, investigation, resources, data curation, writing original draft, funding acquisition. **A.A.K.** sampling, resources, data curation, writing original draft, funding acquisition. **M.S.J.S.** conceptualization, methodology, resources, sampling, data curation, writing original draft, funding acquisition **D.H.N**. data curation, formal analysis, writing original draft. **R.A.** methodology, formal analysis, writing original draft.

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CONFLICT OF INTEREST

The authors assert that there are no conflicts of interest or personal connections that might have affected the results reported in this paper.

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