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# Phytoplankton community structure in PB. Soedirman Reservoir, Banjarnegara District, Central Java, Indonesia

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Program of Aquatic Resources Management, Faculty of Fisheries and Marine Science, Universitas Jenderal Soedirman. Jl. Dr. Soeparno, Purwokerto Utara, Banyumas 53122, Central Java, Indonesia. Tel./fax.: +62-281-642360, ♥email: sesiliarani@unsoed.ac.id

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**Abstract.** *Samudra SR, Islami SF, Sanjayasari D, Firdaus AM, Putri AK, Fikriyya N, Attaqi AN. 2024. Phytoplankton community structure in PB. Soedirman Reservoir, Banjarnegara District, Central Java, Indonesia. Biodiversitas 25: 2161-2169.* Panglima Besar (PB) Soedirman Reservoir (formerly known as Mrica Reservoir), located in Central Java, faces ecological pollution due to organic materials from anthropogenic activities. Monitoring reservoir conditions, comprising physical, chemical, and biological parameters, is important for management. In this context, phytoplankton is a biological parameter that can be used to monitor water conditions. Therefore, this study aimed to observe phytoplankton community structure in PB. Soedirman Reservoir, Banjarnegara District, about the abundance, diversity, and dominance index. Sampling was conducted in July and August 2023 at five stations: the inlet, water around, and those free from floating net cages, ponds, and outlet channels. Data analysis included phytoplankton abundance, Shannon Wiener diversity index (H'), and Simpson dominance index (C). The results showed that the number of phytoplankton genera found was 27, with the average abundance in July being 7,083 cells.$L^{-1}$, and the most abundant class was Bacillariophyceae (54%). The average abundance in August was 59,574 cells.$L^{-1}$, the most abundant class being Bacillariophyceae (82%). Additionally, the diversity index (H') value ranged from 1.23-2.07 with the moderate pollution category. The dominance index (C) ranged from 0.16-0.33, showing no species dominated.

**Keywords:** Bioindicator, PB. Soedirman Reservoir, phytoplankton, water quality

## INTRODUCTION

Panglima Besar (PB) Soedirman Reservoir, located in Banjarnegara District, Central Java, Indonesia, is also known as the Mrica Reservoir has various uses. The uses include aquaculture activities with floating net cages, hydroelectric power generation, agricultural irrigation sources, and recreational facilities. Ecologically, PB. Soedirman Reservoir is seriously threatened by organic material pollution due to anthropogenic activities in the Serayu River watershed, which enters the reservoir. The main threats are organic materials from agricultural activities and domestic waste from residential areas. Semi-intensive floating net cage cultivation in reservoirs also increases the input of organic matter into water (Mensah et al. 2018; Astuti et al. 2020; Pratiwi et al. 2020).

Over the decade, PB. Soedirman Reservoir has experienced ecological pressure due to sedimentation (Widyastuti et al. 2015; Utomo 2017), which leads to a reduction in the capacity and age, underscoring the need for an effective management system (Chamoun et al. 2016; Morris 2020). Sedimentation in reservoirs occurs in organic particles and inorganic minerals carried by runoff (Xu et al. 2016), significantly reducing water quality by increasing the concentration of suspended solids, organic matter, and nutrients. This condition potentially causes decreased dissolved oxygen, increased turbidity, and stimulation of algae production (Cerco and Noel 2016; Tundu et al. 2018).

Water quality is a very important factor in a healthy aquatic ecosystem (Chen et al. 2019); hence, appropriate monitoring is crucial for sustainable use and maintaining the health of reservoir aquatic ecosystems. Sedimentation in reservoirs potentially influences the distribution and abundance of phytoplankton (Filho et al. 2019; Zhang et al. 2021a) by changing water's physical and chemical properties. Furthermore, the relationship between sedimentation and phytoplankton abundance is complex and influenced by various factors, including water quality and nutrient availability (Picapedra et al. 2020; Moura et al. 2021).

Phytoplankton is a group of microscopic organisms with diverse shapes that can function as reservoir bioindicators, reflecting the ecological condition and water quality. These microorganisms are used as water quality bioindicators to detect pollution or decline in water quality (Pourafrasyabi and Ramezanpour 2014; Kostryukova et al. 2021). Polluted water causes changes in the structure of the phytoplankton community, specifically in terms of species diversity and abundance (D'Costa et al. 2017; Shevchenko et al. 2020; Heramza et al. 2021). Furthermore, phytoplankton plays an important role in aquatic ecosystems as autotrophic organisms (Seymour et al. 2017; Bakhtiyar et al. 2020), converting inorganic nutrients into organic materials needed by living things through photosynthesis (Hammer et al. 2019; Kwon et al. 2022). Changes in the community structure of phytoplankton indicate decreasing water quality (Fathan et al. 2020) and have been used to assess the trophic status of the reservoir, showing the potential as a bioindicator of pollution levels (Rosadi et al. 2020).

Phytoplankton, as primary producers, play a crucial role in driving the food chain of life for various types of aquatic organisms. The abundance and diversity are suitable biological indicators for assessing environmental status, water quality, and eutrophication levels. Therefore, it is necessary to research the structure of phytoplankton communities in PB. Soedirman Reservoir, Banjarnegara District, to help explain the dynamics of aquatic ecology related to changes in water quality.

## MATERIALS AND METHODS

This study was conducted from July to August 2023 at PB Soedirman Reservoir, Banjarnegara District, Central Java, Indonesia, formerly known as Mrica Reservoir. Sampling was conducted at five stations representing two inlet areas, one outlet area and the other where fish are cultivated using floating net cages, and one area without cage activity (Figure 1, Table 1).

The tools used in this study were a plankton net mesh size of 20 µm, a 100 mL plankton sample bottle, a 0.05 mL drop pipette, an Olympus CX-43 microscope, a 10 L cooler box, a 4.73 L bucket, a label, object glass 25.4×76.2 mm, and cover glass 18×18 mm. The method used in this study was purposive sampling.

Plankton abundance values were calculated based on the micro transect counting method (APHA 2017) with the formula:

$$N = \frac{3Oi}{Op} \times \frac{Vr}{3Vo} \times \frac{1}{Vs} \times \frac{n}{3p}$$

Where:
N : Total number of plankton (cell.$L^{-1}$)
Oi : Cover glass area (324 $mm^2$)
Op : Area of one field of view (0.237 $mm^2$)
V : Volume of sample water in the collection bottle (65 mL)
Vo : Volume of one drop of sample water (0.05 mL)
Vs : Volume of water filtered with plankton net (47.31 L)
n : Number of individual plankton throughout the field of view
p : Number of the field of view (30)
3 : Number of observation replicates

**Table 1.** Sampling point in PB. Soedirman Reservoir, Banjarnegara District, Central Java, Indonesia

| Sampling point | Coordinate | Description |
|---|---|---|
| 1 | 109º40’07.2” E; 7º23’37.8” S | Inlet area in Selomanik |
| 2 | 109º39’41.9” E; 7º23’02.7” S | Inlet area in Linggasari |
| 3 | 109º36’44.9” E; 7º22’47.1” S | Outlet area in Tapen |
| 4 | 109º37’23.2” E; 7º22’20.9” S | Floating net cages area in Wanadadi |
| 5 | 109º37’05.4” E; 7º23’14.0” S | Area without any cage activity in Bandingan |

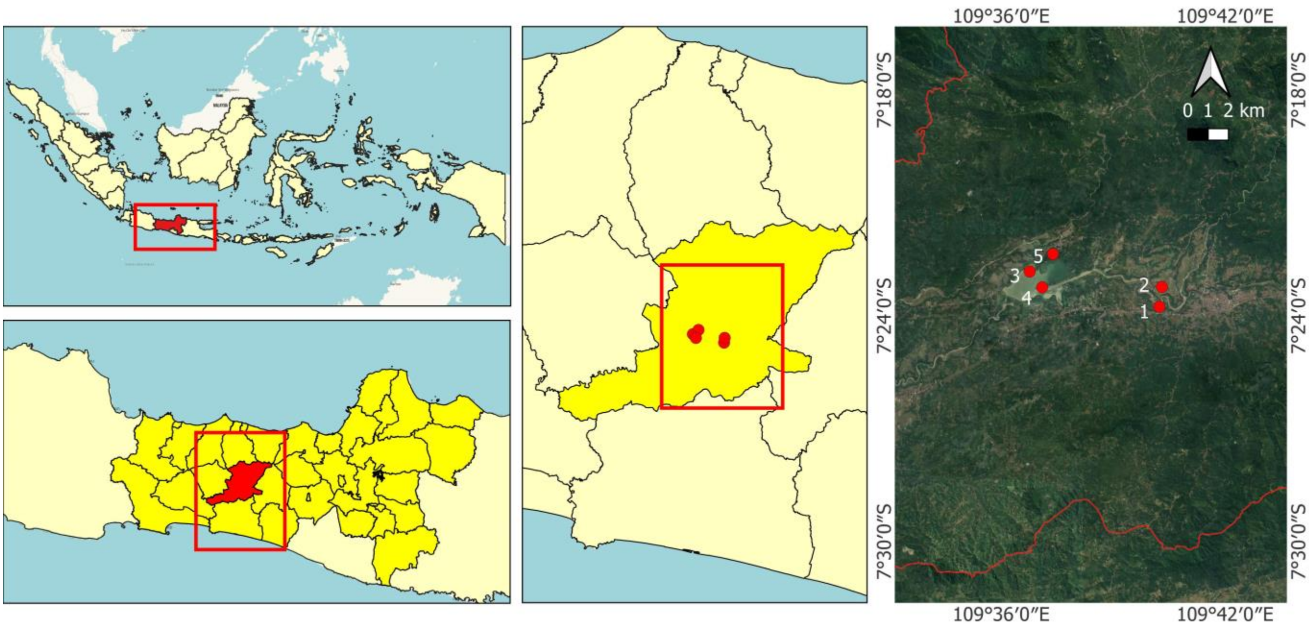


**Figure 1.** Location of the sampling sites in PB. Soedirman Reservoir, Banjarnegara, Central Java, Indonesia

The Shannon-Wiener diversity index calculates the diversity index (Odum 1996).

$$H' = -\sum \frac{ni}{N} \ln \frac{ni}{N}$$

Where:
H' : Shannon-Wiener diversity index
ni : Number of the i-th plankter individual
N : Total number of plankton individuals

The presence or absence of dominating phytoplankton species in PB.Soedirman Reservoir based on the dominance index, which can be calculated using Simpson's formula (Odum 1996):

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

Where:
C : Simpson's dominance index
Ni : Number of the i-th plankton individual
N : Total number of plankton individuals

## RESULTS AND DISCUSSION

Reservoirs are ecosystems that play a crucial role in the life and growth of phytoplankton (Yang et al. 2019; Yan et al. 2020). Phytoplankton is one biological parameter that is applicable as an indicator to evaluate the quality and fertility of water bodies. Table 2 shows the phytoplankton community structure analysis in PB Soedirman reservoir, Banjarnegara District, Central Java, from July to August 2023.

The species originated from seven classes: Bacillariophyceae, Charophyceae, Chlorophyceae, Cyanophyceae, Dinophyceae, Xanthophyceae, and Zygnematophyceae. Phytoplankton species with the highest number were found in the Bacillariophyceae (Diatom) class, with a high level of adaptability (Nakov et al. 2019; Samudra et al. 2022). Organisms in this class can adapt effectively to the surrounding environmental conditions compared to other classes (Samudra et al. 2022), changing physiological and morphological properties in response to physical and chemical factors in the aquatic environment, including temperature, light, pH, and nutrients (Fu et al. 2022). Furthermore, Bacillariophyceae has a greater reproductive ability and can double within 18-36 hours compared to other classes (Nakov et al. 2018; Nakov et al. 2019; Kim et al. 2023). Heramza et al. (2021) stated that mostly predominant in water with moderate levels of organic matter pollutant content include *Cyclotella*, *Thalassiosira*, *Synedra*, and *Navicula*, while the most common genera in water with high levels of organic matter pollutant content are *Nitzschia*, *Melosira*, and *Surirella*.

**Table 2.** Phytoplankton community structure in PB.Soedirman Reservoir, Banjarnegara, Central Java, Indonesia

| Class/species | Phytoplankton abundance (Cell.L$^{-1}$) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Station 1 | | Station 2 | | Station 3 | | Station 4 | | Station 5 | |
| | July | August | July | August | July | August | July | August | July | August |
| **Bacillariophyceae** | | | | | | | | | | |
| *Amphora* sp. | 1,250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Aulacoseira* sp. | 0 | 0 | 0 | 0 | 1,667 | 0 | 0 | 0 | 0 | 0 |
| *Craticula* sp. | 0 | 0 | 417 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Cymbella helvetica* | 0 | 0 | 0 | 1,250 | 0 | 0 | 2,917 | 417 | 0 | 0 |
| *Encyonema montana* | 0 | 1,250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Fragilaria* spp. | 0 | 0 | 0 | 47,491 | 0 | 30,411 | 0 | 9,582 | 0 | 5,832 |
| *Gyrosigma attenuatum* | 417 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Melosira* spp. | 0 | 417 | 0 | 0 | 0 | 18,330 | 0 | 3,333 | 0 | 0 |
| *Navicula* spp. | 417 | 4,166 | 1,250 | 1,667 | 0 | 0 | 1250 | 0 | 0 | 0 |
| *Nitzschia* spp. | 417 | 17,914 | 0 | 13,332 | 0 | 0 | 0 | 10,832 | 0 | 15,414 |
| *Pleurosigma* sp. | 0 | 0 | 0 | 417 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Surirella* spp. | 0 | 4167 | 417 | 1,250 | 0 | 0 | 1,250 | 0 | 0 | 0 |
| *Synedra* spp. | 0 | 17,498 | 417 | 9,582 | 834 | 0 | 1,667 | 4,583 | 4,584 | 24,995 |
| **Charophyceae** | | | | | | | | | | |
| *Mougeotia* sp. | 0 | 0 | 0 | 0 | 0 | 0 | 417 | 0 | 0 | 0 |
| *Staurastrum tetracerum* | 0 | 0 | 0 | 0 | 417 | 417 | 0 | 0 | 0 | 0 |
| **Chlorophyceae** | | | | | | | | | | |
| *Coelastrum* sp. | 0 | 0 | 0 | 6,666 | 0 | 5,416 | 4,583 | 5,833 | 0 | 2,083 |
| *Eudorina* sp. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 417 | 0 |
| *Microspora* sp. | 0 | 2,500 | 0 | 5,833 | 0 | 0 | 0 | 0 | 0 | 3,333 |
| *Pediastrum* spp. | 0 | 0 | 0 | 0 | 0 | 12,498 | 0 | 2,083 | 0 | 2,500 |
| *Scenedesmus* sp. | 417 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Spirogyra* sp. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 834 | 0 | 0 |
| *Treubaria triappendiculata* | 0 | 0 | 0 | 0 | 0 | 834 | 0 | 0 | 0 | 0 |
| **Cyanophyceae** | | | | | | | | | | |
| *Oscillatoria* sp. | 417 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Phormidium* sp. | 0 | 0 | 1,250 | 0 | 0 | 0 | 2,500 | 0 | 0 | 0 |
| **Dinophyceae** | | | | | | | | | | |
| *Ceratium furca* | 0 | 0 | 417 | 0 | 0 | 417 | 0 | 834 | 0 | 0 |
| **Xanthophyceae** | | | | | | | | | | |
| *Tribonema* sp. | 0 | 0 | 0 | 0 | 2,500 | 0 | 0 | 1,667 | 2,083 | 0 |
| **Zygnematophyceae** | | | | | | | | | | |
| *Closterium* sp. | 0 | 0 | 0 | 0 | 834 | 0 | 0 | 0 | 0 | 0 |
| Total Abundance (Cell.L$^{-1}$) | 3,333 | 47,910 | 4,166 | 87,486 | 6,251 | 68,321 | 14,583 | 39,997 | 7,084 | 54,156 |
| Diversity Index (H') | 1.67 | 2.07 | 1.97 | 1.54 | 1.44 | 1.34 | 1.76 | 1.93 | 1.23 | 1.71 |
| Dominance Index ( C ) | 0.22 | 0.16 | 0.16 | 0.33 | 0.27 | 0.31 | 0.2 | 0.18 | 0.31 | 0.21 |

This study found abundant *Nitzschia*, *Melosira*, *Surirella*, *Synedra*, and *Navicula* (Figure 2, Table 3), specifically in August. This shows that in August, PB. Soedirman Reservoir tends to have a higher organic material content than July. The results of nitrate and phosphate measurements showed a high level of organic matter. In July, the average value of nitrate and phosphate was 0.10 $mg.L^{-1}$ and 0.49 $mg.L^{-1}$, while in August, the values were 0.76 $mg.L^{-1}$ and 0.26 $mg.L^{-1,}$ respectively. The nitrate value in August exceeded the quality standard for reservoir water in Indonesia (maximum 0.75 $mg.L^{-1}$), while the phosphate value in both July and August exceeded the quality standard (maximum 0.03 $mg.L^{-1}$). The maximum quality standard values for nitrates and phosphates are based on water quality standards for class 2 lakes or reservoirs, according to Republic of Indonesia government regulation number 22 of 2021.

In August (rainy season), the nitrate content was higher than in July (dry season), with an average of 0.76 mg.L-1 and 0.1 mg.L-1, respectively. In the rainy season, organic matter input from the inlet and runoff around water tends to be higher (Silva et al. 2019). The nutrient results were strengthened by Wang et al. (2019), stating that nitrate plays a significant role in influencing water quality in lakes during the rainy season, while phosphate has the dominant effect during the dry season.

**Table 3.** Value of nitrate and phosphate in PB. Soedirman Reservoir, Banjarnegara, Central Java, Indonesia

| Parameters | Unit | Station 1 | | Station 2 | | Station 3 | | Station 4 | | Station 5 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | July | August | July | August | July | August | July | August | July | August |
| Nitrate | mg/L | 0.10 | 0.80 | 0.10 | 1.40 | 0.10 | 0.40 | 0.1 | 0.6 | 0.1 | 0.6 |
| Phosphate | mg/L | 0.88 | 0.76 | 0.7 | 0.18 | 0.18 | 0.06 | 0.36 | 0.12 | 0.34 | 0.18 |

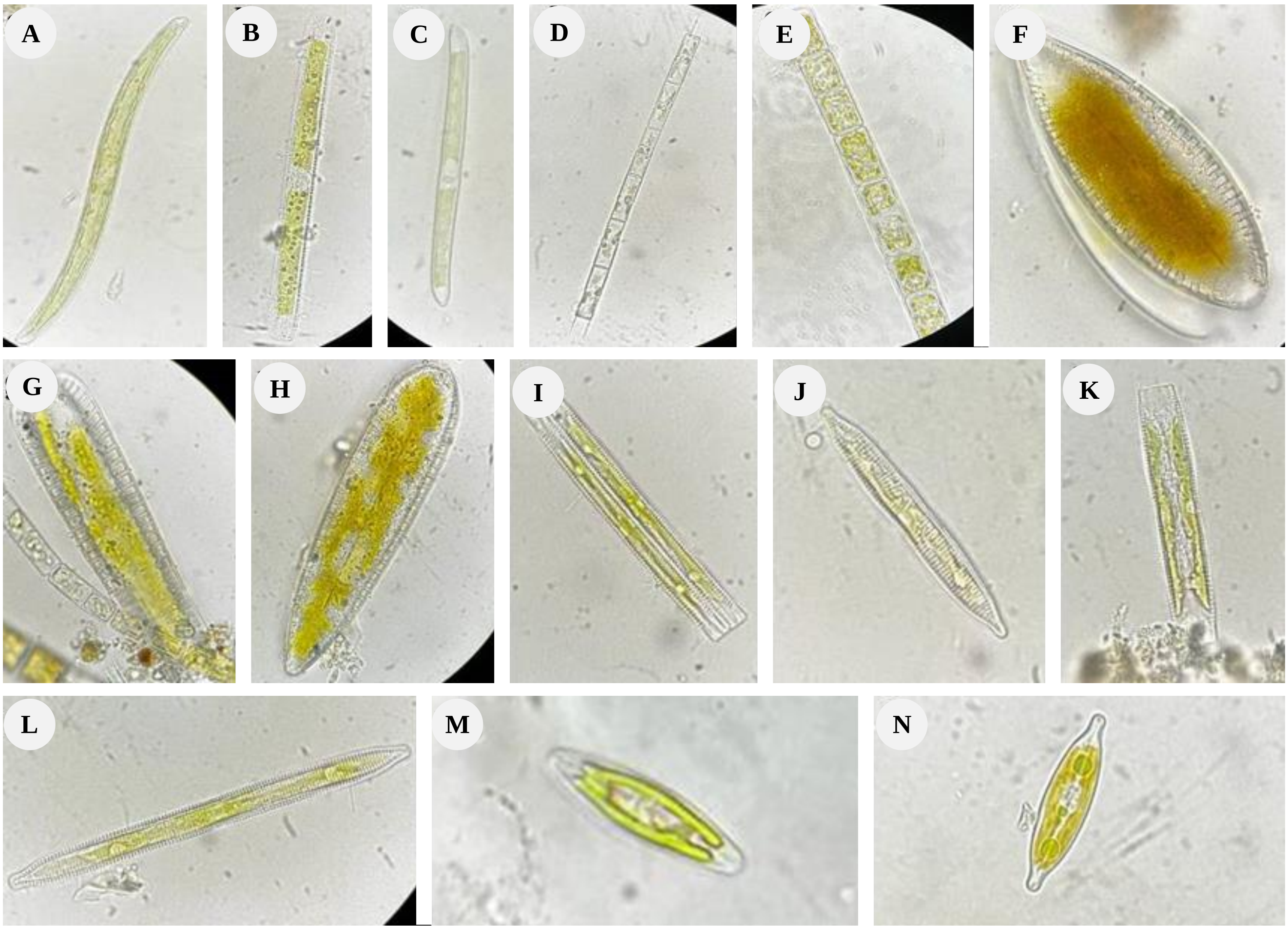


**Figure 2.** Abundant diatoms in PB. Soedirman Reservoir, Banjarnegara, Central Java, Indonesia. a-c. *Nitzschia*; d-e. *Melosira*; f-h. *Surirella*; i-l. *Synedra*; m-n. *Navicula*

The phytoplankton class with the second largest number of genera was Chlorophyceae, often found in lentic water with sufficient sunlight intensity (Pratiwi et al. 2018; Enawgaw and Wagaw 2023). Generally, Chlorophyceae dominate the phytoplankton community at the end of the rainy season or the beginning of the dry season (Ayoade and Aderogba 2020). Meanwhile, this study revealed the genera were mostly found in August, namely at the beginning or transition of the rainy season. Similarly, Muhtadi et al. (2020) show that plankton abundance is greater in the rainy than in the dry season. As stated by Nweze (2006) who conducted a study in a West Africa lake in the dry season, the order of phytoplankton abundance starts from the highest, namely Bacillariophyceae, followed by Cyanophyceae and Dinophyceae. Meanwhile, in the rainy season, the most abundant class is Chlorophyceae, followed by Cyanobacteria, Bacillariophyceae, Euglenophyceae, Dinophyceae, Cryptophyceae, Chrysophyceae, and Xantophyceae. According to Aida et al. (2022) who conducted a study in Bengawan Solo River, Indonesia, the phytoplankton found in the dry season, namely the Bacilariophyceae, Chlorophyceae, and Cyanophyceae, while in the rainy season, there are only two classes, namely the Bacilariophyceae and Chlorophyceae. The results of this study are more similar to the results of Aida et al. (2022). July (dry season) was dominated by Bacillariophyceae, and in August, which marked the beginning of the rainy season, the Chlorophyceae class gradually increased in abundance.

**Phytoplankton abundance in PB. Soedirman Reservoir**

As shown in Figure 3, the abundance was obtained based on observations and calculations carried out in July and August 2023 in PB Soedirman reservoir, Banjarnegara. The most abundant genera in July among the Bacillariophyceae class was *Synedra*, a diatom with a high level of tolerance, leading to survival in extreme water conditions (Heramza et al. 2021; Purba and Ariesyady 2022). *Synedra* thrives in low-nutrient water (Masithah and Islamy 2023) by accumulating nutrients and storing food reserves as non-soluble polymers. Moreover, this organism has layered wrapping cells that can be used as body protection (Kovalcik et al. 2017; Wardhani et al. 2023). *Navicula* and *Cymbella* were the diatoms that were mostly abundant in July after Synedra. In general, the presence of *Navicula* in reservoir water shows deteriorating quality (Yusuf 2020). Several genera of Bacillariophyceae, including *Navicula, Cymbella, Synedra, Nitzschia, Melosira*, *Gomphonema*, and *Fragilaria*, as well as Cyanophyceae namely *Oscillatoria* and *Phormidium*, grow in water contaminated with organic materials (Khalil et al. 2021; Arumugham et al. 2023).

Other phytoplankton abundant in July and found at more than one station include *Tribonema* and *Phormidium* (Figure 4). *Tribonema*, phytoplankton from the class Xanthophyceae, is often found in lentic freshwater and sometimes in rivers (Jimel et al. 2021). The presence had been recorded in the Jatigede Reservoir, Sumedang, Indonesia, characterized by moderate pollution (Khasanah et al. 2022). *Phormidium* belongs to the class Cyanophyceae (Cyanobacteria), better known as blue-green algae, and grows in water polluted by organic materials (Khalil et al. 2021). These organisms accumulate polyphosphate granules in aquatic environments rich in phosphorus (Teta et al. 2019). Furthermore, cyanobacteria are good bioindicators of water quality due to their ability to detect responses to changes rapidly (Teta et al. 2019). As Sari et al. (2013) stated, Phormidium is more abundant in the dry than in the rainy season. A similar case was observed in this study, where *Phormidium* was found only in July during the dry season.

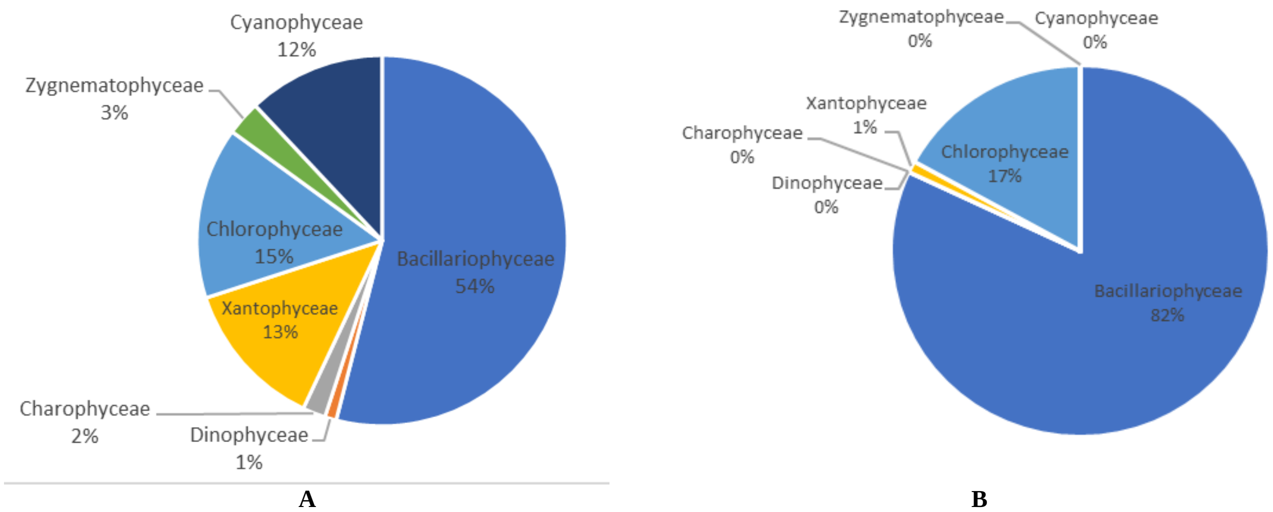


**Figure 3.** Phytoplankton abundance in PB. Soedirman Reservoir, Banjarnegara, Central Java, Indonesia. A. July; B. August

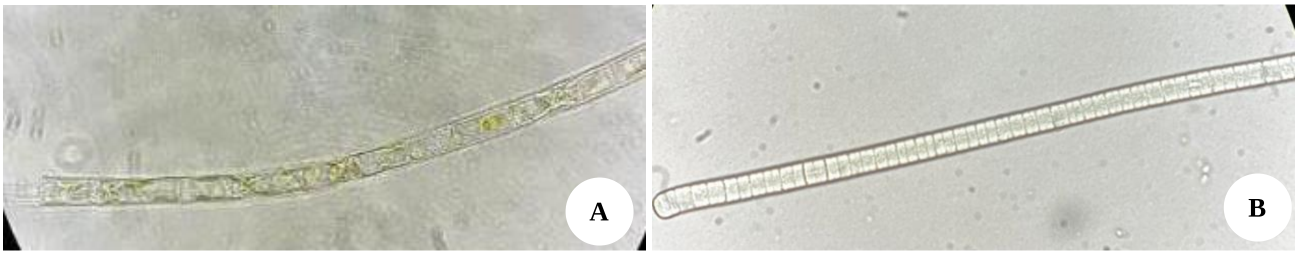


**Figure 4.** The abundant phytoplankton in PB. Soedirman Reservoir, Banjarnegara, Central Java, Indonesia in July. A. *Tribonema*; B. *Phormidium*

The most abundant genera in August among the Bacillariophyceae class was *Fragilaria* (Figure 5), widely known for a range of shapes, including needle-shaped (Krahn et al. 2021), lanceolate with capitate ends (Novais et al. 2019), and linear-lanceolate with strongly capitate apices (Delgado 2015). *Fragilaria* can adapt to various environmental conditions and has a cosmopolitan nature, high tolerance, and adaptability to water with high nutrients (Dochin and Iliev 2019). Based on the result, there was a significant difference in phytoplankton abundance values between July and August, with a total abundance value of 35,416 cells.L-1 and 297,871 cells.L-1, respectively. Therefore, phytoplankton in the PB. Soedirman Reservoir, Banjarnegara District, can be classified as eutrophic water or high water fertility due to the high abundance value of >15,000 cells.$L^{-1}$. This abundance is influenced by environmental conditions and the availability of limiting factors, namely nutrient elements (phosphate and nitrate), sufficient to support phytoplankton's growth and development.

Other phytoplankton from the Bacillariophyceae class are widely abundant in August, including *Nitzschia*, *Synedra*, and *Melosira*. *Nitzschia*, belonging to the pennate diatom group, has an elongated shape, is bilaterally symmetrical, and can be a bioindicator of water experiencing increased nutrients (Masithah and Islamy 2023). It has a high tolerance for pollutants in water contaminated with anthropogenic waste (Setyono and Himawan 2018; Sevindik et al. 2023). Meanwhile, *Melosira* is widely found in freshwater (Yang et al. 2022), surviving in areas heavily polluted by organic matter and characterized by high phosphate and nitrite content (Heramza et al. 2021). The dominance of diatom phytoplankton is shown in the PB. Soedirman Reservoir. has experienced eutrophication (Setyono and Himawan 2018). The eutrophic condition of reservoir water can be observed visually from the blooming of plants such as water hyacinth (*Eichhornia crassipes* (Mart.) Solms) and/or *Hydrilla verticillata* (L.f.) Royle.

*Coelastrum* and *Pediastrum* (Figure 6) were also widely abundant in August, and three genera of phytoplankton belong to the class Chlorophyceae or green algae. Florescu et al. (2022) state that Bacillariophyceae and Chlorophyceae prefer water with higher N and P contents. Some green algae, including Coelastrum, Pediastrum, and Scenedesmus, are sensitive to low light, underscoring the importance of high-intensity sunlight for growth (Yu et al. 2015). *Coelastrum* and *Pediastrum* are abundant in eutrophic water (Stivrins et al. 2018; Jachniak and Jaguś 2023). *Pediastrum* is phytoplankton from the green algae division, which is very common in freshwater, such as lakes and reservoirs. The abundance and composition of species are very sensitive to changes in the aquatic environment. In addition, *Pediastrum* is a species with great potential for paleoenvironmental studies (Xiang et al. 2021).

**Phytoplankton diversity and dominance index**

Phytoplankton diversity index in PB. Soedirman Reservoir was categorized as medium (Figure 7) based on the value of H', which ranged from 1.23-2.07. This implies that the reservoir condition is classified as having a moderate pollution degree with a fair number of species and a relatively stable aquatic ecosystem. The diversity index value was 1≤ H' ≤3; hence, the biota community was declared stable (moderate) or moderately polluted water quality. Various physical and chemical factors influence the diversity of phytoplankton in reservoir water, including river discharge and rainfall (Wang et al. 2022). There is a direct relationship between phytoplankton biomass and diversity and physical variables, including turbidity and nutrient concentration (Guarín et al. 2020). A combination of physical and chemical factors, including river discharge, rainfall, turbidity, nutrient concentration, hydraulic regime, light availability, and nutrient levels, significantly influence diversity in the reservoir (Ishikawa et al. 2022; Wang et al. 2022). Diversity is also crucial in predicting stability and resource use efficiency in phytoplankton communities (Ptáčník et al. 2008).

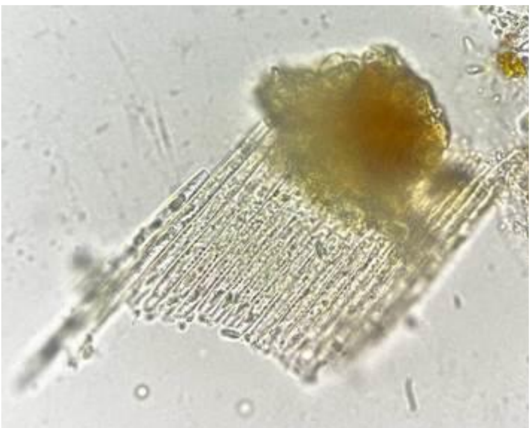

**Figure 5.** *Fragilaria*, the most abundant phytoplankton in August

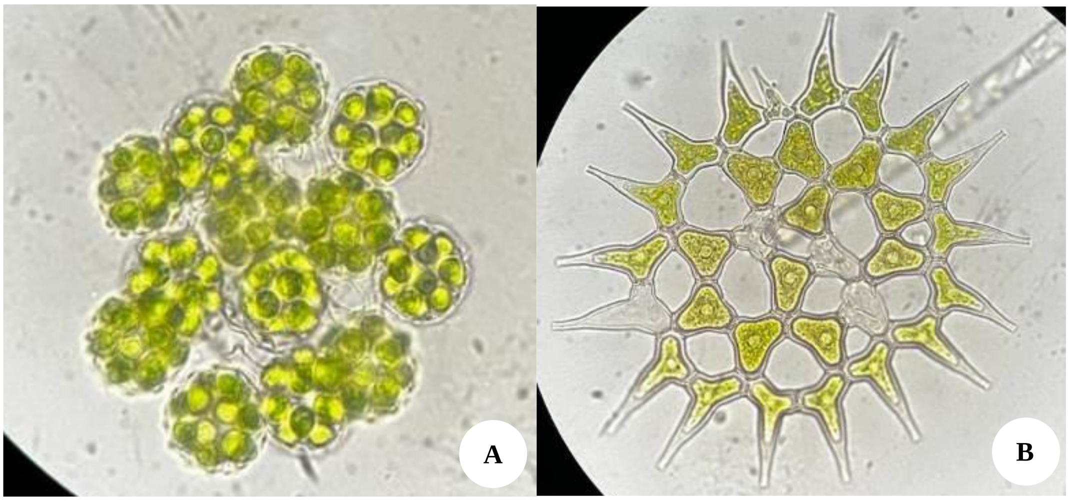


**Figure 6.** Abundant chlorophyceae in PB. Soedirman, Banjarnegara, Central Java, Indonesia. A. *Coleastrum*; B. *Pediastrum*

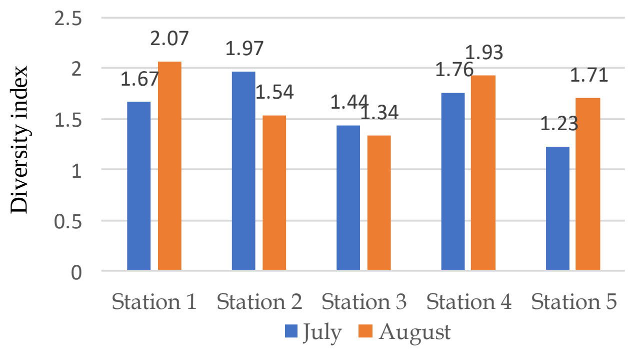


**Figure 7.** Phytoplankton Diversity Index in PB. Soedirman Reservoir, Banjarnegara, Central Java, Indonesia

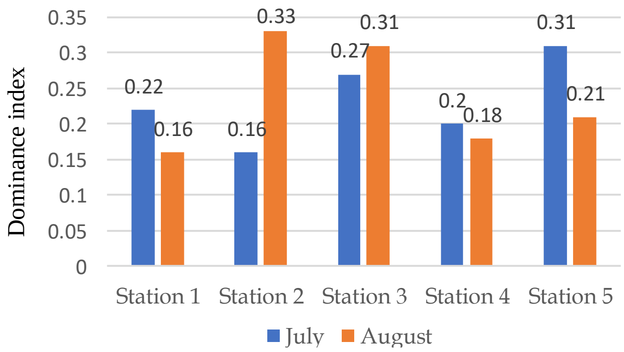


**Figure 8.** Phytoplankton Dominance Index in PB. Soedirman Reservoir, Banjarnegara, Central Java, Indonesia

The plankton community, including phytoplankton, can indicate water quality, with changes in structure reflecting eutrophic conditions (Zhang et al. 2021b; Gong et al. 2022; Huang et al. 2022). Opportunistic and conservative species can indicate water quality, with opportunistic species associated with poor environmental conditions (Gökçe 2016). Generally, the diversity index value in August is higher than in July.

One of the factors that influenced diversity in August was the higher concentration of nitrate reaching 0.76 $mg.L^{-1}$) in water. August is the period of transition from the dry to the rainy season. Hence, more nutrients are carried from inlet flows and land runoff, such as agricultural areas. In addition, a high phosphate content of more than 0.03 $mg.L^{-1}$ also supported phytoplankton growth. Vajravelu et al. (2018) stated that the entry of nutrients such as nitrate and phosphate into water was greater during the rainy season.

The dominance index of phytoplankton in PB. Soedirman Reservoir was categorized as low (Figure 8). Based on the value, which ranged from 0.16-0.33. A species dominance index close to 0 shows no dominant organism in the community. On the other hand, when the dominance index value is close to 1, this shows the presence of a dominant organism. The water body is classified as good when there is no dominating species, giving all phytoplankton an equal opportunity to use environmental resources (Giao and Nnhien 2020).

In conclusion, the analysis of phytoplankton in the PB. Soedirman Reservoir showed that 27 genera were found, the most abundant of which was from the Bacillariophyceae class. The abundance value in August was higher than in July, presumably because the organic material content was higher during the rainy season, originating from river inlets and land runoff. Several genera of phytoplankton found abundantly, including Fragillaria, Synedra, Nitzschia, Coleastrum, Melosira, and Pediastrum, are tolerant to pollution and may serve as bioindicators of the condition of the PB. Soedirman Reservoir has experienced a significant level of organic pollution.

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