JURNAL PERIKANAN DAN KELAUTAN
Volume 30 No. 1, February 2025: 30-39

e-issn : 2721-8902
p-issn : 0853-7607

Phytoplankton Biodiversity of Danau Panjang, Lubuk Siam Village, Siak Hulu District, Kampar District, Riau

Biodiversitas Fitoplankton Danau Panjang, Desa Lubuk Siam Kecamatan Siak Hulu Kabupaten Kampar Provinsi Riau

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Received
23 Desember 2024

Accepted
11 January 2025

Abstract

Danau Panjang is a natural lake located in Lubuk Siam Village. The variety of activities in Danau Panjang can affect phytoplankton biodiversity. Phytoplankton is an important factor for the life of fish and all kinds of biota that live in water as primary producers. The presence of phytoplankton will determine the quality and condition of a body of water. Danau Panjang, as one of the oxbow lakes, currently rarely has any additional discharge from the main river, so it is feared that phytoplankton diversity will be low. This study aims to determine the type and abundance of phytoplankton and phytoplankton biodiversity and the results of the analysis of environmental factors on phytoplankton biodiversity in Danau Panjang. Phytoplankton biodiversity and water quality parameters consisting of temperature, brightness, depth, pH, CO_2, DO, nitrate, and phosphate were observed in September-October 2023. Phytoplankton samples and water quality measurements were taken at three sampling points, three times with an interval of two weeks. Phytoplankton abundance ranged from 2383-7098 cells/L, and 10 phytoplankton classes were found. Phytoplankton biodiversity in Danau Panjang illustrates a relatively stable condition. The species richness index in Weeks 1, 2, and 3 ranged from 3.51-5.52 in the good category. The diversity index in Weeks 1, 2, and 3 ranged from 2.06-3.82, with a high level of diversity. The dominance index in Weeks 1, 2, and 3 ranged from 0.12-0.38, indicating that there was no dominant species. The uniformity index in Weeks 1, 2, and 3 ranged from 0.39-0.69, where uniformity was in balance. In general, the water quality in Weeks 1, 2, and 3 is not much different and is favorable for phytoplankton growth when viewed from the quality standards of class III of PP No. 22 of 2021.

Keywords: Biodiversity, Abundance, Phytoplankton, Panjang Lake

Abstrak

Danau Panjang merupakan danau alami yang berada di Desa Lubuk Siam. Beragamnya aktivitas di Danau Panjang dapat mempengaruhi biodiversitas fitoplankton. Fitoplankton merupakan faktor penting bagi kehidupan ikan dan segala macam biota yang hidup di dalam air sebagai produser primer. Keberadaan fitoplankton akan menentukan kualitas dan kondisi suatu perairan. Danau Panjang sebagai salah satu Danau *Oxbow* saat ini sudah jarang bahkan tidak ada lagi penambahan debit dari sungai induk, sehingga dikhawatirkan keanekaragaman fitoplankton akan rendah. Penelitian ini ditujukan untuk mengetahui jenis dan kelimpahan fitoplankton, biodiversitas fitoplankton, serta hasil analisis faktor-faktor lingkungan terhadap biodiversitas fitoplankton di Danau Panjang. Biodiversitas fitoplankton dan parameter kualitas air yang terdiri dari suhu, kecerahan, kedalaman, pH, CO_2, DO, nitrat dan fosfat diamati pada bulan September-Oktober 2023. Sampel fitoplankton dan pengukuran kualitas air

dilakukan pada 3 titik sampling sebanyak tiga kali dengan interval waktu dua minggu. Kelimpahan fitoplankton berkisar dengan jumlah 2383-7098 sel/L, di temukan 10 kelas fitoplankton. Biodiversitas fitoplankton di Danau Panjang menggambarkan kondisi yang relatif stabil. Indeks kekayaan jenis pada Minggu 1, 2, dan 3 berkisar 3,51-5,52 dalam kategori baik. Indeks keanekaragaman pada Minggu 1, 2, dan 3 berkisar 2,06-3,82 dengan tingkat keanekaragaman tinggi. Indeks dominasi pada Minggu 1, 2, dan 3 berkisar 0,12-0,38 menunjukkan bahwa tidak ada jenis yang dominan. Indeks keseragaman pada Minggu 1, 2, dan 3 berkisar 0,39-0,69 dimana keseragaman dalam keadaan seimbang. Secara umum kualitas air pada Minggu 1, 2, dan 3 tidak jauh berbeda dan mendukung untuk pertumbuhan fitoplankton jika ditinjau dari baku mutu kelas III PP No. 22 tahun 2021.

Kata kunci: Biodiversitas, Kelimpahan, Fitoplankton, Danau Panjang

1. Introduction

Danau Panjang is a natural lake in Lubuk Siam Village, Siak Hulu District, Kampar Regency, Riau Province. This lake is one of the Oxbow lakes that receive water from the Kampar Kanan River. The volume of Danau Panjang water flow is not fixed; fluctuations in the lake's water level will result in changing water quality (Siagian & Simarmata, 2015) and, allegedly, the variety of habitats available to aquatic organisms, especially phytoplankton. The surrounding community utilizes Danau Panjang to support fisheries activities; around Danau Panjang, there has been a change in land use, which is used as a plantation and residential area not so far from the lake. Increased community activities and land use changes can contribute to various organic and non-organic materials. This situation can affect aquatic ecosystems due to changes in physical and chemical conditions. Changes in water conditions will affect marine organisms in the lake, especially the presence of phytoplankton biodiversity.

Biodiversity is the diversity of living things that shows all variations of genes, types (species), and ecosystems in a place (Rahman, 2018). Every living thing has a different form, nature, behavior, and phytoplankton. Factors that can affect phytoplankton biodiversity include light, temperature, pH, free carbon dioxide, dissolved oxygen, nitrate, and phosphate.

Phytoplankton is an essential factor in the life of fish and all kinds of biota that live in water because phytoplankton are primary producers in the food chain cycle. The presence of phytoplankton will further determine the quality and condition of a water body. The presence of phytoplankton as a natural food for fish will also affect the amount of fish obtained, so it will affect the economy of people who work as fish fishermen in Danau Panjang. In addition, the position of Danau Panjang as one of the oxbow lakes is currently rare, and there is no additional discharge from the main river, so it is feared that phytoplankton diversity will be low. The purpose of this study was to determine the type and abundance of phytoplankton, phytoplankton biodiversity, and the results of the analysis of environmental factors on phytoplankton biodiversity in Danau Panjang.

2. Material and Method

2.1. Time and Place

The research was conducted in September-October 2023. The research location was Danau Panjang, Lubuk Siam Village, Siak Hulu District, Kampar Regency, Riau Province. Meanwhile, sample analysis was carried out at the Laboratory of Management Ecology and Aquatic Environment, Faculty of Fisheries and Marine Sciences, Universitas Riau.

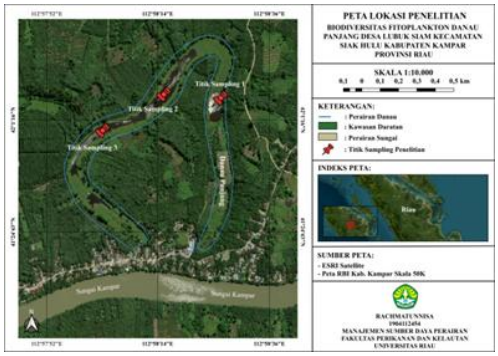

Figure 1. Research location map

2.2. Methods

The survey method was used in this research. Research stations can be determined using a purposive sampling method, namely by considering various factors that can represent the condition of the lake waters. The sampling location was determined using GPS (Global Position System) into three sampling points for three replicates with a time interval of fourteen days. The primary and secondary data used in this study are primary and secondary data. Primary data is taken directly in the field, including temperature, depth brightness, pH, free carbon dioxide, dissolved oxygen, nitrate, and phosphate. Samples taken in the field include phytoplankton samples and nitrate and phosphate samples.

2.3. Procedures

2.3.1. Station Location Determination

The retrieval stations are located at three sampling points: TS 1: This is the inlet of Danau Panjang, where water enters. There are many aquatic plants such as *Pistia straitiotes* (kiyapu) and *Eichhornia crassipes* (water hyacinth). Sampling Point 1 is located at 00°22'38.2"N and 101°29'09.5"E.

TS 2: The activities in this area are fishing activities. There are many aquatic plants such as *P.straitiotes* (kiyapu) and *E.crassipes* (water hyacinth). The position of Sampling Point 2 is located at 00°22'41.7"N and 101°28'58.8"E. TS 3: Lake waters around which there are residential areas. There are plantation activities and many water plants, such as *E. crassipes* (water hyacinth). It is the outlet part of Danau Panjang, where the water comes out. The position of Sampling Point 3 is located at 00°22'37.2"N and 101°28'49.78"E.

2.3.2. Sampling Method

Sampling was conducted at three sampling points, namely the inlet, middle, and outlet of the lake. Sampling in the field was carried out three times, with an interval of fourteen days. Samples to be studied are the results of water filtration taken from each sampling point of as much as 100 L and then filtered using plankton net no.25. The filtered results were put into a 150 ml film bottle with a lid to be preserved using 1% Lugol as much as 3-4 drops so that the sample was tea yellow. Each bottle was labeled according to the station with a permanent marker (Kurniyawan et al., 2022).

Samples obtained were brought to the laboratory for observation of phytoplankton species. Phytoplankton observations were made under a microscope using an object glass with a cover glass area (22 mm x 22 mm). Observation of phytoplankton species is done by shaking the sample bottle containing the sample slowly until homogeneous. The sample is taken using a dropper pipette dripped on a prepared glass and observed using a microscope with a magnification of 10 x 10 using the sweep method, and then each type of phytoplankton found is identified (Said, 2014). Determination of identification using an identification book by adjusting the shape, characteristics, and morphology of the plankton found. Identification refers to the identification book, according to Yunfang (1995); Bellinger & Sigee (2010).

Water quality measurements were taken to determine the condition of the waters at the research site, including physical parameters and chemical parameters. Water quality measurements were carried out at each observation station. Measurements of physicochemical parameters of water are temperature, brightness, depth, acidity (pH), free carbon dioxide, dissolved oxygen, nitrate, and phosphate.

2.4. Data Analysis

The Phytoplankton abundance was grouped based on observation time in Weeks 1, 2, and 3. The grouping results were analyzed by comparing the average abundance between weeks. Plankton abundance was determined using a formula referring to (APHA, 1989), which is as follows:

$$N = Z \times \frac{X}{Y} \times \frac{1}{V}$$

Description:

N	=	Plankton abundance (cells/L)
V	=	Volume of water to be filtered (100,000 mL/L)
X	=	Volume of water after filtering (150 mL)
Y	=	Water volume of 1 dropper pipette {(0.05mL) 10 repetitions}
Z	=	Number of individuals found (cells)

The diversity index is calculated based on the Shannon-Winner method (Odum, 1993) as follows:

$$H' = -\sum_{i=1}^{s} piLog_2 pi$$

Description:

H' = Diversity index
Pi = Proportion of individuals of the i-th species to the total number of individuals of all species (pi= ni/N)
ni = Number of individuals
N = Total individuals/types

s = Number of types
$\log_2$ = 3,321928

Interpretation according to Shannon Weiner (Fachrul, 2007; Odum, 1971): H'≤ 1: Low diversity with uneven distribution of individuals; 1< H'<3: Medium diversity with medium distribution of individuals; H'≥3: High diversity with high distribution of individuals.

The uniformity index used the formula (Krebs, 1985) as follows:

$$E = \frac{H'}{H_{max}} = \frac{H'}{Log_2(s)}$$

Description:
H' : Shannon-Wiener diversity index
H_{max} : Maximum species diversity
$\log_2$ s: (s =number of species) with E values ranging from 0 – 1

Interpretation of the uniformity index according to Weber (1973): If E is close to 1 (>0,5), the uniformity of organisms in a water body is in balance, meaning there is no competition, either for space or food. If E is <0,5 or close to 0, The uniformity of organisms in a water body is unbalanced, where there is competition, both for space and food.

Dominance index using Simpson's formula in Odum (1993), namely:

$$C = \sum_{i=1,2,3}^{n} (pi)^2$$

Description:
C : Species dominance index
pi : Proportion of individuals of the i-th species to the total number of individuals of all species (pi= ni/N)
ni : Number of individuals in the species
N : Total individuals

Interpretation: The species dominance index ranges between 0-1. If the C value is close to 0, it means that there is no dominating species, and if the C value is close to 1, it means that there is a dominant species in the water.

The richness index was calculated using Margalef's (1958) equation as follows:

$$D = \frac{S - 1'}{\ln(N)}$$

Description:
D : Margalef wealth index
S : Number of species
N : Total number of individuals

Interpretation of wealth index values according to Jorgensen et al. (2005): D≥1: species richness in a water body is good; 2,5<D<4: species richness in a water body is in moderately good condition; D≤2,5: species richness in a water body is poor.

3. Result and Discussion

3.1. Overview of the Research Location

Danau Panjang is a natural lake located in Lubuk Siam Village, Siak Hulu Sub-district, Kampar Regency, Riau Province, with a surface area of ± 60,300 m^2. This lake is one of the Oxbow Lakes that receives water from the Kampar Kanan River. Danau Panjang has calm waters, blackish brown in color, and muddy bottom waters with an average depth. 1.77 m and a maximum of 4.35 m (Aini & Sumiarsih, 2021). Many types of aquatic plants overgrow this lake. Around the Danau Panjang environment, there are also many oil palm trees from the plantations of the surrounding community. The surrounding community utilizes Danau Panjang to support fisheries activities such as fishing areas because it has high fisheries potential. During the rainy season, Lubuk Siam Lake gets water from the Kampar River, which affects the organisms in the lake. This is supported by the presence of lake cleaning activities using excavators by village officials at Danau Panjang in week 2 of the study.

This research was conducted in September-October, with weather conditions transitioning from the dry season to the rainy season. High rainfall and many rainy days can affect water quality. This is in accordance with Pratiwi et al. (2017), who state that the quality of lake waters is influenced by the availability of organic matter entering the surrounding environment.

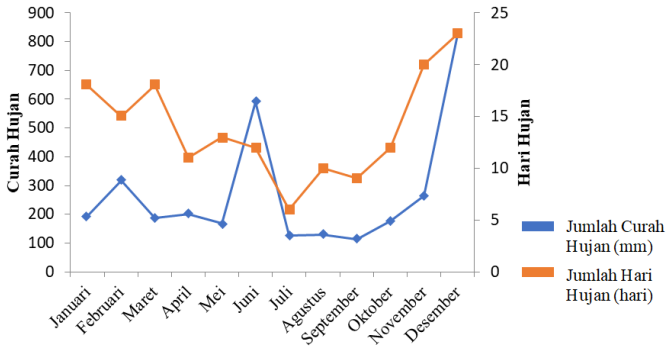

Figure 2. Number of Days and Rainfall in Lubuk Siam Village, Kampar Subdistrict, Siak Hulu District, 2023.

3.2. Water Quality Parameters

The results of measuring water quality parameters show that the temperature value ranges from 29-30 ºC. According to PP No.22 of 2021, the quality standard states that the temperature for class 3 glasses of water must be a deviation of 3 from the standard natural temperature, which means that the temperature in Danau Panjang must range from 26-32˚C. Thus, the temperature in Danau Panjang is still expected to support the life of aquatic biota, including phytoplankton (Aisyah, 2020). Brightness values measured ranged from 61-86 cm. High light intensity provides optimal conditions for phytoplankton to photosynthesize. From the results of the brightness value obtained, it is thought that it is still supportive of the growth of aquatic organisms, especially phytoplankton.

The measurement results of the depth of Danau Panjang ranged from 2.63 to 2.97 m. The depth of water that is still favorable for phytoplankton abundance ranges from <10 m; this is in accordance with the observations of Nurfadillah et al. (2012), where the highest abundance is at a depth of 10 m. Phytoplankton that occupy this layer are phytoplankton that do not like sunlight, especially from the Bacillariophyceae and Dinophyceae classes. The pH measurement results in Danau Panjang ranged from 5-6. Danau Panjang is an acidic, flooded swamp-type lake. In general, the Riau Province area has peat soil with low pH or acidic waters. Ritongga (2016) states that the Riau Province area is generally peatland, so that it will affect the more acidic waters. According to Salim (2017); Wardoyo (1975), the pH value that supports the life of an aquatic organism ranges from 5 to 9.

Based on the results of the study, the measurement value of free carbon dioxide (CO_2) ranged from 6.85-7.34 mg/L. Rahmatin in Sari (2017) states that the carbon dioxide content in a water body is a maximum of 20 mg/L and a minimum of 2 mg/L. DO values range from 4.23-5.36 mg/L. Based on the quality standards according to PP No.22 of 2021 Class III, the minimum threshold of dissolved oxygen is 3 mg/L, so it can be concluded that dissolved oxygen in Danau Panjang Lubuk Siam Village is still in accordance with the established quality standard limits so that the waters of Danau Panjang Lubuk Siam Village can still support phytoplankton growth. Nitrate values range from 0.030-0.087 mg/L. According to Government Regulation No.22 of 2021, concerning the quality standards for water quality management class III, the minimum threshold limit for nitrate value is 20 mg/L. Thus, the content of nitrate value in Danau Panjang Lubuk Siam Village every week is still within the established quality standards. According to Wetzel (2001), based on nitrate, water is divided into three nitrate levels 0-1 mg/L. The waters are classified as oligotrophic, with nitrate levels 1-5 mg / L mesotrophic waters and nitrate levels 5 to 50 mg/L classified as eutrophic waters. Based on this opinion, the waters of Danau Panjang are classified as oligotrophic waters. However, the value obtained still supports phytoplankton growth in the waters, as seen from the value of high diversity, balanced species uniformity, and no dominating species.

Table 1. Results of water quality measurements for each week during the study at Panjang Lake

No.	Water Quality Parameters	Week			Quality Standard
		M1	M2	M3	
	Physics				
1	Temperature (°C)	30	29	29	dev 3*
2	Brightness (cm)	86	72	61	-
3	Depth (m)	2,63	2,82	2,97	-
	Chemistry				
4	pH	6	5	5	6-9*
5	CO_2 (mg/L)	7,34	7,23	6,85	-
6	DO (mg/L)	4,23	4,42	5,36	>3*
7	Nitrate (mg/L)	0,087	0,077	0,030	<20*
8	Phosphate (mg/L)	0,090	0,090	0,057	<0,1*

Description : (*) PP No.22 of 2021 (Class III)

The phosphate value ranges from 0.057-0.090 mg/L. Based on the phosphate value obtained, the waters of Danau Panjang Lubuk Siam Village are still in good fertility condition. This is in accordance with the opinion of Suryani in Sari (2017), which states that the level of water fertility can be divided into 4, namely: 1). Low fertility

ranges from 0.001-0.021 mg/L, 2). Medium fertility ranges from 0.021-0.050 mg/L, 3). Good fertility ranges from 0.050-0.100 mg/L, and 4). Excellent fertility ranges from 0.101-0.200 mg/L. PP No.22 of 2021 concerning Water Quality Management and Environmental Pollution Control states that the class III water quality criteria for phosphate is 0.1 mg/L. Based on the value of phosphate during the study, the waters of Danau Panjang have not exceeded the established quality standards and can still support the life of aquatic organisms such as phytoplankton.

3.3. Phytoplankton Type

Based on the study's result, the types of phytoplankton found in Danau Panjang Lubuk Siam Village were 79 species. The types of phytoplankton are classified into 10 classes, namely Chlorophyceae, Cyanophyceae, Chrysophyceae, Xantophyceae, Bacillariophyceae, Euglenophyceae, Dinophyceae, Klebsor-midiophyceae, Trebouxiophyceae, Zygnematophyceae. The class Chlorophyceae consists of: *Ankistrodesmus* sp, *Bracteacoccus* sp, *Carteria* sp, *Characium* sp, *Chlorella* sp, *Closterium* sp.1, *Closterium* sp.2, *Cosmarium* sp, *Dictyosphaerium* sp, *Eudorina* sp, *Haematococcus* sp, *Micrasterias* sp, *Monoraphidium* sp, *Mougeotia* sp, *Oedogonium* sp, *Oocystis* sp.1, *Oocystis* sp.2, *Palmella* sp, *Pandorina* sp, *Pleurotaenium* sp, *Schroederia* sp, *Sphaerocystis* sp, *Spirogyra* sp, *Staurastrum* sp.1, *Staurastrum* sp.2, *Staurastrum* sp.3, *Staurastrum* sp.4, *Staurastrum* sp.5, *Staurastrum* sp.6, *Tetraedron* sp, *Ulothrix* sp, dan *Xanthidium* sp. Kelas Cyanophyceae antara lain; *Anabaena* sp, *Chroococcus* sp, *Gloeocapsa* sp, *Gomphosphaeria* sp, *Microcystis* sp, *Nostoc* sp, *Oscillatoria* sp, *Pseudanabaena* sp, dan *Spirulina* sp.

Class Chrysophyceae consists of *Dinobryon* sp, dan *Mallomonas* sp. Kelas Xanthophyceae terdiri dari: *Botrydiopsis* sp, dan *Tribonema* sp. Class Bacillariophyceae consists of *Asterionella* sp, *Coscinodiscus* sp, *Cyclotella* sp, *Cymbella* sp, *Eunotia* sp, *Fragilaria* sp, *Frustulia* sp, *Gomphonema* sp, *Melosira* sp, *Navicula* sp, *Nitzschia* sp, *Pinnularia* sp, *Surirella* sp, *Synedra* sp, *Tabellaria* sp, *Ulnaria* sp. Class Euglenophyceae consists of: *Euglena* sp.1, *Euglena* sp.2, *Lepocinclis* sp, *Phacus* sp, *Strombomonas* sp, dan *Trachelomonas* sp.1, *Trachelomonas* sp.2, *Trachelomonas* sp.3, *Trachelomonas* sp.4, *Trachelomonas* sp.5. Kelas Dinophyceae terdiri dari: *Peridinium* sp, dan *Pyrocystis* sp. Class Klebsormidiophyceae consists of *Klebsormidium* sp. Class Trebouxiophyceae consists of *Actinastrum* sp, *Chodatella* sp, and *Crucigenia* sp. Class Zygnematophyceae consists of *Gonatozygon* sp, dan *Sphaerozosma* sp.

The number of types of phytoplankton groups found is mainly from the Chlorophyceae class because, based on the statements of local fishermen before the lake cleaning, since 2018, the ecological conditions of Danau Panjang as one of the oxbow lakes rarely even no longer addition of discharge from the main river so that it can result in lake depths that tend to be shallow. This is reinforced by the lake depth value obtained, which is 2.63-2.97 m. The relatively shallow water bottom can affect sunlight entering the water column to reach the bottom of the lake waters. This is one of the supporting factors for phytoplankton growth, especially in the Chlorophyceae class.

3.4. Phytoplankton Abundance

The average abundance of phytoplankton species in Danau Panjang during the study was 2383-7098 cells/L, and the average total number was 12,047 cells/L. The results of the average phytoplankton abundance during the study were the highest in Week 1 at 7098 cells/L, and the lowest average phytoplankton abundance was in Week 2 at 2383 cells/L. The lowest average range of phytoplankton abundance was in Week 2 at 2383 cells/L (Figure 3); this is because, in Week 2, there had been lake cleaning activities using excavators by village officials starting from the outlet of the lake which allowed some phytoplankton to be carried by the water flow out of the lake area. Week 2 had a reasonably low brightness compared to the other three weeks at 72 cm (Table 1). The brightness value is very supportive for phytoplankton life because brightness is very influential on phytoplankton growth; the higher the brightness, the growth of phytoplankton increases because more light enters the water body and phytoplankton are more active in photosynthesizing (Odum, 1993).

The average abundance of phytoplankton was the highest in Week 1 at 7098 cells/L (Figure 3). The high abundance of phytoplankton in Week 1 was due to the high level of brightness (86 cm) along with sufficient nutrients (Table 1); this was caused by high nitrate and phosphate values in Week 1, namely 0.087 mg/L and 0.090 mg/L. Nutrients are needed by plankton to grow and reproduce (Goldman & Horne, 1994).

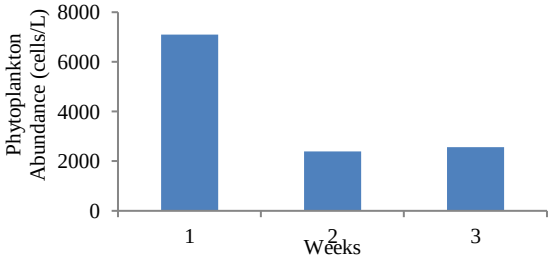

Figure 3. Phytoplankton abundance during the study

The type of phytoplankton that was found each week was *Peridinium* sp. (Dinophyceae), with as many as 3963 cells/L. The high abundance of this type of *Peridinium* sp is because this type has good resistance to environmental fluctuations, including changes in temperature, salinity, and nutrient availability, so this type is found at all stations. *Peridinium* sp. has a distinctive morphology, such as a very thick layer of clothes, commonly called theca (outer sheath), which is wrapped in cellulose and has two flagella.

3.5. Phytoplankton Biodiversity

From the data obtained, in Danau Panjang Lubuk Siam Village there is a phytoplankton community consisting of 79 species of phytoplankton with a total average abundance of 12,047 cells/L found in Danau Panjang Lubuk Siam Village. Based on the abundance of phytoplankton found, phytoplankton biodiversity is relatively still in a balanced condition with the values with value of the species diversity index (H'), Dominance index (C), Diversity Index (E), and Richness Index (D) obtained.

Based on the biodiversity value, species richness (D) of phytoplankton in Danau Panjang in Week 1 was lower than in Weeks 2 and 3. This is indicated by the uniformity value (E), where the uniformity index value in Week 1 is lower than in Weeks 2 and 3. The species diversity of a community is primarily determined by species richness and uniformity. The uniformity index becomes high if there is no concentration of individuals in a particular species (Odum, 1971). So, the diversity of species in Week 1 will also be lower than in Weeks 2 and 3. Likewise, with the dominance value, the dominance value will be inversely proportional to the uniformity value, where the dominance index value in Week 1 will be higher than in Weeks 2 and 3.

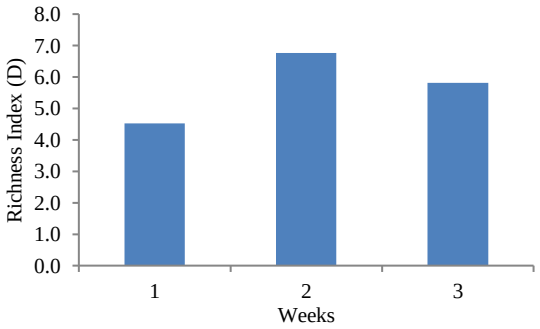

Figure 4. Phytoplankton species richness index

The value of the species richness index (D) in Danau Panjang Lubuk Siam Village ranges from 4.52 to 6.76. The average value of this richness index is 5.69, indicating that the richness of phytoplankton species in Danau Panjang Lubuk Siam Village is included in the good category. The high number of phytoplankton species in Danau Panjang in Weeks 2 and 3 was due to lake cleaning activities, so there was little water input from both the Kampar Kanan River and residential waters into Danau Panjang. The additional volume entering the lake can increase the variety of phytoplankton species carried from the Kampar Kanan River. Coupled with the number of days and rainfall data obtained (Figure 2), it can be seen that in Week 2 and Week 3 the research was carried out at the end of September-October, which is a condition with high days and rainfall. The high rainfall and the number of rainy days can affect water quality, thus affecting the proliferation of biota, including phytoplankton. In Week 1, Danau Panjang had 46 phytoplankton species, while in Week 2, there were 61 phytoplankton species and 53 phytoplankton species in Week 3.

The results of the calculation of the species diversity index (H') showed that the value of the phytoplankton species diversity index in Danau Panjang during the observation ranged from 2.15-4.29. The range of values is 3.53 in the high category; this means that the research location is still relatively stable, has high diversity with high individual distribution, has not experienced disturbance (pressure), and the structure of the community of organisms in the environment is in a good category to support the life of biota living in these waters.

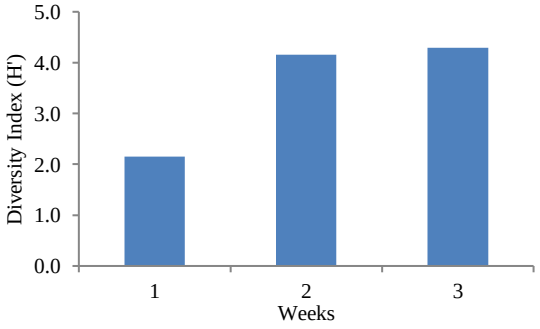

Figure 5. Diversity index of phytoplankton

The diversity index figure above shows that the type of phytoplankton diversity increases every week. In the third week, the research was carried out in early October, with conditions of high days and rainfall. The number of days and high rainfall cause fluctuations in the waters to cause turbidity in the waters. This condition significantly affects the type and abundance of phytoplankton, so the diversity of species obtained should be small because only some types of phytoplankton are able to survive in these water conditions. However, in this condition, the waters of Danau Panjang are being cleaned by local villages using excavators, so it is suspected that phytoplankton carried from the Kampar Kanan River water flow into Danau Panjang.

The value of the species dominance index (C) in Danau Panjang Lubuk Siam Village ranges from 0.08-0.38 (Figure 6). The average value of this dominance index is 0.19 or close to zero (0), indicating that there is no dominant phytoplankton species in Danau Panjang Lubuk Siam Village. Simpson's opinion in Odum (1993) is that if the C value is close to 0, there is no dominating species in a phytoplankton community in these waters.

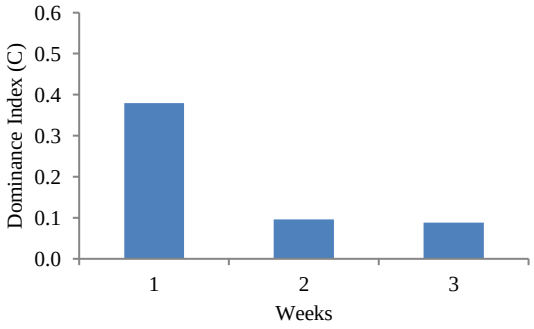

Figure 6. Dominance index (c) of phytoplankton

The graphical pattern of the dominance index in each week during the study shows that the dominance value is decreasing so that the distribution of phytoplankton is relatively stable. Based on the dominance index of phytoplankton in Danau Panjang Lubuk Siam Village, it shows that the waters are quite capable of supporting various types of organisms both from the availability of food and also the habitat where they live so that there is no competition and extreme conditions that cause the emergence of dominance in certain species. The value of the uniformity index (E) describes the species composition of organisms in a community and is used to determine how much similarity is in the distribution of a number of individuals of each genus at the community level. The uniformity index (E) obtained during the study in Danau Panjang Lubuk Siam Village ranged from 0.39 to 0.75 (Figure 7).

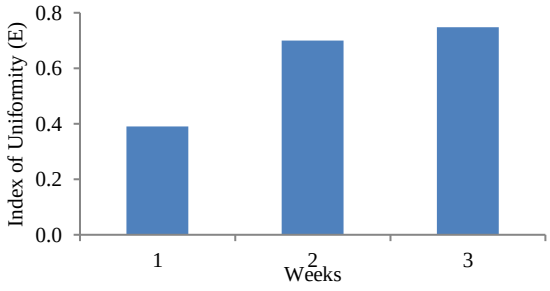

Figure 7. Diversity index of phytoplankton

The average value of the phytoplankton Diversity Index obtained is 0.61, which means that the uniformity of organisms in Danau Panjang is balanced so that there is no competition for both place and food. This is in accordance with the opinion of Weber (1973), which states that if the value of E is close to 1 (>0.5), it means that the uniformity of organisms in a water body is in a balanced state, meaning that there is no competition, either for space or food.

4. Conclusions

Based on the research conducted, it can be concluded that Phytoplankton found in Danau Panjang consists of 10 classes, namely, Chlorophyceae (32 species), Cyanophyceae (9 species), Chrysophyceae (2 species), Xanthophyceae (2 species), Bacillariophyceae (16 species), Euglenophyceae (10 species), Dinophyceae (2 species), Klebsormidiophyceae (1 species), Trebouxiophyceae (3 species), Zygnematophyceae (2 species). Phytoplankton abundance in Danau Panjang ranged from 2383-7098 cells/L. Phytoplankton biodiversity in Danau Panjang describes a relatively stable condition but can change at any time with changes in environmental conditions, with an indication of a suitable species richness index, phytoplankton diversity in the high category or high phytoplankton distribution. The dominance index value of phytoplankton in Danau Panjang indicates that

there is no dominating species in these waters. The phytoplankton uniformity index value during the study was in balance, and there was no competition for space or food.

5. Suggestions

Based on the research, it is recommended that regular research be conducted to monitor changes in phytoplankton biodiversity and water quality of Danau Panjang due to various lake activities. Furthermore, it is hoped that the government can work with the community to pay more attention and preserve the ecosystem around Danau Panjang.

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