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Farhan Muharam Saleh
Jl. Raya Bandung Sumedang, KM 21, Hegarmanah, Jatinangor, Sumedang, Faculty of Fisheries and Marine Science, Universitas Padjadjran West Java, Indonesia

Zahidah Hasan
Jl. Raya Bandung Sumedang, KM 21, Hegarmanah, Jatinangor, Sumedang, Faculty of Fisheries and Marine Science, Universitas Padjadjran West Java, Indonesia

Ibnu Dwi Buwono
Jl. Raya Bandung Sumedang, KM 21, Hegarmanah, Jatinangor, Sumedang, Faculty of Fisheries and Marine Science, Universitas Padjadjran West Java, Indonesia

Herman Hamdani
Jl. Raya Bandung Sumedang, KM 21, Hegarmanah, Jatinangor, Sumedang, Faculty of Fisheries and Marine Science, Universitas Padjadjran West Java, Indonesia

Corresponding Author:
Farhan Muharam Saleh
Jl. Raya Bandung Sumedang, KM 21, Hegarmanah, Jatinangor, Sumedang, Faculty of Fisheries and Marine Science, Universitas Padjadjran West Java, Indonesia

Plankton community structure *in situ* cibeureum, tasikmalaya city, West Java

Farhan Muharam Saleh, Zahidah Hasan, Ibnu Dwi Buwono and Herman Hamdani

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Abstract
The purpose of this study was to determine the plankton community structure as a reference for the management of Situ Cibeureum. This research was conducted on September to November 2021. This study used a survey method with purposive sampling. The plankton community structure in Situ Cibeureum consists of 13 classes, 9 classes of phytoplankton and 4 classes for zooplankton. The abundance of phytoplankton 195 Ind/L – 310 Ind/L and zooplankton 25 Ind/L – 41 Ind/L. The Simpson phytoplankton diversity index value was ranged 0.45±0.29 – 0.60±0.19 and 0.62±0.21 – 0.76±0.07 for zooplankton while the phytoplankton dominance index was ranged 0.40±0.19 – 0.55±0.29 and 0.62±0.21 – 0.76±0.07 for zooplankton. The total biomass of phytoplankton in Situ Cibeureum was 43,433.26 µg/l. Based on the plankton community structure, Situ Cibeureum is categorized as good for supporting fishery activities and one type of activity that might be developed in Situ Cibeureum is restocking tilapia (*Oreochromis niloticus*).

Keywords: Community structure, plankton, biomass, situ cibeureum

Introduction
Situ Cibeureum is a lake which has an area of about 21.5 hectares. This lake is located in Tamansari District, Tasikmalaya City, West Java Province. Situ Cibeureum does not have an inlet from the river but the main supply of water comes from rainwater. This lake has various functions, including ecological functions as ecosystem protection and irrigation sources for local residents, recreation and fisheries [1]. Various water and land use activities around Situ Cibeureum can generate waste such as settlements, stalls, traders, tourists and fishing activities. These wastes can certainly affect the chemical, physical, and biological properties of waters [2].

Situ Cibeureum as one of the public waters in West Java, detailed information about the waters is not yet fully available. One of the important water quality parameters for water management is the biological parameter, specifically the plankton community structure. Community structure is a collection of various types of individuals who interact in a certain zone and the same time [3]. Plankton are small (microscopic) organisms that live in water and drift in currents, another definition of plankton is organisms caught in fine nets [4]. Plankton is one of the biological parameters that becomes an indicator to evaluate the quality and level of fertility of a waters [5]. Plankton also serves as the first link in the food chain [6]. The output of this study is useful because data on plankton which is a natural food source can be used as a reference in optimizing the utilization of Situ Cibeureum, one of which is the use of Situ as a reference for Situ Cibeureum management.

Materials and Methods
Time and Location
This research was conducted in Situ Cibeureum, Tamansari District, Tasikmalaya City, West Java, Indonesia. Water quality analysis and plankton identification were carried out at the Laboratory of Aquatic Resources Management, Faculty of Fisheries and Marine Sciences, Padjadjaran University. The research was conducted in September – November 2021 during the rainy season.

Research Method

The method used in this study is a survey method with purposive sampling in time series with an interval of seven days with six sampling times for each station on the surface of the waters. There are 4 observation stations that have been determined based on the water conditions at the Situ Cibeureum location. The parameters observed and analyzed were plankton samples as the main parameters and water quality parameters as supporting parameters, namely physical parameters (water temperature, transparency, and depth) and chemical parameters (pH, CO_2, DO, BOD, nitrate, and phosphate) which referred to APHA, (2017) [7].

Data Analysis

The main parameters analyzed were the structure of the plankton community which consisted of the composition and abundance of plankton, plankton diversity, plankton dominance and phytoplankton biomass.

The abundance of plankton was calculated using the modified formula (Sachlan 1980) [8]:

$$N = n\ x\ \frac{Vr}{Vo}\ x\frac{1}{Vs}$$

The diversity index (H') is calculated using the Simpson's formula (Zahidah, 2004) [9]:

$$H' = 1 - \sum(\frac{ni}{N})^2$$

Species that dominate a community are calculated using the Simpsons index formula (Odum 1996) [10]:

$$D = \sum Pi^2 = (\frac{ni}{N})^2$$

By measuring the volume of phytoplankton cells geometrically and assuming the density of phytoplankton is equal to 1 [11], the phytoplankton biomass can be estimated using the formula:

$$B = BJ\ x\ V$$

After the data is obtained, then it is calculated and analyzed using exploratory descriptive analysis by explaining the conditions or variables observed and the relationship between each of these variables. The variables in this case are water quality, plankton community structure which includes abundance, diversity, dominance and phytoplankton biomass.

Results and Discussion

Water Quality Parameters

Temperature

Water temperature is influenced by the intensity of sunlight, geographical altitude, and the factor of tree cover (canopy) from the vegetation that grows around it [10]. The average water temperature of Situ Cibeureum can be seen in Figure 1.

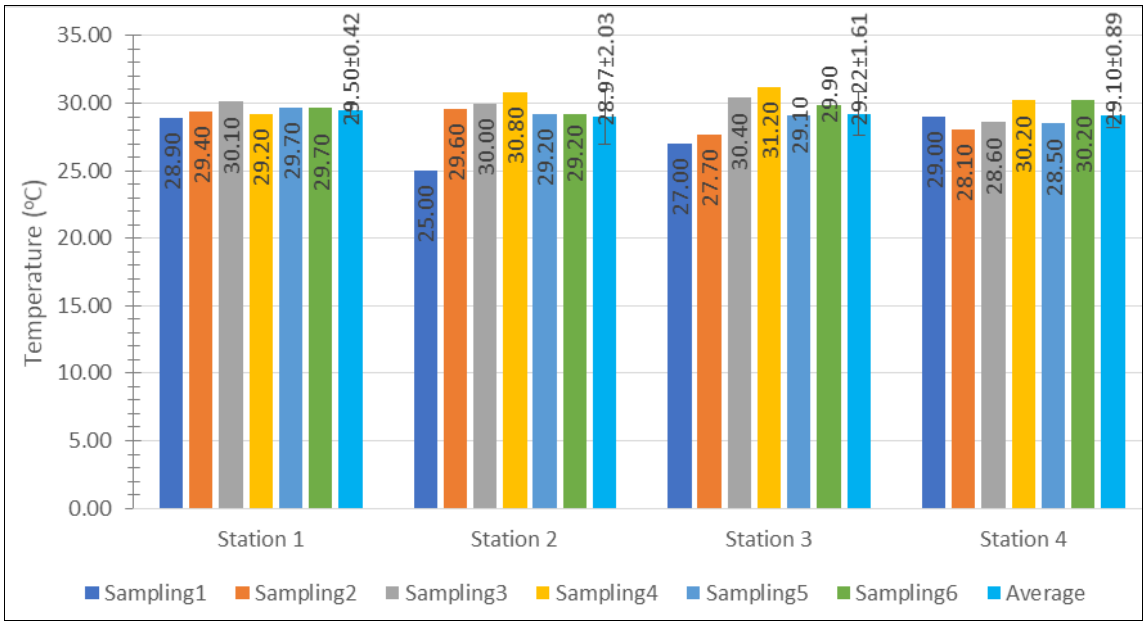

Fig 1: Temperature Value

Based on Figure 1, it shows that the average water temperature of Situ Cibeureum ranges from 28.97±2.03 ºC - 29.50±0.42 ºC. The highest average temperature is at station 1, which is 29.50±0.42 ºC, while the lowest average temperature is at station 2, which is 28.97±2.03 ºC. These results show that the average temperature in the waters of Situ Cibereum is still suitable for the life of aquatic biota there because the optimum temperature for phytoplankton life in the waters is 20-30 ^{0}C while the optimum temperature for zooplankton is in the range of 15-35 ^{0}C. [12].

Transparency

Transparency describes the optical properties of water which are determined based on the amount of light absorbed and emitted by the materials present in the water [13]. Data on the transparency of the waters of Situ Cibeureum can be seen in Figure 2.

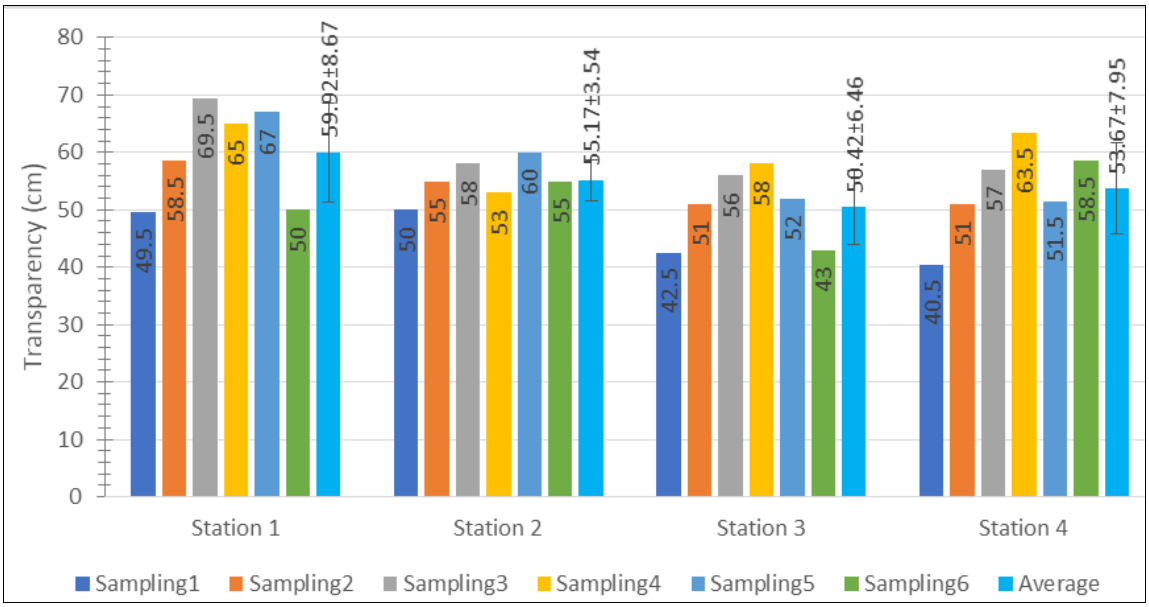

Fig 2: Transparency Value

Based on Figure 2, it can be seen that the average transparency of Situ Cibeureum ranges from 50.42±6.46 – 59.92±8.67 cm. The highest transparency value is at station 1, which is 59.92±8.67 cm, while the lowest transparency is at station 3, which is 50.42±6.46 cm. The highest transparency at station 1 is caused by the weather factor which is always sunny when observed at station 1. The value of transparency is strongly influenced by weather conditions, measurement time and suspended solids. [14]. Meanwhile, the lowest transparency is at station 3 because there are trees around the station, garbage and weather factors.

Phytoplankton need light to photosynthesize, so a decrease in brightness can affect the photosynthetic zone where aquatic habitats are limited by depth [10]. The transparency value of Situ Cibeureum is still feasible for the life of plankton and other aquatic organisms. A good brightness value for living organisms is greater than 45 cm so that penetration and absorption in these waters will take place optimally [15].

Depth

The depth of Situ Cibeureum is strongly influenced by seasonal factors because considering that there is no inlet coming from the river, rainwater is the main water supplier for this lake. Data regarding the average depth of Situ Cibeureum for each station can be seen in Figure 3.

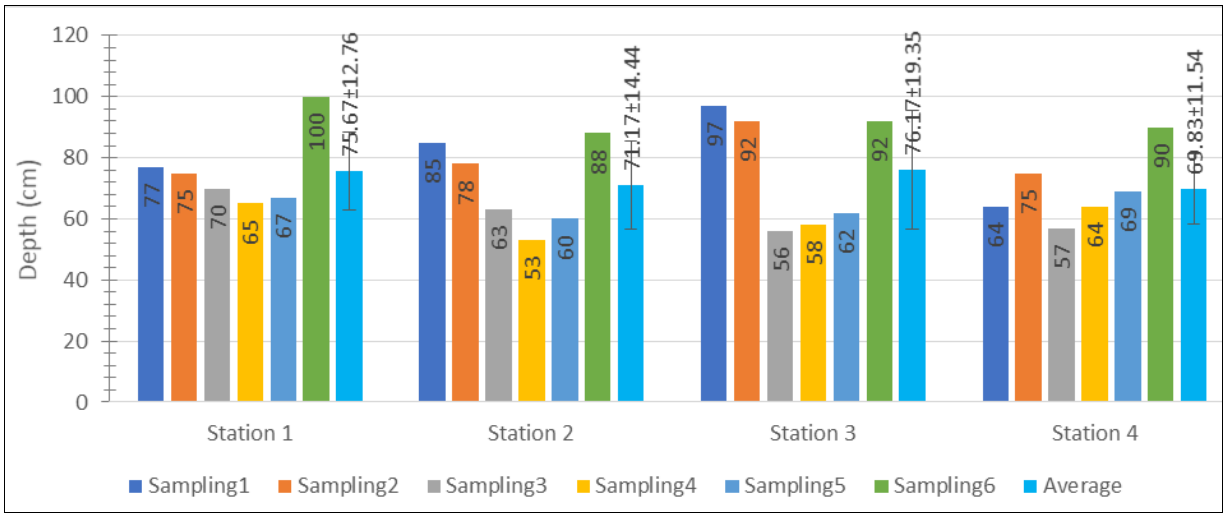

Fig 3: Depth Value

Based on Figure 3, the deepest depth is at station 3 with a depth of 76.17±19.35 cm. Station 3 is an outlet that drains water to the rice fields. While the shallowest depth is at station 4 with a depth of 69.83±11.54 cm. Station 4 is an outlet that leads to rice fields and plantations. The depth of the lake has a very big influence on water quality, especially shallow water lakes, whose agitation is strongly influenced by the wind [16].

Acidity (pH)

The pH value indicates whether the water is neutral, alkaline or acidic. Water with a pH below 7 is acidic and above 7 is alkaline. The average pH of the waters of Situ Cibeureum can be seen in Figure 4.

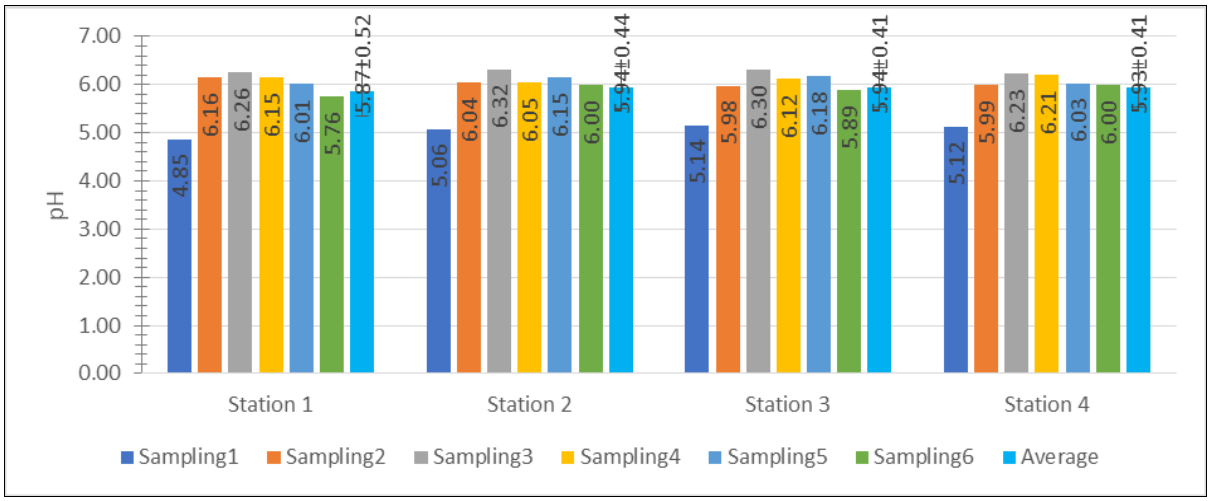

Fig 4: Value of pH

Based on Figure 4, the average pH of each station has a range of 5.87±0.52 – 5.94±0.44. The pH value at each station tends to be the same, which has a pH below 6. The pH value which tends to be acidic in the waters of Situ Cibeureum is strongly influenced by rain. This is because rainwater is naturally acidic due to carbon dioxide in the atmosphere. Carbon dioxide in the water will react with water to form carbonic acid (H_2CO_3). Carbonic acid will immediately dissociate into bicarbonate ions (HCO_3^-) by releasing hydrogen ions (H+) which causes a decrease in the pH of the water [17]. Aquatic biota is sensitive to pH and the pH range of 7 – 8.5 is the pH preferred by aquatic organisms [13]. The optimum pH to support the presence of phytoplankton ranges from 6.5 – 8.0 [18].

Carbon Dioxide (CO_2)

Based on the results of CO_2 measurements in the waters of Situ Cibeureum, the average CO_2 data for each station is obtained as shown in Figure 5.

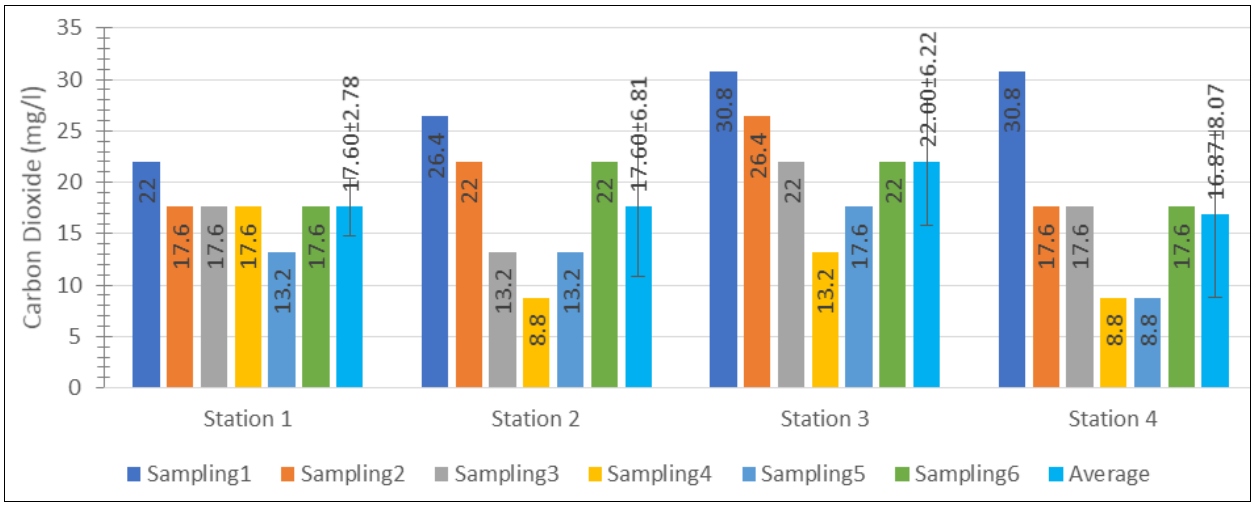

Fig 5: Carbon Dioxide Value

The level of CO_2 in Situ Cibeureum is strongly influenced by the season, especially during the rainy season. This can happen because the sampling was done during the rainy season. Rainwater is naturally acidic due to carbon dioxide in the atmosphere [17]. Sources of CO_2 in waters can come from diffusion from the atmosphere, rainwater, water passing through organic soils, and respiration of aquatic organisms [13]. The highest concentration of carbon dioxide was at station 3, reaching 22.00±6.22 mg/L which was caused by the presence of garbage in the station. Waste or garbage thrown into the waters can increase CO_2 levels in the waters [19]. When viewed from the overall average solubility of carbon dioxide in the Situ Cibeureum, this lake has a relatively high CO_2 solubility. Good levels of carbon dioxide (CO_2) for aquatic organisms, which is approximately 15 mg/L [19].

Dissolved Oxygen (DO)

Dissolved oxygen in waters is needed by all aquatic organisms for metabolic processes, so that in aquatic ecosystems dissolved oxygen is very important to support the existence of organisms and the processes that occur in them. [14]. Dissolved oxygen levels in Situ Cibeureum as a whole can be seen in Figure 6.

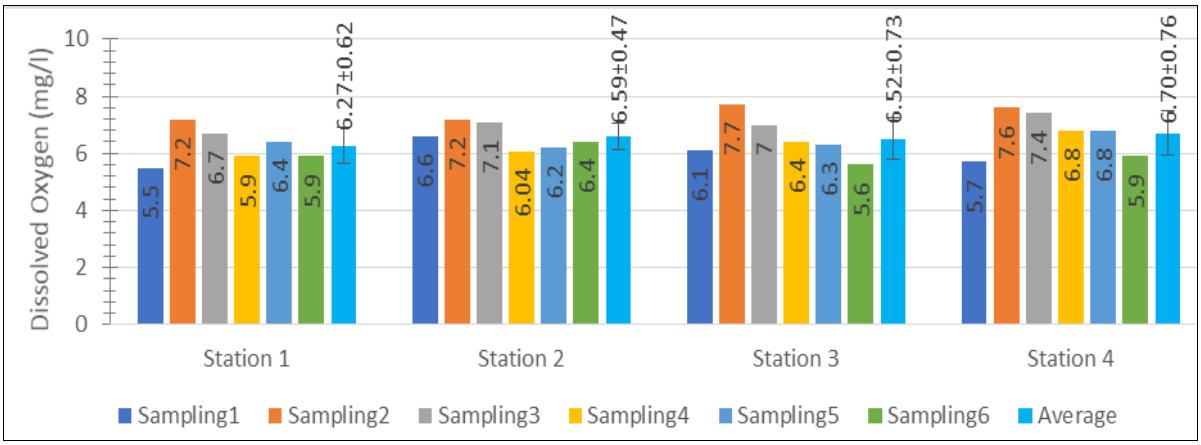

Fig 6: Dissolved Oxygen Value

Based on Figure 6 the average dissolved oxygen level in the waters of Situ Cibeureum has a value of 6.27±0.62 – 6.70±0.76 mg/L with the lowest dissolved oxygen level at station 1 sampling 1 of 5.5 mg/L. This could be because the weather was cloudy and it was raining during sampling, causing a lower light intensity than when the weather was sunny. Station 1 is also the station with the lowest abundance of phytoplankton and there is a domestic waste disposal nearby. This is in accordance with the optimization of the photosynthesis process based on the dissolved oxygen produced which is strongly influenced by the intensity of light [20].

Biochemical Oxygen Demand (BOD)

Biochemical Oxygen Demand (BOD) is one of the parameters that is often used to predict the pollution status of a water body. The average BOD value of Situ Cibeureum is shown in Figure 7.

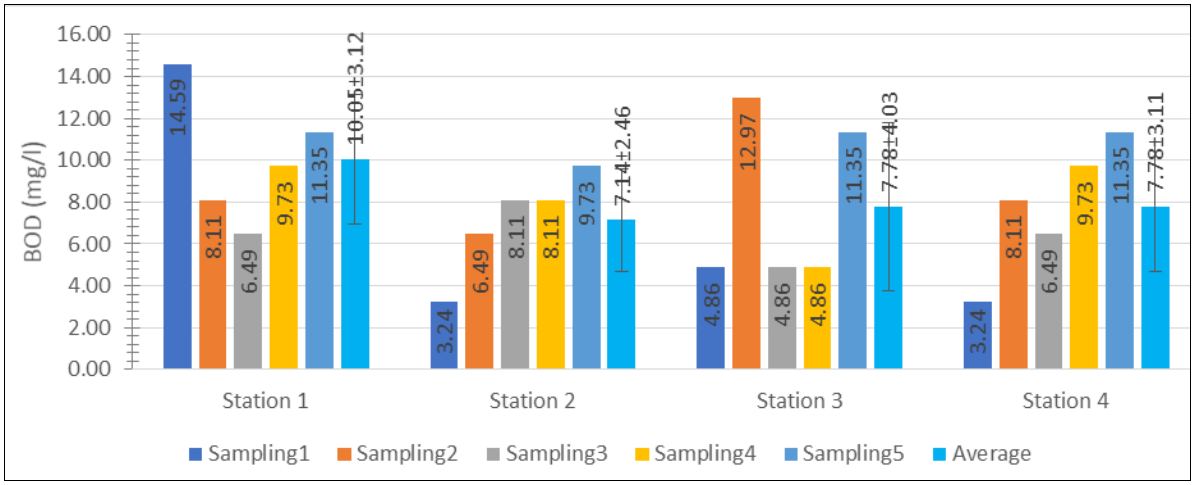

Fig 7: BOD Value

The average value of BOD in the waters of Situ Cibeureum is in the range of 7.14±2.46 – 10.05±3.12 mg/L (Figure 7). The highest BOD value was at station 1, which was 10.05±3.12 mg/L. The high BOD value at station 1 is due to the presence of a domestic sewage drain close to station 1. BOD with the lowest value is at station 2 with a value of 7.14±2.46 mg/L. The low BOD at station 2 is because station 2 is a station that is far from human activities that can cause waste [21]. The greater the concentration of BOD indicates that the water has been polluted, the concentration of BOD whose level of pollution is still low and can be categorized as good waters has a BOD value ranging from 0 - 10 mg/L, moderate level of pollution 10 - 20 mg/L and high level of pollution >25 mg/L [22].

Nitrate (NO_3)

Nitrogen in the form of compounds is one of the nutritional elements whose presence is needed for the growth of phytoplankton in the waters [23]. Nitrate values in Situ Cibeureum as a whole can be seen in Figure 8.

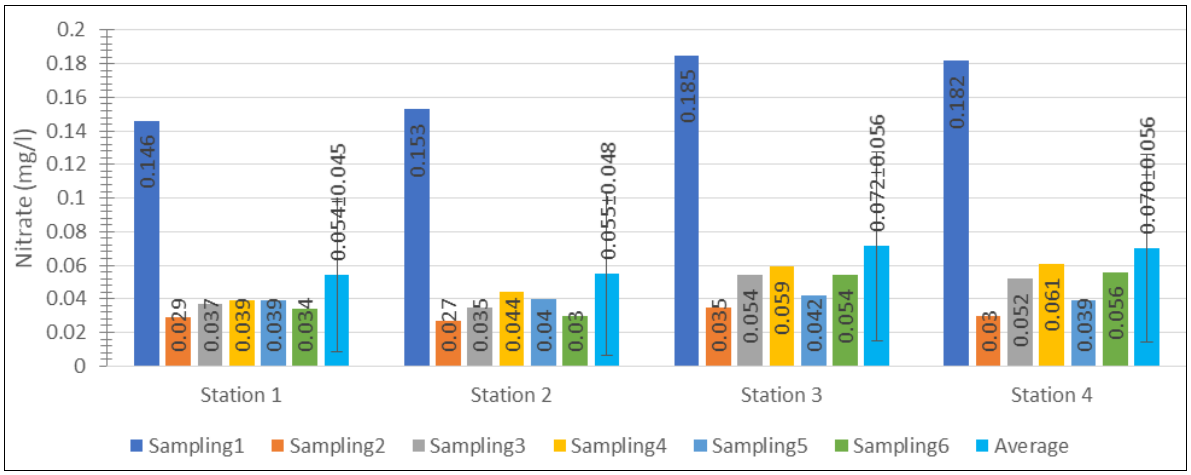

Fig 8: Nitrate Value

Nitrate (NO_3) levels in the waters of Situ Cibeureum can be seen in Figure 8. The average nitrate level at each station has a value between 0.054±0.045 – 0.072±0.056 mg/L. Based on Figure 8, nitrate levels in Sampling 1 (1st week or 1st sampling) show higher nitrate levels than other weeks, this is thought to have occurred due to rain during sampling because rainwater can contain nitric acid (HNO_3) which will increase nitrate levels in the water [24]. Sources of nitrate in the waters come from the waters themselves, namely through processes of decomposition, weathering or decomposition of plants and the remains of dead organisms. In addition, depending on the surrounding conditions, including donations from the mainland through various types of waste containing organic compounds [25]. Variable levels of nitrate can also be caused by phytoplankton and aquatic plants that consume nitran for the manufacture of body fat and protein [26]. Effendi (2003) [13] stated that oligotrophic waters have nitrate levels of 0-1 mg/L, mesotrophic 1-5 mg/L and eutrophic 5-50 mg/L. So that the waters of Situ Cibeureum can be categorized into oligotrophic waters because the nitrate level is less than 1 mg/L.

Phosphate

Phosphate in waters is found in the form of dissolved inorganic compounds, namely orthophosphates and polyphosphates and organic compounds in the form of particulates. Orthophosphate is phosphorus that is utilized directly by aquatic plants. Phosphate in waters is needed for the growth of aquatic biota, which plays a role in the energy transfer process in cells [14]. Data on phosphate in Situ Cibeureum can be seen in Figure 9.

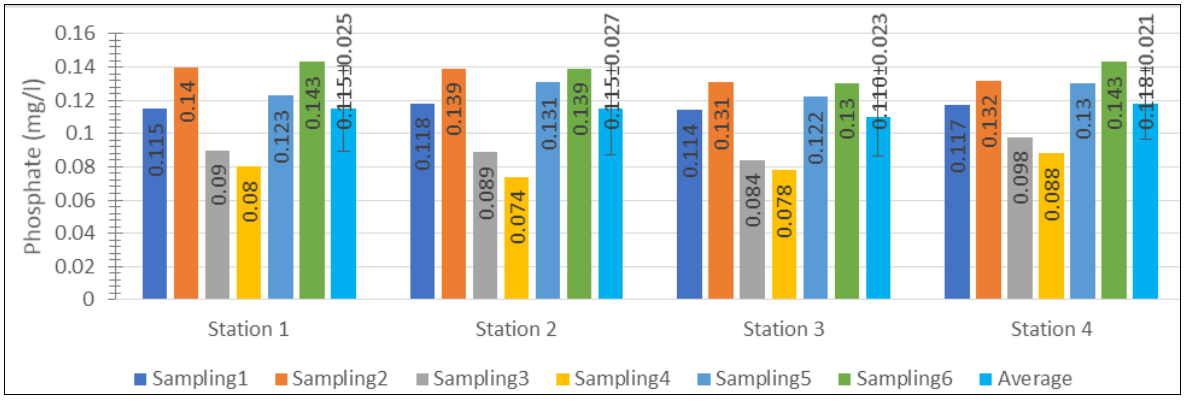

Fig 9: Phosphate Value

Based on Figure 9, Situ Cibeureum has an average phosphate content of around 0.110±0.023 – 0.118±0.021 mg/L. The high level of phosphate at station 4 is thought to be caused during the rainy season, causing the scrub area adjacent to agriculture and plantations to be full of water, allowing water and sediment to enter the area. In addition, near station 4 there is also a place for washing and bathing residents. Natural sources of phosphate in waters are weathering of mineral rocks and decomposition of organic matter. Meanwhile, anthropogenic sources of phosphate are industrial waste, domestic waste and agricultural waste [14].

The high levels of phosphate in the waters of Situ Cibeureum are thought to be caused by contamination of the surrounding domestic waste. There is *E-coli* contamination in the waters of Situ Cibeureum [27], so that it does not rule out the possibility of phosphate-rich domestic waste such as detergents entering these waters.

Phosphate levels in Situ Cibeureum (Figure 9) identify that the waters of Situ Cibeureum are fertile waters, this is based on phosphate levels in oligotrophic waters 0.003 – 0.001 mg/L, mesotrophic waters 0.011 – 0.03 mg/L, and eutrophic waters 0.03 – 0.1 or more [26].

Plankton Community Structure

Plankton Composition and Abundance

The composition of phytoplankton based on the results of identification in the waters of Situ Cibeureum can be distinguished based on the classes shown in Figure 10. The composition of phytoplankton identified during the study consisted of 7 phyla, 9 classes and 33 genera.

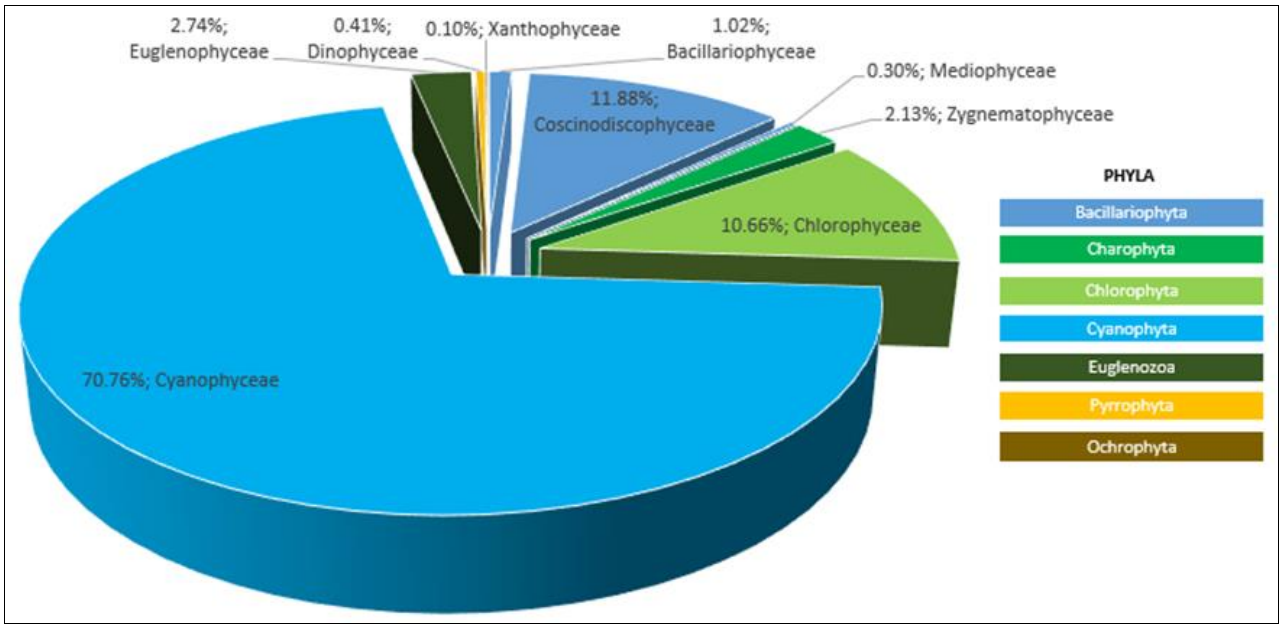

Fig 10: Phytoplankton composition by classes

Based on Figure 10, the phylum Cyanophyta (class: Cyanophyceae) is the phylum with the highest percentage of phytoplankton abundance as much as 70.76%. The high percentage of the Cyanophyceae class indicates that the Cyanophyceae class has a wide distribution in Situ Cibeureum. Cyanophyta are easy to find in various environments because they can live in extreme environments such as high acidity and high temperatures. The ability to fix nitrogen from the air makes Cyanophyta able to survive in a nutrient-poor environment [28]. While the phylum with the smallest percentage contributor is the phylum Ochrophyta (class: Xanthophyceae) as much as 0.10% which only consists of 1 genus, namely Centritractus, this is because Situ Cibeureum is not a suitable ecosystem for brown algae. Brown algae are found in seawater, especially in cold climates and not many in the tropics [29].

The composition of zooplankton based on the results of identification in Situ Cibeureum can be distinguished based on the classes shown in Figure 11. The composition of zooplankton identified during the study consisted of 3 phyla, 4 classes and 13 genera.

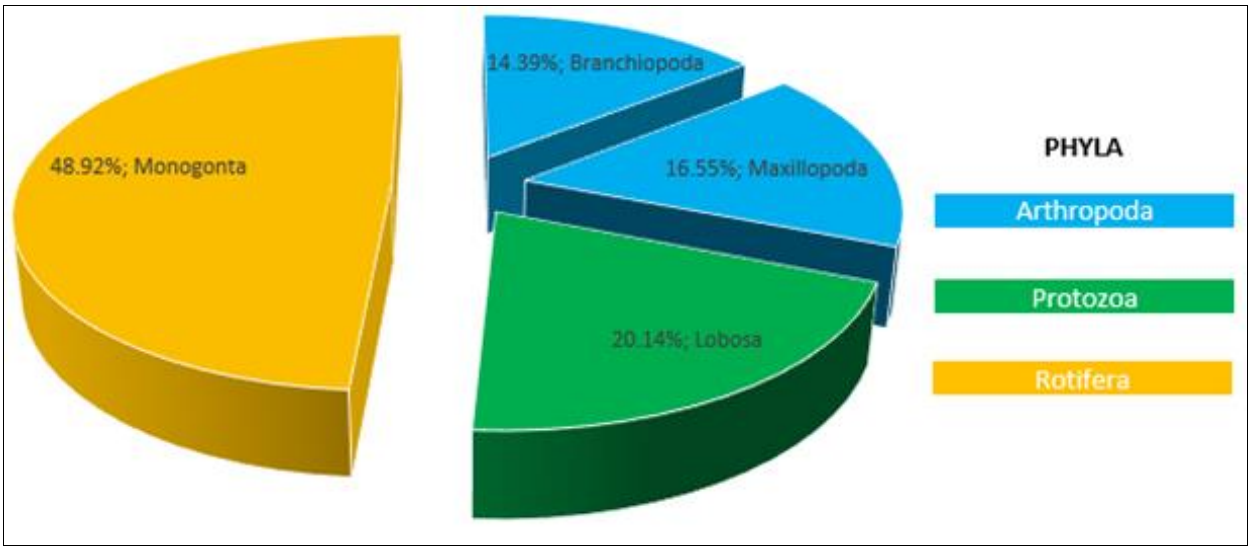

Fig 11: Zooplankton composition by classes

Based on Figure 11, the phylum that makes up the most of the composition of zooplankton abundance is the Rotifera phylum which consists of 1 class, namely the Monogonta class as much as 48.92%. The phylum with the least contribution to the composition of zooplankton abundance was the phylum Protozoa which only consisted of the Lobosa class, which was 20.14%.

The abundance of plankton is expressed in individuals/liter. The average abundance of plankton during the study is presented in Table 1.

Table 1: Abundance of Plankton Situ Cibeureum

Average abundance (Ind/L)					
Organism		Station			
Phytoplankton					
Phylum	Class	1	2	3	4
Bacillariophyta	Bacillariophyceae	5.00	2.00	1.00	2.00
	Coscinodiscophyceae	40.00	30.00	13.00	34.00
	Mediophyceae	1.00	0.00	1.00	1.00
Charophyta	Zygnematophyceae	4.00	4.00	5.00	8.00
Chlorophyta	Chlorophyceae	16.00	30.00	16.00	43.00
Cyanophyta	Cyanophyceae	118.00	186.00	263.00	130.00
Euglenozoa	Euglenophyceae	10.00	3.00	9.00	5.00
Pyrrophyta	Dinophyceae	1.00	1.00	1.00	1.00
Ochrophyta	Xanthophyceae	0.00	0.00	1.00	0.00
Sum		195.00	256.00	310.00	224.00
Zooplankton					
Phylum	Class				
Arthropoda	Branchiopoda	3.00	12.00	1.00	4.00
	Maxillopoda	4.00	9.00	5.00	5.00
Protozoa	Lobosa	8.00	2.00	9.00	9.00
Rotifera	Monogonta	24.00	18.00	10.00	16.00
Sum		39.00	41.00	25.00	34.00
Total		234.00	297.00	335.00	258.00

Based on Table 1, it was found that the greatest abundance of phytoplankton was at station 3 with an average total abundance of 335 Ind/L. The abundance of phytoplankton at station 3 is due to the presence of zooplankton predation on phytoplankton. This is supported by the predation theory which explains that the abundance of phytoplankton is high because predation by zooplankton is low [30]. The lowest abundance of plankton was at station 1 with a value of 234 Ind/L. Apart from the theory of zooplankton predation on phytoplankton, station 1 is the station that has the most acidic pH value, which is around 5.87±0.52 (Figure 4). The pH value is classified as too acidic for the optimum life of phytoplankton to live at a pH of 6.5 – 8.0 [18].

Based on the calculation of the average abundance during the study (Table 1), it was found that the largest abundance of phytoplankton was from the Cyanophyceae class as many as 118 – 263 Ind/L which was dominated by the genus Microcystis. In accordance with the research of Kusumaningrum et al., (2016) [31] at Bromo Lake, Gunung Kidul Regency, Yogyakarta that the dominance of Cyanophyta can also occur in the rainy season because Cyanophyta can dominate waters that receive nutrient input in the form of leaching of soil nutrients by rainwater and resident waste. In addition, Cyanophyta is thought to be able to dominate the waters of Situ Cibeureum because Cyanophyta has the ability to fix free nitrogen which makes Cyanophyta superior to other phytoplankton due to the low nitrate in these waters. [32].

Based on Table 1, the largest abundance of zooplankton is owned by the Rotifera phylum, class Monogonta, which is 68 Ind/L. Rotifera was the most common phylum found in the four research stations because Rotifera was thought to be able to adapt well in the waters of Situ Cibeureum. This is reinforced by Rosińska et al., (2019) [33] which states that Rotifers will dominate when crustaceans cannot control the proliferation of phytoplankton. The abundance of Rotifers also indicates that these waters are eutrophic waters [34].

The average abundance of plankton in the waters of Situ Cibeureum ranged from 234 – 335 Ind/L with phytoplankton as the largest contributor to the abundance of 195 – 310 Ind/L and the abundance of zooplankton ranged from 25 – 41 Ind/L (Table 1). Oligotrophic waters are low fertility waters with phytoplankton abundance ranging from 0 – 2,000 Ind/L, mesotrophic 2,000-15,000 Ind/L and eutrophic >15,000 Ind/L. Meanwhile, trophic estimates based on zooplankton abundance were oligotrophic with zooplankton abundance < 1 Ind/L, mesotrophic 1 – 500 Ind/L and eutrophic >500 Ind/L [35]. Based on the abundance value, it can be stated that Situ Cibeureum is included in the category of waters that tend to be oligotrophic.

The low abundance of plankton in Situ Cibeureum can be caused by the low nutrient in the form of nitrate, this is in accordance with Warsa et al., (2006) [36] which states that the increase in the abundance of phytoplankton is in line with the increase in nutrients (N and P). High rainfall can also cause a low abundance of plankton because the nutrient concentration, brightness, and plankton density are lower than in the dry season [37].

Plankton Diversity Index

The diversity that is calculated is Simpson Diversity which has a value range of 0 – 1. The index value is close to 0 then the diversity is low and if the index value is close to 1, the diversity is high. The diversity of plankton in the waters of Situ Cibeureum is presented in Figure 12.

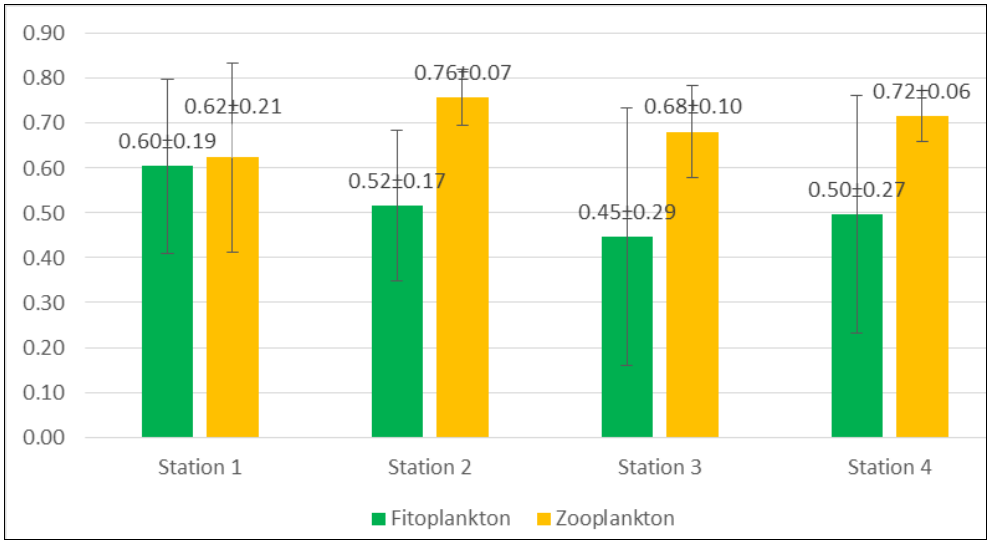

Fig 12: Plankton Diversity Data

Based on the research that has been done (Figure 12) the average phytoplankton diversity in Situ Cibeureum is 0.45±0.29 – 0.60±0.19 which is included in the medium category and the average zooplankton diversity is 0.62±0.21 – 0.76±0.07 which is included in the high category. The value of the phytoplankton diversity index which is in the medium category is caused by the water quality in the waters of Situ Cibeureum that is not optimal, such as acidic pH, high CO_2, high phosphate and low nitrate, which causes the dominant type of phytoplankton, namely Microcystis which is thought to be able to adapt well to the environment. the water conditions of Situ Cibeureum because Cyanophyta have the ability to adapt to low light conditions, low nitrogen and have the ability to store phosphorus [38]. The value of the zooplankton diversity index is included in the high category which shows that zooplankton can adapt well to the water conditions of Situ Cibeureum and the absence of certain species dominates. An aquatic ecosystem is said to have a stable community if the Simpson diversity value is between 0.6-0.8 [10].

Plankton Dominance Index

The dominance index is a parameter that states the degree of centrality of the dominance of species in a community. Besides being able to determine the dominance of a species, community stability can also be analyzed through the plankton dominance index [39]. The value of the plankton dominance index in the waters of Situ Cibeureum is presented in Figure 13.

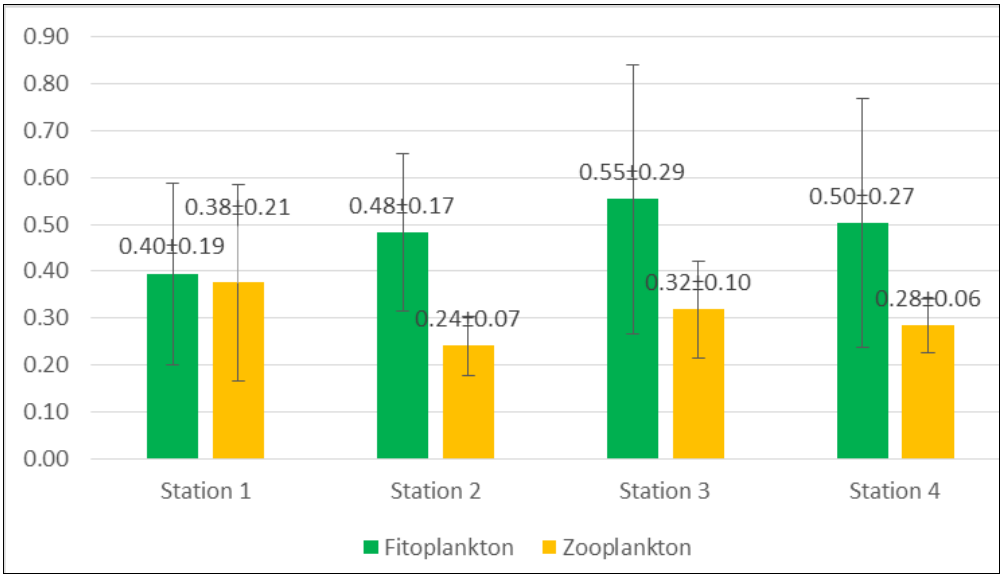

Fig 13: Plankton Dominance Data

Based on Figure 13, the results of the phytoplankton dominance index in Situ Cibeureum waters show numbers with an average of 0.40±0.19 – 0.55±0.29. Meanwhile, the dominance index for zooplankton shows numbers in the range of 0.24±0.07 – 0.38±0.21. The dominance index can be divided into 3 categories, namely 0.50 means almost no dominant species (low dominance), 0.50 - 0.75 means the dominance index is moderate, while 0.75 to close to 1 means the dominance index is high [10]. Based on these criteria, the overall phytoplankton dominance index in the waters of Situ Cibeureum is in the low category except at station 3 (the dominance index value is 0.55±0.29) which is in the medium category. This is due to the dominant type of microcystis phytoplankton at the station. Microcystis can dominate presumably due to predation on other types of phytoplankton which are preferred by zooplankton and fish as natural food. Microcystis are not favored by zooplankton and fish because they can produce toxins and have thick cell walls, and are covered with thick mucus [28]. Phytoplankton remaining in water bodies, either because they are inedible or not favored by zooplankton and fish, will in turn become dominant [40]. The zooplankton dominance index in the waters of Situ Cibeureum based on these criteria is in the low dominance category which shows that there is no dominant species from the zooplankton group.

Phytoplankton Biomass

The value of phytoplankton biomass in this study was calculated by measuring the volume of phytoplankton cells volumetrically. Data on phytoplankton biomass can be seen in Table 2.

Table 2: Phytoplankton biomass Data

Phylum	Genus	Biomassa Individu (µg)	Average Abundance (Ind/L)	Total Biomass (µg/l)	% Total
Bacillariophyta	Nitzchia	2.62	5.00	13.09	0.030
	Diploneis	18.85	1.00	18.85	0.043
	Navicula	18.85	1.00	18.85	0.043
	Pinnularia	120.17	3.00	360.50	0.830
	Aulacoseira	21.99	115.00	2,528.98	5.823
	Melosira	10.21	2.00	20.42	0.047
	Cyclotella	28.27	3.00	84.82	0.195
Sum			130.00	3,045.51	7.012
Charophyta	Closterium	268.61	2.00	537.21	1.237

	Cosmarium	10.47	3.00	31.42	0.072
	Staurastrum	4.19	7.00	29.32	0.068
	Gonatozygon	40.06	9.00	360.50	0.830
Sum			21.00	958.45	2.207
Chlorophyta	Haematococcus	65.45	18.00	1,178.10	2.712
	Volvox	113.10	1.00	113.10	0.260
	Pediastrum	381.70	3.00	1,145.11	2.636
	Tetraedron	40.00	4.00	160.00	0.368
	Coelastrum	14.14	20.00	282.74	0.651
	Scenedesmus	2.09	1.00	2.09	0.005
	Tetrastrum	4.19	1.00	4.19	0.010
	Schroederia	6.28	1.00	6.28	0.014
	Kirchneriella	0.52	43.00	22.51	0.052
	Selenastrum	0.52	13.00	6.81	0.016
Sum			105.00	2,920.94	6.725
Cyanophyta	Microcystis	0.52	490.00	256.56	0.591
	Anabaena	51.84	3.00	155.51	0.358
	Oscillatoria	49.48	7.00	346.36	0.797
	Spirulina	53.41	1.00	53.41	0.123
	Coelosphaerium	179.59	196.00	35,200.50	81.045
Sum			697.00	36,012.34	82.914
Euglenophyta	Euglena	29.32	12.00	351.86	0.810
	Strombomonas	5.59	2.00	11.17	0.026
	Trachelomonas	4.19	7.00	29.32	0.068
	Phacus	4.19	6.00	25.13	0.058
Sum			27.00	417.48	0.961
Pyrrophyta	Ceratium	29.85	1.00	29.85	0.069
	Peridinium	15.71	3.00	47.12	0.108
Sum			4.00	76.97	0.177
Ochrophyta	Centritractus	1.57	1.00	1.57	0.004
Sum			1.00	1.57	0.004
Total			985.00	43,433.26	100.000

The high and low biovolume is determined from the abundance and volume of plankton. Based on the abundance data obtained (Table 2), the largest biomass belonged to the phylum Cyanophyta, which was 36,012.34 µg/l (82,914 %). The abundance of Cyanophyta during the rainy season in Situ Cibeureum is thought to be because it can adapt to the water conditions of Situ Cibeureum. This is supported by Haande et al., (2011) [38] which states that in the tropics, Cyanophyta can show persistent annual dominance with relatively small changes throughout the year and have the ability to adapt to conditions of low light intensity, low nitrogen and have the ability to store phosphorus.

The genus with the largest biomass is Coelosphaerium. This is because each station is found in large numbers and has a large volume. Despite having a large amount of biomass, Coelosphaerium has mucus so it is thought that it is not attractive to zooplankton and fish [41]. Cyanophyta are less potential because in addition to having thick cell walls, the outside of the cells are also covered with thick mucus, causing fish that eat them to be unable to digest [28]. This also causes the dominance of Cyanophyta because the biota that eats phytoplankton do not use it as feed so that it remains in water bodies. [40].

Bacillariophyta or Diatoms are one of the natural fish food sources that are commonly available in nature. Besides Bacillariophyta, the common phytoplankton phylum that can be used as a natural food source is Chlorophyta which was found to contain nutrients such as carbohydrates, protein and fat with the highest content being in protein. [42]. Phylum Bacillariophyta has a biomass of 3,045.51 µg/l (7.012 %), and Chlorophyta of 2,920.94 µg/l (6,725%) with a total phytoplankton biomass of 43,433.26 µg/l (100%) so it is suspected that the availability of natural food in the waters of Situ Cibeureum is categorized as adequate.

Fisheries at Situ Cibeureum

Based on the research results obtained in the form of physical, chemical and biological parameters (plankton) in the waters of Situ Cibeureum, aquaculture activities are deemed unsuitable to be carried out in Situ Cibeureum due to the uncertain water quality, depth and availability of water. This is reinforced by several parameters of the quality of the lake waters that do not support aquaculture activities according to Government Regulation No. 22 year 2021 [43] including transparency with a quality standard of 250 cm, pH with a quality standard of 6-9, BOD with a quality standard of 6 mg/L and phosphate with a quality standard of 0.1 mg/L.

One type of activity that might be developed in Situ Cibeureum is restocking tilapia (*Oreochromis niloticus*) because it has a selling value and can adapt well to the water quality of Situ Cibeureum. One of the important factors to support the life, growth and reproduction of tilapia is the quality of water as a living medium for fish. Several water quality parameters that must be considered, including dissolved oxygen, pH and CO_2. Tilapia can survive and breed in the waters of Situ Cibeureum because tilapia is thought to be able to adapt well in the waters of Situ Cibeureum. This is supported by the availability of natural food in the form of phytoplankton and zooplankton. Phytoplankton that can be used as a natural food source are Bacillariophyta and Chlorophyta [44]. Some of the zooplankton found in Situ Cibeureum such as Rotifera and Copepoda can also be used as natural food for fish larvae [45] it is assumed that the availability of natural food in the waters of Situ Cibeureum is categorized as quite good. In addition, local fishermen always catch fish every day and their catch is dominated by tilapia

which shows that these fish are able to adapt and breed in Situ Cibeureum.

Conclusion

Based on water quality and plankton community structure in the form of an abundance ranging from 234–335 Ind/L, a stable plankton community and a phytoplankton biomass of 43,433.26 (µg/l), Situ Cibeureum is categorized as good to support fishery activities with one type of activity that might be developed in Situ Cibeureum is a restocking of tilapia (*Oreochromis niloticus*).

References

1. SLH Kota Tasikmalaya. Laporan Status Lingkungan Hidup Kota Tasikmalaya Tahun, 2008.
2. Kanwilyanti S, Suryanto A, Supriharyono. Kelimpahan Larva Udang di Sekitar Perairan Pt. Kayu Lapis Indonesia, Kaliwungu, Kendal, Manag. Aquat. Resource. 2013;2(4):71-80.
3. Krebs CJ. Ecology: The Experimental Analysis of Distribution and Abundance, 6th ed. Harlow: Pearson, 2014.
4. Suthers IM, Rissik D, Plankton: A Guide to Their Ecology and Monitoring for Water Quality. Collingwood: CSIRO, 2008.
5. Sari AN, Hutabarat S, Soedarsono P. Struktur Komunitas Plankton pada Padang Lamun di Pantai Pulau Panjang, Jepara, Manag. Aquat. Resour. 2014;3(2):82-91.
6. Sunarto. Karakteristik Biologi dan Peranan Plankton Bagi Ekosistem Laut," Sumedang, 2008.
7. APHA. Standard Methods for the Examination of Water and Wastewater, 23rd ed. American Public Health Association, 2017.
8. Sachlan M, Planktonologi. Semarang: Fakultas Peternakan dan Perikanan Universitas Diponegoro, 1980.
9. Zahidah. Komunitas Fitoplankton di Zone Karamba Jaring Apung (Kja) dan Non Kja di Waduk Cirata, 2004.
10. Odum EP, Dasar-Dasar Ekologi. 3rd ed. Yogyakarta: UGM Press, 1996.
11. Amanta R, Hasan Z, Rosidah. Struktur Komunitas Plankton di Situ Patengan Kabupaten Bandung, Jawa Barat, Perikan. Dan Kelaut. 2012;3(3):193-200.
12. Isnansetyo, Kurniastuti. Teknik Kultur Fitoplankon dan Zooplankton. Yogyakarta: Kanisius, 1995.
13. Effendi H, Telaah Kualitas Air. Yogyakarta: Kanisius, 2003.
14. Indaryanto FR, Saifullah Limnologi: Ilmu tentang Perairan Darat, Weksi Budi. Serang: UNTIRTA Press, 2015.
15. Arizuna M, Suprapto D, Muskananfola MR. Kandungan Nitrat dan Fosfat dalam Air Pori Sedimen di Sungai dan Muara Sungai Wedung Demak, Manag. Aquat. Resour. 2014;3(1):7-16.
16. Muhtadi A, Yunasfi M Ma'rufi, Rizki A. Morfometri dan Daya Tampung Beban Pencemaran Danau Pondok Lapan di Kabupaten Langkat, Sumatra Utara," Oseanologi dan Limnol. di Indones. 2017;2(2):49-63.
17. Supono, Manajemen Lingkungan untuk Akuakultur. Yogyakarta: Plantaxia, 2015.
18. Manurung N, Setyawati TR, Mukarlina. Produktivitas Primer Danau Lait Kecamatan Tayan Hilir Ditinjau dari Kelimpahan dan Kandungan Klorofil-a Fitoplankton, Protobiont. 2015;4(2):30-39.
19. Al Idrus SW. Analisis Kadar Karbon Dioksida di Sungai Ampenan Lombok," Pijar MIPA. 2018;13(2):167-170.
20. Facta M, Zainuri M, Sudjadi, Sakti EP. Pengaruh Pengaturan Intensitas Cahaya yang Berbeda Terhadap Kelimpahan Dunaliella sp. dan Oksigen Terlarutdengan Simulator TRIAC dan Mikrokontroller AT89S52, Ilmu Kelaut. 2006;11(2):67-71.
21. Wirosoedarmo R, Haji ATS, Hidayati EA. Pengaruh Konsentrasi Dan Waktu Kontak Pada Pengolahan Limbah Domestik Menggunakan Karbon Aktif Tongkol Jagung Untuk Menurunkan BOD dan COD," J. Sumberd. Alam dan Lingkung, 2018, 31-38pp.
22. Salmin. Oksigen Terlarut (DO) dan Kebutuhan Oksigen Biologi (BOD) Sebagai Salah Satu Indikator Untuk Menentukan Kualitas Perairan, Oseana. 2005;30(3):21-26.
23. Susana T. Sumber Polutan Nitrogen dalam Air Laut, Oseana. 2004;29(3):25-33.
24. Sutanto, Iryani A. Hujan Asam Dan Perubahan Kadar Nitratdan Sulfat Dalam Air Sumur Di Wilayah Industricibinong-Citeureup Bogor, Teknol. Pengelolaan Limbah, 2011, 14(1).
25. Patty SI, Arfah H, Abdul MS. Zat Hara (Fosfat, Nitrat), Oksigen Terlarut dan pH Kaitannya dengan Kesuburan di Perairan Jikumerasa, Pulau Buru, J. Pesisir dan Laut Trop. 2015;1(1):43-50.
26. Ikhsan MK, Rudiyanti S, Ain C. Hubungan antara Nitrat dan Fosfat dengan Kelimpahan Fitoplankton di Waduk Jatibarang Semarang, J. MAQUARES. 2020;9(1):23-30.
27. Dinas Lingkungan Hidup. Kondisi Danau/Situ Di Kota Tasikmalaya Tahun 2019, 2020. https://data.tasikmalayakota.go.id/dinas-lingkungan-hidup/kondisi-danau-situ-di-kota-tasikmalaya-tahun-2019/.
28. Masithah ED. Cyanophyta, Antagonisme Pembunuh dan Pionir Kehidupan," UNAIR NEWS, 2020. http://news.unair.ac.id/2020/02/25/cyanophyta-antagonisme-pembunuh-dan-pionir-kehidupan/ (accessed Dec. 22, 2021).
29. Mornaten B. Studi Kerapatan dan Keragaman Jenis Makro Algae pada Perairan Desa Jikumerasa, Kebupaten Buru, Scie Map J. 2019;1(2):73-85.
30. Indriyawati N, Abida IW, Triajie H. Hubungan Antara Kelimpahan Fitoplankton Dengan Zooplankton di Perairan Sekitar Jembatan Suramadu Kecamatan Labang Kabupaten Bangkalan, J. Kelaut. 2012;5(2):127-131.
31. Kusumaningrum A, Sudarsono, Suhartini. Struktur Komunitas Plankton pada Musim Penghujan di Telaga Bromo Kecamatan Paliyan Kabupaten Gunungkidul Yogyakarta, 2016.
32. Chrismadha T, Panggabean LM, Mardiati Y. Pengaruh Konsentrasi Nitrogen Dan Fosfor Terhadap Pertumbuhan, Kandungan Protein, Karbohidrat dan Fikosianin pada Kultur Spirulinafusiformis, Ber. Biol. 2006;8(3):163-169.
33. Rosińska J, Romanowicz-Brzozowska W, Kozak A, Gołdyn R. Zooplankton changes during bottom-up and top-down control due to sustainable restoration in a shallow urban lake," Environ. Sci. Pollut. Res. 2019 July;26(19):19575-19587. doi: 10.1007/s11356-019-05107-z.
34. Gurav MN, Pejaver MK. Effect of Pollution on Rotifer Diversity in River Gadhi and Deharang Reservoir, BIONANO Front, 2012, 5(1).
35. AM Suryanto H, H Umi S. Pendugaan Status Trofik

Dengan Pendekatan Kelimpahan Fitoplanktondan Zooplankton di Waduk Sengguruh, Karangkates, Lahor, Wlingiraya Dan Wonorejo Jawa Timur., J. Ilm. Perikan. dan Kelaut. 2009;1(1):7-13.
36. Warsa A, Astuti LP, Krismono AS. Hubungan Nutrien (N Dan P) Terhadap Kelimpahan Fitoplankton Di Waduk Koto Panjang, Propinsi Rlau," Pros. Semin. Nas. Ikan IV, 2006.
37. Nirmalasari KP, Lukitasari M, Widianto J. Pengaruh Intensitas Musim Hujan Terhadap Kelimpahan Fitoplankton Di Waduk Bening Saradan, J. Edukasi Mat. dan Sains, 2014, 41-47pp.
38. Haande S, et al., Phytoplankton dynamics and cyanobacterial dominance in Murchison Bay of Lake Victoria (Uganda) in relation to environmental conditions, Limnologica. 2011 Feb;41(1):20-29. doi: 10.1016/j.limno.2010.04.001.
39. Sirait M, Rahmatia F, Pattulloh. Komparasi Indeks Keanekaragaman dan Indeks Dominansifitoplankton Di Sungai Ciliwung Jakarta, J. Kelaut. 2018;11(1):75-79.
40. Garno YS, Biomanipulasi. paradigma baru dalam pengemndalian limbah organik budidaya perikanan di waduk dan tambak. Jakarta: BPP Teknologi, 2004.
41. Sulastri, Fitoplankton Danau-Danau di Pulau Jawa: Keanekaragaman dan Perannya sebagai Bioindikator Perairan. Jakarta: LIPI Press, 2018.
42. Siswanto DP. Penyebaran dan Peran Mikroalga Chlorophyta di Perairan Indonesia, Malang, 2020.
43. PP No. 22 tahun 2021. Penyelenggaraan Perlindungan Dan Pengelolaan Lingkungan Hidup. 2021.
44. Junda M, Hasrah, Hala Y. Identifikasi Genus Fitoplankton Pada Salah Satu Tambakudang Di Desa Bontomate'ne Kecamatansegeri Kabupaten Pangkep, Bionature. 2012;13(2):108-115.
45. TS Raza'i TS, Putra IP, Suhud MA, MuhammadFirdaus. Kelimpahan Kopepoda (Copepods) sebagai Stok Pakan Alami di Perairan DesaPengudang, Bintan, Intek Akuakultur. 2018;2(1):63-70.