Environmental Conditions Support Ecosystem Services in Jatigede Reservoir,Indonesia

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Abstract. Reservoir has many benefits such as providing a source of drinking water and food from capturefisheries which can be categorized as ecosystem services. This paper aims to see how the environmental conditions ofJatigede Reservoir waters produce provisioning services. The environmental conditions analyzed in this study are physical, chemical, biological, and water quality status using the Storet method. The results showed that in the rainy season, the environmental condition of Jatigede Reservoir was heavily polluted for class 1 (not good for drinking water sources) and also heavily polluted for fisheries (class 2 and class 3). The diversity index of phytoplankton (0.968–1.540) and zooplankton (1.559–1.989) showed a lightly to heavily polluted condition. This canaffect the results of ecosystem services which show that the results of capture fisheries in rainy season there are 8 typesof fish. In the dry season, the condition of Jatigede Reservoir, as seen from the designation of drinking water sources,was heavily polluted, which showed that the benefits as a source of drinking water were less suitable for consumption.Jatigede Reservoir water quality status in class 2 fisheries designation is heavily polluted and class 3 is moderately polluted. Judging from the phytoplankton index (0.589–1.395) and zooplankton index (1.161–2.093), the water conditions in the dry season were heavily polluted to unpolluted, this can be seen from the many types of fish caught,such as 17 species. The environmental condition of the Jatigede Reservoir waters is very influential in supporting ecosystem services.

Keywords: Provisioning Services, Water Quality, Plankton, Fisheries, Diversity

1. Introduction

An ecosystem is a system of living creatures and their surroundings that is constituted by an unbreakable reciprocal relationship. In an ecosystem, interactions between biotic and abiotic components will produce goods and/or services called ecosystem services [1]. According to TEEB [2], ecosystem services are a direct and indirect contribution of ecosystems to human well-being. Ecosystem services are divided into four categories: supporting services, regulating services, cultural services, and provisioning services. Ecosystems are divided into terrestrial ecosystems and aquatic ecosystems, which are further divided into freshwater ecosystems and marine ecosystems[3]. Jatigede Reservoir, located in West Java, is one example of an artificial freshwater habitat. In addition to serving as a tourist destination, Jatigede Reservoir serves a variety of purposes and directly benefits people's lives by providing

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services. These include a hydroelectric power plant, where reservoir water is used as a raw material for drinking water, and a fisheries sector that supplies food and income to the local community by seeking and selling fish caught in the reservoir's waters [4].

In the early days of Jatigede Reservoir operations, the water conditions supported the growth and reproduction of aquatic organisms, especially fish, as seen from the results of water quality parameter values (physics and chemistry) [5]. As the population grows, so does the demand for water, yet water resources are limited. Various reservoir uses and human activities in the watershed influence nutrient inputs, resulting in changes to reservoir trophic status, biotic assemblages, and chemical-physical conditions [6]. Reservoirs are artificial aquatic systems characterized by transitional ecosystems between stagnant waters and flowing waters (Rivers). The classification of ecological situations is based on biological quality indicators (plankton, benthos, fish, and other creatures), which are supported by a set of hydromorphological quality indicators and aquatic physical-chemical indicators [7]. Many human activities occur that endanger ecosystems and the benefits that ecosystems provide. In March 2022, the condition of Jatigede Reservoir waters began to be disturbed and has a moderately polluted water quality status [8].

Changes in the aquatic environment, as well as anthropogenic contamination, are growing sources of worry [9]. Human industrial and residential activities (floating net cages aquaculture) have a negative impact on water quality and aquatic organism survival. Aquatic pollution can alter ecosystem structure and limit the number of species in a community, resulting in a decline in variety[10]. Aquatic ecosystems are assessed by evaluating the physicochemical quality of water and monitoring its biological characteristics.Monitoring biological features such as plankton in seas is not confined to present environmental circumstances or a specific contaminant, but incorporates information about previous disturbances and the consequences of many causes [11]. Plankton are used as bioindicatorsin viewing the condition of aquatic ecosystems. Phytoplankton and zooplankton are natural food sources for fish [12]. The existence of plankton organisms in natural conditions depends on abiotic environmental factors as well as biotic interactions between organisms [13,14]. Ecosystem services, especially provisioning services are felt directly by the community around Jatigede Reservoir, which the benefits of reservoirs as a source of drinking water and fisheries benefits as a source of food and a source of income. Both of these benefits are highly dependent on the condition of the aquatic environment. Therefore, this study aims to analyze the condition of the aquatic environment as a support for the formation of ecosystem services that have good quality and quantity, especially in provisioningservices (drinking water sources and fisheries).

2. Materials and Methods

2.1 Study Site

This study was carried out in 2022 at Jatigede Reservoir in Sumedang Regency, especially during the rainy season when the water level was above normal and during the dry season when the water level was below normal. The research methods employed are quantitative and descriptive research. There were seven sampling stations. Fig. 1 depicts the seven sampling stations listed below.

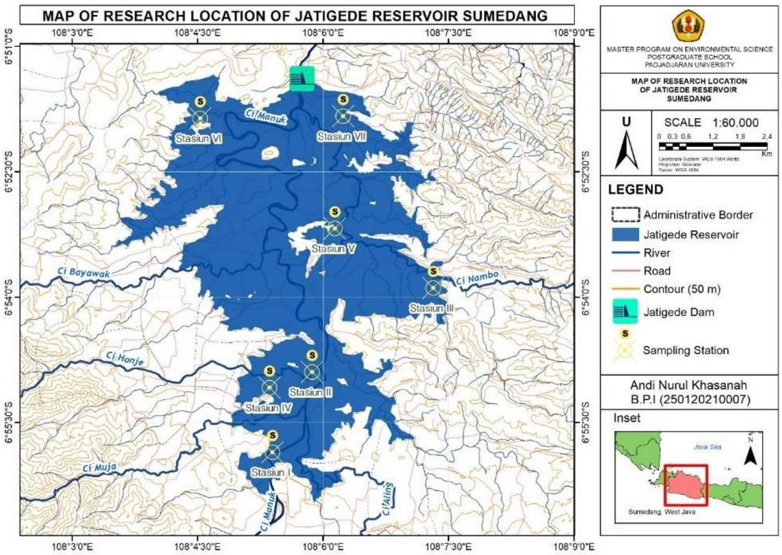


Fig. 1. Research Maps of Jatigede Reservoir

1. Station 1: Riverine area between River ecosystem and reservoir ecosystem (Cimanuk River inlet)
2. Station 2: Transition area (Floating net cage area)
3. Station 3: Riverine area between River ecosystem and reservoir ecosystem (Cinambo River inlet)
4. Station 4: Transition area (Near Settlement areas)
5. Station 5: Lacustrine region (Island in the middle of Jatigede Reservoir)
6. Station 6: Lacustrine region (Floating net cage area)
7. Station 7: Lacustrine region (Near dam area)

2.2 Sample Collection Method

The water samples were collected from the surface, phytoplankton samples were collected in 10 liters, and zooplankton in 50 liters witha plankton net number 20 with a width of 76µm and fish samples were obtained using a 4-6 inch net spread. Water samples were collected from the surface, the plankton samples using a plankton net that has a small mesh size with a width of 76 µm, and fish sampleswere taken with a spread net with a 4-6 inch meshes. All these samples were transported to Padjadjaran University's ecology laboratoryand to Padjadjaran Central Laboratory for analysis, species identification, and morphometric measures. The water sample analyzed in this research is water temperature, air temperature, Total Dissolved Solid (TDS), Total Suspended Solid (TSS), pH, Dissolved Oxygen(DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), nickel (Ni), copper (Cu), iron (Fe), and chromium (Cr).

2.3 Data analysis

2.3.1 Water Quality Status

The STORET method will be used to assess the water quality of Jatigede Reservoir. The results of the water quality analysis were then compared with the quality standards appropriate to water utilization established by the Government Regulation of the Republic of Indonesia Number 22 of 2021 about the Implementation of Environmental Protection and Management. Water quality is assessed based on the provisions of the STORET system issued by the EPA in 1977 (Environmental Protection Agency) which classifies water quality into four criteria [15]. The status of water quality categorized very good has a value of 0 which means that the waters are not polluted. Good criteria have a value range of -1 to -10 which illustrates that the waters have a lightly polluted status. Medium criteria with a value range of -11 to - 30 means that the waters are moderately polluted and poor criteria with a value exceeding 31 which means that the waters are heavily polluted. Table 1 contains data for determining the state of water quality.

Table 1. Determination of the Value System for Determining the status of water quality

Number of Parameters	**Score**	**Parameters**		
		Physics	**Chemical**	**Biology**
<10	Max	-1	-2	-3
	Min	-1	-2	-3
	Average	-3	-6	-9
≥10	Max	-2	-4	-6
	Min	-2	-4	-6
	Average	-6	-12	-18

Source: Minister of Environment Decree No. 115 year 2003

Diversity Index and Fish Abundance

The Diversity Index (H') can be understood as a systematic picture that describes the structure of the community and can aid in the process of assessing information about the types and numbers of organisms. Furthermore, the number of species in the community has a strong influence on variety. The greater the diversity, the more species are discovered; however, this value is heavily dependent on thenumber of individuals observed in each species [16]. The diversity index can describe the balance in each species' population distribution. The Shannon-Wiener formula (H') [17] can be used to determine the index as follows:

$$H' = -\sum_{i-1}^{s} \left(\frac{ni}{N}\right) \ln \left(\frac{ni}{N}\right) \quad (1)$$

Description:

H : Diversity index (Shannon-Wiener)
S : Number of fish species
ni : Number of individuals of the species (i)
N : Total number of individuals obtaines

The index that can be used in analyzing water pollution through the diversity index is [18]:

- Unpolluted : (H' > 2,0),
- Lightly polluted : (1,6-2,0),
- Moderately polluted : (1,0-1,5),

- Heavily polluted : (<1.0).

Abundance is the percentage fraction of all members in a community represented by each species. The formula [19] forcalculating abundance is as follows:

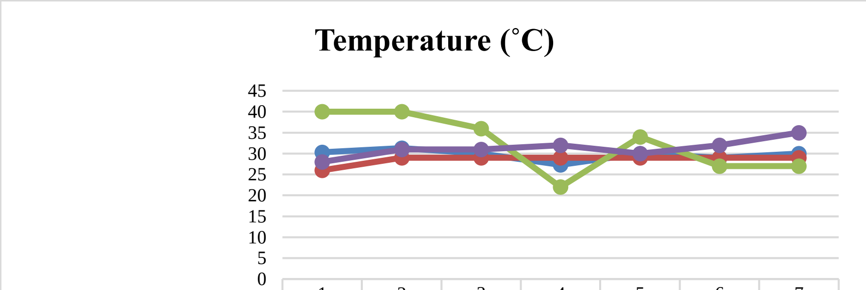
$$\textbf{Abundance} = \frac{ni}{N} x\ 100 \qquad (2)$$

Description:
Ni : Number of individuals in one species
N : Total number of individuals obtained

3. Result

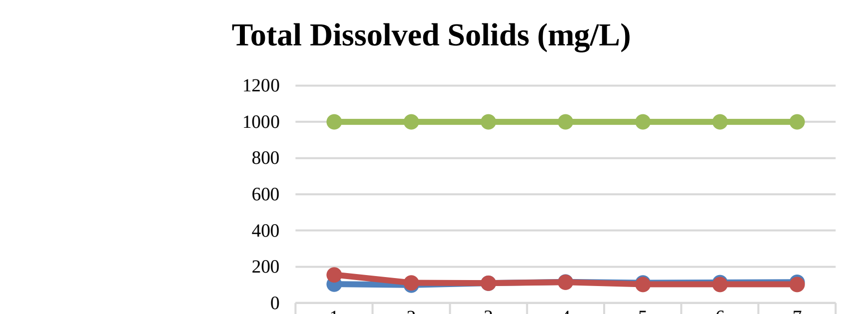
3.1 Water Quality

Communities around the Jatigede Reservoir are very dependent on the benefits provided by this reservoir, especially on direct benefits in the form of drinking water sources, food sources, and the income derived from captured fisheries resources. This shows that the environmental conditions of the Jatigede Reservoir waters must be in good condition to be able to provide these benefits in a sustainable manner. Figs. 2–12 depict the water condition as determined by the water quality analysis. Air temperature, water temperature, Total Dissolved Solid (TDS), Total Suspended Solid (TSS), pH, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Nickel (Ni), Copper (Cu), Iron (Fe), and Chromium (Cr) are the 12 parameters.



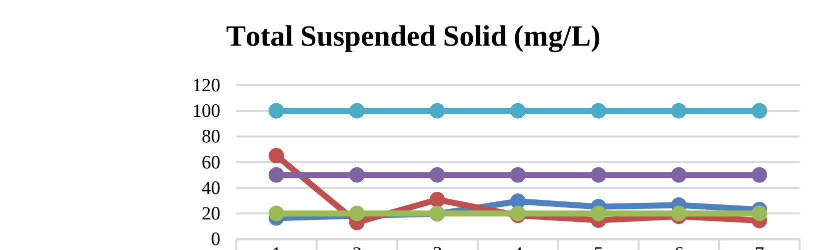
	1	2	3	4	5	6	7
Rainy Season (Water)	30,3	31,3	30	27,3	30	29	30
Dry Season (Water)	26	29	29	29	29	29	29
Rainy Season (Air)	40	40	36	22	34	27	27
Dry Season (Air)	28	31	31	32	30	32	35

Fig. 2. Graph of Water Temperature and Air Temperature



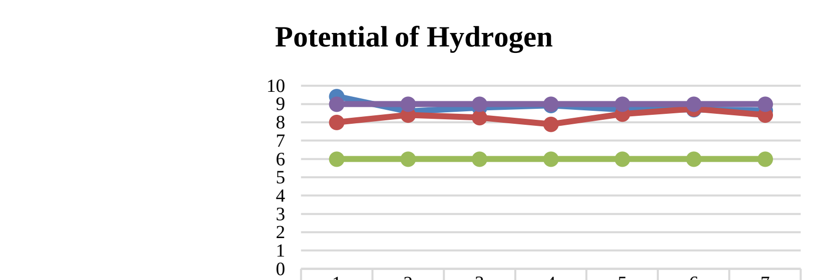
	1	2	3	4	5	6	7
Rainy Season	104	99,3	109,6	116	112	113	114,66
Dry Season	156	112	109	114	103	103	103
Standard class 1,2 and 3	1000	1000	1000	1000	1000	1000	1000

Fig 3. Graph of Total Dissolved Solids (TDS)



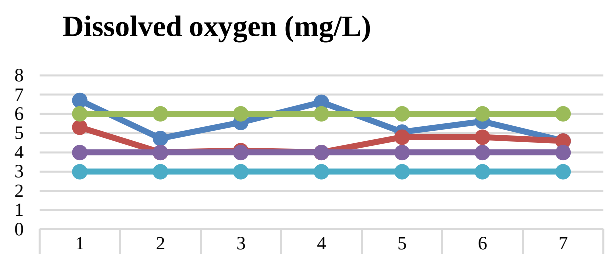
	1	2	3	4	5	6	7
Rainy Season	16,43	18,28	19,78	29,5	25,28	26,5	23
Dry Season	65	13,14	30,86	18,57	14,86	17,71	14,57
Standard class 1	20	20	20	20	20	20	20
Standard class 2	50	50	50	50	50	50	50
Standard class 3	100	100	100	100	100	100	100

Fig 4. Graph of Total Suspended Solids (TSS)



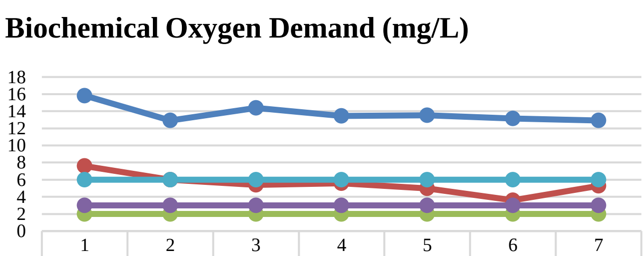
	1	2	3	4	5	6	7
Rainy Season	9,42	8,6	8,8	8,93	8,7	8,7	8,64
Dry Season	8,01	8,4	8,27	7,9	8,45	8,74	8,4
Standard class 1, 2 and 3	6	6	6	6	6	6	6
Standard class 1, 2 and 3	9	9	9	9	9	9	9

Fig 5. Graph of Potential of Hydrogen (pH)



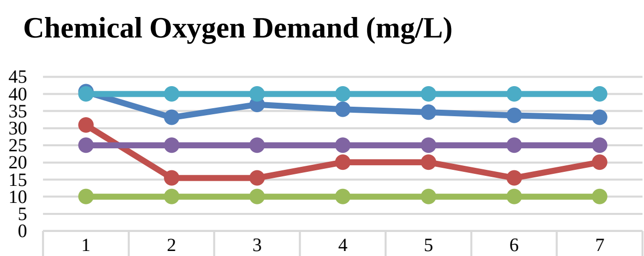
	1	2	3	4	5	6	7
Rainy Season	6,7	4,73	5,56	6,6	5,06	5,6	4,6
Dry Season	5,3	4	4,1	4	4,8	4,8	4,6
Standard class 1	6	6	6	6	6	6	6
Standard class 2	4	4	4	4	4	4	4
Standard class 3	3	3	3	3	3	3	3

Fig 6. Graph of Dissolved oxygen (DO)



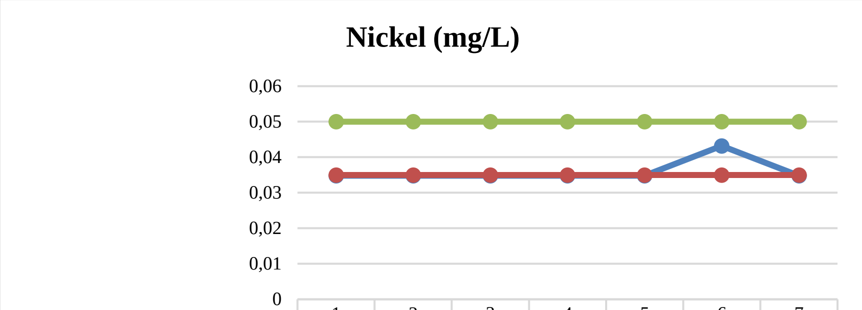
	1	2	3	4	5	6	7
Rainy Season	15,83	12,92	14,38	13,44	13,53	13,16	12,92
Dry Season	7,6	6	5,4	5,6	5	3,6	5,3
Standard class 1	2	2	2	2	2	2	2
Standard class 2	3	3	3	3	3	3	3
Standard class 3	6	6	6	6	6	6	6

Fig 7. Graph of Biochemical Oxygen Demand (BOD)



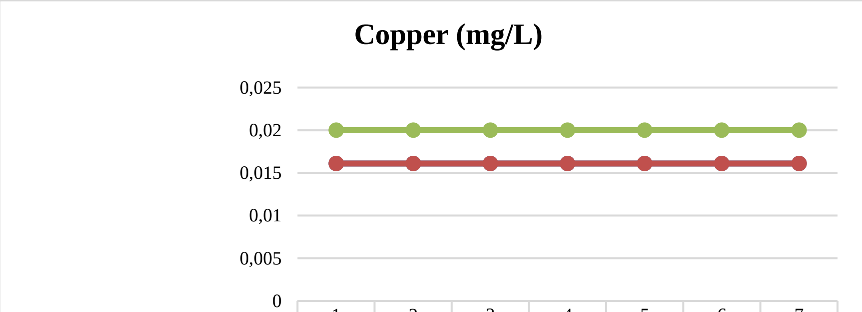
	1	2	3	4	5	6	7
Rainy Season	40,63	33,13	36,88	35,47	34,69	33,75	33,13
Dry Season	30,912	15,456	15,456	20,093	20,093	15,456	20,093
Standard class 1	10	10	10	10	10	10	10
Standard class 2	25	25	25	25	25	25	25
Standard class 3	40	40	40	40	40	40	40

Fig 8. Graph of Chemical Oxygen Demand (COD)



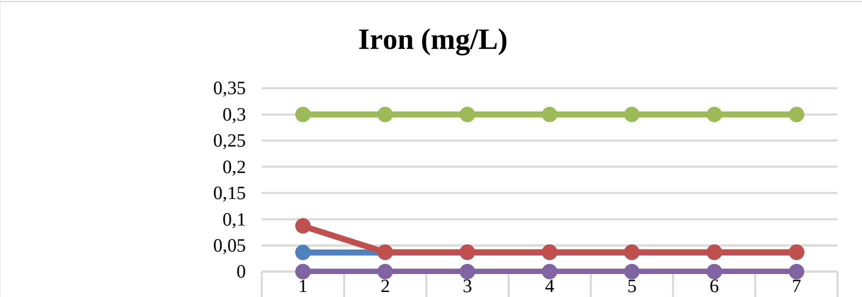
	1	2	3	4	5	6	7
Rainy Season	0,0348	0,0348	0,0348	0,0348	0,0348	0,0432	0,0348
Dry Season	0,035	0,035	0,035	0,035	0,035	0,035	0,035
Standard class 1,2 and 3	0,05	0,05	0,05	0,05	0,05	0,05	0,05

Fig 9. Graph of Nickel (Ni)



	1	2	3	4	5	6	7
Rainy Season	0,0161	0,0161	0,0161	0,0161	0,0161	0,0161	0,0161
Dry Season	0,0161	0,0161	0,0161	0,0161	0,0161	0,0161	0,0161
Standard class 1,2 and 3	0,02	0,02	0,02	0,02	0,02	0,02	0,02

Fig 10. Graph of Copper (Cu)



	1	2	3	4	5	6	7
Rainy Season	0,0365	0,0365	0,0365	0,0365	0,0365	0,0365	0,0365
Dry Season	0,087	0,037	0,037	0,037	0,037	0,037	0,037
Standard class 1	0,3	0,3	0,3	0,3	0,3	0,3	0,3
Standard class 2&3	0	0	0	0	0	0	0

Fig 11. Graph of Iron (Fe)

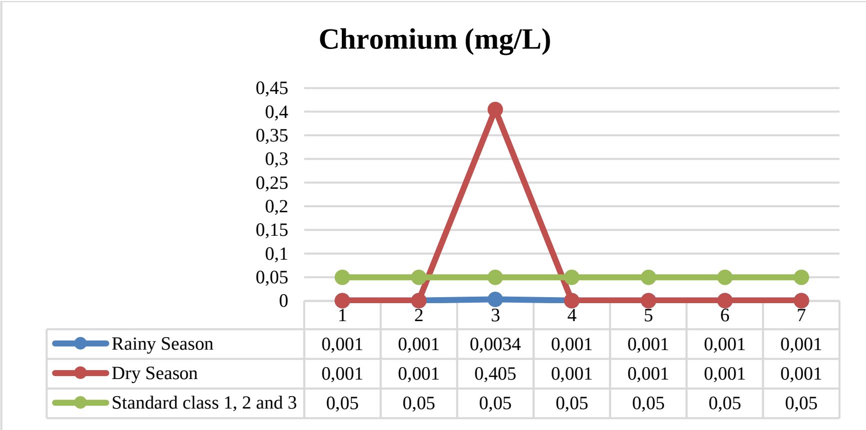


Fig 12. Graph of Chromium (Cr)

Table 2. Water Quality Status

Season	Quality Standard		
	Class 1	Class 2	Class 3
Rainy	-72 Heavily Polluted	-48 Heavily Polluted	-32 Heavily Polluted
Dry	-86 Heavily Polluted	-44 Heavily Polluted	-22 Moderate Polluted

3.2 Diversity Index

The plankton diversity index can be seen in Fig. 13 related to phytoplankton diversity graphs and in Fig.14 zooplankton diversity graphswith 3 diversity indices each which describe the condition of the waters which are divided into 3 conditions such as lightly polluted, moderately polluted, and heavily polluted. The following is a graphic image of phytoplankton diversity and zooplankton diversity:

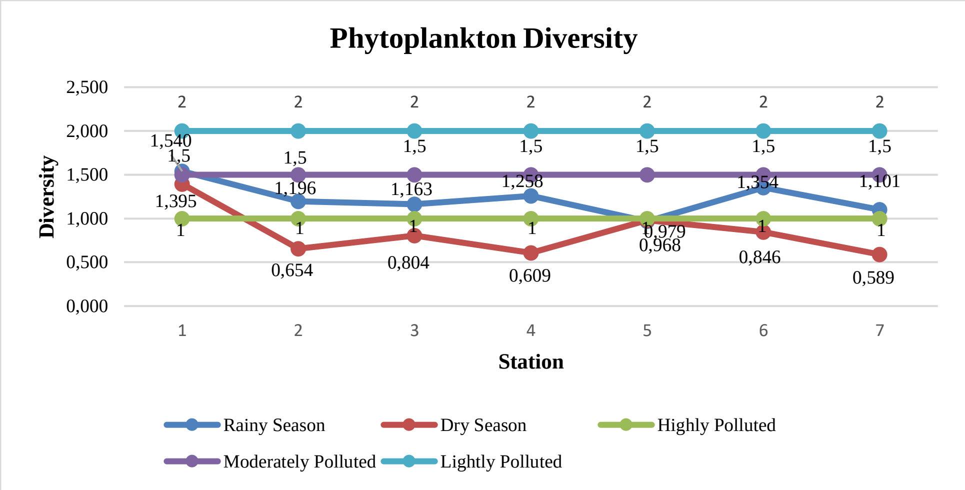


Fig 13. Graph of Phytoplankton Diversity

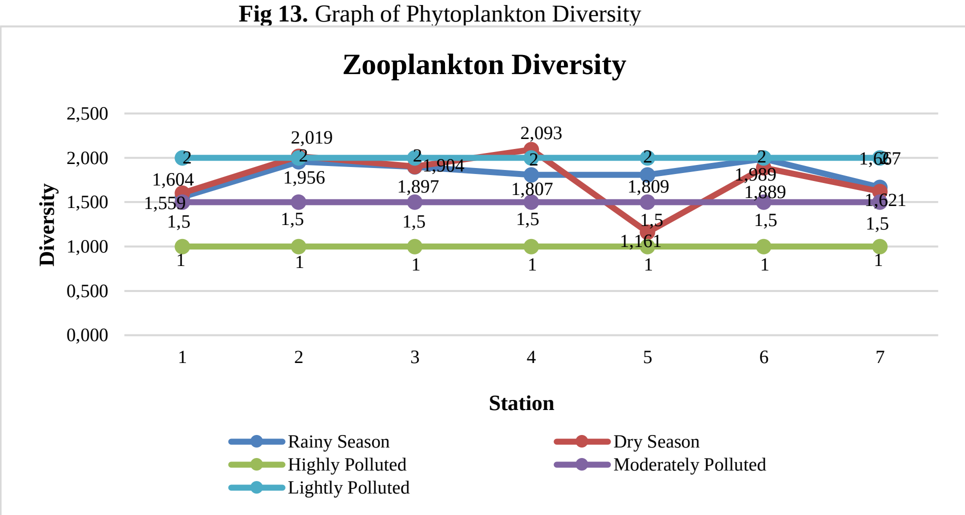


Fig 14. Graph of Zooplankton Diversity

3.3 Fish Compositions

The composition of fish in the freshwater can be seen by identifying the species and calculating the abundance of each species. The results of fish identification in Jatigede Reservoir in the rainy season and dry season obtained from the catch of fishermen are depicted in Fig. 15 and Fig. 16. The results of fish identification show that in the rainy season, the species composition and abundance of fish obtained are quite small compared to the composition and abundance of fish in the dry season, this is due to the water level in the rainy season tends to be high and unfavorable weather has an impact on the fish catch of fishermen.

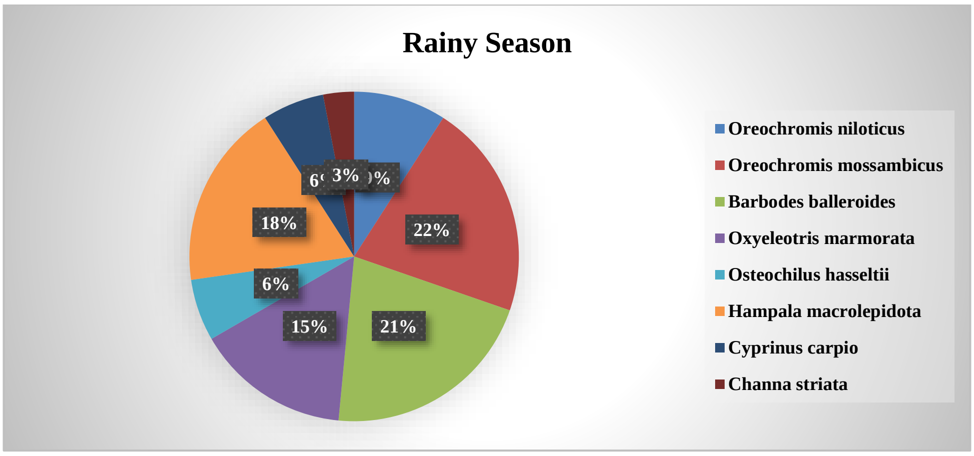


Fig 15. Graph of Fish Composition in Rainy Season

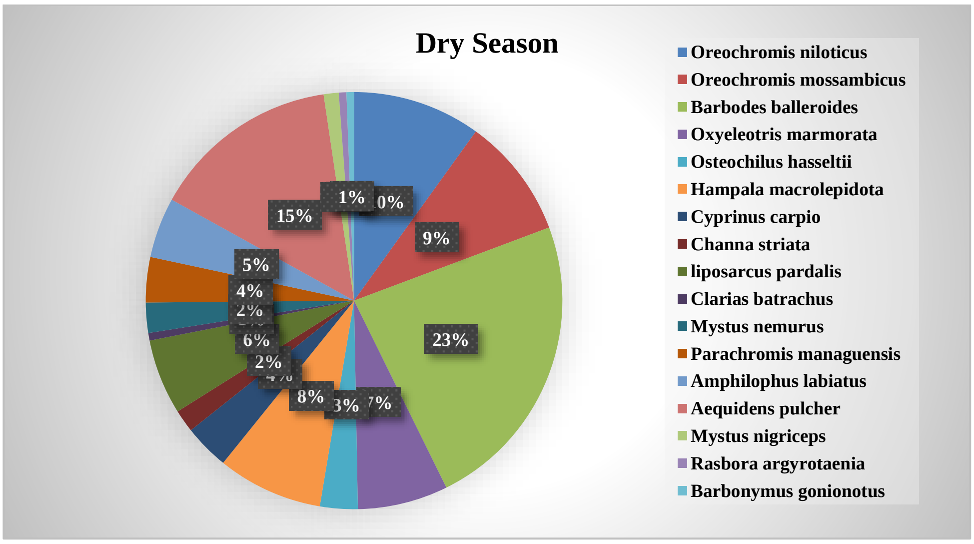


Fig 16. Graph of Fish Composition in Dry Season

4. Discussion

4.1 Environmental Conditions in Jatigede Reservoir Water Quality

The condition of an environment, especially the aquatic environment, is seen from the quality of water and biological communities thatlive in these waters. Water quality is described as the water's ability to support various uses or processes [11]. The biological communitydetermines the condition of water because it is more responsive to poor water quality because organisms are directly affected by water over a long period of time [10]. A good aquatic environment has water quality that is in accordance with the quality standards that havebeen determined according to the designation or benefits of these waters and high diversity in each species in a community. In this study, the water quality measured and analyzed were water temperature, air temperature, Total

Dissolved Solid (TDS), Total Suspended Solid(TSS), pH, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), nickel (Ni), copper (Cu), iron (Fe) and chromium (Cr). The temperature parameters measured are water temperature and air temperature/ambient temperature. Temperature is an important factor that regulates biogeochemical activities in the aquatic environment [9]. In the temperature quality standards listed in government regulation no. 22 of 2021 related to the quality standards of lake waters and the like,the temperature has a quality standard of 3 deviations for class 1 drinking water designation and classes 2 and 3 fisheries designation. The meaning of deviation 3 (quality standard) is ± 3 ºC from the ambient temperature [20]. In the graph (Fig.2) it can be seen the comparison between water temperature and air temperature during the rainy season when water levels are above normal and in the dry season when water levels are below normal. In the rainy season at several stations, the water temperature in the Jatigede reservoir exceeds the quality standards, which are at stations 1, 2, 3, 4, and 5. These five stations have differences in water temperature and ambient temperature ranging from 4 ºC to 10 ºC. In the dry season, the temperature in Jatigede Reservoir that exceeds quality standards is only at station 7 which has a difference in water temperature and the ambient temperature reaching 6 ºC.

Total Dissolved Solids (TDS) is a measure of dissolved substances, both organic and inorganic substances. This parameter is usedin measuring the quality of water used in fisheries, irrigation, and drinking water [21]. The Total Dissolved Solids (TDS) parameter in Jatigede Reservoir is 1000 mg/L. TDS values exceeding 1200 mg/L are not suitable for drinking water consumption [22]. Looking at the results of the TDS analysis when compared to the quality standards that have been set and quoted from [22], the TDS value in Jatigede Reservoir is still in good condition. The parameter Total suspended solid (TSS) is a solid that causes turbidity in the water, which is in the form of small particles, such as oil, sediment, clay, certain organic materials, cells of microorganisms, and insoluble chemicals [21]. The total suspended solid (TSS) value in Jatigede reservoir is compared with the quality standard value in class 1 drinking water designation and classes 2 and 3 fisheries designation, which are the results of an ecosystem process called ecosystem services, especially in provisioning services. The comparison results show that during the rainy season, four stations (stations 4,5,6, and 7) exceed the class 1 quality standards, while the TSS results for class 2 and class 3 fisheries do not exceed the standard, indicating that it is still good for the life of organisms such as fish. Stations 1 and 3 have TSS values that exceed the class 1 quality level during the dryseason. The TSS value in Jatigede Reservoir for class 2 fisheries designation there is only 1 station that exceeds the quality standard, that is station 1 with a TSS value of 65 mg/L, and for class 3 there are no stations that exceed the quality standard limit.

The acidity or pH level in a body of water is determined by dissolved organic and inorganic components that have acidic or basic properties. The pH of water ranges from 0 (very acidic) to 14 (very alkaline) [21]. The results of the analysis of pH values in Jatigede Reservoir range from 8.6-9.42 in the rainy season and pH ranges from 7.9-8.74 in the dry season, which means that the pH in Jatigede Reservoir is classified as alkaline because it exceeds the value of 7. This pH value is then compared with the quality standards of class 1, class 2, and class 3, the pH quality standard ranges from 6 to 9. In the rainy season, the pH of Jatigede Reservoir waters exceeds the quality standard limit at station 1 by 9.42 which makes the aquatic environment at station 1 not good for drinking water sources and hasalso disrupted the living environment of fish in Jatigede Reservoir waters. Dissolved oxygen (DO) is the amount of oxygen available inthe water and one of the important parameters in water quality analysis. The greater the DO value in water, the better the water has goodquality. Conversely, if the DO value is low, it can be known that the water is polluted. DO measurement also seeks to determine the amount to which the water body can support aquatic biota such as fish and bacteria. Furthermore, the ability of water to remove pollutionis affected by the amount of oxygen in the water [21]. Dissolved oxygen (DO) is one of the parameters that are very influential when assessing the condition of an aquatic environment, especially in seeing how the environment can support the formation of an ecosystemservice by providing the benefits of drinking water sources and food sources in the form of fisheries for the community. The quality standard listed is the minimum value that must be possessed by a water body if it is to be utilized as drinking water and fishery resources. The quality standard for class 1 drinking water designation, the DO value in Jatigede Reservoir in the rainy season is only station 1 andstation 4 which exceeds the minimum quality standard of 6 mg/L, and in the dry season, there are no stations that exceed the minimumlimit in class 1, which means that water originating from Jatigede Reservoir in terms of DO value is not good enough to be a source of drinking water. DO quality standards for fisheries designation in class 2 and class 3 are at least 4 mg/L and 3 mg/L. The results of the analysis, the DO value in the rainy season and dry season, at all stations has exceeded the minimum limit of DO value which is above 4mg/L and 3 mg/L, which means that this parameter still indicates a tolerable environment for fish life in Jatigede Reservoir waters.

The amount of dissolved oxygen required by microbes to break down organic matter under aerobic circumstances is referred to as biochemical oxygen demand (BOD) [23,24]. BOD is a measure of the quantity of oxygen consumed by microbial communities in wateras a result of the presence of degradable organic matter [25]. Biochemical Oxygen Demand (BOD) parameters in Jatigede Reservoir waters range from 12.92 mg/L - 15.83 mg/L in the rainy season and range from 5 mg/L - 7.6 mg/L in the dry season. This parameter isone of the parameters that is often used in assessing the condition of an aquatic environment. From the results of the BOD analysis in the rainy season, the BOD value can be said to be very high, which is 2 times to 7 times the standard that has been set for drinking watersources and fish life. the standard or quality standard in class 1 drinking water designation is 2mg/L, when compared to the results of BOD analysis in Jatigede Reservoir, all stations have BOD values that exceed the quality standard limit and are not good for drinking water sources. The BOD value in the dry season for class 1 standards has also exceeded the predetermined limit. The BOD value of class 2 fishery designation in the rainy season and dry season also exceeds the quality standard limit and in class 3 fishery designation in the rainy season all stations have exceeded the quality standard and in the dry season, only 1 station exceeds the quality standard, thatis station 1. It can be concluded that based on the results of the BOD value, the condition of Jatigede Reservoir waters cannot support ecosystem services in the form of drinking water sources and the condition of Jatigede Reservoir waters is threatened for fish life. CODor Chemical Oxygen Demand is the amount of oxygen needed to break down all organic matter contained in water [26]. COD describesthe total amount of organic matter present because the COD value cannot be lower than the BOD value [25]. This parameter has a qualitystandard of 10 mg/L in class 1 drinking water designation, in the rainy season and dry season the COD value at all stations exceeds theclass 1 quality standard which shows that to be a source of drinking water, Jatigede Reservoir waters do not meet the requirements for this parameter. The COD quality standard value in class 2 fisheries designation is 25 mg/L, in the rainy season all stations have COD values more than the standard set by government regulation no 22 of 2021. In the dry season, only station 1 has a COD value that doesnot meet the quality standards, the COD value at station 1 is 30.91 mg/L. The quality standard for class 3 fisheries designation in the COD parameter is 40 mg/L, only station 1 in the rainy season exceeds the quality standard with a value of 40.63 mg/L in the dry seasonthe COD value at each station in Jatigede Reservoir waters does not exceed the predetermined quality standard. The condition of Jatigede Reservoir waters for fisheries has been disrupted and makes it difficult for some vulnerable species to survive.

Heavy metals are elements that can only be biodegraded so that waste containing metals when released into the aquatic environmentwill gradually accumulate, if its availability increases, it will make the waters contaminated and absorbed by organisms that have a negative impact on humans. Heavy metals can enter the environment from various sources such as the weathering of rocks containing heavy metals, volcanic and waste disposal from mining, industry, and transportation [27]. Nickel is a heavy metal that has a silvery colorthat can form alloys with other heavy metals [28]. Nickel can be categorized as a heavy metal with medium toxic properties [29]. However, nickel if dissolved in waters with a certain concentration will turn toxic to aquatic life and humans who consume the fishery products or drink the water [30]. Nickel (Ni) is one of the metal parameters analyzed in Jatigede Reservoir waters. Nickel has the same quality standard in class 1, class 2, and class 3 which is 0.05 mg/L. The results of the nickel analysis on the graph (Fig. 9), there are nostations that exceed the quality standards in the rainy season or dry season. This means that from the dissolved nickel metal parameter in the waters, the benefits of Jatigede Reservoir to provide drinking water sources and fisheries are still in a safe state with nickel valuesranging from 0.01-0.02 mg/L.

Copper is a heavy metal that is commonly found in natural waters and is an essential element for plants and animals. In plants, including algae, copper acts as a constituent of plastocyanin which functions in electron transfer in the photosynthesis process [31,32].The copper metal parameter (Cu) has a quality standard of 0.02 mg/L in class 1 drinking water designation and class 2 and 3 fisheries designation. The analysis results illustrated in Fig. 10 that there are no stations that exceed the quality standard limits in the rainy seasonand dry season. Iron metal (Fe) has a class 1 quality standard for drinking water designation of 0.3 mg/L and does not have a standard quality value in fisheries designation when viewed in government regulation no 22 of 2021. The parameter values obtained from the analysis of iron metal, namely 0.0367 - 0.087, show that there are no iron metal values that exceed the quality standard limits in the rainy season and dry season, this is because iron solubility increases in line with decreasing pH [32], while the pH of the Jatigede Reservoir waters is high. Chromium (Cr) is one of the dissolved metals sourced from textile factories, industries, and household waste that enter water bodies [33]. Jatigede Reservoir waters have chromium values ranging from 0.001 mg/L - 0.0034 mg/L in the rainy season and 0.001 mg/L -

0.405 mg/L in the dry season. The quality criteria for dissolved chromium metal in water is 0.05 mg/L in class1, class 2, and class 3. The graph (Fig. 12) shows that only station 3 surpasses the quality level of 0.405 mg/L during the dry season. This can endanger human health if water from the Jatigede Reservoir is consumed, as well as fish life in the waters.

Some methods of determining the water quality index (WQI) are the Pollution Index, the STORET method, and the Canadian Council of Ministers of Environment (CCME) method. The method used to determine water quality status in this study is the STORETmethod. One way to determine water quality conditions is the STORET method. This approach can identify factors that have met or surpassed water quality regulations. To establish water quality status, the STORET technique compares water quality data with water quality standards adjusted to its designation [34]. Considering that approximately 6 of the 12 water quality measures studied surpass thelimitations of class 1, class 2, and class 3 quality standards during the rainy and dry seasons. As a result, the STORET method was used to calculate and analyze the water quality condition. Table 2 shows the current state of water quality in Jatigede Reservoir. By looking at the quality standards of class 1 for drinking water, class 2, and class 3 for fisheries. In the rainy season the status of class 1 water quality is heavily polluted and for class 2 and class 3 fisheries designation is heavily polluted. In the dry season in the allotment of drinking water (class 1) the status of water quality in Jatigede Reservoir is heavily polluted, for class 2 is heavily polluted and class 3 ismoderately polluted. It can be concluded that the condition of Jatigede reservoir waters in the rainy season when the water level is abovenormal has a relatively poor water quality status compared to the dry season when the water level is below normal. This is in line with the observation of environmental conditions that in the rainy season there is a lot of waste runoff that enters the Jatigede Reservoir waterbody from the river.

4.2 Plankton Diversity

Analyzing and understanding biodiversity distribution patterns is of fundamental importance in ecology [35]. Plankton are microscopicorganisms that are important biological indicators of water quality as they respond rapidly to environmental changes [9]. The productivity of aquatic environments is directly correlated with plankton density. Plankton populations in aquatic systems are the biological wealth of water for fish and are an important link in the food chain in aquatic ecosystems. Plankton is the most sensitive floating community that is the first target of water pollution, so any undesirable changes in the aquatic ecosystem will affect the diversityof the plankton community [12]. Plankton serves as an early warning signal that reflects the good or bad condition of an aquatic system.The existence of planktonic organisms under natural conditions is related to a tolerance range (ecological optimum) that depends on abiotic environmental factors, as well as biotic interactions between organisms [36]. Biological communities such as phytoplankton areuseful in biomonitoring ecological disturbances caused by a number of physicochemical factors, waste pollutants, and other anthropogenic factors. An important application of diversity indices in phytoplankton and zooplankton studies is their use in pollution assessment [14].

hytoplankton is a type of plankton classified as plants that play an important role in the biosynthesis of organic matter (primary production) in aquatic ecosystems that directly or indirectly serve all living organisms in water bodies as food [37] and are influenced by many biotic and abiotic factors [11]. Phytoplankton community ecology in reservoir water plays a role in its management and development in the fisheries sector [38]. Phytoplankton detected in Jatigede Reservoir waters are quite numerous and diverse. Analysis of the quality of water conditions can use the Shannon-Winner diversity index [39]. The diversity index is an indicator that is sensitive to the level of pollution. A greater H' value indicates greater species diversity. Greater diversity in an area indicates a more stable community in that area [10]. Phytoplankton can be used to predict the impact of changes in aquatic ecosystems. In addition to detecting environmental conditions in the fisheries sector, namely the potential fishery resources in a body of water [40], the phytoplankton diversity index can monitor the ecological status of reservoirs for drinking water [41].

The diversity of phytoplankton was calculated to determine whether or not the waterways were polluted. Phytoplankton diversity ranged from 0.968 to 1.540 at seven locations during the rainy season. Station 1 had the largest diversity, while Station 5 had the lowest.Judging from the seven stations in the rainy season, phytoplankton diversity shows that Jatigede Reservoir is mildly polluted to heavilypolluted but of the seven stations there are 5 stations that show moderately polluted results. Phytoplankton diversity ranged from 0.589to 1.395 during the dry season, with station 1 having the highest diversity and station 7 having the lowest. Six stations showed severely contaminated water. The status of Jatigede Reservoir waters as determined by the diversity index during the dry season indicated that Jatigede Reservoir was moderately to badly contaminated.

Zooplankton is an animal-type plankton that passes dietary energy to higher trophic levels, hence establishing a link between energyproviders and consumers [42]. Many environmental elements combine to generate regional and seasonal conditions for zooplankton growth [43]. The variety and density of zooplankton are affected by water body nutritional conditions, abiotic variables, DO, food chain,and soil-water chemistry. The goal of assessing zooplankton diversity is to keep track of the aquatic ecosystem's health [44]. These organisms can be used as bioindicators of environmental pollution because they are easily collected, identified, and respond quickly tostressful conditions such as nutrient loading [45], and fish density [9,46]. Zooplankton responses to individual disturbances as well as chronic alterations. As a result, zooplankton appears to be a promising group of creatures to study as indicators of aquatic environmental conditions [7].

In both the rainy and dry seasons, zooplankton diversity in Jatigede Reservoir is moderate. During the rainy season, zooplankton diversity ranged from 1.559 to 1.989, with station 1 having the lowest diversity and station 6 having the most. The diversity index indicates that the waters of Jatigede Reservoir are a little polluted because all stations have a diversity index value ranging from 1.6 to 2.0. During the dry season, zooplankton diversity ranges from 1.161-2.093, with station 5 having the lowest diversity and station 4 having the most. According to the diversity index, the water in Jatigede Reservoir is moderately polluted to unpolluted. Station 5 has the lowest diversity index (1.161) which is included in the moderately polluted category. Stations 1, 3, 6, and 7 have a diversity index ranging from 1.6-2.0 which shows mildly polluted and 2 stations (station 2 and station 4) show unpolluted conditions.

4.3 Environmental Conditions Supporting Ecosystem Services

Water conditions are very supportive of the creation of drinking water resources that can be utilized by the surrounding community without fear of damaging health. Good water quality will create good quality drinking water sources that are free of chemical pollutantsand bad bacteria tires. This can also facilitate the processing of water from water into drinking water sources because the quality is good.But unfortunately in the Jatigede Reservoir waters, the condition of the waters shows heavy pollution for the rainy season and dry seasonto be used as a source of drinking water. Complex water treatment technology is needed to remove contaminants in order to treat Jatigede Reservoir water to make it suitable for drinking. Water conditions play an important role in supporting the creation of provisioning services, especially drinking water sources. Given that one of the benefits of Jatigede Reservoir as a water supplier for drinking water, it is necessary to improve the quality of the aquatic environment and manage the sources of pollutants entering from the river inlet as well as appeals and assertiveness in suppressing community activities that can damage aquatic ecosystems.

The results of an ecosystem process are called ecosystem services, drinking water resources and capture fisheries are examples of provisioning services in Jatigede Reservoir. The condition of the waters in Jatigede Reservoir in the rainy season is heavily polluted in fisheries designation. The results of the analysis of fish species obtained in the study during the rainy season and water levels above normal, there are 8 types of fish and fish that are often caught are *Oreochromis mossambicus* fish, this type of fish is an invasion fish and one of the fish that is often restocked by the local government. The last fish obtained is *Channa striata*. Water conditions in the dryseason are moderately polluted - heavily polluted fisheries designation. The results of the identification of fish species in the dry seasonwhen the water level is below normal, there are 17 species of fish in Jatigede Reservoir, in this dry season the Jatigede Reservoir waterlevel recedes as far as 10-15 meters. The type of fish that is most often obtained is *Barbodes balleroides* (23%), this type of fish is a local fish species originating from the Cimanuk River, the types of fish that are less obtained are *Clarias batrachus*, *Rasbora argyrotaenia*, *Barbonymus gonionotus*. These three fish species have an abundance of 1%. It can be seen that water conditions can be influential in supporting the creation of the number of provisioning services in the fisheries sector, in this case, the fish population.

Water conditions are very influential in supporting the creation of an ecosystem that has good quality and quantity. Water qualitysuch as temperature, water clarity, nutrient availability, and good biodiversity can create a good availability of fishery resources because it can increase the number of species and abundance of fish (increasing fish population). The creation of good environmental conditions can certainly make aquatic organisms, especially fish, easily adapt and reproduce which will then increase the availability of fishery resources. Optimal fish growth comes from the amount of natural food sources in the waters. The better the water quality, the more it will support the growth of plankton as a natural food source. Conversely, the poorer the water quality, the more difficult it will be to grow plankton as natural food, and will increase the number of plankton that are toxic to organisms such as fish. Poor environmental conditions, in this case, the Jatigede Reservoir has a water quality status that is moderately polluted - heavily polluted for fisheries designation, this affects the health of the fish population, and some types of fish cannot adapt to these water conditions which makes these types of fish die which can affect fish productivity.

Looking at the results of the analysis of water quality and plankton diversity as an indicator of the environmental conditions of Jatigede Reservoir that are polluted affects the function of Jatigede Reservoir as a provider of ecosystem services, especially in the provision of drinking water sources and capture fisheries resources. The sustainability of ecosystem services is very important, considering the benefits provided by the ecosystem for the community around Jatigede Reservoir are very meaningful for their welfare.Environmental management of Jatigede Reservoir waters is needed to improve the quality of the ecosystem which is decreasing every year. The management is related to the affirmation of the prohibition of floating net cages, waste management and waste entering fromthe river inlet to the Jatigede Reservoir water body. It is necessary to do fishing zoning or regulations on fishing restrictions in order toprovide space and time for fish to breed so that the number of fish populations and fishing efforts are balanced.

5. Conclusion

The condition of Jatigede Reservoir waters is measured by looking at the status of water quality and plankton diversity. This water condition is specifically related to the designation of drinking water sources and fishery resources as a result of ecosystem services in Jatigede Reservoir. The results showed that in the rainy season, the environmental conditions of Jatigede Reservoir were heavily polluted for class 1 which made these conditions not good for drinking water sources and also heavily polluted for fisheries (class 2 and class 3) which means that these environmental conditions have disrupted the lives of organisms, especially fish in Jatigede Reservoir. The diversity index of phytoplankton (0.968-1.540) and zooplankton (1.559-1.989) showed lightly polluted - heavily polluted conditions. This can affect the quality and quantity of ecosystem services which shows that in the results of capture fisheries in the rainy season, there are only 8 types of fish caught. In the dry season when the water level is below normal, the condition of Jatigede Reservoir seen from the designation of drinking water sources is in a heavily polluted condition which shows that the benefits as a source of drinking water are less suitable for consumption. Jatigede Reservoir water quality status in class 2 fisheries designation is heavily polluted and class 3 is moderately polluted. Judging from the phytoplankton index (0.589-1.395) and zooplankton (1.161-2.093), water conditions in the dry season are heavily polluted to unpolluted, this can be seen from the number of fish species caught, which is 17 species. Looking at the results of the analysis, it can be concluded that the environmental conditions of Jatigede Reservoir waters are very influential in supporting ecosystem services, especially the benefits of providing drinking water sources and fishery sources for the welfare of the surrounding community.

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